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STATE OF NEW MEXICO
BEFORE THE ENVIRONMENTAL IMPROVEMENT BOARD

IN THE MATTER OF PROPOSED AMENDMENTS TO 20.3.4.404 NMAC, 20.3.4.455 NMAC, 20.3.5.15 NMAC, 20.3.12.13 NMAC, 20.3.15.1519 NMAC,

No. EIB 23-59

Radiation Protection Bureau,
Environmental Protection Division,
New Mexico Environment Department,

Petitioner.

PETITION TO AMEND 20.3.4.404 NMAC, 20.3.4.455 NMAC, 20.3.5.15 NMAC, 20.3.12.13 NMAC, AND 20.3.15.1519 NMAC OF THE RADIATION PROTECTION REGULATIONS AND REQUEST FOR HEARING

The Radiation Protection Bureau ("Bureau") of the Environmental Protection Division ("Division") of the New Mexico Environment Department ("Department") hereby petitions the Environmental Improvement Board ("EIB") for a regulatory change amending the following sections of the Radiation Protection regulations in the New Mexico Administrative Code ("NMAC"): 20.3.4.404 NMAC, 20.3.4.455 NMAC, 20.3.5.15 NMAC, 20.3.12.13 NMAC and 20.3.15.1519 NMAC. As support for this Petition and Request for Hearing, a Statement of Reasons is attached hereto as Exhibit 1. The proposed amendments are attached hereto as Exhibit 2 and a matrix highlighting the proposed amendments is attached hereto as Exhibit 3. In support of this Petition, the Bureau STATES:

1. The proposed revisions to the NMAC are required to remain compatible with the Nuclear Regulatory Commission ("NRC") federal regulations. The revisions contain updates and additions to the current regulations to achieve compatibility. The NRC rules and the

requirements of certain of the Regulation Amendment Tracking System ("RATS") identifier numbers establish the updates to the NMAC.

2. It is the Bureau's position that the proposed amendments will bring it in compliance with the federal requirements and will ensure that the Bureau continues to effectively operate the Radiation Protection Program and thus meet the requirements agreed upon between the State of New Mexico and the U.S. Nuclear Regulatory Commission ("NRC") in the April 4, 1974 Agreement. Without the requested regulatory change, the Radiation Protection Program could revert to the NRC.

3. The EIB has the authority to adopt the proposed amendments pursuant to Section 74-1-8(A)(5) NMSA 1978 (2020), Section 74-1-9 NMSA 1978 (1985), and Section 74-3-5(A) NMSA 1978 (2000).

4. Under the Environmental Improvement Act, Sections 74-1-1 through 74-1-17 NMSA 1978, the amendments would be in the public interest, technically practicable, necessary, and economically reasonable. See Section 74-1-9 NMSA 1978 (1985).

5. For the reasons stated herein, it is necessary and appropriate to amend the regulations to align with the NRC regulations.

6. Pursuant to Section 74-3-5(A) NMSA 1978 (2000), the proposed amendments shall be provided to the Radiation Technology Advisory Council ("RTAC") for its advice and consent on this rulemaking.

7. At EIB's regularly scheduled August 2023 public meeting, the Bureau requests that the EIB order a public hearing to consider the proposed amendments, appoint a hearing officer, and schedule the public hearing to occur at the EIB's regularly scheduled November 2023 or December 2023 meeting. The Bureau anticipates the public hearing will take

approximately one (1) hour. The Bureau reserves the right to supplement and amend this Petition and any exhibits attached hereto.

Respectfully submitted,

NEW MEXICO ENVIRONMENT DEPARTMENT
OFFICE OF GENERAL COUNSEL

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STATEMENT OF REASONS

1. Pursuant to Section 74-3-15 NMSA 1978, the State of New Mexico ("State") administers the Radiation Protection Program through an agreement between the United States Nuclear Regulatory Commission ("NRC") and the State titled "Agreement Between the United States Atomic Energy Commission and the State of New Mexico for Discontinuance of Certain Commission Regulatory Authority and Responsibility within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, As Amended" executed on April 3, 1974 ("Agreement").

2. The Agreement provides for discontinuance of the regulatory authority of the NRC and acceptance of that authority by the Environmental Improvement Board ("EIB") and Environmental Protection Division of the New Mexico Environment Department ("Department"). See Section 74-3-15 NMSA 1978 (1977).

3. For the duration of the Agreement, the EIB shall have the authority to regulate the radioactive materials covered by the Agreement for the protection of the public health and safety and the environment from radiation hazards. See Section 74-3-15 NMSA 1978 (1977).

4. As an agreement state under 42 U.S.C. § 2021 and Section 74-3-15, The State's regulations must be compatible with the NRC's regulations. 42 U.S.C. § 2021(d)(2) (2005).

5. The compatibility requirement is met through the promulgation of state regulations when necessary.

6. The State must maintain a compatible and adequately staffed Radiation Protection Program to keep its agreement status.

7. The NRC provides review summary sheets for the regulation amendments called the Regulation Amendment Tracking System Identification Numbers ("RATS IDs") the RATS IDs are divided into several columns, such as the "NRC Regulation Section", "State Section", and "Compatibility Category."

8. Failure to maintain compatibility with NRC regulations jeopardizes the Agreement between the State and the NRC and potentially endangers the authority of the State to regulate certain uses of radioactive materials within the State and to collect radioactive materials license fees.

9. The Department is authorized by Section 74-1-7(A)(5) NMSA 1978 (2000) to revise New Mexico's radiation regulations to align with their federal counterparts as required by the Agreement between the State and the NRC.

10. The EIB has the authority to adopt the proposed amendments pursuant to Section 74-1-8(A)(5) NMSA 1978 (2020), Section 74-1-9 NMSA 1978 (1985), and Section 74-3-5(A) NMSA 1978 (2000).

11. The amendments currently being proposed to 20.3.4.404 NMAC, 20.3.4.455 NMAC, 20.3.5.15 NMAC, 20.3.12.13 NMAC, and 20.3.15.1519 NMAC are federally required to meet the compatibility and health and safety categories established by the NRC. The required changes are found in the following RATS IDs:

- RATS ID 2020-1;
- RATS ID 2020-2;
- RATS ID 2020-3;
- RATS ID 2021-1;
- RATS ID 2021-2;
- RATS ID 2022-1; and,
- RATS ID 2022-2.

12. The proposed amendments to Part 4 ("STANDARDS FOR PROTECTION AGAINST RADIATION") of Title 20, Chapter 3 of the NMAC occur 20.3.4.404(C) NMAC ("RADIATION PROTECTION PROGRAMS") and 20.3.4.455 ("REPORTS OF TRANSACTIONS INVOLVING NATIONALLY TRACKED SOURCES"). These amendments align with the federal regulations and will ensure the Program is run in compliance with those federal regulations. See Exhibit 2A at p. 9 and pp. 32-34.

13. The proposed amendments to Part 5 ("RADIATION SAFETY REQUIREMENTS FOR INDUSTRIAL RADIOGRAPHIC OPERATIONS") of Title 20, Chapter 3 of the NMAC occur at 20.3.5.15 NMAC ("PERSONNEL MONITORING"), in subsections A, D, E, F and H. These amendments align with the federal regulations and will ensure the Program is run in compliance with those federal regulations. See Exhibit 2B at pp. 8-9.

14. The proposed amendments to Part 12 ("LICENSES AND RADIATION SAFETY REQUIREMENTS FOR WELL LOGGING") of Title 20, Chapter 3 of the NMAC occur at 20.3.12.13(A) ("PERSONNEL MONITORING"). These amendments align with the federal regulations and will ensure the Program is run in compliance with those federal regulations. See Exhibit 2C at p. 5.

15. The proposed amendments to Part 15 ("LICENSES AND RADIATION SAFETY REQUIREMENTS FOR IRRADIATORS") of Title 20, Chapter 3 of the NMAC occur at 20.3.12.1519 ("PERSONNEL MONITORING"). These amendments align with the federal regulations and will ensure the Program is run in compliance with those federal regulations. See Exhibit 2D at p. 8.

16. Adoption of the amendments to 20.3.4.404 NMAC, 20.3.4.455 NMAC, 20.3.5.15 NMAC, 20.3.12.13 NMAC, and 20.3.15.1519 NMAC will allow the State to

become compatible with the current federal regulations required by the NRC's RATS IDs and will provide consistency between the federal and state regulations.

17. Pursuant to Section 74-1-9(A) and 20.1.1.300(A) NMAC, any person may petition the EIB for an amendment of regulations within the jurisdiction of the EIB. The EIB shall determine whether to hold a hearing for the proposed regulations. See Section 74-1-9(A) NMSA 1978 (1985); see also, 20.1.1.300(C) NMAC (2018).

18. The EIB shall, pursuant to the advice and recommendations of the Radiation Technical Advisory Council ("RTAC"), adopt and promulgate such rules, regulations, and licensure standards as may be necessary to effectuate the provisions of the Radiation Protection Act, Sections 74-3-1 through 74-3-16 (1953, as amended). See Section 74-3-5(A) (2000).

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 3 RADIATION PROTECTION
PART 4 STANDARDS FOR PROTECTION AGAINST RADIATION

20.3.4.1 ISSUING AGENCY: Environmental Improvement Board.
[20.3.4.1 NMAC - Rp, 20.3.4.1 NMAC, 4/30/2009]

20.3.4.2 SCOPE: Except as specifically provided in other parts of this chapter, this part applies to persons licensed or registered by the department to receive, possess, use, transfer or dispose of sources of radiation. The limits in this part do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose of medical diagnosis or therapy, to exposure from individuals administered radioactive material and released under Subsection I of 20.3.7.703 NMAC or to exposure from voluntary participation in medical research programs.
[20.3.4.2 NMAC - Rp, 20.3.4.1 NMAC, 4/30/2009]

20.3.4.3 STATUTORY AUTHORITY: Sections 74-1-9, 74-3-5 and 74-3-9 NMSA 1978.
[20.3.4.3 NMAC - Rp, 20.3.4.3 NMAC, 4/30/2009]

20.3.4.4 DURATION: Permanent.
[20.3.4.4 NMAC - Rp, 20.3.4.4 NMAC, 4/30/2009]

20.3.4.5 EFFECTIVE DATE: April 30, 2009, unless a later date is cited at the end of a section.
[20.3.4.5 NMAC - Rp, 20.3.4.5 NMAC, 4/30/2009]

20.3.4.6 OBJECTIVE:

A. The requirements of this part establish standards for protection against ionizing radiation resulting from activities conducted pursuant to licenses or registrations issued by the department.

B. The requirements of this part are designed to control the receipt, possession, use, transfer and disposal of sources of radiation by any licensee or registrant so the total dose to an individual, other than background radiation, does not exceed the standards for protection against radiation prescribed in this part. However, nothing in this part shall be construed as limiting actions that may be necessary to protect public health and safety.
[20.3.4.6 NMAC - Rp, 20.3.4.6 NMAC, 4/30/2009]

20.3.4.7 DEFINITIONS:

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

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

C. "Adult" means an individual 18 or more years of age.

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

E. "Airborne radioactivity area" means a room, enclosure or area in which airborne radioactive materials exist in concentrations:

(1) in excess of the derived air concentrations (DAC) specified in table I of 20.3.4.461 NMAC; or

(2) to such a degree that an individual 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.

F. "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.

G. "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 regulations as is practical, consistent with the purpose for which the licensed or registered activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed or registered sources of radiation in the public interest.

Exhibit 2A

H. "ALI" (annual limit on intake) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems (0.05 sievert) or a committed dose equivalent of 50 rems (0.5 sievert) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in columns 1 and 2 of table I of 20.3.4.461 NMAC.

I. "APF" (assigned protection factor) 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.

J. "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.

K. "Background radiation" means radiation from cosmic sources; naturally occurring radioactive material as it occurs in nature, 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 radioactive material regulated by the department or NRC.

L. "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.

M. "Class" (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.

N. "Collective dose" means the sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

O. "Committed dose equivalent" ($H_{T,50}$) means 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.

P. "Committed effective dose equivalent" ($H_{E,50}$) 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 each of these organs or tissues ($H_{E,50} = \{\text{sum over T}\} w_T H_{T,50}$).

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

R. "Controlled area" means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

S. "Critical Group" means the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

T. "DAC" means the derived air concentration.

U. "DAC-hour" means the derived air concentration - hour.

V. "Declared pregnant woman" means a woman who has voluntarily informed the licensee, 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.

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

X. "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.

Y. "Derived air concentration" (DAC) means the concentration of a given radionuclide in air which, if breathed by reference man for a working year of 2,000 hours under conditions of light work, results in an intake of one ALI. For purposes of these regulations, the condition of light work is an inhalation rate of 1.2 cubic meters of air per hour for 2,000 hours in a year. DAC values are given in column 3 of table I of 20.3.4.461 NMAC.

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

AA. "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).

AB. "Distinguishable from background" means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey and statistical techniques.

AC. "Dose" (radiation dose) is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent or total effective dose equivalent.

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

AE. "Dose limits" (limits) means the permissible upper bounds of radiation doses established in accordance with these regulations.

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

AG. "Effective dose equivalent" (H_E) means the sum of the products of the dose equivalent to each organ or tissue (H_T), and the weighting factor (w_T) applicable to each of the body organs or tissues (T) that are irradiated (H_E = {sum over T}$w_T H_T$).

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

AI. "Entrance or access point" means any opening through which an individual could gain access to radiation areas or to radioactive materials. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

AJ. "Exposure" means being exposed to ionizing radiation or to radioactive material. Exposure also means the quotient of dQ divided by dm where "dQ" is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass "dm" are completely stopped by air. The special unit of exposure is the roentgen (R). The SI unit of exposure is the coulomb per kilogram (C/kg) (see 20.3.4.8 NMAC).

AK. "Exposure rate" means the exposure per unit of time, such as roentgen per minute and milliroentgen per hour.

AL. "External dose" means that portion of the dose equivalent received from any source of radiation outside the body.

AM. "Extremity" means hand, elbow, arm below the elbow, foot, knee and leg below the knee.

AN. "Eye dose equivalent" means the external dose equivalent to the lens of the eye at a tissue depth of 0.3 centimeter (300 mg/cm^2).

AO. "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.

AP. "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.

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

AR. "Generally applicable environmental radiation standards" means standards issued by the EPA under the authority of the Atomic Energy Act that impose limits on radiation exposures or levels, and concentrations or quantities of radioactive material in the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material.

AS. "Gray" (Gy) means the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule per kilogram (1 gray=100 rads).

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

AU. "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 millisievert) in 1 hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

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

AW. "Individual monitoring" means the assessment of:

(1) dose equivalent by the use of individual monitoring devices designed to be worn by an individual; or

(2) committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, that is, DAC-hours; or

(3) dose equivalent by the use of survey data.

AX. "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.

AY. "Inhalation class" (see "class").

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

BA. "Lens dose equivalent" (LDE) 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).

BB. "Limits" (see "dose limits").

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

BD. "Lung class" (see "class").

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

BF. "Minor" means an individual less than 18 years of age.

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

BH. "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.

BI. "Nationally tracked source" is a sealed source containing a quantity equal to or greater than category 1 or category 2 levels of any radioactive material listed in 20.3.4.467 NMAC. 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.

BJ. "Nonstochastic effect" (deterministic effect) means a health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect.

BK. "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 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 materials and released under Subsection I of 20.3.7.703 NMAC; from voluntary participation in medical research programs; or as a member of the public.

BL. "Personnel monitoring equipment" (see "individual monitoring devices").

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

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

BO. "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.

BP. "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.

BQ. "Public dose" means the dose received by a member of the public from exposure to radiation or radioactive material released by a licensee or registrant, or to any other sources of radiation under the control of a

licensee or registrant. Public dose does not include: occupational dose; dose received from background radiation; dose received from any medical administration the individual has received; dose received from exposure to individuals administered radioactive material and released under Subsection I of 20.3.7.703 NMAC; or dose received from voluntary participation in medical research programs.

BR. "Pyrophoric material" means any liquid that ignites spontaneously in dry or moist air at or below 130 degrees fahrenheit (54.4 degrees celsius) or any solid material, other than one classed as an explosive, which under normal conditions is liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily and, when ignited, burns so vigorously and persistently as to create a serious transportation, handling or disposal hazard. Included are spontaneously combustible and water-reactive materials.

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

BT. "Quality factor" (Q) means the modifying factor, listed in table 8.1 of Subsection C of 20.3.4.8 NMAC and table 8.2 of Subsection D of 20.3.4.8 NMAC, that is used to derive dose equivalent from absorbed dose.

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

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

BW. "Radiation area" means any 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 millisievert) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

BX. "Radiation dose" (see "dose").

BY. "Radiobioassay" (see "bioassay").

BZ. "Reference man" means a hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics may be used by researchers and public health employees to standardize results of experiments and to relate biological insult to a common base. A description of reference man is contained in the international commission on radiological protection report (ICRP), publication 23, *report of the task group on reference man.*

CA. "Residual radioactivity" means radioactivity in structures, materials, soils, groundwater and other media at a site resulting from activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radiation. It also includes radioactive materials remaining at the site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made in accordance with the provisions of this part.

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

CC. "Restricted area" means an area, access to which is limited by the licensee or registrant for purposes of protection of individuals against undue risks from exposure to sources of radiation. 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.

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

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

CF. "Shallow-dose equivalent" (H_s), 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).

CG. "SI" means the international system of units.

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

CI. "Stochastic effect" (probabilistic effect) means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

CJ. "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.

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

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

CM. "TODE" (total organ dose equivalent) means the sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in Paragraph (6) of Subsection A of 20.3.4.446 NMAC.

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

CO. "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.

CP. "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 radiation source or 1 meter from any surface that the radiation penetrates.

CQ. "Waste disposal site operators" means persons licensed to dispose of radioactive waste.

CR. "Waste handling licensees" means persons licensed to receive and store radioactive wastes prior to disposal or persons licensed to dispose of radioactive waste.

CS. "Week" means 7 consecutive days starting on Sunday.

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

TABLE 7.1
ORGAN DOSE WEIGHTING FACTORS

Organ or Tissue	w_T
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30[1]
Whole Body	1.00[2]

table 7.1 notes:

[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 specific guidance is issued.

CU. "Whole body" means, for purpose of external exposure, head, trunk including male gonads, arms above the elbow or legs above the knee.

CV. "Worker" means an individual engaged in work under a license or registration issued by the department and controlled by a licensee or registrant, but does not include the licensee or registrant.

CW. "Working level" (WL) means any combination of short-lived radon daughters in 1 liter of air that will result in the ultimate emission of 1.3E+5 megaelectronvolts of potential alpha particle energy. The short-lived radon daughters are 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.

CX. "Working level month" (WLM) means exposure to 1 working level for 170 hours (2,000 working hours per year divided by 12 months per year is approximately equal to 170 hours per month).

CY. "Year" means the period of time beginning in January used to determine compliance with the provisions of these regulations. 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.
[20.3.4.7 NMAC - Rp, 20.3.4.7 NMAC, 4/30/2009; A, 6/30/2011]

20.3.4.8 UNITS OF EXPOSURE AND DOSE:

A. As used in these regulations, the unit of exposure is the coulomb per kilogram (C/kg) of air. One roentgen is equal to 2.58E-4 coulomb per kilogram of air.

B. As used in these regulations, the units of dose are:

(1) gray (Gy) is the SI unit of absorbed dose; one gray is equal to an absorbed dose of 1 joule per kilogram (1 gray = 100 rads);

(2) rad is the special unit of absorbed dose; one rad is equal to an absorbed dose of 100 erg per gram or 0.01 joule per kilogram (1 rad = 0.01 gray);

(3) rem is the special unit of any of the quantities expressed as dose equivalent; the dose equivalent in rem is equal to the absorbed dose in rad multiplied by the quality factor (1 rem = 0.01 sievert); and

(4) sievert is the SI unit of any of the quantities expressed as dose equivalent; the dose equivalent in sievert is equal to the absorbed dose in gray multiplied by the quality factor (1 sievert = 100 rems).

C. As used in these regulations, the quality factors for converting absorbed dose to dose equivalent are shown in table 8.1.

TABLE 8.1
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 and high-speed electrons	1	1
Alpha particles, multiple-charged particles, fission fragments and heavy particles of unknown charge	20	0.05
Neutrons of unknown energy	10	0.1
High-energy protons	10	0.1

Table 8.1 note: [1]absorbed dose in gray equal to 1 sievert or the absorbed dose in rad equal to 1 rem.

D. If it is more convenient to measure the neutron fluence rate than to determine the neutron dose equivalent rate in sievert per hour or rem per hour, as provided in Subsection C of this section, 0.01 sievert (1 rem) of neutron radiation of unknown energies may, for purposes of these regulations, 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 8.2 to convert a measured tissue dose in gray or rad to dose equivalent in sievert or rem (Note: The values in table 8.2 are presented in the "E" notation. In this notation a value of 5E-1 represents a value of $5x10^{-1}$ or 0.5. A value of 4E+2 represents $4x10^{2}$ or 400.)

TABLE 8.2
MEAN QUALITY FACTORS, Q, AND FLUENCE PER UNIT DOSE EQUIVALENT FOR MONOENERGETIC NEUTRONS

Neutron Energy (megaelectronvolt)	Quality Factor[1] (Q)	Fluence per Unit Dose Equivalent[2] (neutrons centimeter^{-2} rem^{-1})	Fluence per Unit Dose Equivalent (neutrons centimeter^{-2} sievert^{-1})
(thermal) 2.5E-8	2	980E+6	980E+8
1E-7	2	980E+6	980E+8
1E-6	2	810E+6	810E+8
1E-5	2	810E+6	810E+8
1E-4	2	840E+6	840E+8

TABLE 8.2 MEAN QUALITY FACTORS, Q, AND FLUENCE PER UNIT DOSE EQUIVALENT FOR MONOENERGETIC NEUTRONS			
Neutron Energy (megaelectronvolt)	**Quality Factor[1] (Q)**	**Fluence per Unit Dose Equivalent[2] (neutrons centimeter^{-2} rem^{-1})**	**Fluence per Unit Dose Equivalent (neutrons centimeter^{-2} sievert^{-1})**
1E-3	2	980E+6	980E+8
1E-2	2.5	1010E+6	1010E+8
1E-1	7.5	170E+6	170E+8
5E-1	11	39E+6	39E+8
1	11	27E+6	27E+8
2.5	9	29E+6	29E+8
5	8	23E+6	23E+8
7	7	24E+6	24E+8
10	6.5	24E+6	24E+8
14	7.5	17E+6	17E+8
20	8	16E+6	16E+8
40	7	14E+6	14E+8
60	5.5	16E+6	16E+8
1E+2	4	20E+6	20E+8
2E+2	3.5	19E+6	19E+8
3E+2	3.5	16E+6	16E+8
4E+2	3.5	14E+6	14E+8

Table 8.2 notes:

[1] value of quality factor (Q) at the point where the dose equivalent is maximum in a 30-centimeter diameter cylinder tissue-equivalent phantom;

[2] monoenergetic neutrons incident normally on a 30-centimeter diameter cylinder tissue-equivalent phantom.

[20.3.4.8 NMAC - Rp, 20.3.1.117 NMAC, 4/30/2009]

20.3.4.9 UNITS OF ACTIVITY: For purposes of these regulations, activity is expressed in the SI unit of becquerel (Bq) or in the special unit of curie (Ci), or their multiples, or disintegrations or transformations per unit of time.

A. One becquerel (Bq) = 1 disintegration or transformation per second (dps or tps).

B. One curie (Ci) = 3.7×10^{10} disintegration or transformation per second (dps or tps) = 3.7×10^{10} becquerel (Bq) = 2.22×10^{12} disintegration or transformation per minute (dpm or tpm).

[20.3.4.9 NMAC - Rp, 20.3.1.7 NMAC 4/30/2009]

20.3.4.10 through 20.3.4.402 [RESERVED]

20.3.4.403 IMPLEMENTATION:

A. Any existing license or registration condition or technical specification that is more restrictive than a requirement in this part remains in force until there is a technical specification change, license amendment or renewal, or registration amendment or renewal.

B. If a license or registration condition or technical specification exempted a licensee or registrant from a requirement in the standards for protection against radiation in effect prior to May 3, 1995 (see 20.3.4 NMAC codified as of May 3, 1995), it continues to exempt the licensee or registrant from the corresponding provision of this part.

C. If a license or registration condition cites provisions of this part in effect prior to the effective date of the regulations in this part, which do not correspond to any current provisions of this part, then the license or registration condition remains in force until there is a technical specification change, an amendment or renewal of the license or registration that modifies or removes that condition.

[20.3.4.403 NMAC - Rp, 20.3.4.403 NMAC, 4/30/2009]

20.3.4.404 RADIATION PROTECTION PROGRAMS:

A. Each licensee or registrant shall develop, document and implement a radiation protection program commensurate with the scope and extent of licensed or registered activities and sufficient to ensure compliance with the provisions of this part (see 20.3.4.441 NMAC for recordkeeping requirements related to these programs.)

B. The licensee or registrant shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA.

C. The licensee or registrant shall, at intervals not to exceed 12 months, review the radiation protection program content and implementation[~~,~~] with all employees before beginning their job duties and annually thereafter.

D. To implement the ALARA requirements of Subsection B of this section, and notwithstanding the requirements in 20.3.4.413 NMAC, a constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established by licensees such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 millirems (0.1 millisievert) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in 20.3.4.453 NMAC and promptly take appropriate corrective action to ensure against recurrence.

[20.3.4.404 NMAC - Rp, 20.3.4.404 NMAC, 4/30/2009, XX/XX/24]

20.3.4.405 OCCUPATIONAL DOSE LIMITS FOR ADULTS:

A. Annual limits. The licensee or registrant shall control the occupational dose to individual adults, except for planned special exposures pursuant to 20.3.4.410 NMAC, to the following dose limits:

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

(a) the total effective dose equivalent being equal to 5 rems (0.05 sievert); or

(b) the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 sievert); and

(2) the annual limits to the lens of the eye, to the skin of the whole body, and to the skin of extremities which are:

(a) a lens dose equivalent of 15 rems (0.15 sievert); and

(b) a shallow dose equivalent of 50 rems (0.5 sievert) to the skin of the whole body or to the skin of any extremity.

B. Doses received in excess of the annual limits, including doses received during accidents, emergencies and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime (see Subsection E of 20.3.4.410 NMAC).

C. Determining, assessing and assigning dose equivalent.

(1) When the 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 department. The assigned shallow-dose equivalent must be the dose averaged over the contiguous 10 square centimeters of skin receiving the highest exposure. The deep-dose equivalent, lens dose equivalent and shallow-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure, or the results of individual monitoring are unavailable.

(2) Working with fluoroscopic equipment. When a protective apron is worn while working with medical fluoroscopic equipment and monitoring is conducted as specified in Paragraph (5) of Subsection A of 20.3.4.417 NMAC, the effective dose equivalent for external radiation shall be determined as follows:

(a) when only one individual monitoring device is used and it is located at the neck outside the protective apron, the reported deep dose equivalent shall be the effective dose equivalent for external radiation; or

(b) when only one individual monitoring device is used and it is located at the neck outside the protective apron, and the reported dose exceeds 25 percent of the limit specified in Subsection A of this

section, the reported deep dose equivalent value multiplied by 0.3 shall be the effective dose equivalent for external radiation; or

(c) when individual monitoring devices are worn, both under the protective apron at the waist and outside the protective apron at the neck, the effective dose equivalent for external radiation shall be assigned the value of the sum of the deep dose equivalent reported for the individual monitoring device located at the waist under the protective apron multiplied by 1.5 and the deep dose equivalent reported for the individual monitoring device located at the neck outside the protective apron multiplied by 0.04.

D. DAC and ALI. Derived air concentration (DAC) and annual limit on intake (ALI) values are specified in table I of 20.3.4.461 NMAC, and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits.

E. Uranium limits. Notwithstanding the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity (see table note 3 of 20.3.4.461 NMAC.)

F. Prior dose. The licensee or registrant shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person during the current year (see 20.3.4.409 NMAC).

[20.3.4.405 NMAC - Rp, 20.3.4.405 NMAC, 4/30/2009; A, 6/30/2011]

20.3.4.406 COMPLIANCE WITH REQUIREMENTS FOR SUMMATION OF EXTERNAL AND INTERNAL DOSES:

A. If the licensee or registrant is required to monitor pursuant to both Subsections A and B of 20.3.4.417 NMAC, the licensee or registrant shall demonstrate compliance with the dose limits by summing external and internal doses. If the licensee or registrant is required to monitor only pursuant to either Subsection A or Subsection B of 20.3.4.417 NMAC, then summation is not required to demonstrate compliance with the dose limits. The licensee or registrant may demonstrate compliance with the requirements for summation of external and internal doses pursuant to Subsections B, C and D of this section. The dose equivalents for the lens of the eye, the skin and the extremities are not included in the summation, but are subject to separate limits.

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

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

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

(3) the sum of the calculated committed effective dose equivalents to all significantly irradiated organs or tissues (T) calculated from bioassay data using appropriate biological models and expressed as a fraction of the annual limit; for purposes of this requirement, an organ or tissue is deemed to be significantly irradiated if, for that organ or tissue, the product of the weighting factors, w_T, and the committed dose equivalent, $H_{T,50}$, per unit intake is greater than 10 percent of the maximum weighted value of $H_{T,50}$, that is, $w_T H_{T,50}$, per unit intake for any organ or tissue.

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

D. Intake through Wounds or Absorption through Skin. The licensee or registrant shall evaluate and, to the extent practical, account for intakes through wounds or skin absorption. The intake through intact skin has been included in the calculation of DAC for hydrogen-3 and does not need to be evaluated or accounted for pursuant to Subsection D of 20.3.4.406 NMAC.

[20.3.4.406 NMAC - Rp, 20.3.4.406 NMAC, 4/30/2009]

20.3.4.407 DETERMINATION OF EXTERNAL DOSE FROM AIRBORNE RADIOACTIVE MATERIAL:

A. Licensees or registrants shall, when determining the dose from airborne radioactive material, include the contribution to the deep dose equivalent, lens dose equivalent and shallow dose equivalent from external exposure to the radioactive cloud (see 20.3.4.461 NMAC, table notes 1 and 2).

B. Airborne radioactivity measurements and DAC values shall not be used as the primary means to assess the deep dose equivalent when the airborne radioactive material includes radionuclides other than noble gases

or if the cloud of airborne radioactive material is not relatively uniform. The determination of the deep dose equivalent to an individual shall be based upon measurements using instruments or individual monitoring devices. [20.3.4.407 NMAC - Rp, 20.3.4.407 NMAC, 4/30/2009]

20.3.4.408 DETERMINATION OF INTERNAL EXPOSURE:

A. For purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee or registrant shall, when required pursuant to 20.3.4.417 NMAC, take suitable and timely measurements of:

(1) concentrations of radioactive materials in air in work areas; or

(2) quantities of radionuclides in the body; or

(3) quantities of radionuclides excreted from the body; or

(4) combinations of these measurements.

B. Unless respiratory protective equipment is used, as provided in 20.3.4.423 NMAC, or the assessment of intake is based on bioassays, the licensee or registrant shall assume that an individual inhales radioactive material at the airborne concentration in which the individual is present.

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

(1) use that information to calculate the committed effective dose equivalent, and, if used, the licensee or registrant shall document that information in the individual's record;

(2) upon prior approval of the department, adjust the DAC or ALI values to reflect the actual physical and chemical characteristics of airborne radioactive material, for example, aerosol size distribution or density; and

(3) separately assess the contribution of fractional intakes of class D, W or Y compounds of a given radionuclide to the committed effective dose equivalent (see 20.3.4.461 NMAC).

D. If the licensee or registrant chooses to assess intakes of class Y material using the measurements given in Paragraphs (2) or (3)of Subsection A of this section, the licensee or registrant may delay the recording and reporting of the assessments for periods up to 7 months, unless otherwise required by 20.3.4.452 NMAC or 20.3.4.453 NMAC. This delay permits the licensee or registrant to make additional measurements basic to the assessments.

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

(1) the sum of the ratios of the concentration to the appropriate DAC value, that is, D, W or Y, from 20.3.4.461 NMAC for each radionuclide in the mixture; or

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

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

G. When a mixture of radionuclides in air exists, a licensee or registrant may disregard certain radionuclides in the mixture if:

(1) the licensee or registrant uses the total activity of the mixture in demonstrating compliance with the dose limits in 20.3.4.405 NMAC and in complying with the monitoring requirements in Subsection B of 20.3.4.417 NMAC; and

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

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

H. When determining the committed effective dose equivalent, the following information may be considered:

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

(2) for an ALI and the associated DAC determined by the nonstochastic organ dose limit of 50 rems (0.5 sievert), the intake of radionuclides that would result in a committed effective dose equivalent of 5 rems (0.05 sievert), that is, the stochastic ALI, is listed in parentheses in table I of 20.3.4.461 NMAC; the licensee or registrant may, as a simplifying assumption, use the stochastic ALI to determine committed effective dose

equivalent; however, if the licensee or registrant uses the stochastic ALI, the licensee or registrant shall also demonstrate that the limit in Paragraph (2) of Subsection A of 20.3.4.405 NMAC is met.
[20.3.4.408 NMAC - Rp, 20.3.4.408 NMAC, 4/30/2009]

20.3.4.409 DETERMINATION OF PRIOR OCCUPATIONAL DOSE:

A. For each individual who may enter the licensee's or registrant's restricted area and is likely to receive, in a year, an occupational dose requiring monitoring pursuant to 20.3.4.417 NMAC, the licensee or registrant shall determine the occupational radiation dose received during the current year.

B. Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant shall determine:

(1) the internal and external doses from all previous planned special exposures; and

(2) all doses in excess of the limits, including doses received during accidents and emergencies, received during the lifetime of the individual.

C. In complying with the requirements of Subsections A or B of this section, a licensee or registrant may:

(1) accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual received during the current year; and

(2) accept, as the record of lifetime cumulative radiation dose, a form *cumulative occupational dose history* or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant; and

(3) obtain reports of the individual's dose equivalent from the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant, by telephone, telegram, facsimile or letter; the licensee or registrant shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

D. Recording exposure history.

(1) The licensee or registrant shall record the exposure history of each individual, as required by Subsections A and B of this section, on department form *cumulative occupational dose history*, or other clear and legible record, including all the information required by that form. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee or registrant obtains reports, the licensee or registrant shall use the dose shown in the report in preparing department form *cumulative occupational dose history* or equivalent. For any period in which the licensee or registrant does not obtain a report, the licensee or registrant shall place a notation on department form *cumulative occupational dose history* or equivalent indicating the periods of time for which data are not available.

(2) Licensees or registrants are not required to partition historical dose between external dose equivalent(s) and internal committed dose equivalent(s). Further, occupational exposure histories obtained and recorded on department form *cumulative occupational dose history* or equivalent before the effective date of these regulations, might not have included effective dose equivalent, but may be used in the absence of specific information on the intake of radionuclides by the individual.

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

(1) in establishing administrative controls pursuant to Subsection F of 20.3.4.405 NMAC for the current year, that the allowable dose limit for the individual is reduced by 1.25 rems (12.5 millisieverts) for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure; and

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

F. The licensee or registrant shall retain the records on department form *cumulative occupational dose history* or equivalent until the department terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing department form *cumulative occupational dose history* or equivalent for 3 years after the record is made.
[20.3.4.409 NMAC - Rp, 20.3.4.409 NMAC, 4/30/2009; A, 6/30/2011]

20.3.4.410 PLANNED SPECIAL EXPOSURES: A licensee or registrant may authorize an adult worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in 20.3.4.405 NMAC provided that each of the following conditions is satisfied:

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

B. the licensee or registrant, and employer if the employer is not the licensee or registrant, specifically authorizes the planned special exposure, in writing, before the exposure occurs;

C. before a planned special exposure, the licensee or registrant ensures that each individual involved is:

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

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

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

D. prior to permitting an individual to participate in a planned special exposure, the licensee or registrant ascertains prior doses as required by Subsection B of 20.3.4.409 NMAC during the lifetime of the individual for each individual involved;

E. subject to Subsection B of 20.3.4.405 NMAC, the licensee or registrant shall not authorize a planned special exposure that would cause an individual to receive a dose from all planned special exposures and all doses in excess of the limits to exceed:

(1) the numerical values of any of the dose limits in Subsection A of 20.3.4.405 NMAC in any year; and

(2) five times the annual dose limits in Subsection A of 20.3.4.405 NMAC during the individual's lifetime;

F. the licensee or registrant maintains records of the conduct of a planned special exposure in accordance with 20.3.4.445 NMAC and submits a written report in accordance with 20.3.4.454 NMAC;

G. the licensee or registrant records the best estimate of the dose resulting from the planned special exposure in the individual's record and informs the individual, in writing, of the dose within 30 days from the date of the planned special exposure; the dose from planned special exposures shall not be considered in controlling future occupational dose of the individual pursuant to Subsection A of 20.3.4.405 NMAC but shall be included in evaluations required by Subsections D and E of this section.

[20.3.4.410 NMAC - Rp, 20.3.4.410 NMAC, 4/30/2009]

20.3.4.411 OCCUPATIONAL DOSE LIMITS FOR MINORS: The annual occupational dose limits for minors are 10 percent of the annual occupational dose limits specified for adult workers in 20.3.4.405 NMAC.

[20.3.4.411 NMAC - Rp, 20.3.4.411 NMAC, 4/30/2009]

20.3.4.412 DOSE EQUIVALENT TO AN EMBRYO/FETUS:

A. The licensee or registrant shall ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 millisieverts) (see 20.3.4.446 NMAC for recordkeeping requirements).

B. The licensee or registrant shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in Subsection A of this section.

C. The dose equivalent to the embryo/fetus is the sum of:

(1) the dose equivalent to the embryo/fetus resulting from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman; and

(2) the deep dose equivalent that is most representative of the dose to the embryo/fetus from external radiation, that is, in the mother's lower torso region:

(a) if multiple measurements have not been made, assignment of the highest deep dose equivalent for the declared pregnant woman shall be the dose to the embryo/fetus, in accordance with Subsection C of 20.3.4.405 NMAC; or

(b) if multiple measurements have been made, assignment of the deep dose equivalent for the declared pregnant woman from the individual monitoring device which is most representative of the dose to the embryo/fetus shall be the dose to the embryo/fetus; assignment of the highest deep dose equivalent

for the declared pregnant woman to the embryo/fetus is not required unless that dose is also the most representative deep dose equivalent for the region of the embryo/fetus.

D. If the dose equivalent to the embryo/fetus is found to have exceeded 0.5 rem (5 millisieverts), or is within 0.05 rem (0.5 millisievert) of this dose, by the time the woman declares the pregnancy to the licensee or registrant, the licensee or registrant shall be deemed to be in compliance with Subsection A of this section if the additional dose equivalent to the embryo/fetus does not exceed 0.05 rem (0.5 millisievert) during the remainder of the pregnancy.

[20.3.4.412 NMAC - Rp, 20.3.4.412 NMAC, 4/30/2009]

20.3.4.413 DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC:

A. Each licensee or registrant shall conduct operations so that:

(1) the total effective dose equivalent to individual members of the public from the licensed or registered operation does not exceed 0.1 rem (1 millisievert) in a year, exclusive of the dose contributions from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released under Subsection I of 20.3.7.703 NMAC, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with 20.3.4.435 NMAC; and

(2) the dose in any unrestricted area from external sources, exclusive of dose contributions from patients administered radioactive material and released under Subsection I of 20.3.7.703 NMAC, does not exceed 0.002 rem (0.02 millisievert) in any one hour.

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

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

(1) demonstration of the need for and the expected duration of operations in excess of the limit in Subsection A of this section;

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

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

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

E. The department 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.

F. Notwithstanding Paragraph (1) of Subsection A of this section, a licensee may permit visitors to an individual who cannot be released, under Subsection I of 20.3.7.703 NMAC, to receive a radiation dose greater than 0.1 rem (1 millisievert) if:

(1) the radiation dose received does not exceed 0.5 rem (5 millisieverts); and

(2) the authorized user, as defined in 20.3.7 NMAC, has determined before the visit that it is appropriate.

[20.3.4.413 NMAC - Rp, 20.3.4.413 NMAC, 4/30/2009]

20.3.4.414 COMPLIANCE WITH DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC:

A. The licensee or registrant shall make or cause to be made surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits in 20.3.4.413 NMAC for individual members of the public.

B. A licensee or registrant shall show compliance with the annual dose limit in 20.3.4.413 NMAC by:

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

(2) demonstrating that:

(a) the annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in table II of 20.3.4.461 NMAC; and

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

C. Upon approval from the department, the licensee or registrant may adjust the effluent concentration values in table II of 20.3.4.461 NMAC for members of the public, to take into account the actual physical and chemical characteristics of the effluents, such as, aerosol size distribution, solubility, density, radioactive decay equilibrium and chemical form.

[20.3.4.414 NMAC - Rp, 20.3.4.414 NMAC, 4/30/2009]

20.3.4.415 TESTING FOR LEAKAGE OR CONTAMINATION OF SEALED SOURCES:

A. The licensee in possession of any sealed source shall assure that:

(1) each sealed source, except as specified in Subsection B of this section, is tested for leakage or contamination and the test results are received before the sealed source is put into use unless the licensee has a certificate from the transferor indicating that the sealed source was tested within the frequencies specified in Paragraphs (2) and (3) of this subsection, before transfer to the licensee;

(2) each sealed source that is not designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed 6 months, or at alternative intervals specified by the source manufacturer and as approved by the department, NRC or an agreement state;

(3) each sealed source that is designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed 3 months, or at alternative intervals specified by the source manufacturer and as approved by the department, NRC or an agreement state;

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

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

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

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

B. A licensee need not perform tests for leakage or contamination on the following sealed sources:

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

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

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

(4) sealed sources containing only hydrogen-3;

(5) seeds of iridium-192 encased in nylon ribbon; and

(6) sealed sources, except teletherapy and brachytherapy sources, which are not being used and identified as in storage; however, the licensee shall test each such sealed source for leakage or contamination and receive the test results before any use or transfer of the source unless it has been tested for leakage or contamination within such frequency as specified in Paragraphs (2) and (3) of Subsection A of this section before the date of use or transfer.

C. Tests for leakage or contamination from sealed sources shall be performed by persons specifically authorized by the department.

D. Test results shall be kept in units of becquerel or microcurie and maintained for inspection by the department. Records of test results for sealed sources shall be made pursuant to 20.3.4.443 NMAC.

E. The following shall be considered evidence that a sealed source is leaking:

(1) the presence of 0.005 microcuries (185 becquerels) or more of removable contamination on any test sample;

(2) leakage of 0.001 microcuries (37 becquerels) of radon-222 per 24 hours for brachytherapy sources manufactured to contain radium; and

(3) the presence of removable contamination resulting from the decay of 0.005 microcuries (185 becquerels) or more of radium.

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

G. Reports of test results for leaking or contaminated sealed sources shall be made pursuant to 20.3.4.458 NMAC.

[20.3.4.415 NMAC - Rp, 20.3.4.415 NMAC, 4/30/2009]

20.3.4.416 GENERAL REQUIREMENTS FOR SURVEY AND MONITORING:

A. Each licensee or registrant shall make, or cause to be made, surveys of areas, including the subsurface, that:

(1) may be necessary to demonstrate compliance with this part; and

(2) are necessary under the circumstances to evaluate:

(a) the magnitude and extent of radiation levels;

(b) concentrations or quantities of radioactive material and residual radioactivity;

(c) the potential radiological hazards of the radiation levels and residual radioactivity detected; and

(d) notwithstanding 10 CFR 20 or equivalent state regulations of this part, 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 the applicable regulations in 10 CFR parts 30, 40, 50, 70, or 72.30 or equivalent state regulations.

B. The licensee or registrant shall ensure that instruments and equipment used for quantitative radiation measurements (e.g. dose rate and effluent monitoring) are calibrated at intervals not to exceed 12 months, except when a more frequent interval is specified in another applicable part of this chapter or in a license condition.

C. All personnel dosimeters (except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to the extremity) that require processing to determine the radiation dose and that are used by licensees and registrants to comply with 20.3.4.405 NMAC, with other applicable provisions of this chapter or with conditions specified in a license or registration shall be processed and evaluated by a dosimetry processor:

(1) holding current personnel dosimetry accreditation from the national voluntary laboratory accreditation program (NVLAP) of the national institute of standards and technology (NIST); and

(2) approved in this accreditation process for the type of radiation or radiations included in the national voluntary laboratory accreditation program (NVLAP) program that most closely approximates the type of radiation or radiations for which the individual wearing the dosimeter is monitored.

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

[20.3.4.416 NMAC - Rp, 20.3.4.416 NMAC, 4/30/2009; A, 6/13/2017]

20.3.4.417 CONDITIONS REQUIRING INDIVIDUAL MONITORING OF EXTERNAL AND INTERNAL OCCUPATIONAL DOSE: Each licensee or registrant shall monitor exposures from sources of radiation at levels sufficient to demonstrate compliance with the occupational dose limits of this part. As a minimum the following requirements shall be met.

A. Each licensee or registrant shall monitor occupational exposure to radiation from licensed and unlicensed radiation sources under the control of the licensee or 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 Subsection A of 20.3.4.405 NMAC;

(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 millisievert), a lens dose equivalent in excess of 0.15 rem (1.5 millisieverts), or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem (5 millisieverts);

(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 millisievert) (note: all of the occupational doses in Subsection A of 20.3.4.405 NMAC continue to be applicable to the declared pregnant worker as long as the embryo/fetus dose limit is not exceeded);

(4) individuals entering a high or very high radiation area; and

(5) individuals working with medical fluoroscopic equipment:

(a) an individual monitoring device used for the dose to an embryo/fetus of a declared pregnant woman, pursuant to Subsection A of 20.3.4.412 NMAC, shall be located under the protective apron at the waist;

(b) an individual monitoring device used for eye dose equivalent shall be located at the neck, or an unshielded location closer to the eye, outside the protective apron; and

(c) when only one individual monitoring device is used to determine the effective dose equivalent for external radiation pursuant to Paragraph (2) of Subsection C of 20.3.4.405 NMAC, it shall be located at the neck outside the protective apron; when a second individual monitoring device is used, for the same purpose, it shall be located under the protective apron at the waist; the second individual monitoring device is required for a declared pregnant woman.

B. Each licensee or registrant shall monitor (see 20.3.4.408 NMAC) the occupational intake of radioactive material by and assess the committed effective dose equivalent to:

(1) adults likely to receive, in 1 year, an intake in excess of 10 percent of the applicable ALI(s) in columns 1 and 2 of table I of 20.3.4.461 NMAC;

(2) minors likely to receive, in 1 year, a committed effective dose equivalent in excess of 0.1 rem (1 millisievert); and

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

C. Each licensee or registrant shall ensure that individuals who are required to monitor occupational doses in accordance with Subsection A of this section wear individual monitoring devices as follows:

(1) an individual monitoring device used for monitoring the dose to the whole body shall be worn at the unshielded location of the whole body likely to receive the highest exposure; when a protective apron is worn, the location of the individual monitoring device is typically at the neck (collar); or

(2) an individual monitoring device used for monitoring the dose to an embryo/fetus of a declared pregnant woman, pursuant to Subsection A of 20.3.4.412 NMAC, shall be located at the waist under any protective apron being worn by the woman; or

(3) an individual monitoring device used for monitoring the eye dose equivalent, to demonstrate compliance with Subparagraph (a) of Paragraph (2) of Subsection A of 20.3.4.405 NMAC, shall be located at the neck (collar), outside any protective apron being worn by the monitored individual, or at an unshielded location closer to the eye; or

(4) an individual monitoring device used for monitoring the dose to the extremities, to demonstrate compliance with Subparagraph (b) of Paragraph (2) of Subsection A of 20.3.4.405 NMAC, shall be worn on the extremity likely to receive the highest exposure; each individual monitoring device shall be oriented to measure the highest dose to the extremity being monitored.

[20.3.4.417 NMAC - Rp, 20.3.4.417 NMAC, 4/30/2009]

20.3.4.418 CONTROL OF ACCESS TO HIGH RADIATION AREAS:

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

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

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

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

B. In place of the controls required by Subsection A of this section for a high radiation area, the licensee or registrant may substitute continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

C. The licensee or registrant may apply to the department for approval of alternative methods for controlling access to high radiation areas.

D. The licensee or registrant shall establish the controls required by Subsections A and C of this section in a way that does not prevent individuals from leaving a high radiation area.

E. The licensee or registrant is not required to control each entrance or access point to a room or other area that is a high radiation area solely because of the presence of radioactive materials prepared for transport, and packaged and labeled in accordance with the regulations of the DOT provided that:

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

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

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

[20.3.4.418 NMAC - Rp, 20.3.4.418 NMAC, 4/30/2009]

20.3.4.419 CONTROL OF ACCESS TO VERY HIGH RADIATION AREAS: In addition to the requirements in 20.3.4.418 NMAC, the licensee or registrant shall institute measures to ensure that an individual is not able to gain unauthorized or inadvertent access to areas in which radiation levels could be encountered at 500 rads (5 grays) or more in 1 hour at 1 meter from a source of radiation or any surface through which the radiation penetrates.

[20.3.4.419 NMAC - Rp, 20.3.4.419 NMAC, 4/30/2009]

20.3.4.420 CONTROL OF ACCESS TO VERY HIGH RADIATION AREAS - IRRADIATORS: In addition to the requirements in 20.3.4.419 NMAC, the licensee shall comply with the requirements specified in 20.3.15 NMAC for access control.

[20.3.4.420 NMAC - Rp, 20.3.4.420 NMAC, 4/30/2009]

20.3.4.421 USE OF PROCESS OR OTHER ENGINEERING CONTROLS: The licensee or registrant shall use, to the extent practicable, process or other engineering controls, such as, containment, decontamination or ventilation, to control the concentrations of radioactive material in air.

[20.3.4.421 NMAC - Rp, 20.3.4.421 NMAC, 4/30/2009]

20.3.4.422 USE OF OTHER CONTROLS:

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

(1) control of access;

(2) limitation of exposure times;

(3) use of respiratory protection equipment; or

(4) other controls.

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

[20.3.4.422 NMAC - Rp, 20.3.4.422 NMAC, 4/30/2009]

20.3.4.423 USE OF INDIVIDUAL RESPIRATORY PROTECTION EQUIPMENT: The requirements of this section apply to licensees and registrants who assign or permit the use of respiratory protection equipment to limit the intake of radioactive material.

A. The licensee or registrant shall use only respiratory protection equipment that is tested and certified by the national institute for occupational safety and health (NIOSH) except as otherwise noted in this part.

B. If the licensee or registrant wishes to use equipment that has not been tested or certified by national institute for occupational safety and health (NIOSH), or for which there is no schedule for testing or certification, the licensee or registrant shall submit an application to the department for authorized use of this equipment except as provided in this part. The application shall include evidence that the material and performance characteristics of the equipment are capable of providing the proposed degree of protection under anticipated conditions of use. This shall be demonstrated either by testing made by the licensee or registrant, or on the basis of reliable test information.

C. The licensee or registrant 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 necessary, to evaluate actual intakes;

(3) testing of respirators for operability (user seal check for face sealing devices and functional check for others) immediately prior to each use;

(4) written procedures regarding:

(a) monitoring, including air sampling and bioassays;

(b) supervision and training of respirator users;

(c) fit testing;

(d) respirator selection;

(e) breathing air quality;

(f) inventory and control;

(g) storage, issuance, maintenance, repair, testing and quality assurance of respiratory protection equipment;

(h) recordkeeping; and

(i) relief from respirator use and limitations on periods of respirator use;

(5) determination by a physician that the individual user is medically fit to use respiratory protection equipment; before:

(a) the initial fitting of a face sealing respirator;

(b) before the first field use of non-face sealing respirators; and

(c) either every 12 months thereafter, or periodically at a frequency determined by a physician;

(6) fit testing, with fit factor greater than or equal to 10 times the APF for negative pressure devices, and a fit factor that is greater than or equal to 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 shall be performed with the facepiece operating in the negative pressure mode.

D. The licensee or registrant 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 or registrant shall also consider limitations appropriate to the type and mode of use. When selecting respiratory devices the licensee or registrant shall provide for vision correction, adequate communication, low temperature work environments and the concurrent use of other safety or radiological protection equipment. The licensee or registrant shall use equipment in such a way as not to interfere with the proper operation of the respirator.

F. 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.

G. 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 at 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 percent;

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

(3) carbon monoxide content of 10 parts per million (ppm) or less;

(4) carbon dioxide content of 1,000 parts per million (ppm) or less; and

(5) lack of noticeable odor.

H. The licensee or registrant 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.

I. 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.

J. Application for Use of Higher Assigned Protection Factors. The licensee or registrant shall obtain authorization from the department before using assigned protection factors in excess of those specified in 20.3.4.460 NMAC. The department may authorize a licensee or registrant to use higher assigned 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.

[20.3.4.423 NMAC - Rp, 20.3.4.423 NMAC, 4/30/2009]

20.3.4.424 FURTHER RESTRICTIONS ON THE USE OF RESPIRATORY PROTECTION EQUIPMENT: The department may impose restrictions in addition to those in sections 20.3.4.422 NMAC, 20.3.4.423 NMAC and 20.3.4.460 NMAC, in order to:

A. ensure that the respiratory protection program of the licensee or registrant is adequate to limit doses to individuals from intakes of airborne radioactive materials consistent with maintaining total effective dose equivalent ALARA; and

B. limit the extent to which a licensee or registrant may use respiratory protection equipment instead of process or other engineering controls.

[20.3.4.424 NMAC - Rp, 20.3.4.424 NMAC, 4/30/2009]

20.3.4.425 SECURITY AND CONTROL OF LICENSED OR REGISTERED SOURCES OF RADIATION:

A. The licensee shall secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas. The licensee possessing category 1 and category 2 quantities of radioactive materials shall comply with 10 CFR 37. The licensee shall comply with 10 CFR 37 except as follows:

(1) any reference to the commission or NRC shall be deemed a reference to the department;

(2) 10 CFR 37.5 definitions of agreement state, byproduct material, commission and person shall not be applicable;

(3) 10 CFR 37.7, 10 CFR 37.9, 10 CFR 37.11(a) and (b), 10 CFR 37.13, 10 CFR 37.27(c), 10 CFR 37.71, 10 CFR 37.105, and 10 CFR 37.107 shall not be applicable; and

(4) for any reporting or notification requirements that the licensee must follow in 10 CFR 37.45, 10 CFR 37.57, 10 CFR 37.77(a) through (d), and 10 CFR 37.81, the licensee shall use the following address when applicable: New Mexico environment department/RCB, P.O. Box 5469, Santa Fe, NM 87502-5469 address information.

B. The licensee shall control and maintain constant surveillance, and use devices or administrative procedures to prevent unauthorized access to licensed radioactive material that is in a controlled or unrestricted area and that is not in storage.

C. The registrant shall secure registered radiation machines from unauthorized removal.

D. The registrant shall use devices or administrative procedures to prevent unauthorized use of registered radiation machines.

[20.3.4.425 NMAC - Rp, 20.3.4.425 NMAC, 4/30/2009; A, 8/10/2021]

20.3.4.426 RADIOLOGICAL CRITERIA FOR LICENSE TERMINATION:

A. General provisions and scope.

(1) The criteria in this part apply to the decommissioning of any facility licensed under this chapter as well as other facilities subject to the department's jurisdiction under the Act. For low-level waste disposal facilities licensed under 20.3.13 NMAC, the criteria apply only to ancillary surface facilities that support radioactive waste disposal activities.

(2) The criteria in this section do not apply to sites which:

(a) have been decommissioned prior to the effective date of the rule; or,

(b) have previously submitted and received department approval on a license termination plan or decommissioning plan that is compatible with applicable department criteria.

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

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

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

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

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

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

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

(a) funds placed into a trust segregated from the licensee's assets and outside the licensee's administrative control, and in which the adequacy of the trust funds is to be assessed based on an assumed annual one percent real rate of return on investment;

(b) surety method, insurance, or other guarantee method as described in Paragraph (2) of Subsection F of 20.3.3.311 NMAC;

(c) a statement of intent in the case of federal, state, or local government licensees, as described in Paragraph (4) of Subsection F of 20.3.3.311 NMAC; or

(d) when a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity;

(4) the licensee has submitted a decommissioning plan or license termination plan to the department indicating the licensee's intent to decommission in accordance with Subsection E of 20.3.3.318 NMAC, and specifying that the licensee intends to decommission by restricting use of the site; the licensee shall document in the license termination plan or decommissioning plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated, as appropriate, following analysis of that advice:

(a) licensees proposing to decommission by restricting use of the site shall seek advice from such affected parties regarding the following matters concerning the proposed decommissioning:

(i) whether provisions for institutional controls proposed by the licensee: **1)** will provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 millirems (0.25 millisievert) TEDE per year; **2)** will be enforceable; and **3)** will not impose undue burdens on the local community or other affected parties;

(ii) whether the licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site;

(b) in seeking advice on the issues identified in Subparagraph (a) of this paragraph, the licensee shall provide for:

(i) participation by representatives of a broad cross section of community interests who may be affected by the decommissioning;

(ii) an opportunity for a comprehensive, collective discussion on the issues by the participants represented; and

(iii) a publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues; and

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

(a) 100 millirems (1 millisievert) per year; or

(b) 500 millirems (5 millisieverts) per year provided the licensee:

(i) demonstrates that further reductions in residual radioactivity necessary to comply with the 100 millirems per year (1 millisievert per year) value of Subparagraph (a) of this paragraph are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm;

(ii) makes provisions for durable institutional controls; and

(iii) provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every five years to assure that the institutional controls remain in place as necessary to meet the criteria of Paragraph (2) of this subsection and to assume and carry out responsibilities for any necessary control and maintenance of those controls; acceptable financial assurance mechanisms are those in Paragraph (3) of this subsection.

D. Alternate Criteria for License Termination.

(1) The department may terminate a license using alternate criteria greater than the dose criterion of Subsection B of this section, Paragraph (2) of Subsection C of this section, and Item (i) of Subparagraph (a) of Paragraph (4) of Subsection C of this section, if the licensee:

(a) provides assurance that public health and safety would continue to be protected, and that it is unlikely that the dose from all man-made sources combined, other than medical, would be more than the 100 millirems per year (1 millisievert per year) limit of 20.3.4.413 NMAC, by submitting an analysis of possible sources of exposure;

(b) has employed to the extent practical restrictions on site use according to the provisions of Subsection C of this section in minimizing exposures at the site;

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

(d) has submitted a decommissioning plan or license termination plan to the department indicating the licensee's intent to decommission in accordance with Subsection E of 20.3.3.318 NMAC, and specifying that the licensee proposes to decommission by use of alternate criteria; the licensee shall document in the decommissioning plan or license termination plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and addressed, as appropriate, following analysis of that advice; in seeking such advice, the licensee shall provide for:

(i) participation by representatives of a broad cross section of community interests who may be affected by the decommissioning;

(ii) an opportunity for a comprehensive, collective discussion on the issues by the participants represented; and

(iii) a publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues.

(e) Has provided sufficient financial assurance in the form of a trust fund to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site.

(2) The use of alternate criteria to terminate a license requires the approval of the department after consideration of the department staff's recommendations that will address any comments provided by state and federal agencies and any public comments submitted pursuant to Subsection E of this section.

E. Public Notification and Public Participation. Upon the receipt of a license termination plan or decommissioning plan from the licensee, or a proposal by the licensee for release of a site pursuant to Subsection C or D of this section, or whenever the department deems such notice to be in the public interest, the department shall:

(1) notify and solicit comments from:

(a) local governments in the vicinity of the site and any Indian nation or other indigenous people that have treaty or statutory rights that could be affected by the decommissioning; and

(b) the EPA for cases where the licensee proposes to release a site pursuant to Subsection D of this section; and

(2) publish a notice in the state register and in a forum, such as local newspapers, letters to state or local organizations, or other appropriate forum, that is readily accessible to individuals in the vicinity of the site, and solicit comments from the public and affected parties; further, that the public notice may be published in any language when appropriate.

F. Minimization of contamination. Licensee shall, to the extent practical, conduct operations to minimize the introduction of residual radioactivity into the site, including the subsurface, in accordance with the existing radiation protection requirements in 20.3.4.404 NMAC and the radiological criteria for license termination in 20.3.4.426 NMAC.

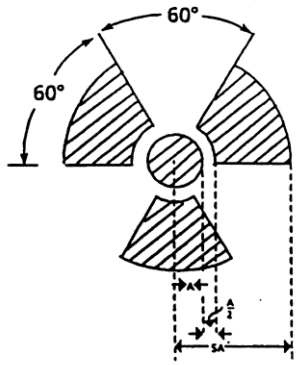
[20.3.4.426 NMAC - Rp, 20.3.4.426 NMAC, 4/30/2009; A, 6/13/2017]

20.3.4.427 CAUTION SIGNS:

A. Standard Radiation Symbol. Unless otherwise authorized by the department, the symbol prescribed by this section shall use the colors magenta, purple or black on yellow background. The symbol prescribed is the three-bladed design as follows:

(1) cross-hatched area is to be magenta, purple or black; and

(2) the background is to be yellow.



B. Exception to Color Requirements for Standard Radiation Symbol. Notwithstanding the requirements of Subsection A of this section, licensees or registrants are authorized to label sources, source holders or device components containing sources of radiation that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without a color requirement.

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

[20.3.4.427 NMAC - Rp, 20.3.4.427 NMAC, 4/30/2009]

20.3.4.428 POSTING REQUIREMENTS:

A. Posting of Radiation Areas. The licensee or registrant shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words “Caution, Radiation Area.”

B. Posting of High Radiation Areas. The licensee or registrant shall post each high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "Caution, High Radiation Area" or "Danger, High Radiation Area."

C. Posting of Very High Radiation Areas. The licensee or registrant shall post each very high radiation area with a conspicuous sign or signs bearing the radiation symbol and words "Grave Danger, Very High Radiation Area."

D. Posting of Airborne Radioactivity Areas. The licensee or registrant shall post each airborne radioactivity area with a conspicuous sign or signs bearing the radiation symbol and the words "Caution, Airborne Radioactivity Area" or "Danger, Airborne Radioactivity Area."

E. Posting of Areas or Rooms in Which Licensed or Registered Material is Used or Stored. The licensee or registrant shall post each area or room in which there is used or stored an amount of licensed or registered material exceeding 10 times the quantity of such material specified in 20.3.4.462 NMAC with a conspicuous sign or signs bearing the radiation symbol and the words "Caution, Radioactive Material" or "Danger, Radioactive Material."

[20.3.4.428 NMAC - Rp, 20.3.4.428 NMAC, 4/30/2009]

20.3.4.429 EXCEPTIONS TO POSTING REQUIREMENTS:

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

(1) the sources of radiation are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to sources of radiation in excess of the limits established in this part; and

(2) the area or room is subject to the licensee's or registrant's control.

B. Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs pursuant to 20.3.4.428 NMAC provided that the patient could be released from licensee control pursuant to Subsection I of 20.3.7.703 NMAC.

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

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

E. Rooms in hospitals or clinics that are used for teletherapy are exempt from the requirement to post caution signs under 20.3.4.428 NMAC if:

(1) access to the room is controlled pursuant to Subsection E of 20.3.7.711 NMAC; and

(2) personnel in attendance take necessary precautions to prevent the inadvertent exposure of workers, other patients and members of the public to radiation in excess of the limits established in this part.

[20.3.4.429 NMAC - Rp, 20.3.4.429 NMAC, 4/30/2009]

20.3.4.430 LABELING CONTAINERS AND RADIATION MACHINES:

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

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

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

[20.3.4.430 NMAC - Rp, 20.3.4.430 NMAC, 4/30/2009]

20.3.4.431 EXEMPTIONS TO LABELING REQUIREMENTS: A licensee is not required to label:

A. containers holding licensed material in quantities less than the quantities listed in 20.3.4.462 NMAC;

B. containers holding licensed material in concentrations less than those specified in table III of 20.3.4.461 NMAC;

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 part;

D. containers when they are in transport and packaged and labeled in accordance with the regulations of the DOT (labeling of packages containing radioactive materials is required by the 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 CFR 173.403 (m) and (w) and 173.421-424);

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

F. installed manufacturing or process equipment, such as piping and tanks.

[20.3.4.431 NMAC - Rp, 20.3.4.431 NMAC, 4/30/2009]

20.3.4.432 PROCEDURES FOR RECEIVING AND OPENING PACKAGES:

A. Each licensee who expects to receive a package containing quantities of radioactive material in excess of a type A quantity, as defined in Subsection A of 20.3.3.306 NMAC, incorporating 10 CFR 71.4 and Appendix A of 10 CFR 71, shall make arrangements to receive:

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

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

B. Each licensee shall:

(1) monitor the external surfaces of a labeled (with a radioactive white I, yellow II or yellow III label as specified in DOT regulations 49 CFR 172.403 and 172.436-440) package for radioactive contamination unless the package contains only radioactive material in the form of gas or in special form as defined in 10 CFR 71.4;

(2) 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 Subsection A of 20.3.3.306 NMAC, incorporating 10 CFR 71.4 and Appendix A to 10 CFR 71; and

(3) monitor all packages known to contain radioactive material for radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet or damaged.

C. The licensee shall perform the monitoring required by Subsection B of this section as soon as practicable after receipt of the package, but not later than 3 hours after the package is received at the licensee's facility if it is received during the licensee's normal working hours. If a package is received after working hours, the package shall be monitored no later than three hours from the beginning of the next working day.

D. The licensee shall immediately notify the final delivery carrier and, by telephone and written communication which can include e-mail, telegram, mailgram or facsimile, the department when:

(1) removable radioactive surface contamination exceeds the limits of 20.3.3.306 NMAC, incorporating 10 CFR 71.87(i); or

(2) external radiation levels exceed the limits of 20.3.3.306 NMAC, incorporating 10 CFR 71.47.

E. Each licensee shall:

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

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

F. Licensees transferring special form sources in vehicles owned or operated by the licensee to and from a work site are exempt from the contamination monitoring requirements of Subsection B of this section, but are not exempt from the survey requirement in Subsection B of this section for measuring radiation levels that ensures that the source is still properly lodged in its shield.

[20.3.4.432 NMAC - Rp, 20.3.4.432 NMAC, 4/30/2009]

20.3.4.433 WASTE DISPOSAL - GENERAL REQUIREMENTS:

A. A licensee shall dispose of licensed material only:

(1) by transfer to an authorized recipient as provided in 20.3.4.438 NMAC or 20.3.3 NMAC, or to the DOE;

(2) by decay in storage;

(3) by release in effluents within the limits in 20.3.4.413 NMAC; or

(4) as authorized pursuant to 20.3.4.434 NMAC, 20.3.4.435 NMAC, 20.3.4.436 NMAC or 20.3.4.437 NMAC and in accordance with 20.3.4.439 NMAC.

B. A person shall be specifically licensed to receive waste containing licensed material from other persons for:

(1) treatment prior to disposal;

(2) treatment or disposal by incineration;

(3) decay in storage;

(4) disposal at a land disposal facility licensed pursuant to 20.3.13 NMAC;

(5) storage until transferred to a storage or disposal facility authorized to receive the waste; or

(6) disposal at a geologic repository under 10 CFR 60 or 10 CFR 63, specifically licensed by NRC.

[20.3.4.433 NMAC - Rp, 20.3.4.433 NMAC, 4/30/2009]

20.3.4.434 METHOD FOR OBTAINING APPROVAL OF PROPOSED DISPOSAL PROCEDURES: A licensee or applicant for a license may apply to the department for approval of proposed procedures, not otherwise authorized in these regulations, to dispose of licensed material generated in the licensee's activities. Each application shall include:

A. a description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal;

B. an analysis and evaluation of pertinent information on the nature of the environment;

C. the nature and location of other potentially affected licensed and unlicensed facilities; and

D. analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this part.

[20.3.4.434 NMAC - Rp, 20.3.4.434 NMAC, 4/30/2009]

20.3.4.435 DISPOSAL BY RELEASE INTO SANITARY SEWAGE:

A. A licensee may discharge licensed material into sanitary sewerage if each of the following conditions is satisfied:

(1) the material is readily soluble, or is readily dispersible biological material, in water;

(2) the quantity of licensed or other radioactive material that the licensee releases into the sewer in 1 month divided by the average monthly volume of water released into the sewer by the licensee does not exceed the concentration listed in table III of 20.3.4.461 NMAC;

(3) if more than one radionuclide is released, the following conditions must also be satisfied:

(a) the licensee shall determine the fraction of the limit in table III of 20.3.4.461 NMAC represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee or registrant into the sewer by the concentration of that radionuclide listed in table III of 20.3.4.461 NMAC; and

(b) the sum of the fractions for each radionuclide required by Subparagraph (a) of Paragraph (3) of this subsection does not exceed unity; and

(4) the total quantity of licensed or other radioactive material that the licensee releases into the sanitary sewerage in a year does not exceed 5 curies (185 gigabecquerels) of hydrogen-3, 1 curie (37 gigabecquerels) of carbon-14, and 1 curie (37 gigabecquerels) of all other radioactive materials combined.

B. Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in Subsection A of this section.

[20.3.4.435 NMAC - Rp, 20.3.4.435 NMAC, 4/30/2009]

20.3.4.436 TREATMENT OR DISPOSAL BY INCINERATION: A licensee may treat or dispose of licensed material by incineration only in the form and concentration specified in 20.3.4.437 NMAC or as specifically approved by the department pursuant to 20.3.4.434 NMAC.

[20.3.4.436 NMAC - Rp, 20.3.4.436 NMAC, 4/30/2009]

20.3.4.437 DISPOSAL OF SPECIFIC WASTES:

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

(1) 0.05 microcurie (1.85 kilobecquerels), or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and

(2) 0.05 microcurie (1.85 kilobecquerels), or less, of hydrogen-3 or carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.

B. A licensee shall not dispose of tissue pursuant to Paragraph (2) of Subsection A of this section in a manner that would permit its use either as food for humans or as animal feed.

C. Disposal of Certain Byproduct Material.

(1) Licensed material as defined in Paragraphs (3), (4) and (5) of the definition of *byproduct material* set forth in 20.3.1.7 NMAC may be disposed of in accordance with 20.3.13 NMAC even though it is not defined as low-level radioactive waste. Therefore, any licensed radioactive material being disposed of at a facility, or transferred for ultimate disposal at a facility licensed under 20.3.13 NMAC, must meet the requirements of 20.3.4.438 NMAC.

(2) A licensee may dispose of byproduct material as defined in Paragraphs (3), (4) and (5) of the definition of *byproduct material* set forth in 20.3.1.7 NMAC, at a disposal facility authorize 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.

D. The licensee shall maintain records of disposal in accordance with 20.3.4.448 NMAC.

[20.3.4.437 NMAC - Rp, 20.3.4.437 NMAC, 4/30/2009]

20.3.4.438 TRANSFER FOR DISPOSAL AND MANIFESTS:

A. The requirements of this section and 20.3.4.466 NMAC are designed to:

(1) control transfers of low-level radioactive waste by any waste generator, waste collector or waste processor licensee, as defined in 20.3.4.466 NMAC (appendix G), who ships low-level waste either directly or indirectly through a waste collector, waste broker or waste processor, to a licensed low-level waste land disposal facility (as defined in 20.3.13 NMAC);

(2) establish a manifest tracking system; and

(3) supplement existing requirements concerning transfers and record keeping for those wastes.

B. Each shipment of radioactive waste intended for disposal at a licensed land disposal facility must be accompanied by a shipment manifest, which contains all the information on the NRC's *uniform low-level radioactive waste manifest* (see 20.3.4.466 NMAC).

C. Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility must document the information required on NRC's *uniform low-level radioactive waste manifest* and transfer this recorded manifest information to the intended consignee in accordance with 20.3.4.466 NMAC.

D. Each shipment manifest must include a certification by the waste generator as specified in Subsection B of 20.3.4.466 NMAC.

E. Each person involved in the transfer for disposal and disposal of waste, including the waste generator, waste collector, waste processor and disposal facility operator, shall comply with the requirements specified in Subsection C of 20.3.4.466 NMAC.

F. Any licensee shipping byproduct material as defined in Paragraphs (3), (4) and (5) of the definition of *byproduct material* set forth in 20.3.4.7 NMAC intended for ultimate disposal at a land disposal facility licensed under 20.3.13 NMAC must document the information required on the NRC's *uniform low-level radioactive waste manifest* and transfer this recorded manifest information to the intended consignee in accordance with 20.3.4.466 NMAC.

[20.3.4.438 NMAC - Rp, 20.3.4.438 NMAC, 4/30/2009]

20.3.4.439 COMPLIANCE WITH ENVIRONMENTAL AND HEALTH PROTECTION REGULATIONS: Nothing in sections 20.3.4.433 NMAC, 20.3.4.434 NMAC, 20.3.4.435 NMAC, 20.3.4.436 NMAC, 20.3.4.437 NMAC or 20.3.4.438 NMAC relieves the licensee from complying with other applicable federal, state and local regulations governing any other toxic or hazardous properties of materials that may be disposed of under these sections.

[20.3.4.439 NMAC - Rp, 20.3.4.439 NMAC, 4/30/2009]

20.3.4.440 RECORDS - GENERAL PROVISIONS:

A. Each licensee or 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 this part.

B. In the records required by this part, the licensee or registrant may record quantities in SI units in parentheses following each of the units specified in Subsection A of this section. However, all quantities must be recorded as stated in Subsection A of this section.

C. Notwithstanding the requirements of Subsection A of this section, when recording information on shipment manifests, as required in Subsection B of 20.3.4.438 NMAC, information must be recorded in the international system of units (SI) or in SI and the units as specified in Subsection A of this section.

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

[20.3.4.440 NMAC - Rp, 20.3.4.440 NMAC, 4/30/2009; A, 6/30/2011]

20.3.4.441 RECORDS OF RADIATION PROTECTION PROGRAMS:

A. Each licensee or registrant shall maintain records of the radiation protection program, including:

(1) the provisions of the program; and

(2) audits and other reviews of program content and implementation.

B. The licensee or registrant shall retain the records required by Paragraph (1) of Subsection A of this section until the department terminates each pertinent license or registration requiring the record. The licensee or registrant shall retain the records required by Paragraph (2) of Subsection A of this section for 3 years after the record is made.

[20.3.4.441 NMAC - Rp, 20.3.4.441 NMAC, 4/30/2009]

20.3.4.442 RECORDS OF SURVEYS:

A. Each licensee or registrant shall maintain records showing the results of surveys and calibrations required by 20.3.4.416 NMAC and Subsection B of 20.3.4.432 NMAC. The licensee or registrant shall retain these records for 3 years after the record is made.

B. The licensee or registrant shall retain each of the following records until the department terminates each pertinent license or registration requiring the record:

(1) records of the results of surveys to determine the dose from external sources of radiation and used, in the absence of or in combination with individual monitoring data, in the assessment of individual dose equivalents;

(2) records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose;

(3) records showing the results of air sampling, surveys and bioassays required pursuant to Subparagraphs (a) and (b) of Paragraph (3) of Subsection A of 20.3.4.423 NMAC;

(4) records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment; and

(5) 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 20.3.3 NMAC as applicable.

[20.3.4.442 NMAC - Rp, 20.3.4.442 NMAC, 4/30/2009; A, 6/13/2017]

20.3.4.443 RECORDS OF TESTS FOR LEAKAGE OR CONTAMINATION OF SEALED SOURCES: Records of tests for leakage or contamination of sealed sources required by 20.3.4.415 NMAC shall be kept in units of microcurie or becquerel, and maintained for inspection by the department for 5 years after the records are made.

[20.3.4.443 NMAC - Rp, 20.3.4.443 NMAC, 4/30/2009]

20.3.4.444 RECORDS OF PRIOR OCCUPATIONAL DOSE:

A. The licensee or registrant shall retain the records of prior occupational dose and exposure history as specified in 20.3.4.409 NMAC on department form *cumulative occupational dose history* or equivalent until the department terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing department form *cumulative occupational dose history* or equivalent for 3 years after the record is made.

B. Upon termination of the license or registration, the licensee or registrant shall permanently store records on department form *cumulative occupational dose history* or equivalent, or shall make provision with the department for transfer to the department.

[20.3.4.444 NMAC - Rp, 20.3.4.444 NMAC, 4/30/2009]

20.3.4.445 RECORDS OF PLANNED SPECIAL EXPOSURES:

A. For each use of the provisions of 20.3.4.410 NMAC for planned special exposures, the licensee or registrant shall maintain records that describe:

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

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

(3) what actions were necessary;

(4) why the actions were necessary;

(5) what precautions were taken to assure that doses were maintained ALARA;

(6) what individual and collective doses were expected to result; and

(7) the doses actually received in the planned special exposure.

B. The licensee or registrant shall retain the records until the department terminates each pertinent license or registration requiring these records.

C. Upon termination of the license or registration, the licensee or registrant shall permanently store records on department form *cumulative occupational dose history* or equivalent, or shall make provision with the department for transfer to the department.

[20.3.4.445 NMAC - Rp, 20.3.4.445 NMAC, 4/30/2009]

20.3.4.446 RECORDS OF INDIVIDUAL MONITORING RESULTS:

A. Record Keeping Requirement. Each licensee or registrant shall maintain records of doses received by all individuals for whom monitoring was required pursuant to 20.3.4.417 NMAC, and records of doses received during planned special exposures, accidents and emergency conditions. Assessments of dose equivalent and records made using units in effect before May 3, 1995 (see 20.3.4 NMAC codified as of May 3, 1995) need not be changed. These records shall include, when applicable:

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

(2) the estimated intake of radionuclides (see 20.3.4.406 NMAC);

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

(4) the specific information used to assess the committed effective dose equivalent pursuant to Subsections A and C of 20.3.4.408 NMAC, and when required by 20.3.4.417 NMAC;

(5) the total effective dose equivalent when required by 20.3.4.406 NMAC; and

(6) the total of the deep dose equivalent and the committed dose to the organ receiving the highest total dose.

B. Record Keeping Frequency. The licensee or registrant shall make entries of the records specified in Subsection A of this section at intervals not to exceed 1 year.

C. Record Keeping Format. The licensee or registrant shall maintain the records specified in Subsection A of this section on department form *occupational dose record for a monitoring period*, in accordance with the instructions to the form, or in clear and legible records containing all the information required by the form.

D. 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, including the estimated date of conception, shall also be kept on file, but may be maintained separately from the dose records.

E. The licensee or registrant shall retain each required form or record until the department terminates each pertinent license or registration requiring the record.

F. Upon termination of the license or registration, the licensee or registrant shall permanently store records on department form *cumulative occupational dose history* or equivalent, or shall make provision with the department for transfer to the department.

G. Privacy Protection. The records required under this section should be protected from public disclosure because of their personal and private nature.

[20.3.4.446 NMAC - Rp, 20.3.4.446 NMAC, 4/30/2009]

20.3.4.447 RECORDS OF DOSE TO INDIVIDUAL MEMBERS OF THE PUBLIC:

A. Each licensee or registrant shall maintain records sufficient to demonstrate compliance with the dose limit for individual members of the public (see 20.3.4.413 NMAC).

B. The licensee or registrant shall retain the records required by Subsection A of this section until the department terminates each pertinent license or registration requiring the record.

[20.3.4.447 NMAC - Rp, 20.3.4.447 NMAC, 4/30/2009]

20.3.4.448 RECORDS OF WASTE DISPOSAL:

A. Each licensee shall maintain records of the disposal of licensed materials made pursuant to 20.3.4.434 NMAC, 20.3.4.435 NMAC, 20.3.4.436 NMAC, 20.3.4.437 NMAC and 20.3.3 NMAC.

B. Each registrant shall maintain records of the disposal of radiation machines.

C. The licensee or registrant shall retain the records required by Subsections A and B of this section until the department terminates each pertinent license or registration requiring the record.

[20.3.4.448 NMAC - Rp, 20.3.4.448 NMAC, 4/30/2009]

20.3.4.449 [RESERVED]

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

[20.3.4.450 NMAC - Rp, 20.3.4.450 NMAC, 4/30/2009]

20.3.4.451 REPORTS OF STOLEN, LOST OR MISSING LICENSED OR REGISTERED SOURCES OF RADIATION:

A. Telephone Reports. Each licensee shall report to the department by telephone as follows:

(1) immediately after its occurrence becomes known to the licensee, stolen, lost or missing licensed radioactive material in an aggregate quantity equal to or greater than 1,000 times the quantity specified in 20.3.4.462 NMAC under such circumstances that it appears to the licensee that an exposure could result to individuals in unrestricted areas; or

(2) within 30 days after its occurrence becomes known to the licensee, lost, stolen or missing licensed radioactive material in an aggregate quantity greater than 10 times the quantity 20.3.4.462 NMAC that is still missing;

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

B. Written Reports. Each licensee or registrant required to make a report pursuant to Subsection A of this section shall, within 30 days after making the telephone report, make a written report to the department setting forth the following information:

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

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

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

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

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

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

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

D. The licensee or registrant shall prepare any report filed with the department pursuant to this section so that names of individuals who may have received exposure to radiation are stated in a separate and detachable portion of the report.

[20.3.4.451 NMAC - Rp, 20.3.4.451 NMAC, 4/30/2009]

20.3.4.452 NOTIFICATION OF INCIDENTS:

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

(1) an individual to receive:

(a) a total effective dose equivalent of 25 rems (0.25 sievert) or more; or

(b) a lens dose equivalent of 75 rems (0.75 sievert) or more; or

(c) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent of 250 rads (2.5 grays) or more; or

(2) the release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the occupational ALI; this provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

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

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

(a) a total effective dose equivalent exceeding 5 rems (0.05 sievert); or

(b) a lens dose equivalent exceeding 15 rems (0.15 sievert); or

(c) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 50 rems (0.5 sievert); or

(2) the release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational ALI; this provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

C. The licensee or registrant shall prepare each report filed with the department pursuant to this section so that names of individuals who have received exposure to sources of radiation are stated in a separate and detachable portion of the report.

D. Licensees and registrants shall make the reports required by Subsections A and B of this section to the department by telephone, and shall confirm the initial contact by e-mail, telegram, mailgram or facsimile to the department.

E. The provisions of this section do not apply to doses that result from planned special exposures, provided such doses are within the limits for planned special exposures and are reported pursuant to 20.3.4.454 NMAC.

[20.3.4.452 NMAC - Rp, 20.3.4.452 NMAC, 4/30/2009]

20.3.4.453 REPORTS OF EXPOSURES, RADIATION LEVELS AND CONCENTRATIONS OF RADIOACTIVE MATERIAL EXCEEDING THE CONSTRAINTS OR LIMITS:

A. Reportable Events. In addition to the notification required by 20.3.4.452 NMAC, each licensee or registrant shall submit a written report within 30 days after learning of any of the following occurrences:

(1) incidents for which notification is required by 20.3.4.452 NMAC; or

(2) doses in excess of any of the following:

(a) the occupational dose limits for adults in 20.3.4.452 NMAC;

(b) the occupational dose limits for a minor in 20.3.4.411 NMAC;

(c) the limits for an embryo/fetus of a declared pregnant woman in 20.3.4.412 NMAC;

(d) the limits for an individual member of the public in 20.3.4.413 NMAC;

(e) the limit in the license or registration; or

(f) the ALARA constraints for air emissions established under Subsection D of 20.3.4.404 NMAC; or

(3) levels of radiation or concentrations of radioactive material in:

(a) a restricted area in excess of applicable limits in the license or registration; or

(b) an unrestricted area in excess of 10 times the applicable limit set forth in this part (20.3.4 NMAC) or in the license or registration, whether or not involving exposure of any individual in excess of the limits in 20.3.4.413 NMAC; or

(4) for licensees subject to the provisions of EPA generally applicable environmental radiation standards in 40 CFR 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

B. Content of Report.

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

(a) estimates of each individual's dose;

(b) the levels of radiation and concentrations of radioactive material involved;

(c) the cause of the elevated exposures, dose rates or concentrations; and

(d) corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, ALARA constraints, generally applicable environmental standards and associated license or registration conditions.

(2) Each report filed pursuant to Subsection A of this section shall include for each occupationally overexposed individual: the name, social security account number and date of birth. With respect to the limit for the embryo/fetus set forth in 20.3.4.412 NMAC, the identifiers should be those of the declared pregnant woman. The report shall be prepared so that this information is stated in a separate and detachable part of the report.

C. All licensees or registrants who make reports pursuant to Subsection A of this section shall submit the report in writing to the department.

[20.3.4.453 NMAC - Rp, 20.3.4.453 NMAC, 4/30/2009]

20.3.4.454 REPORTS OF PLANNED SPECIAL EXPOSURES: The licensee or registrant shall submit a written report to the department within 30 days following any planned special exposure conducted in accordance with 20.3.4.410 NMAC, informing the department that a planned special exposure was conducted and indicating the date the planned special exposure occurred and the information required by 20.3.4.445 NMAC.

[20.3.4.454 NMAC - Rp, 20.3.4.454 NMAC, 4/30/2009]

20.3.4.455 REPORTS OF TRANSACTIONS INVOLVING NATIONALLY TRACKED SOURCES: [~~Each licensee who manufactures, transfers, receives, disassembles or disposes of a nationally tracked source (as defined in 20.3.4.7 NMAC) shall complete and submit a *national source tracking transaction report* as specified in Subsections A through E of this section for each type of transaction.~~] The regulations of the U. S. Nuclear Regulatory Commission set forth in 10 CFR 20.2207 are hereby incorporated by reference.

[~~**A.** 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:~~

~~**(1)** the name, address and license number of the reporting licensee;~~

~~**(2)** the name of the individual preparing the report;~~

~~**(3)** the manufacturer, model and serial number of the source;~~

~~**(4)** the radioactive material in the source;~~

~~**(5)** the initial source strength in becquerels (curies) at the time of manufacture; and~~

~~**(6)** the manufacture date of the source.~~

~~**B.** 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:~~

~~**(1)** the name, address and license number of the reporting licensee;~~

~~**(2)** the name of the individual preparing the report;~~

~~**(3)** the name and license number of the recipient facility and the shipping address;~~

~~**(4)** the manufacturer, model and serial number of the source or, if not available, other information to uniquely identify the source;~~

~~**(5)** the radioactive material in the source;~~

~~**(6)** the initial or current source strength in becquerels (curies);~~

~~**(7)** the date for which the source strength is reported;~~

~~**(8)** the shipping date;~~

~~**(9)** the estimated arrival date; and~~

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~~**(10)** 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.~~

~~**C.** 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:~~

~~**(1)** the name, address and license number of the reporting licensee;~~

~~**(2)** the name of the individual preparing the report;~~

~~**(3)** the name, address and license number of the person that provided the source;~~

~~**(4)** the manufacturer, model and serial number of the source or, if not available, other information to uniquely identify the source;~~

~~**(5)** the radioactive material in the source;~~

~~**(6)** the initial or current source strength in becquerels (curies);~~

~~**(7)** the date for which the source strength is reported;~~

~~**(8)** the date of receipt; and~~

~~**(9)** for material received under a *uniform low-level radioactive waste manifest*, the waste manifest number and the container identification with the nationally tracked source.~~

~~**D.** 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:~~

~~**(1)** the name, address and license number of the reporting licensee;~~

~~**(2)** the name of the individual preparing the report;~~

~~**(3)** the manufacturer, model and serial number of the source or, if not available, other information to uniquely identify the source;~~

~~**(4)** the radioactive material in the source;~~

~~**(5)** the initial or current source strength in becquerels (curies);~~

~~**(6)** the date for which the source strength is reported; and~~

~~**(7)** the disassemble date of the source.~~

~~**E.** 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:~~

~~**(1)** the name, address and license number of the reporting licensee;~~

~~**(2)** the name of the individual preparing the report;~~

~~**(3)** the waste manifest number;~~

~~**(4)** the container identification with the nationally tracked source;~~

~~**(5)** the date of disposal; and~~

~~**(6)** the method of disposal.~~

~~**F.** The reports discussed in Subsections A through E of this section must be submitted 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:~~

~~**(1)** the on-line *national source tracking system*;~~

~~**(2)** electronically using a computer-readable format;~~

~~**(3)** by facsimile;~~

~~**(4)** by mail to the address on the *national source tracking transaction report* form (NRC form 748); or~~

~~**(5)** by telephone with follow-up by facsimile or mail.~~

~~**G.** 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 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 Subsections A through E of this section. 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.~~

~~**H.** Each licensee that possesses category 1 nationally tracked sources shall report its initial inventory of category 1 nationally tracked sources to the *national source tracking system* by January 31, 2009. Each licensee that possesses category 2 nationally tracked sources shall report its initial inventory of category 2 nationally tracked sources to the *national source tracking system* by January 31, 2009. The information may be submitted by using~~

~~any of the methods identified by Paragraph (1) through (4) of Subsection F of this section~~. ~~The initial inventory report must include the following information~~:

(1) ~~the name, address and license number of the reporting licensee~~;

(2) ~~the name of the individual preparing the report~~;

(3) ~~the manufacturer, model and serial number of each nationally tracked source or, if not available, other information to uniquely identify the source~~;

(4) ~~the radioactive material in the sealed source~~;

(5) ~~the initial or current source strength in becquerels (curies); and~~

(6) ~~the date for which the source strength is reported~~.]

[20.3.4.455 NMAC - N, 4/30/2009, XX/XX/24]

20.3.4.456 REPORTS OF INDIVIDUAL MONITORING:

A. This section applies to each person licensed or registered by the department to:

(1) possess or use sources of radiation for purposes of industrial radiography pursuant to 20.3.3 NMAC and 20.3.5 NMAC; or

(2) receive radioactive waste from other persons for disposal pursuant to 20.3.13 NMAC; or

(3) possess or use at any time, for processing or manufacturing for distribution pursuant to 20.3.3 NMAC or 20.3.7 NMAC, radioactive material in quantities exceeding any one of the following quantities:

TABLE 456.1

Radionuclide	Activity[1] Curies	Gigabecquerels
Cesium-137	1	37
Cobalt-60	1	37
Gold-198	100	3,700
Iodine-131	1	37
Iridium-192	10	370
Krypton-85	1,000	37,000
Promethium-147	10	370
Technetium-99m	1,000	37,000

Table 456.1 note: [1]the department may require as a license condition, or by rule, regulation or order pursuant to 20.3.1.111 NMAC, reports from licensees who are licensed to use radionuclides not on this list, in quantities sufficient to cause comparable radiation levels.

B. Each licensee or registrant in a category listed in Subsection A of this section shall submit an annual report of the results of individual monitoring carried out by the licensee or registrant for each individual for whom monitoring was required by 20.3.4.417 NMAC during that year. The licensee or registrant may include additional data for individuals for whom monitoring was provided but not required. The licensee or registrant shall use department form *occupational dose record for a monitoring period* or equivalent, or electronic media containing all the information required by department form *occupational dose record for a monitoring period*.

C. The licensee or registrant shall file the report required by Subsection B of this section, covering the preceding year, on or before April 30 of each year. The licensee or registrant shall submit the report to the department.

[20.3.4.456 NMAC - Rp, 20.3.4.456 NMAC, 4/30/2009]

20.3.4.457 NOTIFICATIONS AND REPORTS TO INDIVIDUALS OF EXCEEDING DOSE LIMITS:

A. Requirements for notification and reports to individuals of exposure to radiation or radioactive material are specified in 20.3.10.1003 NMAC.

B. When a licensee or registrant is required pursuant to the provisions of 20.3.4.453 NMAC or 20.3.4.454 NMAC to report to the department 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 a copy of the report submitted to the department to the individual. This report must be transmitted at a time not later than the transmittal to the department, and shall comply with the provisions of 20.3.10.1003 NMAC.

[20.3.4.457 NMAC - Rp, 20.3.4.457 NMAC, 4/30/2009; A, 6/30/2011]

20.3.4.458 REPORTS OF LEAKING OR CONTAMINATED SEALED SOURCES: The licensee shall file a report within 5 days with the department if the test for leakage or contamination required pursuant to

20.3.4.415 NMAC indicates a sealed source is leaking or contaminated. The report shall include the equipment involved, the test results and the corrective action taken.
[20.3.4.458 NMAC - Rp, 20.3.4.458 NMAC, 4/30/2009]

20.3.4.459 VACATING PREMISES: Each specific licensee shall, no less than 30 days before vacating or relinquishing possession or control of premises which may have been contaminated with radioactive material as a result of his activities, notify the department in writing of intent to vacate. When deemed necessary by the department, the licensee shall decontaminate the premises in such a manner as the department may specify.
[20.3.4.459 NMAC - Rp, 20.3.4.459 NMAC, 4/30/2009]

20.3.4.460 APPENDIX A - PROTECTION FACTORS FOR RESPIRATORS: The assigned protection factors specified in this section apply only in a respiratory protection program that meets the requirements of this part. 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 shall also comply with department of labor regulations. Radioactive contaminants for which the concentration values in column 3 of table I of 20.3.4.461 NMAC 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.

A. Air Purifying Respirators.

Configuration (air purifying respirators only)	**Operating Mode**	**Assigned Protection Factors**
Filtering facepiece disposable. (Refer to Paragraph (4) of this subsection.)	Negative Pressure	(Refer to Paragraph (4) of this subsection.)
Facepiece, half (Refer to paragraph (5) of this subsection.)	Negative Pressure	10
Facepiece, full	Negative Pressure	100
Facepiece, half	Power air-purifying respirators	50
Facepiece, full	Power air-purifying respirators	1000
Helmet/hood	Power air-purifying respirators	1000
Facepiece, loose-fitting	Power air-purifying respirators	25

(1) The assigned protection factors apply for protection against particulate only.

(2) 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.

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

(4) Special requirements and indications for filtering facepiece disposable respirators. Licensees may permit individuals to use this type of respirator who have not been medically screened or fit tested on the device provided that no credit is 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 20.3.4.423 NMAC apply. An assigned protection factor

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has not been assigned for these devices. However, an APF equal to 10 may be used if the licensee can demonstrate a fit factor of at least 100 by use of a validated or evaluated, qualitative or quantitative fit test.

(5) Special requirements and indications for half facepiece, negative pressure respirators. The requirements in this paragraph apply to the under-chin configuration only. No distinction is made in this section 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 part are met.

B. Air-Line Respirators (Atmosphere Supplying).

Configuration (air-line respirators only)	Operating Mode	Assigned Protection Factors
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	1000
Facepiece, loose-fitting	Continuous	25
Suit	Continuous	(Refer to Paragraph (3) of this subsection.)

(1) The assigned protection factors apply for protection against particulate, gases and vapors.

(2) 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.

(3) Special requirements and indications for suits. No national institute for occupational safety and health (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 (see 20.3.4.423 NMAC).

C. Self-Contained Breathing Apparatus "SCBA" (Atmosphere Supplying).

Configuration (SCBA respirators only)	Operating Mode	Assigned Protection Factors
Facepiece, full	Demand	100 (Refer to Paragraph (3) of this subsection.)
Facepiece, full	Pressure Demand	10,000 (Refer to Paragraph (4) of this subsection.)
Facepiece, full	Demand-Recirculating	100 (Refer to Paragraph (3) of this subsection.)
Facepiece, full	Positive Pressure Recirculating	10,000 (Refer to Paragraph (4) of this subsection.)

(1) The assigned protection factors apply for protection against particulate, gases and vapors.

(2) 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.

(3) Special requirements and indications for demand and demand-recirculating self-contained breathing apparatus (SCBA). The licensee should implement institutional controls to assure that these devices are not used in areas immediately dangerous to life or health (IDLH).

(4) Special requirements and indications for pressure demand and positive pressure recirculating self-contained breathing apparatus (SCBA). 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.

D. Combination Respirators.

Configuration (combination respirators only)	**Operating Mode and Assigned Protection Factors**
Any combination of air-purifying and atmosphere-supplying respirators	Assigned protection factor for type and mode of operation as listed above.

[20.3.4.460 NMAC - Rp, 20.3.4.460 NMAC, 4/30/2009]

20.3.4.461 APPENDIX B - ANNUAL LIMITS ON INTAKE (ALI) AND DERIVED AIR CONCENTRATIONS (DAC) OF RADIONUCLIDES FOR OCCUPATIONAL EXPOSURE; EFFLUENT CONCENTRATIONS; CONCENTRATIONS FOR RELEASE TO SANITARY SEWERAGE:

A. Introduction. For each radionuclide, table I of this section 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 micrometer, and for three classes (D,W and 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 columns 2 and 3 of table I of this section. Table II of this section provides concentration limits for airborne and liquid effluents released to the general environment. Table III of this section provides concentration limits for discharges to sanitary sewerage.

B. Note. The values in tables I, II and III of this section are presented in the E-notation. In this notation a value of 6E-02 represents a value of $6x10^{-2}$ or 0.06, 6E+2 represents $6x10^{2}$ or 600, and 6E+0 represents $6x10^{0}$ or 6.

C. Table I "Occupational Values".

(1) Note that the columns in table I of this section titled "Oral Ingestion ALI," "Inhalation ALI" and "DAC," are applicable to occupational exposure to radioactive material.

(2) The ALI's in this section are the annual intakes of given radionuclide by "reference man" which would result in either a committed effective dose equivalent of 5 rems (0.05 sievert) (stochastic ALI), or a committed dose equivalent of 50 rems (0.5 sievert) to an organ or tissue (non-stochastic ALI). The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of 5 rems (0.05 sievert). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, w_T. This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of w_T are listed under the definition of weighting factor in 20.3.4.7 NMAC. The non-stochastic ALI's were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

(3) 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 gastro-intestinal (GI) tract - stomach, small intestine, upper large intestine and lower large intestine - are to be treated as four separate organs.

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(4) 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.

(5) 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:

(a) LLI wall = lower large intestine wall;

(b) St wall = stomach wall;

(c) Blad wall = bladder wall; and

(d) Bone surf = bone surface.

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

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

DAC = ALI (in microcuries) / (2000 hours per working year x 60 minutes/hour x 20000 milliliter per minute) = (ALI / 2.4 x 10^9 ml) microcuries/milliliter, where 20000 milliliter is the volume of air breathed per minute at work by reference man under working conditions of light work.

(8) 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.

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

(10) 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 20.3.4.406 NMAC). 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.

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

D. Table II "Effluent Concentrations".

(1) The columns in table II of this section titled "effluents," "air" and "water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of 20.3.4.414 NMAC. The concentration values given in columns 1 and 2 of table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (0.5 millisievert).

(2) 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 of this subsection. For this reason, the DAC and airborne effluent limits are not always proportional as was the case in appendix A of part D of the eighth edition of volume I of the s*uggested state regulations for control of radiation*.

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

(4) For those radionuclides for which submersion, that is external dose, is limiting, the occupational DAC in column 3 of table I 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.

(5) 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 milliliter includes the following components: the factors of 50 and 2 described above and a factor of 7.3×10^5 milliliter which is the annual water intake of reference man.

(6) Note 2 of Subsection F of this section 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.

E. Table III "Releases to Sewers". The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in 20.3.4.435 NMAC. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^6 milliliter. The factor of 7.3×10^6 milliliter is composed of a factor of 7.3×10^5 milliliter, the annual water intake by reference man, and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by reference man during a year, would result in a committed effective dose equivalent of 0.05 rem (5 millisieverts).

List of Elements and their Corresponding Atomic Numbers

Element	Atomic Symbol	Atomic Number
Actinium	Ac	89
Aluminum	Al	13
Americium	Am	95
Antimony	Sb	51
Argon	Ar	18
Arsenic	As	33
Astatine	At	85
Barium	Ba	56
Berkelium	Bk	97
Beryllium	Be	4
Bismuth	Bi	83
Bromine	Br	35
Cadmium	Cd	48
Calcium	Ca	20
Californium	Cf	98
Carbon	C	6

List of Elements and their Corresponding Atomic Numbers		
Element	Atomic Symbol	Atomic Number
Cerium	Ce	58
Cesium	Cs	55
Chlorine	Cl	17
Chromium	Cr	24
Cobalt	Co	27
Copper	Cu	29
Curium	Cm	96
Dysprosium	Dy	66
Einsteinium	Es	99
Erbium	Er	68
Europium	Eu	63
Fermium	Fm	100
Fluorine	F	9
Francium	Fr	87
Gadolinium	Gd	64
Gallium	Ga	31
Germanium	Ge	32
Gold	Au	79
Hafnium	Hf	72
Holmium	Ho	67
Hydrogen	H	1
Indium	In	49
Iodine	I	53
Iridium	Ir	77
Iron	Fe	26
Krypton	Kr	36
Lanthanum	La	57
Lead	Pb	82
Lutetium	Lu	71
Magnesium	Mg	12
Manganese	Mn	25
Mendelevium	Md	101
Mercury	Hg	80
Molybdenum	Mo	42
Neodymium	Nd	60
Neptunium	Np	93
Nickel	Ni	28
Niobium	Nb	41
Nitrogen	N	7
Osmium	Os	76
Oxygen	O	8
Palladium	Pd	46
Phosphorus	P	15
Platinum	Pt	78
Plutonium	Pu	94
Polonium	Po	84
Potassium	K	19

Exhibit 2A

List of Elements and their Corresponding Atomic Numbers		
Element	Atomic Symbol	Atomic Number
Praseodymium	Pr	59
Promethium	Pm	61
Protactinium	Pa	91
Radium	Ra	88
Radon	Rn	86
Rhenium	Re	75
Rhodium	Rh	45
Rubidium	Rb	37
Ruthenium	Ru	44
Samarium	Sm	62
Scandium	Sc	21
Selenium	Se	34
Silicon	Si	14
Silver	Ag	47
Sodium	Na	11
Strontium	Sr	38
Sulfur	S	16
Tantalum	Ta	73
Technetium	Tc	43
Tellurium	Te	52
Terbium	Tb	65
Thallium	T1	81
Thorium	Th	90
Thulium	Tm	69
Tin	Sn	50
Titanium	Ti	22
Tungsten	W	74
Uranium	U	92
Vanadium	V	23
Xenon	Xe	54
Ytterbium	Yb	70
Yttrium	Y	39
Zinc	Zn	30
Zirconium	Zr	40

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
1	Hydrogen-3	Water, DAC includes skin absorption	8E+4	8E+4	2E-5	1E-7	1E-3	1E-2
		Gas (HT or T_2) Submersion[1]: Use above values as HT and T_2 oxidize in air and in the body to HTO.						
4	Beryllium-7	W, all compounds except those given for Y	4E+4	2E+4	9E-6	3E-8	6E-4	6E-3
		Y, oxides, halides, and nitrates	-	2E+4	8E-6	3E-8	-	-
4	Beryllium-10	W, see ^{7}Be	1E+3 LLI wall (1E+3)	2E+2 -	6E-8 -	2E-10 -	- 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
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 St wall (5E+4)	7E+4 -	3E-5 -	1E-7 -	- 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 8E+4	4E-5 3E-5	1E-7 1E-7	- -	- -
		Y, lanthanum fluoride						
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

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
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 LLI wall (3E+3)	2E+2	1E-7	3E-10	-	-
		W, see ^{31}Si	-	-	-	-	4E-5	4E-4
		Y, see ^{31}Si	-	1E+2	5E-8	2E-10	-	-
				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	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentration (µCi/ml)
16	Sulfur-35	Vapor	-	1E+4	6E-6	2E-8	-	-
		D, sulfides and sulfates	1E+4	2E+4	7E-6	2E-8	-	-
		except those given for W	LLI wall (8E+3)	-	-	-	1E-4	1E-3
		W, elemental sulfur,	6E+3	-	-	-	-	-
		sulfides of Sr, Ba, Ge,	-	2E+3	9E-7	3E-9	-	-
		Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi						
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 St wall (3E+4)	4E+4	2E-5	6E-8	-	-
		W, see ^{36}Cl	-	- 5E+4	- 2E-5	- 6E-8	3E-4 -	3E-3 -
17	Chlorine-39[2]	D, see ^{36}Cl	2E+4 St wall (4E+4)	5E+4	2E-5	7E-8	-	-
		W, see ^{36}Cl	-	- 6E+4	- 2E-5	- 8E-8	5E-4 -	5E-3 -
18	Argon-37	Submersion[1]	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion[1]	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion[1]	-	-	3E-6	1E-8	-	-
19	Potassium-40	D, all compounds	3E+2	4E+2	2E-7	6E-10	4E-6	4E-5

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
19	Potassium-42	D, all compounds	5E+3	5E+3	2E-6	7E-9	6E-5	6E-4
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44[2]	D, all compounds	2E+4 St wall (4E+4)	7E+4 -	3E-5 -	9E-8 -	- 5E-4	- 5E-3
19	Potassium-45[2]	D, all compounds	3E+4 St wall (5E+4)	1E+5 -	5E-5 -	2E-7 -	- 7E-4	- 7E-3
20	Calcium-41	W, all compounds	3E+3 Bone surf (4E+3)	4E+3 Bone surf (4E+3)	2E-6 -	- 5E-9	- 6E-5	- 6E-4
20	Calcium-45	W, all compounds	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
20	Calcium-47	W, all compounds	8E+2	9E+2	4E-7	1E-9	1E-5	1E-4
21	Scandium-43	Y, all compounds	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
21	Scandium-44m	Y, all compounds	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
21	Scandium-44	Y, all compounds	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
21	Scandium-46	Y, all compounds	9E+2	2E+2	1E-7	3E-10	1E-5	1E-4
21	Scandium-47	Y, all compounds	2E+3 LLI wall (3E+3)	3E+3 -	1E-6 -	4E-9 -	- 4E-5	- 4E-4
21	Scandium-48	Y, all compounds	8E+2	1E+3	6E-7	2E-9	1E-5	1E-4
21	Scandium-49[2]	Y, all compounds	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
22	Titanium-44	D, all compounds except those given for W and Y W, oxides, hydroxides, carbides, halides, and nitrates Y, SrTiO	3E+2 - -	1E+1 3E+1 6E+0	5E-9 1E-8 2E-9	2E-11 4E-11 8E-12	4E-6 - -	4E-5 - -
22	Titanium-45	D, see ^{44}Ti W, see ^{44}Ti Y, see ^{44}Ti	9E+3 - -	3E+4 4E+4 3E+4	1E-5 1E-5 1E-5	3E-8 5E-8 4E-8	1E-4 - -	1E-3 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
23	Vanadium-47[2]	D, all compounds except those given for W	3E+4 St wall (3E+4)	8E+4 -	3E-5 -	1E-7 -	- 4E-4	- 4E-3
		W, oxides, hydroxides, carbides, and halides	-	1E+5	4E-5	1E-7	-	-
23	Vandium-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	Vandium-49	D, see ^{47}V	7E+4 LLI wall (9E+4)	3E+4 Bone surf (3E+4)	1E-5 -	- 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 St Wall (4E+4)	9E+4 -	4E-5 -	1E-7 -	- 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 Bone surf (2E+4)	5E-6 -	- 3E-8	7E-4 -	7E-3 -
		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	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
25	Manganese-56	D, see ^{51}Mn W, see ^{51}Mn	5E+3 -	2E+4 2E+4	6E-6 9E-6	2E-8 3E-8	7E-5 -	7E-4 -
26	Iron-52	D, all compounds except those given for W W, oxides, hydroxides, and halides	9E+2 -	3E+3 2E+3	1E-6 1E-6	4E-9 3E-9	1E-5 -	1E-4 -
26	Iron-55	D, see ^{52}Fe W, see ^{52}Fe	9E+3 -	2E+3 4E+3	8E-7 2E-6	3E-9 6E-9	1E-4 -	1E-3 -
26	Iron-59	D, see ^{52}Fe W, see ^{52}Fe	8E+2 -	3E+2 5E+2	1E-7 2E-7	5E-10 7E-10	1E-5 -	1E-4 -
26	Iron-60	D, see ^{52}Fe W, see ^{52}Fe	3E+1 -	6E+0 2E+1	3E-9 8E-9	9E-12 3E-11	4E-7 -	4E-6 -
27	Cobalt-55	W, all compounds except those given for Y Y, oxides, hydroxides, halides, and nitrates	1E+3 -	3E+3 3E+3	1E-6 1E-6	4E-9 4E-9	2E-5 -	2E-4 -
27	Cobalt-56	W, see ^{55}Co Y, see ^{55}Co	5E+2 4E+2	3E+2 2E+2	1E-7 8E-8	4E-10 3E-10	6E-6 -	6E-5 -
27	Cobalt-57	W, see ^{55}Co Y, see ^{55}Co	8E+3 4E+3	3E+3 7E+2	1E-6 3E-7	4E-9 9E-10	6E-5 -	6E-4 -
27	Cobalt-58m	W, see ^{55}Co Y, see ^{55}Co	6E+4 -	9E+4 6E+4	4E-5 3E-5	1E-7 9E-8	8E-4 -	8E-3 -
27	Cobalt-58	W, see ^{55}Co Y, see ^{55}Co	2E+3 1E+3	1E+3 7E+2	5E-7 3E-7	2E-9 1E-9	2E-5 -	2E-4 -
27	Cobalt-60m[2]	W, see ^{55}Co Y, see ^{55}Co	1E+6 St wall (1E+6) -	4E+6 - 3E+6	2E-3 - 1E-3	6E-6 - 4E-6	- 2E-2 -	- 2E-1 -
27	Cobalt-60	W, see ^{55}Co Y, see ^{55}Co	5E+2 2E+2	2E+2 3E+1	7E-8 1E-8	2E-10 5E-11	3E-6 -	3E-5 -
27	Cobalt-61[2]	W, see ^{55}Co Y, see ^{55}Co	2E+4 2E+4	6E+4 6E+4	3E-5 2E-5	9E-8 8E-8	3E-4 -	3E-3 -
27	Cobalt-62m[2]	W, see ^{55}Co Y, see ^{55}Co	4E+4 St wall (5E+4) -	2E+5 - 2E+5	7E-5 - 6E-5	2E-7 - 2E-7	- 7E-4 -	- 7E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
28	Nickel-56	D, all compounds except those given for W W, oxides, hydroxides, and carbides Vapor	1E+3 - -	2E+3 1E+3 1E+3	8E-7 5E-7 5E-7	3E-9 2E-9 2E-9	2E-5 - -	2E-4 - -
28	Nickel-57	D, see ^{56}Ni W, see ^{56}Ni Vapor	2E+3 - -	5E+3 3E+3 6E+3	2E-6 1E-6 3E-6	7E-9 4E-9 9E-9	2E-5 - -	2E-4 - -
28	Nickel-59	D, see ^{56}Ni W, see ^{56}Ni Vapor	2E+4 - -	4E+3 7E+3 2E+3	2E-6 3E-6 8E-7	5E-9 1E-8 3E-9	3E-4 - -	3E-3 - -
28	Nickel-63	D, see ^{56}Ni W, see ^{56}NI Vapor	9E+3 - -	2E+3 3E+3 8E+2	7E-7 1E-6 3E-7	2E-9 4E-9 1E-9	1E-4 - -	1E-3 - -
28	Nickel-65	D, see ^{56}Ni W, see ^{56}Ni Vapor	8E+3 - -	2E+4 3E+4 2E+4	1E-5 1E-5 7E-6	3E-8 4E-8 2E-8	1E-4 - -	1E-3 - -
28	Nickel-66	D, see ^{56}Ni W, see ^{56}Ni Vapor	4E+2 LLI Wall (5E+2) - -	2E+3 - 6E+2 3E+3	7E-7 - 3E-7 1E-6	2E-9 - 9E-10 4E-9	- 6E-6 - -	- 6E-5 - -
29	Copper-60[2]	D, all compounds except those given for W and Y W, sulfides, halides, and nitrates Y, oxides and hydroxides	3E+4 St wall (3E+4) - -	9E+4 - 1E+5 1E+5	4E-5 - 5E-5 4E-5	1E-7 - 2E-7 1E-7	- 4E-4 - -	- 4E-3 - -
29	Copper-61	D, see ^{60}Cu W, see ^{60}Cu Y, see ^{60}Cu	1E+4 - -	3E+4 4E+4 4E+4	1E-5 2E-5 1E-5	4E-8 6E-8 5E-8	2E-4 - -	2E-3 - -
29	Copper-64	D, see ^{60}Cu W, see ^{60}Cu Y, see ^{60}Cu	1E+4 - -	3E+4 2E+4 2E+4	1E-5 1E-5 9E-6	4E-8 3E-8 3E-8	2E-4 - -	2E-3 - -
29	Copper-67	D, see ^{60}Cu W, see ^{60}Cu Y, see ^{60}Cu	5E+3 - -	8E+3 5E+3 5E+3	3E-6 2E-6 2E-6	1E-8 7E-9 6E-9	6E-5 - -	6E-4 - -
30	Zinc-62	Y, all compounds	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
30	Zinc-63[2]	Y, all compounds	2E+4 St wall (3E+4)	7E+4 -	3E-5 -	9E-8 -	- 3E-4	- 3E-3
30	Zinc-65	Y, all compounds	4E+2	3E+2	1E-7	4E-10	5E-6	5E-5

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
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 St wall (6E+4)	2E+5	7E-5	2E-7	-	-
		W	-	-	-	-	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 St wall (7E+4)	2E-5	7E-5	2E-7	-	-
		W, see ^{65}Ga	-	- 2E+5	- 8E-5	- 3E-7	1E-3 -	1E-2 -
31	Gallium-72	D, see ^{65}Ga	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{65}Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-73	D, see ^{65}Ga	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{65}Ga	-	2E+4	6E-6	2E-8	-	-
32	Germanium-66	D, all compounds except those given for W, oxides, sulfides and halides	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
			-	2E+4	8E-6	3E-8	-	-
32	Germanium-67[2]	D, see ^{66}Ge	3E+4 St wall (4E+4)	9E+4	4E-5	1E-7	-	-
		W, see ^{66}Ge	-	- 1E+5	- 4E-5	- 1E-7	6E-4 -	6E-3 -
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	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
32	Germanium-75[2]	D, see ^{66}Ge W, see ^{66}Ge	4E+4 St wall (7E+4) -	8E+4 8E+4	3E-5 4E-5	1E-7 1E-7	- 9E-4 -	- 9E-3 -
32	Germanium-77	D, see ^{66}Ge W, see ^{66}Ge	9E+3 -	1E+4 6E+3	4E-6 2E-6	1E-8 8E-9	1E-4 -	1E-3 -
32	Germanium-78[2]	D, see ^{66}Ge W, see ^{66}Ge	2E+4 St wall (2E+4) -	2E+4 2E+4	9E-6 9E-6	3E-8 3E-8	- 3E-4 -	- 3E-3 -
33	Arsenic-69[2]	W, all compounds	3E+4 St wall (4E+4)	1E+5 -	5E-5 -	2E-7 -	- 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 LLI wall (5E+3)	5E+3 -	2E-6 -	7E-9 -	- 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 W, oxides, hydroxides, carbides and elemental Se	2E+4 1E+4	4E+4 4E+4	2E-5 2E-5	5E-8 6E-8	1E-4 -	1E-3 -
34	Selenium-73m[2]	D, see ^{70}Se W, see ^{70}Se	6E+4 3E+4	2E+5 1E+5	6E-5 6E-5	2E-7 2E-7	4E-4 -	4E-3 -
34	Selenium-73	D, see ^{70}Se W, see ^{70}Se	3E+3 -	1E+4 2E+4	5E-6 7E-6	2E-8 2E-8	4E-5 -	4E-4 -
34	Selenium-75	D, see ^{70}Se W, see ^{70}Se	5E+2 -	7E+2 6E+2	3E-7 3E-7	1E-9 8E-10	7E-6 -	7E-5 -
34	Selenium-79	D, see ^{70}Se W, see ^{70}Se	6E+2 -	8E+2 6E+2	3E-7 2E-7	1E-9 8E-10	8E-6 -	8E-5 -
34	Selenium-81m[2]	D, see ^{70}Se W, see ^{70}Se	4E+4 2E+4	7E+4 7E+4	3E-5 3E-5	9E-8 1E-7	3E-4 -	3E-3 -

Exhibit 2A

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

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
35	Bromine-84[2]	D, see ^{74m}Br	2E+4 St wall (3E+4)	6E+4	2E-5	8E-8	-	-
		W, see ^{74m}Br	-	- 6E+4	- 3E-5	- 9E-8	4E-4 -	4E-3 -
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	-	-
36	Krypton-81	Submersion[1]	-	-	7E-4	3E-6	-	-
36	Krypton-83m[2]	Submersion[1]	-	-	1E-2	5E-5	-	-
36	Krupton-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 St wall (6E+4)	1E+5 -	5E-5 -	2E-7 -	- 8E-4	- 8E-3
37	Rubidium-81m[2]	D, all compounds	2E+5 St wall (3E+5)	3E+5 -	1E-4 -	5E-7 -	- 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 St wall (3E+4)	6E+4 -	3E-5 -	9E-8 -	- 4E-4	- 4E-3
37	Rubidium-89[2]	D, all compounds	4E+4 St wall (6E+4)	1E+5 -	6E-5 -	2E-7 -	- 9E-4	- 9E-3
38	Strontium-80[2]	D, all soluble compounds except $SrTi0_3$	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	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
38	Strontium-82	D, see ^{80}Sr Y, see ^{80}Sr	3E+2 LLI wall (2E+2) 2E+2	4E+2 - 9E+1	2E-7 - 4E-8	6E-10 - 1E-10	- 3E-6 -	- 3E-5 -
38	Strontium-83	D, see ^{80}Sr Y, see ^{80}Sr	3E+3 2E+3	7E+3 4E+3	3E-6 1E-6	1E-8 5E-9	3E-5 -	3E-4 -
38	Strontium-85m[2]	D, see ^{80}Sr Y, see ^{80}Sr	2E+5 -	6E+5 8E+5	3E-4 4E-4	9E-7 1E-6	3E-3 -	3E-2 -
38	Strontium-85	D, see ^{80} Y, see ^{80}Sr	3E+3 -	3E+3 2E+3	1E-6 6E-7	4E-9 2E-9	4E-5 -	4E-4 -
38	Strontium-87m	D, see ^{80}Sr Y, see ^{80}Sr	5E+4 4E+4	1E+5 2E+5	5E-5 6E-5	2E-7 2E-7	6E-4 -	6E-3 -
38	Strontium-89	D, see ^{80}Sr Y, see ^{80}Sr	6E+2 LLI Wall (6E+2) 5E+2	8E+2 - 1E+2	4E-7 - 6E-8	1E-9 - 2E-10	- 8E-6 -	- 8E-5 -
38	Strontium-90	D, see ^{80}Sr Y, see ^{80}Sr	3E+1 Bone surf (4E+1) -	2E+1 Bone surf (2E+1) 4E+0	8E-9 - 2E-9	- 3E-11 6E-12	- 5E-7 -	- 5E-6 -
38	Strontium-91	D, see ^{80}Sr Y, see ^{80}Sr	2E+3 -	6E+3 4E+3	2E-6 1E-6	8E-9 5E-9	2E-5 -	2E-4 -
38	Strontium-92	D, see ^{80}Sr Y, see ^{80}Sr	3E+3 -	9E+3 7E+3	4E-6 3E-6	1E-8 9E-9	4E-5 -	4E-4 -
39	Yttrium-86m[2]	W, all compounds except those given for Y Y, oxides and hydroxides	2E+4 -	6E+4 5E+4	2E-5 2E-5	8E-8 8E-8	3E-4 -	3E-3 -
39	Yttrium-86	W, see ^{86m}Y Y, see ^{86m}Y	1E+3 -	3E+3 3E+3	1E-6 1E-6	5E-9 5E-9	2E-5 -	2E-4 -
39	Yttrium-87	W, see ^{86m}Y Y, see ^{86m}Y	2E+3 -	3E+3 3E+3	1E-6 1E-6	5E-9 5E-9	3E-5 -	3E-4 -
39	Yttrium-88	W, see ^{86m}Y Y, see ^{86m}Y	1E+3 -	3E+2 2E+2	1E-7 1E-7	3E-10 3E-10	1E-5 -	1E-4 -
39	Yttrium-90m	W, see ^{86m}Y Y, see ^{86m}Y	8E+3 -	1E+4 1E+4	5E-6 5E-6	2E-8 2E-8	1E-4 -	1E-3 -
39	Yttrium-90	W, see ^{86m}Y Y, see ^{86m}Y	4E+2 LLI wall (5E+2) -	7E+2 - 6E+2	3E-7 - 3E-7	9E-10 - 9E-10	- 7E-6 -	- 7E-5 -
39	Yttrium-91m[2]	W, see ^{86m}Y Y, see ^{86m}Y	1E+5 -	2E+5 2E+5	1E-4 7E-5	3E-7 2E-7	2E-3 -	2E-2 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
39	Yttrium-91	W, see ^{86m}Y Y, see ^{86m}Y	5E+2 LLI wall (6E+2) -	2E+2 - 1E+2	7E-8 - 5E-8	2E-10 - 2E-10	- 8E-6 -	- 8E-5 -
39	Yttrium-92	W, see ^{86m}Y Y, see ^{86m}Y	3E+3 -	9E+3 8E+3	4E-6 3E-6	1E-8 1E-8	4E-5 -	4E-4 -
39	Yttrium-93	W, See ^{86m}Y Y, see ^{86m}Y	1E+3 -	3E+3 2E+3	1E-6 1E-6	4E-9 3E-9	2E-5 -	2E-4 -
39	Yttrium-94[2]	W, see ^{86m}Y Y, see ^{86m}Y	2E+4 St wall (3E+4) -	8E+4 - 8E+4	3E-5 - 3E-5	1E-7 - 1E-7	- 4E-4 -	- 4E-3 -
39	Yttrium-95[2]	W, see ^{86m}Y Y, see ^{86m}Y	4E+4 St wall (5E+4) -	2E+5 - 1E+5	6E-5 - 6E-5	2E-7 - 2E-7	- 7E-4 -	- 7E-3 -
40	Zirconium-86	D, all compounds except those given for W and Y W, oxides, hydroxides, halides, and nitrates Y, carbide	1E+3 - -	4E+3 3E+3 2E+3	2E-6 1E-6 1E-6	6E-9 4E-9 3E-9	2E-5 - -	2E-4 - -
40	Zirconium-88	D, see ^{86}Zr W, see ^{86}Zr Y, see ^{86}Zr	4E+3 - -	2E+2 5E+2 3E+2	9E-8 2E-7 1E-7	3E-10 7E-10 4E-10	5E-5 - -	5E-4 - -
40	Zirconium-89	D, see ^{86}Zr W, see ^{86}Zr Y, see ^{86}Zr	2E+3 - -	4E+3 2E+3 2E+3	1E-6 1E-6 1E-6	5E-9 3E-9 3E-9	2E-5 - -	2E-4 - -
40	Zirconium-93	D, see ^{86}Zr W, see ^{86}Zr Y, see ^{86}Zr	1E+3 Bone surf (3E+3) - - - -	6E+0 Bone surf (2E+1) 2E+1 Bone surf (6E+1) 6E+1 Bone surf (7E+1)	3E-9 - 1E-8 - 2E-8 -	- 2E-11 - 9E-11 - 9E-11	- 4E-5 - - - -	- 4E-4 - - - -
40	Zirconium-95	D, see ^{86}Zr W, see ^{86}Zr Y, see ^{86}Zr	1E+3 - - -	1E+2 Bone surf (3E+2) 4E+2 3E+2	5E-8 - 2E-7 1E-7	- 4E-10 5E-10 4E-10	2E-5 - - -	2E-4 - - -
40	Zirconium-97	D, see ^{86}Zr W, see ^{86}Zr Y, see ^{86}Zr	6E+2 - -	2E+3 1E+3 1E+3	8E-7 6E-7 5E-7	3E-9 2E-9 2E-9	9E-6 - -	9E-5 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
41	Niobium-88[2]	W, all compounds except those given for Y Y, oxides and hydroxides	5E+4 St wall (7E+4) -	2E+5 - 2E+5	9E-5 - 9E-5	3E-7 - 3E-7	- 1E-3 -	- 1E-2 -
41	Niobium-89[2] (66 min)	W, see ^{88}Nb Y, see ^{88}Nb	1E+4 -	4E+4 4E+4	2E-5 2E-5	6E-8 5E-8	1E-4 -	1E-3 -
41	Niobium-89 (122 min)	W, see ^{88}Nb Y, see ^{88}Nb	5E+3 -	2E+4 2E+4	8E-6 6E-6	3E-8 2E-8	7E-5 -	7E-4 -
41	Niobium-90	W, see ^{88}Nb Y, see ^{88}Nb	1E+3 -	3E+3 2E+3	1E-6 1E-6	4E-9 3E-9	1E-5 -	1E-4 -
41	Niobium-93m	W, see ^{88}Nb Y, see ^{88}Nb	9E+3 LLI wall (1E+4) -	2E+3 - 2E+2	8E-7 - 7E-8	3E-9 - 2E-10	- 2E-4 -	- 2E-3 -
41	Niobium-94	W, see ^{88}Nb Y, see ^{88}Nb	9E+2 -	2E+2 2E+1	8E-8 6E-9	3E-10 2E-11	1E-5 -	1E-4 -
41	Niobium-95m	W, see ^{88}Nb Y, see ^{88}Nb	2E+3 LLI wall (2E+3) -	3E+3 - 2E+3	1E-6 - 9E-7	4E-9 - 3E-9	- 3E-5 -	- 3E-4 -
41	Niobium-95	W, see ^{88}Nb Y, see ^{88}Nb	2E+3 -	1E+3 1E+3	5E-7 5E-7	2E-9 2E-9	3E-5 -	3E-4 -
41	Niobium-96	W, see ^{88}Nb Y, see ^{88}Nb	1E+3 -	3E+3 2E+3	1E-6 1E-6	4E-9 3E-9	2E-5 -	2E-4 -
41	Niobium-97[2]	W, see ^{88}Nb Y, see ^{88}Nb	2E+4 -	8E+4 7E+4	3E-5 3E-5	1E-7 1E-7	3E-4 -	3E-3 -
41	Niobium-98[2]	W, see ^{88}Nb Y, see ^{88}Nb	1E+4 -	5E+4 5E+4	2E-5 2E-5	8E-8 7E-8	2E-4 -	2E-3 -
42	Molybdenum-90	D, all compounds except those given for Y Y, oxides, hydroxides, and MoS_2	4E+3 2E+3	7E+3 5E+3	3E-6 2E-6	1E-8 6E-9	3E-5 -	3E-4 -
42	Molybdenum-93m	D, see ^{90}Mo Y, see ^{90}Mo	9E+3 4E+3	2E+4 1E+4	7E-6 6E-6	2E-8 2E-8	6E-5 -	6E-4 -
42	Molybdenum-93	D, see ^{90}Mo Y, see ^{90}Mo	4E+3 2E+4	5E+3 2E+2	2E-6 8E-8	8E-9 2E-10	5E-5 -	5E-4 -
42	Molybdenum-99	D, see ^{90}Mo Y, see ^{90}Mo	2E+3 LLI wall (1E+3) 1E+3	3E+3 - 1E+3	1E-6 - 6E-7	4E-9 - 2E-9	- 2E-5 -	- 2E-4 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
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	
		W, see ^{93m}Tc	-	4E+5	2E-4	5E-7	-	2E-2 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
43	Technetium-104[2]	D, see ^{93m}Tc	2E+4	7E+4	3E-5	1E-7	-	-
		W, see ^{93m}Tc	St wall (3E+4)	- 9E+4	- 4E-5	- 1E-7	4E-4 -	4E-3 -
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	-	-
		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	-	-
		W, see ^{94}Ru	LLI wall (2E+2)	- 5E+1	- 2E-8	- 8E-11	3E-6 -	3E-5 -
		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	-	-
		W, see ^{99m}Rh	LLI wall (1E+3)	- 4E+2	- 2E-7	- 5E-10	2E-5 -	2E-4 -
		Y, see ^{99m}Rh	-	1E+2	5E-8	2E-10	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
45	Rhodium-102	D, see ^{99m}Rh W, see ^{99m}Rh Y, see ^{99M}Rh	6E+2 - -	9E+1 2E+2 6E+1	4E-8 7E-8 2E-8	1E-10 2E-10 8E-11	8E-6 - -	8E-5 - -
45	Rhodium-103m[2]	D, see ^{99m}Rh W, see ^{99m}Rh Y, see ^{99M}Rh	4E+5 - -	1E+6 1E+6 1E+6	5E-4 5E-4 5E-4	2E-6 2E-6 2E-6	6E-3 - -	6E-2 - -
45	Rhodium-105	D, see ^{99m}Rh W, see ^{99m}Rh Y, see ^{99M}Rh	4E+3 LLI wall (4E+3) - -	1E+4 - 6E+3 6E+3	5E-6 - 3E-6 2E-6	2E-8 - 9E-9 8E-9	- 5E-5 - -	- 5E-4 - -
45	Rhodium-106m	D, see ^{99m}Rh W, see ^{99m}Rh Y, see ^{99M}Rh	8E+3 - -	3E+4 4E+4 4E+4	1E-5 2E-5 1E-5	4E-8 5E-8 5E-8	1E-4 - -	1E-3 - -
45	Rhodium-107[2]	D, see ^{99m}Rh W, see ^{99m}Rh Y, see ^{99M}Rh	7E+4 St wall (9E+4) - -	2E+5 - 3E+5 3E+5	1E-4 - 1E-4 1E-4	3E-7 - 4E-7 3E-7	- 1E-3 - -	- 1E-2 - -
46	Palladium-100	D, all compounds except those given for W and Y W, nitrates Y, oxides and hydroxides	1E+3 - -	1E+3 1E+3 1E+3	6E-7 5E-7 6E-7	2E-9 2E-9 2E-9	2E-5 - -	2E-4 - -
46	Palladium-101	D, see ^{100}Pd W, see ^{100}Pd Y, see ^{100}Pd	1E+4 - -	3E+4 3E+4 3E+4	1E-5 1E-5 1E-5	5E-8 5E-8 4E-8	2E-4 - -	2E-3 - -
46	Palladium-103	D, see ^{100}Pd W, see ^{100}Pd Y, see ^{100}Pd	6E+3 LLI wall (7E+3) - -	6E+3 - 4E+3 4E+3	3E-6 - 2E-6 1E-6	9E-9 - 6E-9 5E-9	- 1E-4 - -	- 1E-3 - -
46	Palladium-107	D, see ^{100}Pd W, see ^{100}Pd Y, see ^{100}Pd	3E+4 LLI wall (4E+4) - -	2E+4 Kidneys (2E+4) 7E+3 4E+2	9E-6 - 3E-6 2E-7	- 3E-8 1E-8 6E-10	- 5E-4 - -	- 3E-3 - -
46	Palladium-109	D, see ^{100}Pd W, see ^{100}Pd Y, see ^{100}Pd	2E+3 - -	6E+3 5E+3 5E+3	3E-6 2E-6 2E-6	9E-9 8E-9 6E-9	3E-5 - -	3E-4 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
47	Silver-102[2]	D, all compounds except those given for W and Y W, nitrates and sulfides Y, oxides and hydroxides	5E+4 St wall (6E+4) - -	2E+5 - 2E+5 2E+5	8E-5 - 9E-5 8E-5	2E-7 - 3E-7 3E-7	- 9E-4 - -	- 9E-3 - -
47	Silver-103[2]	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	4E+4 - -	1E+5 1E+5 1E+5	4E-5 5E-5 5E-5	1E-7 2E-7 2E-7	5E-4 - -	5E-3 - -
47	Silver-104m[2]	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	3E+4 - -	9E+4 1E+5 1E+5	4E-5 5E-5 5E-5	1E-7 2E-7 2E-7	4E-4 - -	4E-3 - -
47	Silver-104[2]	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	2E+4 - -	7E+4 1E+5 1E+5	3E-5 6E-5 6E-5	1E-7 2E-7 2E-7	3E-4 - -	3E-3 - -
47	Silver-105	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	3E+3 - -	1E+3 2E+3 2E+3	4E-7 7E-7 7E-7	1E-9 2E-9 2E-9	4E-5 - -	4E-4 - -
47	Silver-106m	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	8E+2 - -	7E+2 9E+2 9E+2	3E-7 4E-7 4E-7	1E-9 1E-9 1E-9	1E-5 - -	1E-4 - -
47	Silver-106[2]	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	6E+4 St wall (6E+4) - -	2E+5 - 2E+5 2E+5	8E-5 - 9E-5 8E-5	3E-7 - 3E-7 3E-7	- 9E-4 - -	- 9E-3 - -
47	Silver-108m	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	6E+2 - -	2E+2 3E+2 2E+1	8E-8 1E-7 1E-8	3E-10 4E-10 3E-11	9E-6 - -	9E-5 - -
47	Silver-110m	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	5E+2 - -	1E+2 2E+2 9E+1	5E-8 8E-8 4E-8	2E-10 3E-10 1E-10	6E-6 - -	6E-5 - -
47	Silver-111	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	9E+2 LLI wall (1E+3) - -	2E+3 Liver (2E+3) 9E+2 9E+2	6E-7 - 4E-7 4E-7	- 2E-9 1E-9 1E-9	- 2E-5 - -	- 2E-4 - -
47	Silver-112	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	3E+3 - -	8E+3 1E+4 9E+3	3E-6 4E-6 4E-6	1E-8 1E-8 1E-8	4E-5 - -	4E-4 - -
47	Silver-115[2]	D, see ^{102}Ag W, see ^{102}Ag Y, see ^{102}Ag	3E+4 St wall (3E+4) - -	9E+4 - 9E+4 8E+4	4E-5 - 4E-5 3E-5	1E-7 - 1E-7 1E-7	- 4E-4 - -	- 4E-3 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
48	Cadmium-104[2]	D, all compounds except those given for W and Y W, sulfides, halides, and nitrates Y, oxides and hydroxides	2E+4 - -	7E+4 1E+5 1E+5	3E-5 5E-5 5E-5	9E-8 2E-7 2E-7	3E-4 - -	3E-3 - -
48	Cadmium-107	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	2E+4 - -	5E+4 6E+4 5E+4	2E-5 2E-5 2E-5	8E-8 8E-8 7E-8	3E-4 - -	3E-3 - -
48	Cadmium-109	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	3E+2 Kidneys (4E+2) - -	4E+1 Kidneys (5E+1) 1E+2 Kidneys (1E+2) 1E+2	1E-8 - 5E-8 - 5E-8	- 7E-11 - 2E-10 2E-10	- 6E-6 - - -	- 6E-5 - - -
48	Cadmium-113m	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	2E+1 Kidneys (4E+1) - -	2E+0 Kidneys (4E+0) 8E+0 Kidneys (1E+1) 1E+1	1E-9 - 4E-9 - 5E-9	- 5E-12 - 2E-11 2E-11	- 5E-7 - - -	- 5E-6 - - -
48	Cadmium-113	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	2E+1 Kidneys (3E+1) - -	2E+0 Kidneys (3E+0) 8E+0 Kidneys (1E+1) 1E+1	9E-10 - 3E-9 - 6E-9	- 5E-12 - 2E-11 2E-11	- 4E-7 - - -	- 4E-6 - - -
48	Cadmium-115m	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	3E+2 - - -	5E+1 Kidneys (8E+1) 1E+2 1E+2	2E-8 - 5E-8 6E-8	- 1E-10 2E-10 2E-10	4E-6 - - -	4E-5 - - -
48	Cadmium-115	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	9E+2 LLI wall (1E+3) - -	1E+3 - 1E+3 1E+3	6E-7 - 5E-7 6E-7	2E-9 - 2E-9 2E-9	- 1E-5 - -	- 1E-4 - -
48	Cadmium-117m[2]	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	5E+3 - -	1E+4 2E+4 1E+4	5E-6 7E-6 6E-6	2E-8 2E-8 2E-8	6E-5 - -	6E-4 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
48	Cadmium-117	D, see ^{104}Cd W, see ^{104}Cd Y, see ^{104}Cd	5E+3 - -	1E+4 2E+4 1E+4	5E-6 7E-6 6E-6	2E-8 2E-8 2E-8	6E-5 - -	6E-4 - -
49	Indium-109	D, all compounds except those given for W W, oxides, hydroxides, halides,and nitrates	2E+4 -	4E+4 6E+4	2E-5 3E-5	6E-8 9E-8	3E-4 -	3E-3 -
49	Indium-110[2] (69.1 min)	D, see ^{109}In W, see ^{109}In	2E+4 -	4E+4 6E+4	2E-5 2E-5	6E-8 8E-8	2E-4 -	2E-3 -
49	Indium-110 (4.9 h)	D, see ^{109}In W, see ^{109}In	5E+3 -	2E+4 2E+4	7E-6 8E-6	2E-8 3E-8	7E-5 -	7E-4 -
49	Indium-111	D, see ^{109}In W, see ^{109}In	4E+3 -	6E+3 6E+3	3E-6 3E-6	9E-9 9E-9	6E-5 -	6E-4 -
49	Indium-112[2]	D, see ^{109}In W, see ^{109}In	2E+5 -	6E+5 7E+5	3E-4 3E-4	9E-7 1E-6	2E-3 -	2E-2 -
49	Indium-113m[2]	D, see ^{109}In W, see ^{109}In	5E+4 -	1E+5 2E+5	6E-5 8E-5	2E-7 3E-7	7E-4 -	7E-3 -
49	Indium-114m	D, see ^{109}In W, see ^{109}In	3E+2 LLI wall (4E+2) -	6E+1 - 1E+2	3E-8 - 4E-8	9E-11 - 1E-10	- 5E-6 -	- 5E-5 -
49	Indium-115m	D, see ^{109}In W, see ^{109}In	1E+4 -	4E+4 5E+4	2E-5 2E-5	6E-8 7E-8	2E-4 -	2E-3 -
49	Indium-115	D, see ^{109}In W, see ^{109}In	4E+1 -	1E+0 5E+0	6E-10 2E-9	2E-12 8E-12	5E-7 -	5E-6 -
49	Indium-116m[2]	D, see ^{109}In W, see ^{109}In	2E+4 -	8E+4 1E+5	3E-5 5E-5	1E-7 2E-7	3E-4 -	3E-3 -
49	Indium-117m[2]	D, see ^{109}In W, see ^{109}In	1E+4 -	3E+4 4E+4	1E-5 2E-5	5E-8 6E-8	2E-4 -	2E-3 -
49	Indium-117[2]	D, see ^{109}In W, see ^{109}In	6E+4 -	2E+5 2E+5	7E-5 9E-5	2E-7 3E-7	8E-4 -	8E-3 -
49	Indium-119m[2]	D, see ^{109}In W, see ^{109}In	4E+4 St wall (5E+4) -	1E+5 - 1E+5	5E-5 - 6E-5	2E-7 - 2E-7	- 7E-4 -	- 7E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
50	Tin-110	D, all compounds except those given for W W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	4E+3 -	1E+4 1E+4	5E-6 5E-6	2E-8 2E-8	5E-5 -	5E-4 -
50	Tin-111[2]	D, see ^{110}Sn W, see ^{110}Sn	7E+4 -	2E+5 3E+5	9E-5 1E-4	3E-7 4E-7	1E-3 -	1E-2 -
50	Tin-113	D, see ^{110}Sn W, see ^{110}Sn	2E+3 LLI wall (2E+3) -	1E+3 - 5E+2	5E-7 - 2E-7	2E-9 - 8E-10	- 3E-5 -	- 3E-4 -
50	Tin-117m	D, see ^{110}Sn W, see ^{110}Sn	2E+3 LLI wall (2E+3) -	1E+3 Bone surf (2E+3) 1E+3	5E-7 - 6E-7	- 3E-9 2E-9	- 3E-5 -	- 3E-4 -
50	Tin-119m	D, see ^{110}Sn W, see ^{110}Sn	3E+3 LLI wall (4E+3) -	2E+3 - 1E+3	1E-6 - 4E-7	3E-9 - 1E-9	- 6E-5 -	- 6E-4 -
50	Tin-121m	D, see ^{110}Sn W, see ^{110}Sn	3E+3 LLI wall (4E+3) -	9E+2 - 5E+2	4E-7 - 2E-7	1E-9 - 8E-10	- 5E-5 -	- 5E-4 -
50	Tin-121	D, see ^{110}Sn W, see ^{110}Sn	6E+3 LLI wall (6E+3) -	2E+4 - 1E+4	6E-6 - 5E-6	2E-8 - 2E-8	- 8E-5 -	- 8E-4 -
50	Tin-123m[2]	D, see ^{110}Sn W, see ^{110}Sn	5E+4 -	1E+5 1E+5	5E-5 6E-5	2E-7 2E-7	7E-4 -	7E-3 -
50	Tin-123	D, see ^{110}Sn W, see ^{110}Sn	5E+2 LLI wall (6E+2) -	6E+2 - 2E+2	3E-7 - 7E-8	9E-10 - 2E-10	- 9E-6 -	- 9E-5 -
50	Tin-125	D, see ^{110}Sn W, see ^{110}Sn	4E+2 LLI wall (5E+2) -	9E+2 - 4E+2	4E-7 - 1E-7	1E-9 - 5E-10	- 6E-6 -	- 6E-5 -
50	Tin-126	D, see ^{110}Sn W, see ^{110}Sn	3E+2 -	6E+1 7E+1	2E-8 3E-8	8E-11 9E-11	4E-6 -	4E-5 -
50	Tin-127	D, see ^{110}Sn W, see ^{110}Sn	7E+3 -	2E+4 2E+4	8E-6 8E-6	3E-8 3E-8	9E-5 -	9E-4 -
50	Tin-128[2]	D, see ^{110}Sn W, see ^{110}Sn	9E+3 -	3E+4 4E+4	1E-5 1E-5	4E-8 5E-8	1E-4 -	1E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
51	Antimony-115[2]	D, all compounds except those given for W W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	8E+4 -	2E+5 3E+5	1E-4 1E-4	3E-7 4E-7	1E-3 -	1E-2 -
51	Antimony-116m[2]	D, see ^{115}Sb W, see ^{115}Sb	2E+4 -	7E+4 1E+5	3E-5 6E-5	1E-7 2E-7	3E-4 -	3E-3 -
51	Antimony-116[2]	D, see ^{115}Sb W, see ^{115}Sb	7E+4 St wall (9E+4) -	3E+5 - 3E+5	1E-4 - 1E-4	4E-7 - 5E-7	- 1E-3 -	- 1E-2 -
51	Antimony-117	D, see ^{115}Sb W, see ^{115}Sb	7E+4 -	2E+5 3E+5	9E-5 1E-4	3E-7 4E-7	9E-4 -	9E-3 -
51	Antimony-118m	D, see ^{115}Sb W, see ^{115}Sb	6E+3 5E+3	2E+4 2E+4	8E-6 9E-6	3E-8 3E-8	7E-5 -	7E-4 -
51	Antimony-119	D, see ^{115}Sb W, see ^{115}Sb	2E+4 2E+4	5E+4 3E+4	2E-5 1E-5	6E-8 4E-8	2E-4 -	2E-3 -
51	Antimony-120[2] (16 min)	D, see ^{115}Sb W, see ^{115}Sb	1E+5 St wall (2E+5) -	4E+5 - 5E+5	2E-4 - 2E-4	6E-7 - 7E-7	- 2E-3 -	- 2E-2 -
51	Antimony-120 (5.76 d)	D, see ^{115}Sb W, see ^{115}Sb	1E+3 9E+2	2E+3 1E+3	9E-7 5E-7	3E-9 2E-9	1E-5 -	1E-4 -
51	Antimony-122	D, see ^{115}Sb W, see ^{115}Sb	8E+2 LLI wall (8E+2) 7E+2	2E+3 - 1E+3	1E-6 - 4E-7	3E-9 - 2E-9	- 1E-5 -	- 1E-4 -
51	Antimony-124m[2]	D, see ^{115}Sb W, see ^{115}Sb	3E+5 2E+5	8E+5 6E+5	4E-4 2E-4	1E-6 8E-7	3E-3 -	3E-2 -
51	Antimony-124	D, see ^{115}Sb W, see ^{115}Sb	6E+2 5E+2	9E+2 2E+2	4E-7 1E-7	1E-9 3E-10	7E-6 -	7E-5 -
51	Antimony-125	D, see ^{115}Sb W, see ^{115}Sb	2E+3 -	2E+3 5E+2	1E-6 2E-7	3E-9 7E-10	3E-5 -	3E-4 -
51	Antimony-126m[2]	D, see ^{115}Sb W, see ^{115}Sb	5E+4 St wall (7E+4) -	2E+5 - 2E+5	8E-5 - 8E-5	3E-7 - 3E-7	- 9E-4 -	- 9E-3 -
51	Antimony-126	D, see ^{115}Sb W, see ^{115}Sb	6E+2 5E+2	1E+3 5E+2	5E-7 2E-7	2E-9 7E-10	7E-6 -	7E-5 -
51	Antimony-127	D, see ^{115}Sb W, see ^{115}Sb	8E+2 LLI wall (8E+2) 7E+2	2E+3 - 9E+2	9E-7 - 4E-7	3E-9 - 1E-9	- 1E-5 -	- 1E-4 -

Exhibit 2A

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

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
52	Tellurium-127m	D, see ^{116}Te W, see ^{116}Te	6E+2 - -	3E+2 Bone surf (4E+2) 3E+2	1E-7 - 1E-7	- 6E-10 4E-10	9E-6 - -	9E-5 - -
52	Tellurium-127	D, see ^{116}Te W. see ^{116}Te	7E+3 -	2E+4 2E+4	9E-6 7E-6	3E-8 2E-8	1E-4 -	1E-3 -
52	Tellurium-129m	D, see ^{116}Te W, see ^{116}Te	5E+2 -	6E+2 2E+2	3E-7 1E-7	9E-10 3E-10	7E-6 -	7E-5 -
52	Tellurium-129[2]	D, see ^{116}Te W, see ^{116}Te	3E+4 -	6E+4 7E+4	3E-5 3E-5	9E-8 1E-7	4E-4 -	4E-3 -
52	Tellurium-131m	D, see ^{116}Te W, see ^{116}Te	3E+2 Thyroid (6E+2) - -	4E+2 Thyroid (1E+3) 4E+2 Thyroid (9E+2)	2E-7 - 2E-7 -	- 2E-9 - 1E-9	- 8E-6 - -	- - 8E-5 - -
52	Tellurium-131[2]	D, see ^{116}Te W, see ^{116}Te	3E+3 Thyroid (6E+3) - -	5E+3 Thyroid (1E+4) 5E+3 Thyroid (1E+4)	2E-6 - 2E-6 -	- 2E-8 - 2E-8	- 8E-5 - -	- - 8E-4 - -
52	Tellurium-132	D, see ^{116}Te W, see ^{116}Te	2E+2 Thyroid (7E+2) - -	2E+2 Thyroid (8E+2) 2E+2 Thyroid (6E+2)	9E-8 - 9E-8 -	- 1E-9 - 9E-10	- 9E-6 - -	- - 9E-5 - -
52	Tellurium-133m[2]	D, see ^{116}Te W, see ^{116}Te	3E+3 Thyroid (6E+3) - -	5E+3 Thyroid (1E+4) 5E+3 Thyroid (1E+4)	2E-6 - 2E-6 -	- 2E-8 - 2E-8	- 9E-5 - -	- 9E-4 - -
52	Tellurium-133[2]	D, see ^{116}Te W, see ^{116}Te	1E+4 Thyroid (3E+4) - -	2E+4 Thyroid (6E+4) 2E+4 Thyroid (6E+4)	9E-6 - 9E-6 -	- 8E-8 - 8E-8	- 4E-4 - -	- 4E-3 - -
52	Tellurium-134[2]	D, see ^{116}Te W, see ^{116}Te	2E+4 Thyroid (2E+4) - -	2E+4 Thyroid (5E+4) 2E+4 Thyroid (5E+4)	1E-5 - 1E-5 -	- 7E-8 - 7E-8	- 3E-4 - -	- 3E-3 - -
53	Iodine-120m[2]	D, all compounds	1E+4 Thyroid (1E+4)	2E+4 -	9E-6 -	3E-8 -	- 2E-4	- 2E-3

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
53	Iodine-120[2]	D, all compounds	4E+3 Thyroid (8E+3)	9E+3 Thyroid (1E+4)	4E-6 -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-121	D, all compounds	1E+4 Thyroid (3E+4)	2E+4 Thyroid (5E+4)	8E-6 -	- 7E-8	- 4E-4	- 4E-3
53	Iodine-123	D, all compounds	3E+3 Thyroid (1E+4)	6E+3 Thyroid (2E+4)	3E-6 -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-124	D, all compounds	5E+1 Thyroid (2E+2)	8E+1 Thyroid (3E+2)	3E-8 -	- 4E-10	- 2E-6	- 2E-5
53	Iodine-125	D, all compounds	4E+1 Thyroid (1E+2)	6E+1 Thyroid (2E+2)	3E-8 -	- 3E-10	- 2E-6	- 2E-5
53	Iodine-126	D, all compounds	2E+1 Thyroid (7E+1)	4E+1 Thyroid (1E+2)	1E-8 -	- 2E-10	- 1E-6	- 1E-5
53	Iodine-128[2]	D, all compounds	4E+4 St wall (6E+4)	1E+5 -	5E-5 -	2E-7 -	- 8E-4	- 8E-3
53	Iodine-129	D, all compounds	5E+0 Thyroid (2E+1)	9E+0 Thyroid (3E+1)	4E-9 -	- 4E-11	- 2E-7	- 2E-6
53	Iodine-130	D, all compounds	4E+2 Thyroid (1E+3)	7E+2 Thyroid (2E+3)	3E-7 -	- 3E-9	- 2E-5	- 2E-4
53	Iodine-131	D, all compuonds	3E+1 Thyroid (9E+1)	5E+1 Thyroid (2E+2)	2E-8 -	- 2E-10	- 1E-6	- 1E-5
53	Iodine-132m[2]	D, all compounds	4E+3 Thyroid (1E+4)	8E+3 Thyroid (2E+4)	4E-6 -	- 3E-8	- 1E-4	- 1E-3
53	Iodine-132	D, all compounds	4E+3 Thyroid (9E+3)	8E+3 Thyroid (1E+4)	3E-6 -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-133	D, all compounds	1E+2 Thyroid (5E+2)	3E+2 Thyroid (9E+2)	1E-7 -	- 1E-9	- 7E-6	- 7E-5
53	Iodine-134[2]	D, all compounds	2E+4 Thyroid (3E+4)	5E+4 -	2E-5 -	6E-8 -	- 4E-4	- 4E-3
53	Iodine-135	D, all compounds	8E+2 Thyroid (3E+3)	2E+3 Thyroid (4E+3)	7E-7 -	- 6E-9	- 3E-5	- 3E-4
54	Xenon-120[2]	Submersion[1]	-	-	1E-5	4E-8	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
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 St wall (9E+4)	1E+5 -	6E-5 -	2E-7 -	- 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 St wall (1E+5)	2E+5 -	8E-5 -	3E-7 -	- 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 St wall (1E+5)	1E+5 -	6E-5 -	2E-7 -	- 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 St wall (3E+4)	6E+4 -	2E-5 -	8E-8 -	- 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

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
56	Barium-131m[2]	D, all compounds	4E+5 St wall (5E+5)	1E+6 -	6E-4 -	2E-6 -	- 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 LLI wall (3E+3)	9E+3 -	4E-6 -	1E-8 -	- 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 LLI wall (6E+2)	1E+3 -	6E-7 -	2E-9 -	- 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
57	Lanthanum-131[2]	D, all compounds except those given for W W, oxides and hydroxides	5E+4 -	1E+5 2E+5	5E-5 7E-5	2E-7 2E-7	6E-4 -	6E-3 -
57	Lanthanum-132	D, see ^{131}La W, see ^{131}La	3E+3 -	1E+4 1E+4	4E-6 5E-6	1E-8 2E-8	4E-5 -	4E-4 -
57	Lanthanum-135	D, see ^{131}La W, see ^{131}La	4E+4 -	1E+5 9E+4	4E-5 4E-5	1E-7 1E-7	5E-4 -	5E-3 -
57	Lanthanum-137	D, see ^{131}La W, see ^{131}La	1E+4 - - -	6E+1 Liver (7E+1) 3E+2 Liver (3E+2)	3E-8 - 1E-7 -	- 1E-10 - 4E-10	2E-4 - - -	2E-3 - - -
57	Lanthanum-138	D, see ^{131}La W, see ^{131}La	9E+2 -	4E+0 1E+1	1E-9 6E-9	5E-12 2E-11	1E-5 -	1E-4 -
57	Lanthanum-140	D, see ^{131}La W, see ^{131}La	6E+2 -	1E+3 1E+3	6E-7 5E-7	2E-9 2E-9	9E-6 -	9E-5 -
57	Lanthanum-141	D, see ^{131}La W, see ^{131}La	4E+3 -	9E+3 1E+4	4E-6 5E-6	1E-8 2E-8	5E-5 -	5E-4 -
57	Lanthanum-142[2]	D, see ^{131}La W, see ^{131}La	8E+3 -	2E+4 3E+4	9E-6 1E-5	3E-8 5E-8	1E-4 -	1E-3 -
57	Lanthanum-143[2]	D, see ^{131}La W, see ^{131}La	4E+4 St wall (4E+4) -	1E+5 9E+4	4E-5 4E-5	1E-7 1E-7	- 5E-4 -	- 5E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
58	Cerium-134	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	5E+2 LLI wall (6E+2) -	7E+2 - 7E+2	3E-7 - 3E-7	1E-9 - 9E-10	- 8E-6 -	- 8E-5 -
58	Cerium-135	W, see ^{134}Ce Y, see ^{134}Ce	2E+3 -	4E+3 4E+3	2E-6 1E-6	5E-9 5E-9	2E-5 -	2E-4 -
58	Cerium-137m	W, see ^{134}Ce Y, see ^{134}Ce	2E+3 LLI wall (2E+3) -	4E+3 - 4E+3	2E-6 - 2E-6	6E-9 - 5E-9	- 3E-5 -	- 3E-4 -
58	Cerium-137	W, see ^{134}Ce Y, see ^{134}Ce	5E+4 -	1E+5 1E+5	6E-5 5E-5	2E-7 2E-7	7E-4 -	7E-3 -
58	Cerium-139	W, see ^{134}Ce Y, see ^{134}Ce	5E+3 -	8E+2 7E+2	3E-7 3E-7	1E-9 9E-10	7E-5 -	7E-4 -
58	Cerium-141	W, see ^{134}Ce Y, see ^{134}Ce	2E+3 LLI wall (2E+3) -	7E+2 - 6E+2	3E-7 - 2E-7	1E-9 - 8E-10	- 3E-5 -	- 3E-4 -
58	Cerium-143	W, see ^{134}Ce Y, see ^{134}Ce	1E+3 LLI wall (1E+3) -	2E+3 - 2E+3	8E-7 - 7E-7	3E-9 - 2E-9	- 2E-5 -	- 2E-4 -
58	Cerium-144	W, see ^{134}Ce Y, see ^{134}Ce	2E+2 LLI wall (3E+2) -	3E+1 - 1E+1	1E-8 - 6E-9	4E-11 - 2E-11	- 3E-6 -	- 3E-5 -
59	Praseodymium-136[2]	W, all compounds except those given for Y Y, oxides, hydroxides, carbides, and fluorides	5E+4 St wall (7E+4) -	2E+5 - 2E+5	1E-4 - 9E-5	3E-7 - 3E-7	- 1E-3 -	- 1E-2 -
59	Praseodymium-137[2]	W, see ^{136}Pr Y, see ^{136}Pr	4E+4 -	2E+5 1E+5	6E-5 6E-5	2E-7 2E-7	5E-4 -	5E-3 -
59	Praseodymium-138m	W, see ^{136}Pr Y, see ^{136}Pr	1E+4 -	5E+4 4E+4	2E-5 2E-5	8E-8 6E-8	1E-4 -	1E-3 -
59	Praseodymium-139	W, see ^{136}Pr Y, see ^{136}Pr	4E+4 -	1E+5 1E+5	5E-5 5E-5	2E-7 2E-7	6E-4 -	6E-3 -
59	Praseodymium-142m[2]	W, see ^{136}Pr Y, see ^{136}Pr	8E+4 -	2E+5 1E+5	7E-5 6E-5	2E-7 2E-7	1E-3 -	1E-2 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
59	Praseodymium-142	W, see ^{136}Pr Y, see ^{136}Pr	1E+3 -	2E+3 2E+3	9E-7 8E-7	3E-9 3E-9	1E-5 -	1E-4 -
59	Praseodymium-143	W, see ^{136}Pr Y, see ^{136}Pr	9E+2 LLI wall (1E+3) -	8E+2 - 7E+2	3E-7 - 3E-7	1E-9 - 9E-10	- 2E-5 -	- 2E-4 -
59	Praseodymium-144[2]	W, see ^{136}Pr Y, see ^{136}Pr	3E+4 St wall (4E+4) -	1E+5 - 1E+5	5E-5 - 5E-5	2E-7 - 2E-7	- 6E-4 -	- 6E-3 -
59	Praseodymium-145	W, see ^{136}Pr Y, see ^{136}Pr	3E+3 -	9E+3 8E+3	4E-6 3E-6	1E-8 1E-8	4E-5 -	4E-4 -
59	Praseodymium-147[2]	W, see ^{136}Pr Y, see ^{136}Pr	5E+4 St wall (8E+4) -	2E+5 - 2E+5	8E-5 - 8E-5	3E-7 - 3E-7	- 1E-3 -	- 1E-2 -
60	Neodymium-144[2]	W, all compounds except those given for Y Y, oxides, hydroxides, carbides, and fluorides	1E+4 -	6E+4 5E+4	2E-5 2E-5	8E-8 8E-8	2E-4 -	2E-3 -
60	Neodymium-138	W, see ^{136}Nd Y, see ^{136}Nd	2E+3 -	6E+3 5E+3	3E-6 2E-6	9E-9 7E-9	3E-5 -	3E-4 -
60	Neodymium-139m	W, see ^{136}Nd Y, see ^{136}Nd	5E+3 -	2E+4 1E+4	7E-6 6E-6	2E-8 2E-8	7E-5 -	7E-4 -
60	Neodymium-139[2]	W, see ^{136}Nd Y, see ^{136}Nd	9E+4 -	3E+5 3E+5	1E-4 1E-4	5E-7 4E-7	1E-3 -	1E-2 -
60	Neodymium-141	W, see ^{136}Nd Y, see ^{136}Nd	2E+5 -	7E+5 6E+5	3E-4 3E-4	1E-6 9E-7	2E-3 -	2E-2 -
60	Neodymium-147	W, see ^{136}Nd Y, see ^{136}Nd	1E+3 LLI wall (1E+3) -	9E+2 - 8E+2	4E-7 - 4E-7	1E-9 - 1E-9	- 2E-5 -	- 2E-4 -
60	Neodymium-149[2]	W, see ^{136}Nd Y, see ^{136}Nd	1E+4 -	3E+4 2E+4	1E-5 1E-5	4E-8 3E-8	1E-4 -	1E-3 -
60	Neodymium-151[2]	W, see ^{136}Nd Y, see ^{136}Nd	7E+4 -	2E+5 2E+5	8E-5 8E-5	3E-7 3E-7	9E-4 -	9E-3 -
61	Promethium-141[2]	W, all compounds except those for Y Y, oxides, hydroxides, carbides, and fluorides	5E+4 St wall (6E+4) -	2E+5 - 2E+5	8E-5 - 7E-5	3E-7 - 2E-7	- 8E-4 -	- 8E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
61	Promethium-143	W, see ^{141}Pm Y, see ^{141}Pm	5E+3 -	6E+2 7E+2	2E-7 3E-7	8E-10 1E-9	7E-5 -	7E-4 -
61	Promethium-144	W, see ^{141}Pm Y, see ^{141}Pm	1E+3 -	1E+2 1E+2	5E-8 5E-8	2E-10 2E-10	2E-5 -	2E-4 -
61	Promethium-145	W, see ^{141}Pm Y, see ^{141}Pm	1E+4 - -	2E+2 Bone surf (2E+2) 2E+2	7E-8 - 8E-8	- 3E-10 3E-10	1E-4 - -	1E-3 - -
61	Promethium-146	W, see ^{141}Pm Y, see ^{141}Pm	2E+3 -	5E+1 4E+1	2E-8 2E-8	7E-11 6E-11	2E-5 -	2E-4 -
61	Promethium-147	W, see ^{141}Pm Y, see ^{141}Pm	4E+3 LLI wall (5E+3) -	1E+2 Bone surf (2E+2) 1E+2)	5E-8 - 6E-8	- 3E-10 2E-10	- 7E-5 -	- 7E-4 -
61	Promethium-148m	W, see ^{141}Pm Y, see ^{141}Pm	7E+2 -	3E+2 3E+2	1E-7 1E-7	4E-10 5E-10	1E-5 -	1E-4 -
61	Promethium-148	W, see ^{141}Pm Y, see ^{141}Pm	4E+2 LLI wall (5E+2) -	5E+2 - 5E+2	2E-7 - 2E-7	8E-10 - 7E-10	- 7E-6 -	- 7E-5 -
61	Promethium-149	W, see ^{141}Pm Y, see ^{141}Pm	1E+3 LLI wall (1E+3) -	2E+3 - 2E+3	8E-7 - 8E-7	3E-9 - 2E-9	- 2E-5 -	- 2E-4 -
61	Promethium-150	W, see ^{141}Pm Y, see ^{141}Pm	5E+3 -	2E+4 2E+4	8E-6 7E-6	3E-8 2E-8	7E-5 -	7E-4 -
61	Promethium-151	W, see ^{141}Pm Y, see ^{141}Pm	2E+3 -	4E+3 3E+3	1E-6 1E-6	5E-9 4E-9	2E-5 -	2E-4 -
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 St wall (6E+4)	2E+5 -	8E-5 -	2E-7 -	- 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 Bone surf (3E+1)	4E-2 Bone surf (6E-2)	1E-11 -	- 9E-14	- 3E-7	- 3E-6
62	Samarium-147	W, all compounds	2E+1 Bone surf (3E+1)	4E-2 Bone surf (7E-2)	2E-11 -	- 1E-13	- 4E-7	- 4E-6

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
62	Samarium-151	W, all compounds	1E+4 LLI wall (1E+4)	1E+2 Bone surf (2E+2)	4E-8 -	- 2E-10	- 2E-4	- 2E-3
62	Samarium-153	W, all compounds	2E+3 LLI wall (2E+3)	3E+3 -	1E-6 -	4E-9 -	- 3E-5	- 3E-4
62	Samarium-155[2]	W, all compounds	6E+4 St wall (8E+4)	2E+5 -	9E-5 -	3E-7 -	- 1E-3	- 1E-2
62	Samarium-156	W, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
63	Europium-145	W, all compounds	2E+3	2E+3	8E-7	3E-9	2E-5	2E-4
63	Europium-146	W, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
63	Europium-147	W, all compounds	3E+3	2E+3	7E-7	2E-9	4E-5	4E-4
63	Europium-148	W, all compounds	1E+3	4E+2	1E-7	5E-10	1E-5	1E-4
63	Europium-149	W, all compounds	1E+4	3E+3	1E-6	4E-9	2E-4	2E-3
63	Europium-150 (12.62 h)	W, all compounds	3E+3	8E+3	4E-6	1E-8	4E-5	4E-4
63	Europium-150 (34.2 y)	W, all compounds	8E+2	2E+1	8E-9	3E-11	1E-5	1E-4
63	Europium-152m	W, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
63	Europium-152	W, all compounds	8E+2	2E+1	1E-8	3E-11	1E-5	1E-4
63	Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6	7E-5
63	Europium-155	W, all compounds	4E+3	9E+1 Bone surf (1E+2)	4E-8 -	- 2E-10	5E-5 -	5E-4 -
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 W, oxides, hydroxides, and fluorides	5E+4 St wall (5E+4) -	2E+5 - 2E+5	6E-5 - 7E-5	2E-7 - 2E-7	- 6E-4 -	- 6E-3 -
64	Gadolinium-146	D, see ^{145}Gd W, see ^{145}Gd	1E+3 -	1E+2 3E+2	5E-8 1E-7	2E-10 4E-10	2E-5 -	2E-4 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
64	Gadolinium-147	D, see ^{145}Gd W, see ^{145}Gd	2E+3 -	4E+3 4E+3	2E-6 1E-6	6E-9 5E-9	3E-5 -	3E-4 -
64	Gadolinium-148	D, see ^{145}Gd W, see ^{145}Gd	1E+1 Bone surf (2E+1) - -	8E+3 Bone surf (2E-2) 3E-2 Bone surf (6E-2)	3E-12 - 1E-11 -	- 2E-14 - 8E-14	- 3E-7 - -	- 3E-6 - -
64	Gadolinium-149	D, see ^{145}Gd W, see ^{145}Gd	3E+3 -	2E+3 2E+3	9E-7 1E-6	3E-9 3E-9	4E-5 -	4E-4 -
64	Gadolinium-151	D, see ^{145}Gd W, see ^{145}Gd	6E+3 - -	4E+2 Bone surf (6E+2) 1E+3	2E-7 - 5E-7	- 9E-10 2E-9	9E-5 - -	9E-4 - -
64	Gadolinium-152	D, see ^{145}Gd W, see ^{145}Gd	2E+1 Bone surf (3E+1) - -	1E-2 Bone surf (2E-2) 4E-2 Bone surf (8E-2)	4E-12 - 2E-11 -	- 3E-14 - 1E-13	- 4E-7 - -	- 4E-6 - -
64	Gadolinium-153	D, see ^{145}Gd W, see ^{145}Gd	5E+3 - -	1E+2 Bone surf (2E+2) 6E+2	6E-8 - 2E-7	- 3E-10 8E-10	6E-5 - -	6E-4 - -
64	Gadolinium-159	D, see ^{145}Gd W, see ^{145}Gd	3E+3 -	8E+3 6E+3	3E-6 2E-6	1E-8 8E-9	4E-5 -	4E-4 -
65	Terbium-147[2]	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3
65	Terbium-149	W, all compounds	5E+3	7E+2	3E-7	1E-9	7E-5	7E-4
65	Terbium-150	W, all compounds	5E+3	2E+4	9E-6	3E-8	7E-5	7E-4
65	Terbium-151	W, all compounds	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
65	Terbium-153	W, all compounds	5E+3	7E+3	3E-6	1E-8	7E-5	7E-4
65	Terbium-154	W, all compounds	2E+3	4E+3	2E-6	6E-9	2E-5	2E-4
65	Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5	8E-4
65	Terbium-156m (5.0 h)	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4	2E-3
65	Terbium-156m (24.4 h)	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4	1E-3
65	Terbium-156	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
65	Terbium-157	W, all compounds	5E+4 LLI wall (5E+4)	3E+2 Bone surf (6E+2)	1E-7 -	- 8E-10	- 7E-4	- 7E-3
65	Terbium-158	W, all compounds	1E+3	2E+1	8E-9	3E-11	2E-5	2E-4
65	Terbium-160	W, all compounds	8E+2	2E+2	9E-8	3E-10	1E-5	1E-4
65	Terbium-161	W, all compounds	2E+3 LLI wall (2E+3)	2E+3 -	7E-7 -	2E-9 -	- 3E-5	- 3E-4
66	Dysprosium-155	W, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
66	Dysprosium-157	W, all compounds	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
66	Dysprosium-159	W, all compounds	1E+4	2E+3	1E-6	3E-9	2E-4	2E-3
66	Dysprosium-165	W, all compounds	1E+4	5E+4	2E-5	6E-8	2E-4	2E-3
66	Dysprosium-166	W, all compounds	6E+2 LLI wall (8E+2)	7E+2 -	3E-7 -	1E-9 -	- 1E-5	- 1E-4
67	Holmium-155[2]	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
67	Holmium-157[2]	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159[2]	W, all compounds	2E+5	1E+6	4E-4	1E-6	3E-3	3E-2
67	Holmium-161	W, all compounds	1E+5	4E+5	2E-4	6E-7	1E-3	1E-2
67	Holmium-162m[2]	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162[2]	W, all compounds	5E+5 St wall (8E+5)	2E+6 -	1E-3 -	3E-6 -	- 1E-2	- 1E-1
67	Holmium-164m[2]	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164[2]	W, all compounds	2E+5 St wall (2E+5)	6E+5 -	3E-4 -	9E-7 -	- 3E-3	- 3E-2
67	Holmium-166m	W, all compounds	6E+2	7E+0	3E-9	9E-12	9E-6	9E-5
67	Holmium-166	W, all compounds	9E+2 LLI wall (9E+2)	2E+3 -	7E-7 -	2E-9 -	- 1E-5	- 1E-4
67	Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
67	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

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
68	Erbium-169	W, all compounds	3E+3 LLI wall (4E+3)	3E+3 -	1E-6 -	4E-9 -	- 5E-5	- 5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4
68	Erbium-172	W, all compounds	1E+3 LLI wall (1E+2)	1E+3 -	6E-7 -	2E-9 -	- 2E-5	- 2E-4
69	Thulium-162[2]	W, all compounds	7E+4 St wall (7E+4)	3E+5 -	1E-4 -	4E-7 -	- 1E-3	- 1E-2
69	Thulium-166	W, all compounds	4E+3	1E+4	6E-6	2E-8	6E-5	6E-4
69	Thulium-167	W, all compounds	2E+3 LLI wall 2E+3)	2E+3 -	8E-7 -	3E-9 -	- 3E-5	- 3E-4
69	Thulium-170	W, all compounds	8E+2 LLI wall (1E+3)	2E+2 -	9E-8 -	3E-10 -	- 1E-5	- 1E-4
69	Thulium-171	W, all compounds	1E+4 LLI wall (1E+4)	3E+2 Bone surf (6E+2)	1E-7 -	- 8E-10	- 2E-4	- 2E-3
69	Thulium-172	W, all compounds	7E+2 LLI wall (8E+2)	1E+3 -	5E-7 -	2E-9 -	- 1E-5	- 1E-4
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175[2]	W, all compounds	7E+4 St wall (9E+4)	3E+5 -	1E-4 -	4E-7 -	- 1E-3	- 1E-2
70	Ytterbium-162[2]	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	7E+4 -	3E+5 3E+5	1E-4 1E-4	4E-7 4E-7	1E-3 -	1E-2 -
70	Ytterbium-166	W, see ^{162}Yb Y, see ^{162}Yb	1E+3 -	2E+3 2E+3	9E-7 8E-7	3E-9 3E-9	2E-5 -	2E-4 -
70	Ytterbium-167[2]	W, see ^{162}Yb Y, see ^{162}Yb	3E+5 -	8E+5 7E+5	3E-4 3E-4	1E-6 1E-6	4E-3 -	4E-2
70	Ytterbium-169	W, see ^{162}Yb Y, see ^{162}Yb	2E+3 -	8E+2 7E+2	4E-7 3E-7	1E-9 1E-9	2E-5 -	2E-4 -
70	Ytterbium-175	W, see ^{162}Yb Y, see ^{162}Yb	3E+3 LLI wall (3E+3) -	4E+3 - 3E+3	1E-6 - 1E-6	5E-9 - 5E-9	- 4E-5 -	- 4E-4 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
70	Ytterbium-177[2]	W, see ^{162}Yb Y, see ^{162}Yb	2E+4 -	5E+4 5E+4	2E-5 2E-5	7E-8 6E-8	2E-4 -	2E-3 -
70	Ytterbium-178[2]	W, see ^{162}Yb Y, see ^{162}Yb	1E+4 -	4E+4 4E+4	2E-5 2E-5	6E-8 5E-8	2E-4 -	2E-3 -
71	Lutetium-169	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	3E+3 -	4E+3 4E+3	2E-6 2E-6	6E-9 6E-9	3E-5 -	3E-4 -
71	Lutetium-170	W, see ^{169}Lu Y, see ^{169}Lu	1E+3 -	2E+3 2E+3	9E-7 8E-7	3E-9 3E-9	2E-5 -	2E-4 -
71	Lutetium-171	W, see ^{169}Lu Y, see ^{169}Lu	2E+3 -	2E+3 2E+3	8E-7 8E-7	3E-9 3E-9	3E-5 -	3E-4 -
71	Lutetium-172	W, see ^{169}Lu Y, see ^{169}Lu	1E+3 -	1E+3 1E+3	5E-7 5E-7	2E-9 2E-9	1E-5 -	1E-4 -
71	Lutetium-173	W, see ^{169}Lu Y, see ^{169}Lu	5E+3 - -	3E+2 bone surf (5E+2) 3E+2	1E-7 - 1E-7	- 6E-10 4E-10	7E-5 - -	7E-4 - -
71	Lutetium-174m	W, see ^{169}Lu Y, see ^{169}Lu	2E+3 LLI wall (3E+3) -	2E+2 Bone surf (3E+2) 2E+2	1E-7 - 9E-8	- 5E-10 3E-10	- 4E-5 -	- 4E-4 -
71	Lutetium-174	W, see ^{169}Lu Y, see ^{169}Lu	5E+3 - -	1E+2 Bone surf (2E+2) 2E+2	5E-8 - 6E-8	- 3E-10 2E-10	7E-5 - -	7E-4 - -
71	Lutetium-176m	W, see ^{169}Lu Y, see ^{169}Lu	8E+3 -	3E+4 2E+4	1E-5 9E-6	3E-8 3E-8	1E-4 -	1E-3 -
71	Lutetium-176	W, see ^{169}Lu Y, see ^{169}Lu	7E+2 - -	5E+0 Bone surf (1E+1) 8E+0	2E-9 - 3E-9	- 2E-11 1E-11	1E-5 - -	1E-4 - -
71	Lutetium-177m	W, see ^{169}Lu Y, see ^{169}Lu	7E+2 - -	1E+2 Bone surf (1E+2) 8E+1	5E-8 - 3E-8	- 2E-10 1E-10	1E-5 - -	1E-4 - -
71	Lutetium-177	W, see ^{169}Lu Y, see ^{169}Lu	2E+3 LLI wall (3E+3) -	2E+3 - 2E+3	9E-7 - 9E-7	3E-9 - 3E-9	- 4E-5 -	- 4E-4 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
71	Lutetium-178m[2]	W, see ^{169}Lu Y, see ^{169}Lu	5E+4 St. wall (6E+4) -	2E+5 - 2E+5	8E-5 - 7E-5	3E-7 - 2E-7	- 8E-4 -	- 8E-3 -
71	Lutetium-178[2]	W, see ^{169}Lu Y, see ^{169}Lu	4E+4 St wall (4E+4) -	1E+5 - 1E+5	5E-5 - 5E-5	2E-7 - 2E-7	- 6E-4 -	- 6E-3 -
71	Lutetium-179	W, see ^{169}Lu Y, see ^{169}Lu	6E+3 -	2E+4 2E+4	8E-6 6E-6	3E-8 3E-8	9E-5 -	9E-4 -
72	Hafnium-170	D, all compounds except those given for W W, oxides, hydroxides, carbides, and nitrates	3E+3 -	6E+3 5E+3	2E-6 2E-6	8E-9 6E-9	4E-5 -	4E-4 -
72	Hafnium-172	D, see ^{170}Hf W, see ^{170}Hf	1E+3 - - -	9E+0 Bone surf (2E+1 4E+1 Bone surf (6E+1	4E-9 - 2E-8 -	- 3E-11 - 8E-11	2E-5 - - -	2E-4 - - -
72	Hafnium-173	D, see ^{170}Hf W, see ^{170}Hf	5E+3 -	1E+4 1E+4	5E-6 5E-6	2E-8 2E-8	7E-5 -	7E-4 -
72	Hafnium-175	D, see ^{170}Hf W, see ^{170}Hf	3E+3 - -	9E+2 Bone surf (1E+3) 1E+3	4E-7 - 5E-7	- 1E-9 2E-9	4E-5 - -	4E-4 - -
72	Hafnium-177m[2]	D, see ^{170}Hf W, see ^{170}Hf	2E+4 -	6E+4 9E+4	2E-5 4E-5	8E-8 1E-7	3E-4 -	3E-3 -
72	Hafnium-178m	D, see ^{170}Hf W, see ^{170}Hf	3E+2 - - -	1E+0 Bone surf (2E+0) 5E+0 Bone surf (9E+0)	5E-10 - 2E-9 -	- 3E-12 - 1E-11	3E-6 - - -	3E-5 - - -
72	Hafnium-179m	D, see ^{170}Hf W, see ^{170}Hf	1E+3 - -	3E+2 Bone surf (6E+2) 6E+2	1E-7 - 3E-7	- 8E-10 8E-10	1E-5 - -	1E-4 - -
72	Hafnium-180m	D, see ^{170}Hf W, see ^{170}Hf	7E+3 -	2E+4 3E+4	9E-6 1E-5	3E-8 4E-8	1E-4 -	1E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
72	Hafnium-181	D, see ^{170}Hf W, see ^{170}Hf	1E+3 - -	2E+2 Bone surf (4E+2) 4E+2	7E-8 - 2E-7	- 6E-10 6E-10	2E-5 - -	2E-4 - -
72	Hafnium-182m[2]	D, see ^{170}Hf W, see ^{170}Hf	4E+4 -	9E+4 1E+5	4E-5 6E-5	1E-7 2E-7	5E-4 -	5E-3 -
72	Hafnium-182	D, see ^{170}Hf W, see ^{170}Hf	2E+2 Bone surf (4E+2) - -	8E-1 Bone surf (2E+0) 3E+0 Bone surf (7E+0)	3E-10 - 1E-9 -	- 2E-12 - 1E-11	- 5E-6 - -	- 5E-5 - -
72	Hafnium-183[2]	D, see ^{170}Hf W, see ^{170}Hf	2E+4 -	5E+4 6E+4	2E-5 2E-5	6E-8 8E-8	3E-4 -	3E-3 -
72	Hafnium-184	D, see ^{170}Hf W, see ^{170}Hf	2E+3 -	8E+3 6E+3	3E-6 3E-6	1E-8 9E-9	3E-5 -	3E-4 -
73	Tantalum-172[2]	W, all compounds except those given for Y Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	4E+4 -	1E+5 1E+5	5E-5 4E-5	2E-7 1E-7	5E-4 -	5E-3 -
73	Tantalum-173	W, see ^{172}Ta Y, see ^{172}Ta	7E+3 -	2E+4 2E+4	8E-6 7E-6	3E-8 2E-8	9E-5 -	9E-4 -
73	Tantalum-174[2]	W, see ^{172}Ta Y, see ^{172}Ta	3E+4 -	1E+5 9E+4	4E-5 4E-5	1E-7 1E-7	4E-4 -	4E-3 -
73	Tantalum-175	W, see ^{172}Ta Y, see ^{172}Ta	6E+3 -	2E+4 1E+4	7E-6 6E-6	2E-8 2E-8	8E-5 -	8E-4 -
73	Tantalum-176	W, see ^{172}Ta Y, see ^{172}Ta	4E+3 -	1E+4 1E+4	5E-6 5E-6	2E-8 2E-8	5E-5 -	5E-4 -
73	Tantalum-177	W, see ^{172}Ta Y, see ^{172}Ta	1E+4 -	2E+4 2E+4	8E-6 7E-6	3E-8 2E-8	2E-4 -	2E-3 -
73	Tantalum-178	W, see ^{172}Ta Y, see ^{172}Ta	2E+4 -	9E+4 7E+4	4E-5 3E-5	1E-7 1E-7	2E-4 -	2E-3 -
73	Tantalum-179	W, see ^{172}Ta Y, see ^{172}Ta	2E+4 -	5E+3 9E+2	2E-6 4E-7	8E-9 1E-9	3E-4 -	3E-3 -
73	Tantalum-180m	W, see ^{172}Ta Y, see ^{172}Ta	2E+4 -	7E+4 6E+4	3E-5 2E-5	9E-8 8E-8	3E-4 -	3E-3 -
73	Tantalum-180	W, see ^{172}Ta Y, see ^{172}Ta	1E+3 -	4E+2 2E+1	2E-7 1E-8	6E-10 3E-11	2E-5 -	2E-4 -

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Releases to Sewers Monthly Average Concentration (µCi/ml)
73	Tantalum-182m[2]	W, see ^{172}Ta Y, see ^{172}Ta	2E+5 St wall (2E+5) -	5E+5 - 4E+5	2E-4 - 2E-4	8E-7 - 6E-7	- 3E-3 -	- 3E-2 -
73	Tantalum-182	W, see ^{172}Ta Y, see ^{172}Ta	8E+2 -	3E+2 1E+2	1E-7 6E-8	5E-10 2E-10	1E-5 -	1E-4 -
73	Tantalum-183	W, see ^{172}Ta Y, see ^{172}Ta	9E+2 LLI wall (1E+3) -	1E+3 - 1E+3	5E-7 - 4E-7	2E-9 - 1E-9	- 2E-5 -	- 2E-4 -
73	Tantalum-184	W, see ^{172}Ta Y, see ^{172}Ta	2E+3 -	5E+3 5E+3	2E-6 2E-6	8E-9 7E-9	3E-5 -	3E-4 -
73	Tantalum-185[2]	W, see ^{172}Ta Y, see ^{172}Ta	3E+4 -	7E+4 6E+4	3E-5 3E-5	1E-7 9E-8	4E-4 -	4E-3 -
73	Tantalum-186[2]	W, see ^{172}Ta Y, see ^{172}Ta	5E+4 St wall (7E+4) -	2E+5 - 2E+5	1E-4 - 9E-5	3E-7 - 3E-7	- 1E-3 -	- 1E-2 -
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 LLI wall (3E+3)	7E+3 -	3E-6 -	9E-9 -	- 4E-5	- 4E-4
74	Tungsten-187	D, all compounds	2E+3	9E+3	4E-6	1E-8	3E-5	3E-4
74	Tungsten-188	D, all compounds	4E+2 LLI wall (5E+2)	1E+3 -	5E-7 -	2E-9 -	- 7E-6	- 7E-5
75	Rhenium-177[2]	D, all compounds except those given for W W, oxides, hydroxides, and nitrates	9E+4 St wall (1E+5) -	3E+5 - 4E+5	1E-4 - 1E-4	4E-7 - 5E-7	- 2E-3 -	- 2E-2 -
75	Rhenium-178[2]	D, see ^{177}Re W, see ^{177}Re	7E+4 St wall (1E+5) -	3E+5 - 3E+5	1E-4 - 1E-4	4E-7 - 4E-7	- 1E-3 -	- 1E-2 -
75	Rhenium-181	D, see ^{177}Re W, see ^{177}Re	5E+3 -	9E+3 9E+3	4E-6 4E-6	1E-8 1E-8	7E-5 -	7E-4 -

Exhibit 2A

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Releases to Sewers Monthly Average Concentration (µCi/ml)
75	Rhenium-182 (12.7 h)	D, see ^{177}Re W, see ^{177}Re	7E+3 -	1E+4 2E+4	5E-6 6E-6	2E-8 2E-8	9E-5 -	9E-4 -
75	Rhenium-182 (64.0 h)	D, see ^{177}Re W, see ^{177}Re	1E+3 -	2E+3 2E+3	1E-6 9E-7	3E-9 3E-9	2E-5 -	2E-4 -
75	Rhenium-184m	D, see ^{177}Re W, see ^{177}Re	2E+3 -	3E+3 4E+2	1E-6 2E-7	4E-9 6E-10	3E-5 -	3E-4 -
75	Rhenium-184	D, see ^{177}Re W, see ^{177}Re	2E+3 -	4E+3 1E+3	1E-6 6E-7	5E-9 2E-9	3E-5 -	3E-4 -
75	Rhenium-186m	D, see ^{177}Re W, see ^{177}Re	1E+3 St wall (2E+3) -	2E+3 St wall (2E+3) 2E+2	7E-7 6E-8	- 3E-9 2E-10	- 2E-5 -	- 2E-4 -
75	Rhenium-186	D, see ^{177}Re W, see ^{177}Re	2E+3 -	3E+3 2E+3	1E-6 7E-7	4E-9 2E-9	3E-5 -	3E-4 -
75	Rhenium-187	D, see ^{177}Re W, see ^{177}Re	6E+5 - -	8E+5 St wall (9E+5) 1E+5	4E-4 4E-5	- 1E-6 1E-7	8E-3 - -	8E-2 - -
75	Rhenium-188m[2]	D, see ^{177}Re W, see ^{177}Re	8E+4 -	1E+5 1E+5	6E-5 6E-5	2E-7 2E-7	1E-3 -	1E-2 -
75	Rhenium-188	D, see ^{177}Re W, see ^{177}Re	2E+3 -	3E+3 3E+3	1E-6 1E-6	4E-9 4E-9	2E-5 -	2E-4 -
75	Rhenium-189	D, see ^{177}Re W, see ^{177}Re	3E+3 -	5E+3 4E+3	2E-6 2E-6	7E-9 6E-9	4E-5 -	4E-4 -
76	Osmium-180[2]	D, all compounds except those given for W and Y W, halides and nitrates Y, oxides and hydroxides	1E+5 - -	4E+5 5E+5 5E+5	2E-4 2E-4 2E-4	5E-7 7E-7 6E-7	1E-3 - -	1E-2 - -
76	Osmium-181[2]	D, see ^{180}Os W, see ^{180}Os Y, see ^{180}Os	1E+4 - -	4E+4 5E+4 4E+4	2E-5 2E-5 2E-5	6E-8 6E-8 6E-8	2E-4 - -	2E-3 - -
76	Osmium-182	D, see ^{180}Os W, see ^{180}Os Y, see ^{180}Os	2E+3 - -	6E+3 4E+3 4E+3	2E-6 2E-6 2E-6	8E-9 6E-9 6E-9	3E-5 - -	3E-4 - -
76	Osmium-185	D, see ^{180}Os W, see ^{180}Os Y, see ^{180}Os	2E+3 - -	5E+2 8E+2 8E+2	2E-7 3E-7 3E-7	7E-10 1E-9 1E-9	3E-5 - -	3E-4 - -
76	Osmium-189m	D, see ^{180}Os W, see ^{180}Os Y, see ^{180}Os	8E+4 - -	2E+5 2E+5 2E+5	1E-4 9E-5 7E-5	3E-7 3E-7 2E-7	1E-3 - -	1E-2 - -
76	Osmium-191m	D, see ^{180}Os W, see ^{180}Os Y, see ^{180}Os	1E+4 - -	3E+4 2E+4 2E+4	1E-5 8E-6 7E-6	4E-8 3E-8 2E-8	2E-4 - -	2E-3 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
76	Osmium-191	D, see ^{180}Os	2E+3 LLI wall (3E+3)	2E+3	9E-7	3E-9	-	-
		W, see ^{180}Os	-	-	-	-	3E-5	3E-4
		Y, see ^{180}Os	-	2E+3	7E-7	2E-9	-	-
				1E+3	6E-7	2E-9	-	-
76	Osmium-193	D, see ^{180}Os	2E+3 LLI wall (2E+3)	5E+3	2E-6	6E-9	-	-
		W, see ^{180}Os	-	-	-	-	2E-5	2E-4
		Y, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-
				3E+3	1E-6	4E-9	-	-
76	Osmium-194	D, see ^{180}Os	4E+2 LLI wall (6E+2)	4E+1	2E-8	6E-11	-	-
		W, see ^{180}Os	-	-	-	-	8E-6	8E-5
		Y, see ^{180}Os	-	6E+1	2E-8	8E-11	-	-
				8E+0	3E-9	1E-11	-	-
77	Iridium-182[2]	D, all compounds except those given for W and Y	4E+4 St wall (4E+4)	1E+5	6E-5	2E-7	-	-
		W, halides, nitrates, and metallic iridium	-	-	-	-	6E-4	6E-3
		Y, oxides and hydroxides	-	2E+5	6E-5	2E-7	-	-
			-	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 LLI wall (5E+3)	5E+3	2E-6	7E-9	-	-
		W, see ^{182}Ir	-	-	-	-	7E-5	7E-4
		Y, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
				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	-	-

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
77	Iridium-190	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	1E+3 - -	9E+2 1E+3 9E+2	4E-7 4E-7 4E-7	1E-9 1E-9 1E-9	1E-5 - -	1E-4 - -
77	Iridium-192m	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	3E+3 - -	9E+1 2E+2 2E+1	4E-8 9E-8 6E-9	1E-10 3E-10 2E-11	4E-5 - -	4E-4 - -
77	Iridium-192	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	9E+2 - -	3E+2 4E+2 2E+2	1E-7 2E-7 9E-8	4E-10 6E-10 3E-10	1E-5 - -	1E-4 - -
77	Iridium-194m	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	6E+2 - -	9E+1 2E+2 1E+2	4E-8 7E-8 4E-8	1E-10 2E-10 1E-10	9E-6 - -	9E-5 - -
77	Iridium-194	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	1E+3 - -	3E+3 2E+3 2E+3	1E-6 9E-7 8E-7	4E-9 3E-9 3E-9	1E-5 - -	1E-4 - -
77	Iridium-195m	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	8E+3 - -	2E+4 3E+4 2E+4	1E-5 1E-5 9E-6	3E-8 4E-8 3E-8	1E-4 - -	1E-3 - -
77	Iridium-195	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	1E+4 - -	4E+4 5E+4 4E+4	2E-5 2E-5 2E-5	6E-8 7E-8 6E-8	2E-4 - -	2E-3 - -
78	Platinum-186	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78	Platinum-188	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78	Platinum-189	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78	Platinum-191	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
78	Platinum-193m	D, all compounds	3E+3 LLI wall (3E+4)	6E+3 -	3E-6 -	8E-9 -	- 4E-5	- 4E-4
78	Platinum-193	D, all compounds	4E+4 LLI wall (5E+4)	2E+4 -	1E-5 -	3E-8 -	- 6E-4	- 6E-3
78	Platinum-195m	D, all compounds	2E+3 LLI wall (2E+3)	4E+3 -	2E-6 -	6E-9 -	- 3E-5	- 3E-4
78	Platinum-197m[2]	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
78	Platinum-199[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
78	Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
79	Gold-193	D, all compounds except those given for W and Y W, halides and nitrates Y, oxides and hydroxides	9E+3 - -	3E+4 2E+4 2E+4	1E-5 9E-6 8E-6	4E-8 3E-8 3E-8	1E-4 - -	1E-3 - -
79	Gold-194	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	3E+3 - -	8E+3 5E+3 5E+3	3E-6 2E-6 2E-6	1E-8 8E-9 7E-9	4E-5 - -	4E-4 - -
79	Gold-195	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	5E+3 - -	1E+4 1E+3 4E+2	5E-6 6E-7 2E-7	2E-8 2E-9 6E-10	7E-5 - -	7E-4 - -
79	Gold-198m	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	1E+3 - -	3E+3 1E+3 1E+3	1E-6 5E-7 5E-7	4E-9 2E-9 2E-9	1E-5 - -	1E-4 - -
79	Gold-198	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	1E+3 - -	4E+3 2E+3 2E+3	2E-6 8E-7 7E-7	5E-9 3E-9 2E-9	2E-5 - -	2E-4 - -
79	Gold-199	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	3E+3 LLI wall (3E+3) - -	9E+3 - 4E+3 4E+3	4E-6 - 2E-6 2E-6	1E-8 - 6E-9 5E-9	- 4E-5 - -	- 4E-4 - -
79	Gold-200m	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	1E+3 - -	4E+3 3E+3 2E+4	1E-6 1E-6 1E-6	5E-9 4E-9 3E-9	2E-5 - -	2E-4 - -
79	Gold-200[2]	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	3E+4 - -	6E+4 8E+4 7E+4	3E-5 3E-5 3E-5	9E-8 1E-7 1E-7	4E-4 - -	4E-3 - -
79	Gold-201[2]	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	7E+4 St wall (9E+4) - -	2E+5 - 2E+5 2E+5	9E-5 - 1E-4 9E-5	3E-7 - 3E-7 3E-7	- 1E-3 - -	- 1E-2 - -
80	Mercury-193m	Vapor Organic D D, sulfates W, oxides, hydroxides, halides, nitrates, and sulfides	- 4E+3 3E+3 -	8E+3 1E+4 9E+3 8E+3	4E-6 5E-6 4E-6 3E-6	1E-8 2E-8 1E-8 1E-8	- 6E-5 4E-5 -	- 6E-4 4E-4 -
80	Mercury-193	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 2E+4 2E+4 -	3E+4 6E+4 4E+4 4E+4	1E-5 3E-5 2E-5 2E-5	4E-8 9E-8 6E-8 6E-8	- 3E-4 2E-4 -	- 3E-3 2E-3 -

Exhibit 2A

Atomic No.	Radionuclide	Class	Table I Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Table I Occupational Values Col. 2 Inhalation ALI (µCi)	Table I Occupational Values Col. 3 Inhalation DAC (µCi/ml)	Table II Effluent Concentrations Col. 1 Air (µCi/ml)	Table II Effluent Concentrations Col. 2 Water (µCi/ml)	Table III Releases to Sewers Monthly Average Concentration (µCi/ml)
80	Mercury-194	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 2E+1 8E+2 -	3E+1 3E+1 4E+1 1E+2	1E-8 1E-8 2E-8 5E-8	4E-11 4E-11 6E-11 2E-10	- 2E-7 1E-5 -	- 2E-6 1E-4 -
80	Mercury-195m	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 3E+3 2E+3 -	4E+3 6E+3 5E+3 4E+3	2E-6 3E-6 2E-6 2E-6	6E-9 8E-9 7E-9 5E-9	- 4E-5 3E-5 -	- 4E-4 3E-4 -
80	Mercury-195	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 2E+4 1E+4 -	3E+4 5E+4 4E+4 3E+4	1E-5 2E-5 1E-5 1E-5	4E-8 6E-8 5E-8 5E-8	- 2E-4 2E-4 -	- 2E-3 2E-3 -
80	Mercury-197m	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 4E+3 3E+3 -	5E+3 9E+3 7E+3 5E+3	2E-6 4E-6 3E-6 2E-6	7E-9 1E-8 1E-8 7E-9	- 5E-5 4E-5 -	- 5E-4 4E-4 -
80	Mercury-197	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 7E+3 6E+3 -	8E+3 1E+4 1E+4 9E+3	4E-6 6E-6 5E-6 4E-6	1E-8 2E-8 2E-8 1E-8	- 9E-5 8E-5 -	- 9E-4 8E-4 -
80	Mercury-199m[2]	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 6E+4 St wall (1E+5) 6E+4 -	8E+4 2E+5 - 1E+5 2E+5	3E-5 7E-5 - 6E-5 7E-5	1E-7 2E-7 - 2E-7 2E-7	- - 1E-3 8E-4 -	- - 1E-2 8E-3 -
80	Mercuy-203	Vapor Organic D D, see ^{193m}Hg W, see ^{193m}Hg	- 5E+2 2E+3	8E+2 8E+2 1E+3 1E+3	4E-7 3E-7 5E-7 5E-7	1E-9 1E-9 2E-9 2E-9	- 7E-6 3E-5 -	- 7E-5 3E-4 -
81	Thallium-194m[2]	D, all compounds	5E+4 St wall (7E+4)	2E+5 -	6E-5 -	2E-7 -	- 1E-3	- 1E-2
81	Thallium-194[2]	D, all compounds	3E+5 St wall (3E+5)	6E+5 -	2E-4 -	8E-7 -	- 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

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5	2E-4
82	Lead-195m[2]	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4	8E-3
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
82	Lead-199[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4	1E-3
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6	2E-5
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5	5E-4
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
82	Lead-210	D, all compounds	6E-1 Bone surf (1E+0)	2E-1 Bone surf (4E-1)	1E-10 -	- 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 Bone surf (1E+2)	3E+1 -	1E-8 -	5E-11 -	- 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 W, all other compounds	3E+4 -	8E+4 1E+5	4E-5 4E-5	1E-7 1E-7	4E-4 -	4E-3 -
83	Bismuth-201[2]	D, see ^{200}Bi W, see ^{200}Bi	1E+4 -	3E+4 4E+4	1E-5 2E-5	4E-8 5E-8	2E-4 -	2E-3 -
83	Bismuth-202[2]	D, see ^{200}Bi W, see ^{200}Bi	1E+4 -	4E+4 8E+4	2E-5 3E-5	6E-8 1E-7	2E-4 -	2E-3 -
83	Bismuth-203	D, see ^{200}Bi W, see ^{200}Bi	2E+3 -	7E+3 6E+3	3E-6 3E-6	9E-9 9E-9	3E-5 -	3E-4 -
83	Bismuth-205	D, see ^{200}Bi W, see ^{200}Bi	1E+3 -	3E+3 1E+3	1E-6 5E-7	3E-9 2E-9	2E-5 -	2E-4 -
83	Bismuth-206	D, see ^{200}Bi W, see ^{200}Bi	6E+2 -	1E+3 9E+2	6E-7 4E-7	2E-9 1E-9	9E-6 -	9E-5 -
83	Bismuth-207	D, see ^{200}Bi W, see ^{200}Bi	1E+3 -	2E+3 4E+2	7E-7 1E-7	2E-9 5E-10	1E-5 -	1E-4 -
83	Bismuth-210m	D, see ^{200}Bi W, see ^{200}Bi	4E+1 Kidneys (6E+1) -	5E+0 Kidneys (6E+0) 7E-1	2E-9 3E-10	- 9E-12 9E-13	- 8E-7 -	- 8E-6 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
83	Bismuth-210	D, see ^{200}Bi W, see ^{200}Bi	8E+2 - -	2E+2 Kidneys (4E+2) 3E+1	1E-7 - 1E-8	- 5E-10 4E-11	1E-5 - -	1E-4 - -
83	Bismuth-212[2]	D, see ^{200}Bi W, see ^{200}Bi	5E+3 -	2E+2 3E+2	1E-7 1E-7	3E-10 4E-10	7E-5 -	7E-4 -
83	Bismuth-213[2]	D, see ^{200}Bi W, see ^{200}Bi	7E+3 -	3E+2 4E+2	1E-7 1E-7	4E-10 5E-10	1E-4 -	1E-3 -
83	Bismuth-214[2]	D, see ^{200}Bi W, see ^{200}Bi	2E+4 St wall (2E+4) -	8E+2 - 9E-2	3E-7 - 4E-7	1E-9 - 1E-9	- 3E-4 -	- 3E-3 -
84	Polonium-203[2]	D, all compounds except those given for W W, oxides, hydroxides, and nitrates	3E+4 -	6E+4 9E+4	3E-5 4E-5	9E-8 1E-7	3E-4 -	3E-3 -
84	Polonium-205[2]	D, see ^{203}Po W, see ^{203}Po	2E+4 -	4E+4 7E+4	2E-5 3E-5	5E-8 1E-7	3E-4 -	3E-3 -
84	Polonium-207	D, see ^{203}Po W, see ^{203}Po	8E+3 -	3E+4 3E+4	1E-5 1E-5	3E-8 4E-8	1E-4 -	1E-3 -
84	Polonium-210	D, see ^{203}Po W, see ^{203}Po	3E+0 -	6E-1 6E-1	3E-10 3E-10	9E-13 9E-13	4E-8 -	4E-7 -
85	Astatine-207[2]	D, Halides W	6E+3 -	3E+3 2E+3	1E-6 9E-7	4E-9 3E-9	8E-5 -	8E-4 -
85	Astatine-211	D, halides W	1E+2 -	8E+1 5E+1	3E-8 2E-8	1E-10 8E-11	2E-6 -	2E-5 -
86	Radon-220	With daughters removed With daughters present	- -	2E+4 2E+1 (or 12 WLM)	7E-6 9E-9 (or 1.0 WL)	2E-8 3E-11	- -	- -
86	Radon-222	With daughters removed With daughters present	- -	1E+4 1E+2 (or 4 WLM)	4E-6 3E-8 (or 0.33 WL)	1E-8 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 Bone surf (9E+0)	7E-1 -	3E-10 -	9E-13 -	- 1E-7	- 1E-6

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
88	Radium-224	W, all compounds	8E+0 Bone surf (2E+1)	2E+0 -	7E-10 -	2E-12 -	- 2E-7	- 2E-6
88	Radium-225	W, all compounds	8E+0 Bone surf (2E+1)	7E-1 -	3E-10 -	9E-13 -	- 2E-7	- 2E-6
88	Radium-226	W, all compounds	2E+0 Bone surf (5E+0)	6E-1 -	3E-10 -	9E-13 -	- 6E-8	- 6E-7
88	Radium-227[2]	W, all compounds	2E+4 Bone surf (2E+4)	1E+4 Bone surf (2E+4)	6E-6 -	- 3E-8	- 3E-4	- 3E-3
88	Radium-228	W, all compounds	2E+0 Bone surf (4E+0)	1E+0 -	5E-10 -	2E-12 -	- 6E-8	- 6E-7
89	Actinium-224	D, all compounds except those given for W and Y W, halides and nitrates Y, oxides and hydroxides	2E+3 LLI wall (2E+3) - -	3E+1 Bone surf (4E+1) 5E+1 5E+1	1E-8 - 2E-8 2E-8	- 5E-11 7E-11 6E-11	- 3E-5 - -	- 3E-4 - -
89	Actinium-225	D, see ^{224}Ac W, see ^{224}Ac Y, see ^{224}Ac	5E+1 LLI wall (5E+1) - -	3E-1 Bone surf (5E-1) 6E-1 6E-1	1E-10 - 3E-10 3E-10	- 7E-13 9E-13 9E-13	- 7E-7 - -	- 7E-6 - -
89	Actinium-226	D, see ^{224}Ac W, see ^{224}Ac Y, see ^{224}Ac	1E+2 LLI wall (1E+2) - -	3E+0 Bone surf (4E+0) 5E+0 5E+0	1E-9 - 2E-9 2E-9	- 5E-12 7E-12 6E-12	- 2E-6 - -	- 2E-5 - -
89	Actinium-227	D, see ^{224}Ac W, see ^{224}Ac Y, see ^{224}Ac	2E-1 Bone surf (4E-1) - - -	4E-4 Bone surf (8E-4) 2E-3 Bone surf (3E-3) 4E-3	2E-13 - 7E-13 - 2E-12	- 1E-15 - 4E-15 6E-15	- 5E-9 - - -	- 5E-8 - - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
89	Actinium-228	D, see ^{224}Ac	2E+3	9E+0 Bone surf	4E-9	-	3E-5	3E-4
		W, see ^{224}Ac	-	(2E+1)	-	2E-11	-	-
			-	4E+1	2E-8	-	-	-
		Y, see ^{224}Ac	-	Bone surf	-	8E-11	-	-
				(6E+1)	2E-8	6E-11	-	-
				4E+1				
90	Thorium-226[2]	W, all compounds except those given for Y	5E+3 St wall	2E+2	6E-8	2E-10	-	-
			(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 Bone surf	1E-2 Bone surf	4E-12	-	-	-
		Y, see ^{226}Th	(1E+1)	(2E-2)	-	3E-14	2E-7	2E-6
			-	2E-2	7E-12	2E-14	-	-
90	Thorium-229	W, see ^{226}Th	6E-1 Bone surf	9E-4 Bone surf	4E-13	-	-	-
		Y, see ^{226}Th	(1E+0)	(2E-3)	-	3E-15	2E-8	2E-7
			-	2E-3 Bone surf	1E-12	-	-	-
			-	(3E-3)	-	4E-15	-	-
90	Thorium-230	W, see ^{226}Th	4E+0 Bone surf	6E-3 Bone surf	3E-12	-	-	-
		Y, see ^{226}Th	(9E+0)	(2E-2)	-	2E-14	1E-7	1E-6
			-	2E-2 Bone surf	6E-12	-	-	-
			-	(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 Bone surf	1E-3 Bone surf	5E-13	-	-	-
		Y, see ^{226}Th	(2E+0)	(3E-3)	-	4E-15	3E-8	3E-7
			-	3E-3 Bone surf	1E-12	-	-	-
			-	(4E-3)	-	6E-15	-	-
90	Thorium-234	W, see ^{226}Th	3E+2 LLI wall	2E+2	8E-8	3E-10	-	-
		Y, see ^{226}Th	(4E+2)	-	-	-	5E-6	5E-5
			-	2E+2	6E-8	2E-10	-	-

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
91	Protactinium-227[2]	W, all compounds except those given for Y Y, oxides and hydroxides	4E+3 -	1E+2 1E+2	5E-8 4E-8	2E-10 1E-10	5E-5 -	5E-4 -
91	Protactinium-228	W, see ^{227}Pa Y, see ^{227}Pa	1E+3 - -	1E+1 Bone surf (2E+1) 1E+1	5E-9 - 5E-9	- 3E-11 2E-11	2E-5 - -	2E-4 - -
91	Protactinium-230	W, see ^{227}Pa Y, see ^{227}Pa	6E+2 Bone surf (9E+2) -	5E+0 - 4E+0	2E-9 - 1E-9	7E-12 - 5E-12	- 1E-5 -	- 1E-4 -
91	Protactinium-231	W, see ^{227}Pa Y, see ^{227}Pa	2E-1 Bone surf (5E-1) - -	2E-3 Bone surf (4E-3) 4E-3 Bone surf (6E-3)	6E-13 - 2E-12 -	- 6E-15 - 8E-15	- 6E-9 - -	- 6E-8 - -
91	Protactinium-232	W, see ^{227}Pa Y, see ^{227}Pa	1E+3 - - -	2E+1 Bone surf (6E+1) 6E+1 Bone surf (7E+1)	9E-9 - 2E-8 -	- 8E-11 - 1E-10	2E-5 - - -	2E-4 - - -
91	Protactinium-233	W, see ^{227}Pa Y, see ^{227}Pa	1E+3 LLI wall (2E+3) -	7E+2 - 6E+2	3E-7 - 2E-7	1E-9 - 8E-10	- 2E-5 -	- 2E-4 -
91	Protactinium-234	W, see ^{227}Pa Y, see ^{227}Pa	2E+3 -	8E+3 7E+3	3E-6 3E-6	1E-8 9E-9	3E-5 -	3E-4 -
92	Uranium-230	D, UF, UO_2F_2, $UO_2(NO_3)_2$ W, UO_3, UF_4, UC_{14} Y, UO_2, U_30_8	4E+0 Bone surf (6E+0) - -	4E-1 Bone surf (6E-1) 4E-1 3E-1	2E-10 - 1E-10 1E-10	- 8E-13 5E-13 4E-13	- 8E-8 - -	- 8E-7 - -
92	Uranium-231	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	5E+3 LLI wall (4E+3) - -	8E+3 - 6E+3 5E+3	3E-6 - 2E-6 2E-6	1E-8 - 8E-9 6E-9	- 6E-5 - -	- 6E-4 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
92	Uranium-232	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	2E+0 Bone surf (4E+0) - -	2E-1 Bone surf (4E-1) 4E-1 8E-3	9E-11 - 2E-10 3E-12	- 6E-13 5E-13 1E-14	- 6E-8 - -	- 6E-7 - -
92	Uranium-233	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+1 Bone surf (2E+1) - -	1E+0 Bone surf (2E+0) 7E-1 4E-2	5E-10 - 3E-10 2E-11	- 3E-12 1E-12 5E-14	- 3E-7 - -	- 3E-6 - -
92	Uranium-234[3]	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+1 Bone surf (2E+1) - -	1E+0 Bone surf (2E+0 7E-1 4E-2	5E-10 - 3E-10 2E-11	- 3E-12 1E-12 5E-14	- 3E-7 - -	- 3E-6 - -
92	Uranium-235[3]	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+1 Bone surf (2E+1) - -	1E+0 Bone surf (2E+0) 8E-1 4E-2	6E-10 - 3E-10 2E-11	- 3E-12 1E-12 6E-14	- 3E-7 - -	- 3E-6 - -
92	Uranium-236	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+1 Bone surf (2E+1) - -	1E+0 Bone surf (2E+0) 8E-1 4E-2	5E-10 - 3E-10 2E-11	- 3E-12 1E-12 6E-14	- 3E-7 - -	- 3E-6 - -
92	Uranium-237	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	2E+3 LLI wall (2E+3) - -	3E+3 - 2E+3 2E+3	1E-6 - 7E-7 6E-7	4E-9 - 2E-9 2E-9	- 3E-5 - -	- 3E-4 - -
92	Uranium-238[3]	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+1 Bone surf (2E+1) - -	1E+0 Bone surf (2E+0) 8E-1 4E-2	6E-10 - 3E-10 2E-11	- 3E-12 1E-12 6E-14	- 3E-7 - -	- 3E-6 - -
92	Uranium-239[2]	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	7E+4 - -	2E+5 2E+5 2E+5	8E-5 7E-5 6E-5	3E-7 2E-7 2E-7	9E-4 - -	9E-3 - -
29	Uranium-240	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+3 - -	4E+3 3E+3 2E+3	2E-6 1E-6 1E-6	5E-9 4E-9 3E-9	2E-5 - -	2E-4 - -
92	Uranium-natural[3]	D, see ^{230}U W, see ^{230}U Y, see ^{230}U	1E+1 Bone surf (2E+1) - -	1E+0 Bone surf (2E+0) 8E-1 5E-2	5E-10 - 3E-10 2E-11	- 3E-12 9E-13 9E-14	- 3E-7 - -	- 3E-6 - -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
93	Neptunium-232[2]	W, all compounds	1E+5 -	2E+3 Bone surf (5E+2)	7E-7 -	- 6E-9	2E-3 -	2E-2 -
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 LLI wall (2E+4)	8E+2 Bone surf (1E+3)	3E-7 -	- 2E-9	- 3E-4	- 3E-3
93	Neptunium-236 (1.15E+5 y)	W, all compounds	3E+0 Bone surf (6E+0)	2E-2 Bone surf (5E-2)	9E-12 -	- 8E-14	- 9E-8	- 9E-7
93	Neptunium-236 (22.5 h)	W, all compounds	3E+3 Bone surf (4E+3)	3E+1 Bone surf (7E+1)	1E-8 -	- 1E-10	- 5E-5	- 5E-4
93	Neptunium-237	W, all compounds	5E-1 Bone surf (1E+0)	4E-3 Bone surf (1E-2)	2E-12 -	- 1E-14	- 2E-8	- 2E-7
93	Neptunium-238	W, all compounds	1E+3 -	6E+1 Bone surf (2E+2)	3E-8 -	- 2E-10	2E-5 -	2E-4 -
93	Neptunium-239	W, all compounds	2E+3 LLI wall (2E+3)	2E+3 -	9E-7 -	3E-9 -	- 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 Y, PuO_2	8E+3 -	2E 2 2E+2	9E-8 8E-8	3E-10 3E-10	1E-4 -	1E-3 -
94	Plutonium-235[2]	W, see ^{234}Pu Y, see ^{234}Pu	9E+5 -	3E+6 3E+6	1E-3 1E-3	4E-6 3E-6	1E-2 -	1E-1 -
94	Plutonium-236	W, see ^{234}Pu Y, see ^{234}Pu	2E+0 Bone surf (4E+0) -	2E-2 Bone surf (4E-2) 4E-2	8E-12 - 2E-11	- 5E-14 6E-14	- 6E-8 -	- 6E-7 -
94	Plutonium-237	W, see ^{234}Pu Y, see ^{234}Pu	1E+4 -	3E+3 3E+3	1E-6 1E-6	5E-9 4E-9	2E-4 -	2E-3 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
94	Plutonium-238	W, see ^{234}Pu Y, see ^{234}Pu	9E-1 Bone surf (2E+0) -	7E-3 Bone surf (1E-2) 2E-2	3E-12 - 8E-12	- 2E-14 2E-14	- 2E-8 -	- 2E-7 -
94	Plutonium-239	W, see ^{234}Pu Y, see ^{234}Pu	8E-1 Bone surf (1E+0) - -	6E-3 Bone surf (1E-2) 2E-2 Bone surf (2E-2)	3E-12 - 7E-12 -	- 2E-14 - 2E-14	- 2E-8 - -	- 2E-7 - -
94	Plutonium-240	W, see ^{234}Pu Y, see ^{234}Pu	8E-1 Bone surf (1E+0) - -	6E-3 Bone surf (1E-2) 2E-2 Bone surf (2E-2)	3E-12 - 7E-12 -	- 2E-14 - 2E-14	- 2E-8 - -	- 2E-7 - -
94	Plutonium-241	W, see ^{234}Pu Y, see ^{234}Pu	4E+1 Bone surf (7E+1) - -	3E-1 Bone surf (6E-1) 8E-1 Bone surf (1E+0)	1E-10 - 3E-10 -	- 8E-13 - 1E-12	- 1E-6 - -	- 1E-5 - -
94	Plutonium-242	W, see ^{234}Pu Y, see ^{234}Pu	8E-1 Bone surf (1E+0) - -	7E-3 Bone surf (1E-2) 2E-2 Bone surf (2E-2)	3E-12 - 7E-12 -	- 2E-14 - 2E-14	- 2E-8 - -	- 2E-7 - -
94	Plutonium-243	W, see ^{234}Pu Y, see ^{234}Pu	2E+4 -	4E+4 4E+4	2E-5 2E-5	5E-8 5E-8	2E-4 -	2E-3 -
94	Plutonium-244	W, see ^{234}Pu Y, see ^{234}Pu	8E-1 Bone surf (2E+0) - -	7E-3 Bone surf (1E-2) 2E-2 Bone surf (2E-2)	3E-12 - 7E-12 -	- 2E-14 - 2E-14	- 2E-8 - -	- 2E-7 - -
94	Plutonium-245	W, see ^{234}Pu Y, see ^{234}Pu	2E+3 -	5E+3 4E+3	2E-6 2E-6	6E-9 6E-9	3E-5 -	3E-4 -
94	Plutonium-246	W, see ^{234}Pu Y, see ^{234}Pu	4E+2 LLI wall (4E+2) -	3E+2 - 3E+2	1E-7 - 1E-7	4E-10 - 4E-10	- 6E-6 -	- 6E-5 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentration (µCi/ml)
95	Americium-237[2]	W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-238[2]	W, all compounds	4E+4 -	3E+3 Bone surf (6E+3)	1E-6 -	- 9E-9	5E-4 -	5E-3 -
95	Americium-239	W, all compounds	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
95	Americium-240	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
95	Americium-241	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
95	Americium-242m	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
95	Americium-242	W, all compounds	4E+3 -	8E+1 Bone surf (9E+1)	4E-8 -	- 1E-10	5E-5 -	5E-4 -
95	Americium-243	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
95	Americium-244m[2]	W, all compounds	6E+4 St wall (8E+4)	4E+3 Bone surf (7E+3)	2E-6 -	- 1E-8	- 1E-3	- 1E-2
95	Americium-244	W, all compounds	3E+3 -	2E+2 Bone surf (3E+2)	8E-8	- 4E-10	4E-5 -	4E-4 -
95	Americium-245	W, all compounds	3E+4	8E+4	3E-5	1E-7	4E-4	4E-3
95	Americium-246m[2]	W, all compounds	5E+4 St wall (6E+4)	2E+5 -	8E-5 -	3E-7 -	- 8E-4	- 8E-3
95	Americium-246[2]	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
96	Curium-238	W, all compounds	2E+4	1E+3	5E-7	2E-9	2E-4	2E-3
96	Curium-240	W, all compounds	6E+1 Bone surf (8E+1)	6E-1 Bone surf (6E-1)	2E-10 -	- 9E-13	- 1E-6	- 1E-5

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentration (µCi/ml)
96	Curium-241	W, all compounds	1E+3 -	3E+1 Bone surf (4E+1)	1E-8 -	- 5E-11	2E-5 -	2E-4 -
96	Curium-242	W, all compounds	3E+1 Bone surf (5E+1)	3E-1 Bone surf (3E-1)	1E-10 -	- 4E-13	- 7E-7	- 7E-6
96	Curium-243	W, all compounds	1E+0 Bone surf (2E+0)	9E-3 Bone surf (2E-2)	4E-12 -	- 2E-14	- 3E-8	- 3E-7
96	Curium-244	W, all compounds	1E+0 Bone surf (3E+0)	1E-2 Bone surf (2E-2)	5E-12 -	- 3E-14	- 3E-8	- 3E-7
96	Curium-245	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96	Curium-246	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96	Curium-247	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96	Curium-248	W, all compounds	2E-1 Bone surf (4E-1)	2E-3 Bone surf (3E-3)	7E-13 -	- 4E-15	- 5E-9	- 5E-8
96	Curium-249[2]	W, all compounds	5E+4 -	2E+4 Bone surf (3E+4)	7E-6 -	- 4E-8	7E-4 -	7E-3 -
96	Curium-250	W, all compounds	4E-2 Bone surf (6E-2)	3E-4 Bone surf (5E-4)	1E-13 -	- 8E-16	- 9E-10	- 9E-9
97	Berkelium-245	W, all compounds	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
97	Berkelium-246	W, all compounds	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
97	Berkelium-247	W, all compounds	5E-1 Bone surf (1E+0)	4E-3 Bone surf (9E-3)	2E-12 -	- 1E-14	- 2E-8	- 2E-7

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
97	Berkelium-249	W, all compounds	2E+2 Bone surf (5E+2)	2E+0 Bone surf (4E+0)	7E-10 -	- 5E-12	- 6E-6	6E-5
97	Berkelium-250	W, all compounds	9E+3 -	3E+2 Bone surf (7E+2)	1E-7 -	- 1E-9	1E-4 -	1E-3 -
98	Californium-244[2]	W, all compounds except those given for Y Y, oxides and hydroxides	3E+4 St wall (3E+4) -	6E+2 - 6E+2	2E-7 - 2E-7	8E-10 - 8E-10	- 4E-4 -	- 4E-3 -
98	Californium-246	W, see ^{244}Cf Y, see ^{244}Cf	4E+2 -	9E+0 9E+0	4E-9 4E-9	1E-11 1E-11	5E-6 -	5E-5 -
98	Californium-248	W, see ^{244}Cf Y, see ^{244}Cf	8E+0 Bone surf (2E+1) -	6E-2 Bone surf (1E-1) 1E-1	3E-11 - 4E-11	- 2E-13 1E-13	- 2E-7 -	- 2E-6 -
98	Californium-249	W, see ^{244}Cf Y, see ^{244}Cf	5E-1 Bone surf (1E+0) - -	4E-3 Bone surf (9E-3) 1E-2 Bone surf (1E-2)	2E-12 - 4E-12 -	- 1E-14 - 2E-14	- 2E-8 - -	- 2E-7 - -
98	Californium-250	W, see ^{244}Cf Y, see ^{244}Cf	1E+0 Bone surf (2E+0) -	9E-3 Bone surf (2E-2) 3E-2	4E-12 - 1E-11	- 3E-14 4E-14	- 3E-8 -	- 3E-7 -
98	Californium-251	W, see ^{244}Cf Y, see ^{244}Cf	5E-1 Bone surf (1E+0) - -	4E-3 Bone surf (9E-3) 1E-2 Bone surf (1E-2)	2E-12 - 4E-12 -	- 1E-14 - 2E-14	- 2E-8 - -	- 2E-7 - -
98	Californium-252	W, see ^{244}Cf Y, see ^{244}Cf	2E+0 Bone surf (5E+0) -	2E-2 Bone surf (4E-2) 3E-2	8E-12 - 1E-11	- 5E-14 5E-14	- 7E-8 -	- 7E-7 -

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
98	Californium-253	W, see ^{244}Cf Y, see ^{244}Cf	2E+2 Bone surf (4E+2) -	2E+0 - 2E+0	8E-10 - 7E-10	3E-12 - 2E-12	- 5E-6 -	- 5E-5 -
98	Californium-254	W, see ^{244}Cf Y, see ^{244}Cf	2E+0 -	2E-2 2E-2	9E-12 7E-12	3E-14 2E-14	3E-8 -	3E-7 -
99	Einsteinium-250	W, all compounds	4E+4 -	5E+2 Bone surf (1E+3)	2E-7 -	- 2E-9	6E-4 -	6E-3 -
99	Einsteinium-251	W, all compounds	7E+3 -	9E+2 Bone surf (1E+3)	4E-7 -	- 2E-9	1E-4 -	1E-3 -
99	Einsteinium-253	W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6	2E-5
99	Einsteinium-254m	W, all compounds	3E+2 LLI wall (3E+2)	1E+1 -	4E-9 -	1E-11 -	- 4E-6	- 4E-5
99	Einsteinium-254	W, all compounds	8E+0 Bone surf (2E+1)	7E-2 Bone surf (1E-1)	3E-11 -	- 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 Bone surf (4E+1)	2E-1 Bone surf (2E-1)	7E-11 -	- 3E-13	- 5E-7	- 5E-6
101	Mendelevium-257	W, all compounds	7E+3 -	8E+1 Bone surf (9E+1)	4E-8 -	- 1E-10	1E-4 -	1E-3 -
101	Mendelevium-258	W, all compounds	3E+1 Bone surf (5E+1)	2E-1 Bone surf (3E-1)	1E-10 -	- 5E-13	- 6E-7	- 6E-6

Exhibit 2A

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	
			Oral Ingestion	Inhalation				Monthly Average
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Concentration (µCi/ml)
- 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

Tables I, II and III notes:

[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 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 microcurie per milliliter (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 20.3.4.407 NMAC);

[3] for soluble mixtures of U-238, U-234 and U-235 in air, chemical toxicity may be the limiting factor (see Subsection E of 20.3.4.405 NMAC). If the percent of 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) microcurie-hours per milliliter (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 uranium. The specific activity for other mixtures of U-238, U-235 and U-234, if not known, shall be:

SA = 3.6E-7 curies/gram U for depleted uranium; and

SA = $(0.4 + 0.38 \text{ (enrichment)} + 0.0034 \text{ (enrichment)}^2)$E-6 for enrichment > 0.72,

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

F. Notes.

(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 section 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 section for any radionuclide that is not known to be absent from the mixture; or

Radionuclide	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
	Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
	Oral Ingestion	Inhalation				Monthly Average
	ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
If it is known that Ac-227-D and Cm-250-W are not present	-	7E-4	3E-13	-	-	-
If, in addition, it is known that Ac-227-W, Y, Th-229-W, Y, Th-230-W, Th-232-W, Y, Pa-231-W, Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present	-	7E-3	3E-12	-	-	-
If, in addition, it is known that Sm-146-W, Sm-147-W, Gd-148-D, W, Gd-152-D, W, Th-228-W, Y, Th-230-Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, Np-236-W, Pu-236-W, Y, Pu-238-W, Y, Pu-239-Y, Pu-240-Y, Pu-242-Y, Pu-244-W, Y, Cm-243-W, Cm-244-W, Cf-248-W, Cf-249-Y, Cf-250-W, Y, Cf-251-Y, Cf-252-W, Y, and Cf-254-W, Y are not present	-	7E-2	3E-11	-	-	-
If, in addition, it is known that Pb-210-D, Bi-210m-W, Po-210-D, W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D, W, Y, Th-227-W, Y, U-230-D, W, Y, U-232-D, W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-Y, Es-254-W, Fm-257-W, and Md-258-W are not present	-	7E-1	3E-10	-	-	-
If, in addition, it is known that Si-32-Y, Ti-44-Y, Fe-60-D, Sr-90-Y, Zr-93-D, Cd-113m-D, Cd-113-D, In-115-D, W, La-138-D, Cd-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	-	-

Exhibit 2A

Radionuclide	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
	Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
	Oral Ingestion	Inhalation				Monthly Average
	ALI (μCi)	ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	Concentration (μCi/ml)
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, 1-129, 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 micrometers 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 microcurie of gross alpha activity from uranium-238, uranium-234, thorium-230 and radium-226 per milliliter of air; 3E-11 microcurie 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 this section 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:

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

(5) To convert microcuries to kilobecquerels, multiply the microcurie value by 37.

[20.3.4.461 NMAC - Rp, 20.3.4.461 NMAC, 4/30/2009]

20.3.4.462 APPENDIX C - QUANTITIES[1] OF LICENSED MATERIAL REQUIRING LABELING:

A. Table 462.1.

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
Hydrogen-3	1,000
Beryllium-7	1,000
Beryllium-10	1
Carbon-11	1,000
Carbon-14	100
Fluorine-18	1,000
Sodium-22	100
Sodium-24	100

Exhibit 2A

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
Cobalt-60	1
Cobalt-61	1,000
Cobalt-62m	1,000
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
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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
Rhodium-103m	1,000
Rhodium-105	100

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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 (69.1 min)	1,000
Indium-110 (4.9 h)	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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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 (16 min.)	1,000
Antimony-120 (5.76 d)	100
Antimony-122	100
Antimony-124m	1,000
Antimony-124	10
Antimony-125	100
Antimony-126m	1,000
Antimony-126	100
Antimony-127	100
Antimony-128 (10.4 min)	1,000
Antimony-128 (9.01 h)	100
Antimony-129	100
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
Tellurium-127m	10
Tellurium-127	1,000
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
Iodine-132	100
Iodine-133	10
Iodine-134	1,000
Iodine-135	100
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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-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 (12.62 h)	100

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
Europium-150 (34.2 y)	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
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 (24.4 h)	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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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
Rhenium-177	1,000
Rhenium-178	1,000
Rhenium-181	1,000
Rhenium-182 (12.7 h)	1,000
Rhenium-182 (64.0 h)	100
Rhenium-184m	10
Rhenium-184	100
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 (1.4 m)	10
Iridium-192 (73.8 d)	1
Iridium-194m	10
Iridium-194	100
Iridium-195m	1,000

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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 y)	0.001
Neptunium-236 (22.5 h)	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	0.001
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

TABLE 462.1	
Radionuclide	**Quantity (microcuries[2])**
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-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
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

Table 462.1 notes:

[1] the quantities listed above were derived by taking 1/10th of the most restrictive ALI listed in columns 1 and 2 of table I of 20.3.4.461 NMAC, rounding to the nearest factor of 10, and constraining the values listed between 0.001 and 1,000 microcuries (37 becquerels and 37 megabecquerels). Values of 100 microcuries (3.7 megabecquerels) have been assigned for radionuclides having a radioactive half-life in excess of E+9 years, except rhenium, 1,000 microcuries (37 megabecquerels) to take into account their low specific activity;

[2] to convert microcuries to kilobecquerels, multiply the microcurie value by 37.

B. Note. For purposes of Subsection E of 20.3.4.428 NMAC, Subsection A of 20.3.4.431 NMAC and Subsection A of 20.3.4.451 NMAC 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.
[20.3.4.462 NMAC - Rp, 20.3.4.462 NMAC, 4/30/2009; A, 8/10/2021]

20.3.4.463 [RESERVED]

20.3.4.464 [RESERVED]

20.3.4.465 [RESERVED]

20.3.4.466 APPENDIX G - REQUIREMENTS FOR TRANSFERS OF LOW-LEVEL RADIOACTIVE WASTE INTENDED FOR DISPOSAL AT LICENSED LAND DISPOSAL FACILITIES AND MANIFESTS: LLW means low-level radioactive waste as defined in the Low-Level Radioactive Waste Policy Act.

A. Manifest.

(1) A waste generator, collector or processor who transports, or offers for transportation LLW intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a manifest [NRC OMB Control Numbers 3150-0164, -0165 and -0166] reflecting information requested on applicable NRC forms 540 (*uniform low-level radioactive waste manifest* (shipping paper) and 541 (u*niform low-level radioactive waste manifest* (container and waste description)) and, if necessary, on an applicable NRC form 542 (u*niform low-level radioactive waste manifest* (manifest index and regional compact tabulation)). NRC forms 540 and 540A must be completed and must physically accompany the pertinent low-level waste shipment. Upon agreement between shipper and consignee, NRC forms 541, 541A, 542 and 542A may be completed, transmitted and stored in electronic media with the capability for producing legible, accurate and complete records on the respective forms. Licensees are not required by NRC to comply with the manifesting requirements of this part when they ship the following:

(a) LLW for processing and expect its return (i.e., for storage under their license) prior to disposal at a licensed land disposal facility;

(b) LLW that is being returned to the licensee who is the "waste generator" or "generator", as defined in this part; or

(c) radioactively contaminated material to a "waste processor" that becomes the processor's "residual waste" unless regulated by other applicable federal or state regulations;

(d) these exclusions from manifesting requirements do not, however, exempt the licensee from complying with applicable DOT requirements for shipments referencing 49 CFR, including the preparation of shipping papers.

(2) For guidance in completing these forms, refer to the instructions that accompany the forms. Copies of manifests required by this section may be legible carbon copies, photocopies or computer printouts that reproduce the data in the format of the uniform manifest.

(3) NRC forms 540, 540A, 541, 541A, 542 and 542A, and the accompanying instructions, in hard copy, may be obtained by writing or calling the Office of the Chief information Officer, United States Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone (301) 415-5877, or by visiting the NRC's web site at http://www.nrc.gov and selecting forms from the index found on the home page.

(4) This section includes information requirements of the DOT, as codified in 49 CFR Part 172. Additional 49 CFR requirements may be applicable. Information on hazardous, medical or other waste, required to meet EPA regulations, as codified in 40 CFR Parts 259, 261 or elsewhere, is not addressed in this section, and must be provided on the required EPA forms. However, any required EPA forms must accompany the *uniform low-level radioactive waste manifest* required by this chapter.

(5) As used in this section, the following definitions apply:

(a) "chelating agent" has the same meaning as that given in 20.3.13.7 NMAC;

(b) "chemical description" means a description of the principal chemical characteristics of a low-level radioactive waste;

(c) "computer-readable medium" means that the department's computer can transfer the information from the medium into its memory;

(d) "consignee" means the designated receiver of the shipment of low-level radioactive waste;

(e) "decontamination facility" means a facility operating under a department, NRC or agreement state license whose principal purpose is decontamination of equipment or materials to accomplish recycle, reuse or other waste management objectives, and, for purposes of this part, is not considered to be a consignee for LLW shipments;

(f) "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;

(g) "EPA identification number" means the number received by a transporter following application to the administrator of EPA as required by 40 CFR Part 263;

(h) "generator" means a licensee operating under a department, NRC or agreement state license who *(1)* is a waste generator as defined in this part, or *(2)* is the licensee to whom waste can be attributed within the context of the Low-Level Radioactive Waste Policy Amendments Act (e.g., waste generated as a result of decontamination or recycle activities);

(i) "high integrity container" (HIC) means a container commonly designed to meet the structural stability requirements of 20.3.13.1325 NMAC, and to meet DOT requirements for a type A package;

(j) "land disposal facility" has the same meaning as that given in 20.3.13.7 NMAC;

(k) "NRC forms 540, 540A, 541, 541A, 542 and 542A" are official NRC forms referenced in this section; 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 must have the capability for producing legible, accurate and complete records in the format of the uniform manifest;

(l) "package" means the assembly of components necessary to ensure compliance with the packaging requirements of DOT regulations, together with its radioactive contents, as presented for transport;

(m) "physical description" means the items called for on NRC form 541 to describe a LLW;

(n) "residual waste" means LLW 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, provided that other federal laws or regulations, such as those of Resource Conservation and Recovery Act (RCRA), are not applicable;

(o) "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;

(p) "shipping paper" means NRC form 540 and, if required, NRC form 540A which includes the information required by DOT in 49 CFR part 172;

(q) "source material" has the same meaning as that given in 20.3.3.7 NMAC;

(r) "special nuclear material" has the same meaning as that given in 20.3.3.7 NMAC;

(s) "*uniform low-level radioactive waste manifest*" or "uniform manifest" means the combination of NRC forms 540, 541 and, if necessary, 542, and their respective continuation sheets as needed, or equivalent;

(t) "waste collector," including "waste broker," means an entity, operating under a department, NRC or agreement state license, 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;

(u) "waste description" means the physical, chemical and radiological description of a low-level radioactive waste as called for on NRC form 541;

(v) "waste generator" means an entity, operating under a department, NRC or agreement state license, who *(1)* possesses any material or component that contains radioactivity or is radioactively contaminated for which the licensee foresees no further use, and *(2)* transfers this material or component to a licensed land disposal facility or to a licensed waste collector or processor for handling or treatment prior to 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";

(w) "waste processor" means an entity, operating under a department, NRC or agreement state license, whose principal purpose is to process, repackage or otherwise treat low-level radioactive material or waste generated by others prior to eventual transfer of waste to a licensed low-level radioactive waste land disposal facility; and

(x) "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).

(6) Information requirements.

(a) General information. The shipper of the radioactive waste shall provide the following information on the uniform manifest:

(i) the name, facility address and telephone number of the licensee shipping the waste;

(ii) an explicit declaration indicating whether the shipper is acting as a waste generator, collector, processor or a combination of these identifiers for purposes of the manifested shipment; and

(iii) the name, address and telephone number, or the name and EPA identification number for the carrier transporting the waste.

(b) Shipment information. The shipper of the radioactive waste shall provide the following information regarding the waste shipment on the uniform manifest:

(i) the date of the waste shipment;

(ii) the total number of packages or disposal containers;

(iii) the total disposal volume and disposal weight in the shipment;

(iv) the total radionuclide activity in the shipment;

(v) the activity of each of the radionuclides H-3, C-14, Tc-99 and I-129 contained in the shipment; and

(vi) 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:

(i) an alphabetic or numeric identification that uniquely identifies each disposal container in the shipment;

(ii) a physical description of the disposal container, including the manufacturer and model of any high integrity container;

(iii) the volume displaced by the disposal container;

(iv) the gross weight of the disposal container, including the waste;

(v) for waste consigned to a disposal facility, the maximum radiation level at the surface of each disposal container;

(vi) a physical and chemical description of the waste;

(vii) the total weight percentage of chelating agent for any waste containing more than 0.1% chelating agent by weight, plus the identity of the principal chelating agent;

(viii) the approximate volume of waste within a container;

(ix) the sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name;

(x) 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, including fissile category classification; 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;

(xi) the total radioactivity within each container;

(xii) for wastes consigned to a disposal facility, the classification of the waste pursuant to 20.3.13.1324 NMAC; waste not meeting the structural stability requirements of Subsection B of 20.3.13.1325 NMAC; and

(xiii) any other information required on a manifest or shipping paper by the DOT, the NRC or other regulatory agencies.

(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:

(i) the approximate volume and weight of the waste;

(ii) a physical and chemical description of the waste;

(iii) the total weight percentage of chelating agent if the chelating agent exceeds 0.1% by weight, plus the identity of the principal chelating agent;

(iv) for waste consigned to a disposal facility, the classification of the waste pursuant to 20.3.13.1324 NMAC; waste not meeting the structural stability requirements of Subsection B of 20.3.13.1325 NMAC must be identified;

(v) 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

(vi) 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 section). 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.

(i) 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.

(ii) 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: (1) the volume of waste within the disposal container; (2) a physical and chemical description of the waste, including the solidification agent, if any; (3) the total weight percentage of chelating agents for any disposal container containing more than 0.1% chelating agent by weight, plus the identity of the principal chelating agent; (4) 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 Subsection B of 20.3.13.1325 NMAC; and (5) 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.

B. Certification. An authorized representative of the waste generator, processor or collector shall certify by signing and 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 department, the DOT and the NRC. A collector in signing the certification is certifying that nothing has been done to the collected waste which would invalidate the waste generator's certification.

C. Control and Tracking.

(1) Any licensee who transfers radioactive waste to a land disposal facility or a licensed waste collector shall comply with the requirements in Subparagraphs (a) through (i) of this paragraph. Any licensee who transfers waste to a licensed waste processor for waste treatment or repackaging shall comply with the requirements of Subparagraphs (d) through (i) of this paragraph. A licensee shall:

(a) prepare all wastes so that the waste is classified according to 20.3.13.1324 NMAC, and meets the waste characteristics requirements in 20.3.13.1325 NMAC;

(b) 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 then class C waste, in accordance with 20.3.13.1324 NMAC;

(c) conduct a quality assurance program to assure compliance with 20.3.13.1324 NMAC and 20.3.13.1325 NMAC (the program must include management evaluation of audits);

(d) prepare the NRC *uniform low-level radioactive waste manifest* as required by Subsection A of this section;

(e) forward a copy or electronically transfer the *uniform low-level radioactive waste manifest* to the intended consignee so that either *(1)* receipt of the manifest precedes the LLW shipment or *(2)* the

manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both delivery methods *(1)* and *(2)* is also acceptable;

(f) include NRC form 540 (and NRC form 540A, if required) with the shipment regardless of the option chosen in Subparagraph (e) of this paragraph;

(g) receive acknowledgment of the receipt of the shipment in the form of a signed copy of NRC form 540;

(h) retain a copy of or electronically store the *uniform low-level radioactive waste manifest* and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by 20.3.3 NMAC; and

(i) for any shipments or any part of a shipment for which acknowledgment of receipt has not been received within the times set forth in this section, conduct an investigation in accordance with Paragraph (5) of this subsection.

(2) Any waste collector licensee who handles only prepackaged waste shall:

(a) acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of NRC form 540;

(b) prepare a new manifest to reflect consolidated shipments that meet the requirements of this section; the waste collector shall ensure that, for each container of waste in the shipment, the manifest identifies the generator of that container of waste;

(c) forward a copy or electronically transfer the *uniform low-level radioactive waste manifest* to the intended consignee so that either *(1)* receipt of the manifest precedes the LLW shipment or *(2)* the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee; using both delivery methods *(1)* and *(2)* is also acceptable;

(d) include NRC form 540 (and NRC form 540A, if required) with the shipment regardless of the option chosen in Subparagraph (c) of this paragraph;

(e) receive acknowledgment of the receipt of the shipment in the form of a signed copy of NRC form 540;

(f) retain a copy of or electronically store the *uniform low-level radioactive waste manifest* and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by 20.3.3 NMAC;

(g) for any shipments or any part of a shipment for which acknowledgment of receipt has not been received within the times set forth in this section, conduct an investigation in accordance with Paragraph (5) of this subsection; and

(h) notify the shipper and the department 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.

(3) Any licensed waste processor who treats or repackages waste shall:

(a) acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of NRC form 540;

(b) prepare a new manifest that meets the requirements of this section; 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 as required in Subparagraph (e) of Paragraph (6) of Subsection A of this section;

(c) prepare all wastes so that the waste is classified according to 20.3.13.1324 NMAC, and meets the waste characteristics requirements in 20.3.13.1325 NMAC;

(d) label each package of waste to identify whether it is class A waste, class B waste or class C waste, in accordance with 20.3.13.1324 NMAC and 20.3.13.1326 NMAC;

(e) conduct a quality assurance program to assure compliance with 20.3.13.1324 NMAC and 20.3.13.325 NMAC (the program shall include management evaluation of audits);

(f) forward a copy or electronically transfer the *uniform low-level radioactive waste manifest* to the intended consignee so that either *(1)* receipt of the manifest precedes the LLW shipment or *(2)* the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee; using both delivery methods *(1)* and *(2)* is also acceptable;

(g) include NRC form 540 (and NRC form 540A, if required) with the shipment regardless of the option chosen in paragraph Subparagraph (f) of this paragraph;

(h) receive acknowledgment of the receipt of the shipment in the form of a signed copy of NRC form 540;

(i) retain a copy of or electronically store the *uniform low-level radioactive waste manifest* and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by 20.3.3 NMAC;

(j) for any shipment or any part of a shipment for which acknowledgment of receipt has not been received within the times set forth in this section, conduct an investigation in accordance with Paragraph (5) of this subsection; and

(k) notify the shipper and the department 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 canceled.

(4) The land disposal facility operator shall:

(a) acknowledge receipt of the waste within one 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;

(b) maintain copies of all completed manifests and electronically store the information required by 20.3.13.1334 NMAC until the department terminates the license; and

(c) notify the shipper and the department 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 canceled.

(5) Any shipment or part of a shipment for which acknowledgment is not received within the times set forth in this section must:

(a) be investigated by the shipper if the shipper has not received notification or receipt within 20 days after transfer; and

(b) be traced and reported; the investigation shall include tracing the shipment and filing a report with the department; each licensee who conducts a trace investigation shall file a written report with the department within 2 weeks of completion of the investigation.

[20.3.4.466 NMAC - Rp, 20.3.4.466 NMAC, 4/30/2009; A, 8/10/2021]

20.3.4.467 NATIONALLY TRACKED SOURCE THRESHOLDS: The terabecquerel values are the regulatory standard. The curie values specified are obtained by converting from the terabecquerel value. The curie values are provided for practical usefulness only and are rounded after conversion.

TABLE 467.1

Radioactive Material	**Category 1** terabecquerel	**Category 1** curie	**Category 2** terabecquerel	**Category 2** curie
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

TABLE 467.1				
Radioactive Material	**Category 1** terabecquerel	**Category 1** curie	**Category 2** terabecquerel	**Category 2** curie
Ytterbium-169	300	8,100	3	81

[20.3.4.467 NMAC - N, 4/30/2009]

HISTORY OF 20.3.4 NMAC:

Pre-NMAC History: The material in this part was derived from that previously filed as follows:
EIB 73-2, Regulations for Governing the Health and Environmental Aspects of Radiation filed on 7/9/1973;
EIB 73-2, Amendment 1, Regulations for Governing the Health and Environmental Aspects of Radiation filed on 4/17/1978;
EIB RPR-1, Radiation Protection Regulations filed on 4/21/1980;
EIB RPR-1, Amendment 1, Radiation Protection Regulations filed on 10/13/1981;
EIB RPR-1, Amendment 2, Radiation Protection Regulations filed on 12/15/1982; and
EIB RPR-1, Radiation Protection Regulations filed on 3/10/1989.

History of Repealed Material: 20.3.4 NMAC, Standards for Protection Against Radiation (filed 3/15/2004) repealed 4/30/2009.

Other History: EIB RPR 1, Radiation Protection Regulations, filed 3/10/1989 renumbered and reformatted to 20 NMAC 3.1; Radioactive Materials and Radiation Machines, effective 5/3/1995;
20 NMAC 3.1; Radioactive Materials and Radiation Machines (filed 4/3/1995) internally renumbered, reformatted and replaced by 20 NMAC 3.1, Radioactive Materials and Radiation Machines, effective 7/30/1999.
20 NMAC 3.1.Subpart 4, Standards for Protection Against Radiation (filed 6/17/1999) reformatted, amended and replaced by 20.3.4 NMAC, Standards for Protection Against Radiation, effective 4/15/2004.
20.3.4 NMAC, Standards for Protection Against Radiation (filed 03/15/2004) replaced by 20.3.4 NMAC, Standards for Protection Against Radiation, effective 4/30/2009.

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 3 RADIATION PROTECTION
PART 5 RADIATION SAFETY REQUIREMENTS FOR INDUSTRIAL RADIOGRAPHIC OPERATIONS

20.3.5.1 ISSUING AGENCY: Environmental Improvement Board.
[20.3.5.1 NMAC - N, 5/19/2002]

20.3.5.2 SCOPE: The regulations in this part apply to all licensees or registrants who use sources of radiation for industrial radiography. Except for those regulations of this Part clearly applicable only to sealed radioactive sources, both radiation machine and sealed radioactive sources are covered by this part. The requirements of this part are in addition to, and not in substitution for, other applicable requirements of 20.3 NMAC.
[20.3.5.2 NMAC - Rp, 20 NMAC 3.1.5.501, 5/19/2002]

20.3.5.3 STATUTORY AUTHORITY: Sections 74-1-8, 74-1-9, 74-3-5, and 74-3-9 NMSA 1978.
[20.3.5.3 NMAC - N, 5/19/2002]

20.3.5.4 DURATION: Permanent.
[20.3.5.4 NMAC - N, 5/19/2002]

20.3.5.5 EFFECTIVE DATE: May 19, 2002, unless a later date is cited at the end of a section.
[20.3.5.5 NMAC - N, 5/19/2002]

20.3.5.6 OBJECTIVE: To establish radiation safety requirements for both radiation machines and sealed radioactive sources used for industrial radiography.
[20.3.5.6 NMAC - Rp, 20 NMAC 3.1.5.500, 5/19/2002]

20.3.5.7 DEFINITIONS: As used in this Part, the following apply:

A. "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 specified in Part 4 of 20.3 NMAC as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of radiation and licensed materials in the public interest;

B. "Annual refresher safety training" means a review conducted or provided by the licensee or registrant for its employees on radiation safety aspects of industrial radiography. The review may include, as appropriate, the results of internal inspections, new procedures or equipment, new or revised regulations, accidents or errors that have been observed, and should also provide opportunities for employees to ask safety questions;

C. "Associated equipment" means equipment that is used in conjunction with a radiographic exposure device to make radiographic exposures that drives, guides, or comes in contact with the source, (e.g., guide tube, control tube, control (drive) cable, removable source stop, "J" tube and collimator when it is used as an exposure head;

D. "Becquerel" (Bq) means one disintegration per second;

E. "Cabinet radiography" means industrial radiography conducted in an enclosure or cabinet shielded so that radiation levels at every location on the exterior meet the limitations specified in 20.3.4.406 NMAC;

F. "Cabinet x-ray system" means an x-ray system with the x-ray tube installed in an enclosure (hereinafter termed "Cabinet") which, independently of existing architectural structures except the floor on which it may be placed, is intended to contain at least that portion of a material thing irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of x-radiation. Included are all x-ray systems designed primarily for the inspection of carry-on baggage at airline, railroad, and bus terminals, and in similar facilities. An x-ray tube used within a shielded part of a building, or x-ray equipment that may temporarily or occasionally incorporate portable shielding is not considered a cabinet x-ray system;

G. "Certified cabinet x-ray system" means an x-ray system which has been certified in accordance with 21 CFR 1010.2 as being manufactured and assembled pursuant to the provisions of 21 CFR 1020.40;

H. "Certifying Entity" means an independent certifying organization meeting the requirements in 20.3.5.12 NMAC or an Agreement State meeting the requirements in 20.3.5.12 NMAC;

I. "Collimator" means a radiation shield that is placed on the end of the guide tube or directly onto a radiographic exposure device to restrict the size of the radiation beam when the sealed source is cranked into position to make a radiographic exposure;

J. "Control (drive) cable" means the cable that is connected to the source assembly and used to drive the source to and from the exposure location;

K. "Control drive mechanism" means a device that enables the source assembly to be moved to and from the exposure device;

L. "Control tube" means a protective sheath for guiding the control cable. The control tube connects the control drive mechanism to the radiographic exposure device;

M. "Exposure head" means a device that locates the gamma radiography sealed source in the selected working position. (an exposure head is also known as a source stop);

N. "Field station" means a facility where licensed material or registered machines may be stored or used, and from which equipment is dispatched;

O. "Gray" means the SI unit of absorbed dose; one gray is equal to an absorbed dose of 1 Joule/kilogram. It is also equal to 100 rads;

P. "Guide tube" (Projection sheath) means a flexible or rigid tube (i.e., "J" tube) for guiding the source assembly and the attached control cable from the exposure device to the exposure head; the guide tube may also include the connections necessary for attachment to the exposure device and to the exposure head;

Q. "Hands-on experience" means experience in all of those areas considered to be directly involved in the radiography process;

R. "Independent certifying organization" means an independent organization that meets all of the criteria of 20.3.5.12 NMAC;

S. "Industrial radiography" means the examination of the macroscopic structure of materials by nondestructive methods using sources of ionizing radiation to produce radiographic images;

T. "Lixiscope" means a portable light-intensified imaging device using a sealed source;

U. "Permanent radiographic installation" means an enclosed shielded room, cell, or vault, not located at a temporary jobsite, in which radiography is performed;

V. "Personal supervision" means guidance and instruction to a radiographer trainee by a radiographer instructor who is present at the site, in visual contact with the trainee while the trainee is using sources of radiation, and in such proximity that immediate assistance can be given if required;

W. "Practical examination" means a documented demonstration through practical application of the safety rules and principles in industrial radiography including use of all appropriate equipment and procedures;

X. "Radiation safety officer" (RSO) for industrial radiography means an individual with the responsibility for the overall radiation safety program on behalf of the licensee or registrant and who meets the requirements as specified in Subsection C of 20.3.5.11 NMAC;

Y. "Radiographer" means any individual who performs, or in attendance personally supervises, industrial radiographic operations and who is responsible to the licensee or registrant for assuring compliance with the requirements of these regulations and all license and/or certificate of registration conditions; this individual must meet the training requirements as specified in Subsection B of 20.3.5.11 NMAC;

Z. "Radiographer certification" means written approval received from a certifying entity stating that an individual has satisfactorily met certain established radiation safety, testing, and experience criteria;

AA. "Radiographer instructor" means any radiographer who provides on-the-job training to radiographer trainees in accordance with Subsection D of 20.3.5.11 NMAC;

AB. "Radiographer trainee" means any individual who, under the personal supervision of a radiographer instructor, uses sources of radiation, related handling tools, or radiation survey instruments during the course of his instruction;

AC. "Radiographer's assistant" means any individual who under the direct supervision of a radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instruments in industrial radiography;

AD. "Radiographic exposure device" means any instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure;

AE. "Radiographic operations" means all activities performed with a radiographic device, or with a radiation machine; these include however are not limited to activities associated with the use of the device or machine, or transport (except when being transported by a common or contract transport), including surveys to confirm the adequacy of boundaries, setting up equipment and any activity inside restricted area boundaries;

AF. "Radiographic personnel" means any radiographer, radiographer's assistant, radiographer instructor, or radiographer trainee;

AG. "Residential location" means any area where structures in which people lodge or live are located, and the grounds on which structures are located including, but not limited to, houses, apartments, condominiums, and garages;

AH. "S-tube" means a tube through which the radioactive source travels when inside a radiographic exposure device;

AI. "Sealed source" means any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material;

AJ. "Shielded position" means the location within the radiographic exposure device or source changer where the sealed source is secured and restricted from movement;

AK. "Shielded-room radiography" means industrial radiography conducted in an enclosed room, the interior of which is not occupied during radiographic operations, which is shielded so that radiation levels at every location on the exterior meet the limitations specified in 20.3.4.406 NMAC;

AL. "sievert" (Sv) means 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);

AM. "Source assembly" means an assembly that consists of the sealed source and a connector that attaches the source to the control cable; the source assembly may also include a stop ball used to secure the source in the shielded position;

AN. "Source changer" means a device designed and used for replacement of sealed sources in radiographic exposure devices, including those source changers also used for transporting and storage of sealed sources;

AO. "Storage area" means any location, facility, or vehicle which is used to store, to transport, or to secure a radiographic exposure device, a storage container, or a sealed source when it is not in use and which is locked or has a physical barrier to prevent accidental exposure, tampering with, or unauthorized removal of the device, container, or source;

AP. "Storage container" means a shielded device in which sealed sources are secured and stored;

AQ. "Temporary job site" means any location where industrial radiography is performed and where licensed material or X-ray machines may be stored other than the location(s) listed in a specific license or certificate of registration; and

AR. "Transport container" means a package that is designed to provide radiation safety and security when sealed sources are transported and which meets all applicable requirements of the U.S. department of transportation;

AS. "Underwater radiography" means industrial radiography performed when the radiographic exposure device and/or related equipment are beneath the surface of the water.

[20.3.5.7 NMAC - Rp, 20 NMAC 3.1.5.502, 5/19/2002]

20.3.5.8 EXEMPTIONS:

A. Except for the requirements of Subsections B and C of 20.3.5.25 NMAC, certified x-ray systems designed to exclude individuals from the interior of the cabinet are exempt from the requirements of this part.

B. Industrial uses of lixiscopes are exempt from the requirements of this part.

[20.3.5.8 NMAC - Rp, 20 NMAC 3.1.5.503, 5/19/2002]

20.3.5.9 PROHIBITIONS: Industrial radiography performed with a sealed source that is not fastened to or contained in a radiographic exposure device, known as fish pole radiography, is prohibited unless specifically authorized in a license issued by the department.

[20.3.5.9 NMAC - Rp, 20 NMAC 3.1.5.526, 5/19/2002]

20.3.5.10 SPECIFIC LICENSE FOR INDUSTRIAL RADIOGRAPHY: An application for a specific license for the use of licensed material in industrial radiography will be approved if the applicant meets the following requirements:

A. The applicant satisfies the general requirements specified in Part 3 of 20.3 NMAC for byproduct material, as appropriate, and any special requirements contained in this part.

B. An application for a specific license of category 1 and category 2 quantities of radioactive material shall comply with 10 CFR 37. The licensee shall comply with 10 CFR 37 except as follows:

(1) any reference to the commission or NRC shall be deemed a reference to the department;

(2) 10 CFR 37.5 definitions of agreement state, byproduct material, commission and person shall not be applicable;

(3) 10 CFR 37.7, 10 CFR 37.9, 10 CFR 37.11(a) and (b), 10 CFR 37.13, 10 CFR 37.27(c), 10 CFR 37.71, 10 CFR 37.105, and 10 CFR 37.107 shall not be applicable; and

(4) for any reporting or notification requirements that the licensee must follow in 10 CFR 37.45, 10 CFR 37.57, 10 CFR 37.77(a) through (d), and 10 CFR 37.81 the licensee shall use the following address: when applicable: New Mexico environment department/RCB, P.O. Box 5469, Santa Fe, NM 87502-5469 address information.

C. The applicant submits an adequate program for training radiographers and radiographers' assistants that meets the requirements of Paragraph (1) of Subsection A of 20.3.5.11 NMAC. License applicants need not describe the initial training and examination program for radiographers in the subjects outlined in Paragraph (1) of Subsection A of 20.3.5.11 NMAC.

D. The applicant submits procedures for verifying and documenting the certification status of radiographers and for ensuring that the certification of individuals acting as radiographers remains valid.

E. The applicant submits written operating and emergency procedures as described in 20.3.5.29 NMAC.

F. The applicant submits a description of a program for inspections of the job performance of each radiographer and radiographers' assistant. The intervals for these performance inspections are not to exceed six months as described in Subsection B of 20.3.5.13 NMAC.

G. The applicant submits a description of the applicant's overall organizational structure as it applies to the radiation safety responsibilities in industrial radiography, including specified delegation of authority and responsibility.

H. The applicant identifies and lists the qualifications of the individual(s) designated as the RSO and potential designees responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures. Refer to Subsection C of 20.3.5.11 NMAC for RSO qualification requirements.

I. If an applicant intends to perform leak testing of sealed sources or exposure devices containing depleted uranium (DU) shielding, the applicant must describe the procedures for performing and the qualifications of the person(s) authorized to do the leak testing. If the applicant intends to analyze its own wipe samples, the application must include a description of the procedures to be followed. The description must include the:

(1) instruments to be used;

(2) methods of performing the analysis; and

(3) pertinent experience of the person who will analyze the wipe samples.

J. If the applicant intends to perform "in-house" calibrations of survey instruments the applicant must describe methods to be used and the relevant experience of the person(s) who will perform the calibrations. All calibrations must be performed according to the procedures described and at the intervals prescribed in 20.3.5.16 NMAC.

K. The applicant identifies and describes the location(s) of all field stations and permanent radiographic installations.

L. The applicant identifies the location(s) where all records required by this part and other parts of 20.3 NMAC will be maintained. If a license is issued to the applicant, the licensee shall maintain copies of records required by this Part and other applicable Parts of 20.3 NMAC at the specified location(s).

[20.3.5.12 NMAC - N, 5/19/02; A, 02/14/2023]

20.3.5.11 TRAINING AND QUALIFICATION REQUIREMENTS:

A. Radiographer’s assistant. Licensees and registrants may not permit any individual to act as a radiographer's assistant until the requirements of this subsection have been completed. Until completion of these requirements the individual is considered to be a radiographer trainee. Licensees and registrants will have 120 days from the effective date of these regulations to comply with these requirements:

(1) Training shall be provided regarding the fundamentals of radiation safety including:

(a) Characteristics of gamma and X-ray radiation;

(b) Units of radiation dose and quantity of radioactivity;

(c) Hazards of exposure to radiation during radiographic operations, including case histories of accidents in radiography;

(d) Levels of radiation experienced during radiographic operations; and

(e) Methods of controlling radiation dose (time, distance, and shielding).

(f) Proper techniques for use and operation, and limitations of, the specific radiation survey instruments and personnel monitoring equipment used by the licensee or registrant.

(2) The individual has been provided copies of and instruction in the requirements contained in this part, applicable sections of Parts 3, 4, and 10 of 20.3 NMAC, 10 CFR 71 of federal regulations, and conditions of the radioactive materials license or registration under which the radiographer will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;

(3) The individual has developed competence to use, under the personal supervision of the radiographer or radiographer instructor, the radiographic exposure devices, sealed sources, radiation machines, associated equipment, and radiation survey instruments that the assistant will use; and

(4) The individual has demonstrated understanding of the instructions provided under Paragraph (2) of Subsection A of 20.3.5.11 NMAC by successfully completing a written test on the subjects covered and has demonstrated competence in the use of hardware described in Paragraph (3) of Subsection A of 20.3.5.11 NMAC by successful completion of a practical examination on the use of such hardware.

B. Radiographer. Licensees may not permit any individual to act as a radiographer until the individual has completed the requirements of this subsection. With the exception of Paragraph (3) of Section B of 20.3.5.11 NMAC, licensees and registrants will have 120 days from the effective date of these regulations to comply with these requirements:

(1) The requirements of Subsection A of 20.3.5.11 NMAC; and,

(2) Two months minimum on-the-job training in addition to paragraph (1) of Subsection B of 20.3.5.11 NMAC; and,

(3) Certification through a radiographer certification program by a certifying entity in accordance with the criteria specified in 20.3.5.12 NMAC. Licensees or registrants will have one calendar year from the effective date of these regulations to comply with this requirement. Records of radiographer certification maintained in accordance with Subsection F of 20.3.5.11 NMAC provide appropriate affirmation of meeting this certification requirement; and,

(4) Has demonstrated understanding of the license or registration and the operating and emergency procedures by successful completion of a written or oral examination covering this material; and,

(5) Has received adequate training and has demonstrated understanding in the use of the licensee's or registrant's radiation survey instruments and associated equipment by successful completion of a practical examination covering the following material:

(a) Use, operation, calibration, and limitations of radiation survey instruments; and

(b) Survey techniques; and

(c) Use of personnel monitoring equipment; and

(6) Has received adequate training and has demonstrated understanding in the use of the licensee's or registrant's radiographic exposure devices, sources, radiation machines, and associated equipment by successful completion of a practical examination covering the following material:

(a) Operation and control of radiographic exposure equipment, radiation machines, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtails); and

(b) Storage, control, and disposal of licensed material; and

(c) Inspection and maintenance of equipment.

C. Radiation safety officer (RSO). The licensee may not permit any individual to act as an RSO until the requirements of this subsection have been satisfied. Licensees and registrants will have one year from the effective date of these regulations to comply with these requirements:

(1) The minimum qualifications, training, and experience for RSOs are as follows:

(a) Completion of the training and qualification requirements of Subsection B of 20.3.5.11 NMAC; and

(b) 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and

(c) Formal training in the establishment and maintenance of a radiation protection program.

(2) The department will consider alternatives to these requirements when the RSO has appropriate training and/or experience in the field of ionizing radiation, and in addition, has adequate formal training with respect to the establishment and maintenance of a radiation safety protection program.

D. Radiographer instructor. No individual shall act as a radiographer instructor unless such individual:

(1) Has met the requirements of Subsection B of 20.3.5.11 NMAC; and

(2) Has 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and

(3) Has been named as a radiographer instructor on the license or a registration certificate issued by the Department.

E. Annual refresher training. The licensee or registrant shall provide annual refresher training in radiation safety for each radiographer and radiographer's assistant at intervals not to exceed 12 months.

F. Records of training and certification. Each licensee or registrant shall maintain the following records (of training and certification) for three years after the record is made:

(1) Records of training of each radiographer and each radiographer's assistant. The record must include radiographer certification documents and verification of certification status, copies of written tests, dates of oral and practical examinations, and names of individuals conducting and receiving the oral and practical examinations; and

(2) Records of annual refresher safety training for each radiographer and each radiographer's assistant. The records must list the topics discussed during the refresher safety training, the dates the annual refresher safety training was conducted, and names of the instructors and attendees. For inspections of job performance required by Subsection B of 20.3.5.13 NMAC, the records must also include a list showing the items checked and any non-compliances observed by the RSO.

[20.3.5.11 NMAC - Rp, 20 NMAC 3.1.5.515, 5/19/2002]

20.3.5.12 Requirements For An Independent Certifying Organization:

A. An independent certifying organization shall:

(1) be an organization such as a society or association, whose members participate in, or have an interest in, the fields of industrial radiography; and

(2) make its membership available to the general public nationwide that is not restricted because of race, color, religion, sex, age, national origin or disability; and

(3) have a certification program open to nonmembers, as well as members; and

(4) be an incorporated, nationally recognized organization, that is involved in setting national standards of practice within its fields of expertise; and

(5) have an adequate staff, a viable system for financing its operations, and a policy-and decision-making review board; and

(6) have a set of written organizational by-laws and policies that provide adequate assurance of lack of conflict of interest and a system for monitoring and enforcing those by-laws and policies; and

(7) have a committee, whose members can carry out their responsibilities impartially, to review and approve the certification guidelines and procedures, and to advise the organization's staff in implementing the certification program; and

(8) have a committee, whose members can carry out their responsibilities impartially, to review complaints against certified individuals and to determine appropriate sanctions; and

(9) have written procedures describing all aspects of its certification program, maintain records of the current status of each individual's certification and the administration of its certification program; and

(10) have procedures to ensure that certified individuals are provided due process with respect to the administration of its certification program, including the process of becoming certified and any sanctions imposed against certified individuals; and

(11) have procedures for proctoring examinations, including qualifications for proctors. These procedures must ensure that the individuals proctoring each examination are not employed by the same company or corporation (or a wholly-owned subsidiary of such company or corporation) as any of the examinees; and

(12) exchange information about certified individuals with other independent certifying organizations, the Department, the U.S. nuclear regulatory commission, and/or Agreement States and allow periodic review of its certification program and related records; and

(13) provide a description to the department of its procedures for choosing examination sites and for providing an appropriate examination environment.

B. Requirements for certification programs. All certification programs must:

(1) require applicants for certification to:

(a) receive training in the topics set forth in Subsection D of 20.3.5.12 NMAC or equivalent Agreement State regulations; and

(b) satisfactorily complete a written examination covering these topics.

(2) require applicants for certification to provide documentation that demonstrates that the applicant has:

(a) received training in the topics set forth in Subsection D of 20.3.5.12 NMAC or equivalent Agreement State regulations;

(b) satisfactorily completed a minimum period of on-the-job training; and

(c) has received verification by an Agreement State or a NRC licensee that the applicant has demonstrated the capability of independently working as a radiographer; and

(3) include procedures to ensure that all examination questions are protected from disclosure; and

(4) include procedures for denying an application, revoking, suspending, and reinstating a certificate; and

(5) provide a certification period of not less than three years nor more than five years; and

(6) include procedures for renewing certifications and, if the procedures allow renewals without examination, require evidence of recent full-time employment and annual refresher training.

(7) Provide a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

C. Requirements for written examinations. All examinations must be:

(1) designed to test an individual's knowledge and understanding of the topics listed in Subsection D of 20.3.5.12 NMAC or equivalent Agreement State requirements; and

(2) written in a multiple-choice format; and

(3) have test items drawn from a question bank containing psychometrically valid questions based on the material in Subsection D of 20.3.5.12 NMAC.

D. Required Training Topics. All certification programs shall include training in the following topics:

(1) fundamentals of radiation safety including:

(a) characteristics of gamma radiation; and

(b) units of radiation dose and quantity of radioactivity; and

(c) hazards of exposure to radiation; and

(d) levels of radiation from licensed material; and

(e) methods of controlling radiation dose (time, distance, and shielding); and

(2) radiation detection instruments including:

(a) use, operation, calibration, and limitations of radiation survey instruments; and

(b) survey techniques; and

(c) use of personnel monitoring equipment; and

(3) equipment to be used including:

(a) operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtails); and

(b) storage, control, and disposal of licensed material; and

(c) inspection and maintenance of equipment; and

(4) the requirements of pertinent State and Federal regulations; and

(5) case histories of accidents in radiography.

[20.3.5.12 NMAC - N, 5/19/2002]

20.3.5.13 Requirements Of The Radiation Safety Officer (RSO):

A. The specific duties and authorities of the RSO include, but are not limited to:

(1) Ensuring that radiation safety activities are being performed in accordance with approved procedures and regulatory requirements in the daily operation of the licensee's or registrant’s program; and

(2) Establish, document, and oversee all operating, emergency, and ALARA procedures required by Part 4 of 20.3 NMAC. The procedures shall be revised by the RSO whenever necessary to ensure procedural accuracy. The procedures shall be reviewed regularly by the RSO at intervals not to exceed one calendar year to ensure that they conform to Part 4, other pertinent regulations, and to the conditions of the license or registration; and

(3) Overseeing and approving all phases of the training program for radiographic personnel, ensuring that appropriate and effective radiation protection practices are taught; and

(4) Ensuring that required radiation surveys and leak tests are performed and documented in accordance with the regulations, including any corrective measures when levels of radiation exceed established limits; and

(5) Ensuring that personnel monitoring devices are calibrated and used properly by occupationally-exposed personnel, that records are kept of the monitoring results, and that timely notifications are made as required by 20.3.4.453 NMAC; and

(6) Ensuring that operations are conducted safely and to assume control for instituting corrective actions including stopping of operations when necessary.

B. Inspections of Job Performance. Except as provided in paragraph (4) of Subsection B of 20.3.5.13 NMAC, the RSO or designee shall conduct an inspection program of the job performance of each radiographer and radiographer's assistant to ensure that the Department's regulations, license or registration requirements, and the applicant's operating and emergency procedures are followed. The inspection program must:

(1) Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals not to exceed 6 months; and

(2) Provide that, if a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than six months since the last inspection, the radiographer must demonstrate knowledge of the training requirements of paragraph (5) of Subsection B of 20.3.5.11 NMAC and the radiographer's assistant must re-demonstrate knowledge of the training requirements of paragraph (3) of Subsection A of 20.3.5.11 NMAC by a practical examination before these individuals can next participate in a radiographic operation.

(3) The Department may consider alternatives requested in writing in those situations where the individual serves as both radiographer and RSO.

(4) Records of semi-annual inspections of job performance for each radiographer and each radiographer's assistant shall include a list showing the items checked and any non-compliances observed by the RSO.

[20.3.5.13 NMAC - N, 5/19/2002]

20.3.5.14 SUPERVISION OF RADIOGRAPHER'S ASSISTANTS: Whenever a radiographer's assistant uses radiographic exposure devices, associated equipment, sealed sources, radiation machines, or conducts radiation surveys required by Subsection B of 20.3.5.17 NMAC to determine that the sealed source has returned to the shielded position after an exposure, the assistant shall be under the personal supervision of a radiographer. The personal supervision must include:

A. The radiographer's physical presence at the site where the sealed sources or radiation machines are being used;

B. The availability of the radiographer to give immediate assistance if required; and

C. The radiographer's direct observation of the assistant's performance of the operations referred to in this section.

[20.3.5.14 NMAC - Rp, 20 NMAC 3.1.5.518, 5/19/2002]

20.3.5.15 PERSONNEL MONITORING:

A. The licensee or registrant may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a [~~combination of~~]direct reading dosimeter, an operating alarm ratemeter, and a [~~NVLAP certified~~] personnel dosimeter. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, the wearing of an alarming ratemeter is not required.

(1) Pocket dosimeters must have a range from zero to two millisieverts (200 millirems) and must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.

(2) Each [~~NVLAP certified~~] personnel dosimeter must be assigned to and worn by only one individual.

(3) Film badges must be replaced [~~at periods not to exceed one month. All other NVLAP certified~~] personnel [~~dosimeters must be replaced at periods not to exceed three months.~~] as least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters that must be evaluated must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.

[**(4)** ~~After replacement, each~~ ~~NVLAP~~ ~~certified~~ ~~dosimeter must be processed as soon as possible~~.]

B. Direct reading dosimeters such as pocket dosimeters or electronic personal dosimeters must be read and the exposures recorded at the beginning and end of each shift. Records shall be maintained in accordance with paragraph (2) of Subsection H of 20.3.5.15 NMAC.

C. Pocket dosimeters, or electronic personal dosimeters, must be checked at periods not to exceed 12 months for correct response to radiation. Acceptable dosimeters must read within plus or minus 20 percent of the true radiation exposure. Records shall be maintained in accordance with paragraph (1) of Subsection H of 20.3.5.15 NMAC.

D. If an individual's pocket [~~dosimeter~~] chamber is found to be off-scale, or if his or her electronic personal dosimeter reads greater than two millisieverts (200 millirems), and the possibility of radiation exposure cannot be ruled out as the cause, the individual's [~~NVLAP certified~~] personnel dosimeter must be sent for processing within 24 hours. In addition, the individual may not resume work associated with [~~radiation~~] licensed material use until a determination of the individual's radiation [~~exposure~~] dose has been made. This determination must be made by the RSO or the RSO's designee. The results of this determination shall be documented. The documents shall be maintained in accordance with [~~paragraph (4) of~~] Subsection H of 20.3.5.15 NMAC.

E. If a [~~NVLAP~~ ~~certified~~] personnel dosimeter that is required by Subsection A of 20.3.5.15 NMAC is lost or damaged, the worker shall cease work immediately until a replacement dosimeter is provided and the exposure is calculated for the time period from issuance to loss or damage of the dosimeter. The results of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged shall be documented. The documents shall be maintained in accordance with paragraph (4) of Subsection H of 20.3.5.15 NMAC.

F. [~~Reports received from~~] [~~d~~] Dosimetry [~~processors~~] results shall be maintained in accordance with paragraph (3) of Subsection H of 20.3.5.15 NMAC.

G. Each alarm ratemeter must--

(1) Be checked to ensure that the alarm functions properly (sounds) before using at the start of each shift;

(2) Be set to give an alarm signal at a preset dose rate of five mSv/hr (500 mrem/hr); with an accuracy of plus or minus 20 percent of the true radiation dose rate;

(3) Require special means to change the preset alarm function; and

(4) Be calibrated at periods not to exceed 12 months for correct response to radiation. The licensee or registrant shall maintain records of alarm ratemeter calibrations in accordance with paragraph (2) of Subsection H of 20.3.5.15 NMAC.

H. Personnel Monitoring Records. Each licensee and registrant shall maintain the following exposure records pursuant to 20.3.5.15 NMAC:

(1) Direct reading dosimeter readings and yearly operability checks required by Subsections B and C of 20.3.5.15 NMAC for three years after the record is made.

(2) Records of alarm ratemeter calibrations for three years after the record is made.

(3) Reports received [~~from~~] for personnel dosimetry [~~processors~~] shall be maintained until the Department terminates the license or registration.

(4) Records of estimates of exposures as a result of: off-scale personal direct reading dosimeters, or lost or damaged [~~external~~ ~~dosimetric~~ ~~device~~] personnel dosimeters, until the Department terminates the license or registration.

[20.3.5.15 NMAC - Rp, 20 NMAC 3.1.5.517, 5/19/2002, XX/XX/24]

20.3.5.16 RADIATION SURVEY INSTRUMENTS:

A. Licensees and registrants shall keep sufficient calibrated and operable radiation survey instruments at each location to make the radiation surveys required by this Part and by 20.3.4.416 NMAC. Instrumentation required by this section must be capable of measuring a range from 0.02 millisieverts (2 millirems) per hour through 0.01 sievert (one rem) per hour.

B. Each radiation survey instrument shall be calibrated:

(1) At energies appropriate for use and at intervals not to exceed 6 months and after each instrument servicing (except battery changes);

(2) Such that accuracy within plus or minus 20 percent can be demonstrated; and

(3) At two points located approximately one-third and two-third of full-scale on each scale for linear scale instruments; at mid-range of each decade, and at two points of at least one decade for logarithmic scale instruments; and at appropriate points for digital instruments.

C. Records of these calibrations shall be maintained for three years after the calibration date for inspection by the Department.

D. Each radiation survey instrument shall be checked with a radiation source at the beginning of each day of use and at the beginning of each work shift to ensure it is operating properly.

[20.3.5.16 NMAC - Rp, 20 NMAC 3.1.5.509, 5/19/2002]

20.3.5.17 RADIATION SURVEYS AND SURVEY RECORDS:

A. No radiographic operation shall be conducted unless calibrated and operable radiation survey instrumentation, as described in 20.3.5.16 NMAC is available and used at each site where radiographic exposures are made.

B. Survey Requirements for Devices Containing Radioactive Materials.

(1) Using a survey instrument meeting the requirements of Subsection A of 20.3.5.17 NMAC, conduct a survey of the radiographic exposure device and the guide tube after each exposure when approaching the device or the guide tube. The survey must determine that the sealed source has returned to its shielded position before exchanging films, repositioning the exposure head, or dismantling equipment.

(2) Conduct a survey of the radiographic exposure device with a calibrated radiation survey instrument any time the source is exchanged and whenever a radiographic exposure device is placed in a storage area (as defined in Subsection AO of 20.3.5.7 NMAC), to ensure that the sealed source is in its shielded position.

C. Survey Requirements for Radiation Machines. A physical radiation survey shall be made after each radiographic exposure using radiation machines to determine that the machine is "off".

D. Records shall be kept of the surveys required by Subsection B of 20.3.5.17 NMAC. Such records shall be maintained for inspection by the Department for three years after completion of the survey. If the survey was used to determine an individual's exposure, however, the records of the survey shall be maintained until the Department authorizes their disposition.

[20.3.5.17 NMAC - Rp, 20 NMAC 3.1.5.521, 5/19/2002]

20.3.5.18 SPECIFIC REQUIREMENTS FOR RADIOGRAPHIC OPERATIONS:

A. Licensees and registrants shall supply the following items at each job site:

(1) At least one operable, calibrated survey instrument;

(2) A current whole body NVLAP certified dosimeter for each individual;

(3) An operable, calibrated pocket dosimeter with a range of 0 to 200 milliroentgens (two milligrays) for each worker; and

(4) The appropriate barrier ropes and signs.

B. Industrial radiographic operations shall not be performed if any of the items in Subsection A of 20.3.5.18 NMAC are not available at the job site or are inoperable.

C. No individual other than a qualified radiographer, radiographer's assistant, radiographer instructor, or radiographer trainee (under the personal supervision of a radiographer instructor) shall manipulate controls or operate equipment used in industrial radiographer operations.

D. No individual shall act as radiographer instructor unless such individual possesses the qualifications required for radiographer instructors as listed in Subsection D of 20.3.5.11 NMAC.

E. During an inspection by the Department, the Department inspector may terminate an operation if any of the items in Subsection A of 20.3.5.18 NMAC are not available and operable or if the required number of radiographic personnel is not present. Operations shall not be resumed until such conditions are met.

F. All radiographic operations conducted at locations of use authorized on the license or registration must be conducted in a permanent radiographic installation, unless specifically authorized by the Department.

G. Whenever radiography is performed at a location other than a permanent radiographic installation, the radiographer must be accompanied by at least one other qualified radiographer or a radiographer's assistant who has at a minimum met the requirements specified within Subsections B or A of 20.3.5.11 NMAC as appropriate. The additional qualified individual shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. Radiography may not be performed if only one qualified individual is present. Licensees will have one calendar year from the effective date of these regulations to meet the requirements for having two qualified individuals present at locations other than a permanent radiographic installation.

H. During each radiographic operation the radiographer, or the other individual present as required by Subsection G of 20.3.5.18 NMAC, shall maintain continuous direct visual surveillance of the operation to protect against unauthorized entry into a high radiation area, as defined in Part 1 of 20.3 NMAC, except:

(1) Where the high radiation area is equipped with a control device or alarm system as described in Part 4 of 20.3 NMAC; or

(2) Where the high radiation area is locked to protect against unauthorized or accidental entry.

I. All areas in which industrial radiography is being performed must be conspicuously posted as required by Part 4 of 20.3 NMAC. Exceptions to posting requirements listed in Part 4 do not apply to industrial radiographic operations.

J. Utilization Logs. Each licensee or registrant shall maintain current logs which shall be kept available for inspection by the Department for three years from the date of the recorded event, showing for each source of radiation the following information:

(1) A description, including the make, model, and serial number of the radiographic exposure device or transport or storage container in which the sealed source is located;

(2) The identity and signature of the radiographer to whom assigned;

(3) Locations where used and dates of use; and

(4) The date(s) each source of radiation is removed from storage and returned to storage.

K. Locking of Sources of Radiation.

(1) Each radiographic exposure device must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The exposure device and/or its container must be kept locked (and if a keyed-lock, with the key removed at all times) when not under the direct surveillance of a radiographer or a radiographer's assistant except at permanent radiographic installations as stated in Subsection G of 20.3.5.18 NMAC. In addition, during radiographic operations the sealed source assembly must be secured in the shielded position each time the source is returned to that position.

(2) Each sealed source storage container and source changer must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers must be kept locked (and if a keyed-lock, with the key removed at all times) when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.

L. A licensee may conduct underwater radiography only if procedures have been approved by the Department.

[20.3.5.18 NMAC - Rp, 20 NMAC 3.1.5.523, 5/19/2002]

20.3.5.19 PERMANENT RADIOGRAPHIC INSTALLATIONS:

A. Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have either:

(1) An entrance control of the type described in Part 4 of 20.3 NMAC that reduces the radiation level upon entry into the area, or

(2) Both conspicuous visible and audible warning signals to warn of the presence of radiation. The visible signal must be actuated by radiation whenever the source is exposed. The audible signal must be actuated when an attempt is made to enter the installation while the source is exposed.

B. The alarm system must be tested for proper operation with a radiation source each day before the installation is used for radiographic operations. The test must include a check of both the visible and audible signals. Entrance control devices that reduce the radiation level upon entry (designated in Subsection A of 20.3.5.19 NMAC) must be tested monthly. If an entrance control device or an alarm is operating improperly, it must be immediately labeled as defective and repaired within seven calendar days. The facility may continue to be used during this seven-day period, provided the licensee implements the continuous surveillance requirements of Subsection H of 20.3.5.18 NMAC and uses an alarming ratemeter.

C. Test records for entrance controls and audible and visual alarms must be maintained for three years after they are made.

[20.3.5.19 NMAC - Rp, 20 NMAC 3.1.5.514, 5/19/2002]

20.3.5.20 LABELING, STORAGE, AND TRANSPORTATION:

A. The licensee may not use a source changer or a container to store licensed material unless the source changer or the storage container has securely attached to it a durable, legible, and clearly visible label bearing

the standard trefoil radiation caution symbol conventional colors, i.e., magenta, purple or black on a yellow background, having a minimum diameter of 25 mm, and the wording:

CAUTION (or "DANGER")
RADIOACTIVE MATERIAL
NOTIFY CIVIL AUTHORITIES (or "NAME OF COMPANY")

B. The licensee may not transport licensed radioactive material unless the material is packaged, and the package is labeled, marked, and accompanied with appropriate shipping papers in accordance with regulations set out in 10 CFR part 71.

C. Locked radiographic exposure devices, storage containers, and radiation machines shall be physically secured to prevent tampering or removal by unauthorized personnel. The licensee shall store licensed material in a manner which will minimize danger from explosion or fire.

D. The licensee shall lock and physically secure the transport package containing licensed material or radiation machine(s) in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal of the licensed material from the vehicle.

[20.3.5.20 NMAC - N, 5/19/2002]

20.3.5.21 PERFORMANCE REQUIREMENTS FOR RADIOGRAPHY EQUIPMENT: Equipment used in industrial radiographic operations must meet the following minimum criteria:

A. Each radiographic exposure device and all associated equipment must meet the requirements specified in American national standard N432-1980 “Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography,” (published as NBS handbook 136, issued January 1981). This publication has been approved for incorporation by reference by the director of the federal register in accordance with 5 U.S.C. 552(a). This publication may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 and from the American National Standards Institute, Inc., 25 West 43rd Street, New York, New York 10036, Telephone (212) 642-4900.

B. In addition to the requirements specified in Subsection A of 20.3.5.21 NMAC, the following requirements apply to radiographic exposure devices and associated equipment;

(1) Each radiographic exposure device utilizing radioactive material must have attached to it by the user, a durable, legible, clearly visible label bearing the:

(a) chemical symbol and mass number of the radionuclide in the device;
(b) activity and the date on which this activity was last measured;
(c) model number and serial number of the sealed source;
(d) manufacturer of the sealed sources; and
(e) licensee's name, address, and telephone number.

(2) Radiographic exposure devices intended for use as type B transport containers must meet the applicable requirements of 10 CFR part 71; and

(3) Modification of any exposure devices and associated equipment is prohibited, unless the design of any replacement component, including source holder, source assembly, controls or guide tubes would not compromise the design safety features of the system.

C. In addition to the requirements specified in Subsections A and B of 20.3.5.21 NMAC, the following requirements apply to radiographic exposure devices and associated equipment that allow the source to be moved out of the device for routine operation.

(1) The coupling between the source assembly and the control cable must be designed in such a manner that the source assembly will not become disconnected if cranked outside the guide tube. The coupling must be such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions.

(2) The device must automatically secure the source assembly when it is cranked back into the fully shielded position within the device. This securing system may only be released by means of a deliberate operation on the exposure device.

(3) The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device must be equipped with safety plugs or covers which must be installed during storage and transportation to protect the source assembly from water, mud, sand or other foreign matter.

(4) Each sealed source or source assembly must have attached to it or engraved in it, a durable, legible, visible label with the words "DANGER--RADIOACTIVE." The label must not interfere with the safe operation of the exposure device or associated equipment.

(5) The guide tube must be able to withstand a crushing test that closely approximates the crushing forces that are likely to be encountered during use, and be able to withstand a kinking resistance test that closely approximates the kinking forces that are likely to be encountered during use.

(6) Guide tubes must be used when moving the source out of the device.

(7) An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during radiographic operations.

(8) The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.

(9) Source changers must provide a system for assuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting the drive cable to or from a source assembly.

D. All radiographic exposure devices and associated equipment in use must comply with the requirements of this section.

E. Notwithstanding Subsection A of 20.3.5.21 NMAC, equipment used in industrial radiographic operations need not comply with §8.9.2(c) of the endurance test in American national standards institute N432-1980, if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment can realistically exert on the lever or crankshaft of the drive mechanism.

[20.3.5.21 NMAC - Rp, 20 NMAC 3.1.5.506, 5/19/2002; A, 6/13/2017]

20.3.5.22 LIMITS ON EXTERNAL RADIATION LEVELS FROM STORAGE CONTAINERS AND SOURCE CHANGERS: The maximum exposure rate limits for storage containers and source changers are two millisieverts (200 millirem) per hour at any exterior surface, and 0.1 millisieverts (10 millirem) per hour at one meter from any exterior surface with the sealed source in the shielded position.

[20.3.5.22 NMAC - Rp, 20 NMAC 3.1.5.504, 5/19/2002]

20.3.5.23 INSPECTION AND MAINTENANCE:

A. The licensee or registrant shall perform visual and operability checks on survey meters, radiation machines, radiographic exposure devices, transport and storage containers, associated equipment and source changers before use on each day the equipment is to be used to ensure that the equipment is in good working condition, that the sources are adequately shielded, and that required labeling is present. Survey instrument operability must be performed using check sources or other appropriate means. If equipment problems are found, the equipment must be removed from service until repaired.

B. Each licensee or registrant shall perform, and have written procedures for, inspection and routine maintenance of radiation machines, radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments at intervals not to exceed three months or before the first use thereafter to ensure the proper functioning of components important to safety. Replacement components shall meet design specifications. If equipment problems are found, the equipment must be removed from service until repaired.

C. The inspection and maintenance program must include procedures to assure that Type B packages are shipped and maintained in accordance with the certificate of compliance or other approval.

D. If any inspection conducted pursuant to Subsections A, B, or C of 20.3.5.23 NMAC reveals damage to components critical to radiation safety, the device shall be removed from service and labeled as defective until repairs have been made.

E. Records of equipment problems and of any maintenance performed pursuant to the requirements of this section shall be made in accordance with the following:

(1) Each licensee or registrant shall maintain records of equipment problems found in daily checks and quarterly inspections of radiation machines, radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments; and retain each record for three years after it is made.

(2) The record must include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/or maintenance, if any, was done.

[20.3.5.23 NMAC - Rp, 20 NMAC 3.1.5.513, 5/19/2002]

20.3.5.24 LEAK TESTING, REPAIR, TAGGING, OPENING, MODIFICATION, AND REPLACEMENT OF SEALED SOURCES:

A. The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing, repair, tagging, opening, or any other modification of any sealed source shall be performed only by persons specifically authorized to do so by the Department.

B. Each sealed source shall be tested for leakage at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within the six-month period prior to the transfer, the sealed source shall not be put into use until tested.

C. The leak test shall be capable of detecting the presence of 185 becquerels (0.005 microcuries) of removable contamination on the sealed source. An acceptable leak test for sealed sources in the possession of a radiography licensee would be to test at the nearest accessible point to the sealed source storage position, or other appropriate measuring point, by a procedure to be approved pursuant to Part 3 of 20.3 NMAC. Records of leak test results shall be kept in units of becquerels or microcuries and maintained for inspection by the Department for three years.

D. Any test conducted pursuant to Subsections B and C of 20.3.5.24 NMAC that reveals the presence of 185 becquerels (0.005 microcuries) or more of removable radioactive material shall be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with 20.3 NMAC. Within five days after obtaining results of the test, the licensee shall file a report with the Department describing the equipment involved, the test results, and the corrective action taken.

E. A sealed source which is not fastened to or contained in a radiographic exposure device shall have permanently attached to it a square durable tag at least 2.5 cm on each side bearing the prescribed radiation caution symbol in conventional colors, magenta or purple on a yellow background, and at least the instructions: “Danger - Radioactive Material - Do Not Handle - Notify Civil Authorities if Found.”

F. Each exposure device using depleted uranium (DU) shielding and an "S" tube configuration must be tested for DU contamination at intervals not to exceed 12 months. The analysis must be capable of detecting the presence of 185 Bq (0.005 microcuries) of radioactive material on the test sample and must be performed by a person specifically authorized by the Department to perform the analysis. Should such testing reveal the presence of 185 Bq (0.005 microcuries) or more of removable DU contamination, the exposure device must be removed from use until an evaluation of the wear on the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. DU shielded devices do not have to be tested for DU contamination while in storage and not in use. Before using or transferring such a device however, the device must be tested for DU contamination if the interval of storage exceeded 12 months. Records of DU leak tests results shall be kept in units of microcuries (becquerels) and maintained for inspection by the department for 3 years.

[20.3.5.24 NMAC - Rp, 20 NMAC 3.1.5.510, 5/19/2002]

20.3.5.25 SPECIAL REQUIREMENTS AND EXEMPTIONS FOR CABINET RADIOGRAPHY:

A. Systems for cabinet radiography designed to allow admittance of individuals shall:

(1) Comply with all applicable requirements of this Part, and Sections 405 to 412 of 20.3.4 NMAC. If such a system is a certified cabinet x-ray system, it shall comply with all applicable requirements of this Part and 21 CFR 1020.40; and

(2) Be evaluated at intervals not to exceed one year to assure compliance with the applicable requirements as specified in paragraph (1) of Subsection A of 20.3.5.25 NMAC. Records of these evaluations shall be maintained for inspection by the Department for a period of three years after the evaluation.

B. Certified cabinet x-ray systems designed to exclude individuals from the interior of the cabinet are exempt from the requirements of this Part except that:

(1) Operating personnel must be provided with a NVLAP certified dosimeter, and reports of the results shall be maintained for inspection by the Department;

(2) No registrant shall permit any individual to operate a cabinet x-ray system until such individual has received a copy of and instruction in the operating procedures for the unit and has demonstrated competence in its use. Records which demonstrate compliance with this section shall be maintained for inspection by the Department until disposition is authorized by the Department;

(3) Tests for proper operation of high radiation area control devices or alarm systems, where applicable, shall be conducted, recorded, and maintained in accordance with Subsection B of 20.3.5.19 NMAC; and

(4) The registrant shall perform an evaluation at intervals not to exceed one year, to determine conformance with Sections 405 to 412 of 20.3.4 NMAC. If such a system is a certified cabinet x-ray

system, it shall be evaluated at intervals not to exceed one year to determine conformance with 21 CFR 1020.40. Records of these evaluations shall be maintained for inspection by the Department for a period of three years after the evaluation.

C. Certified cabinet x-ray systems shall be maintained in compliance with 21 CFR 1020.49 unless prior approval has been granted by the Department pursuant to Subsection A of 20.3.1.107 NMAC.

[20.3.5.25 NMAC - Rp, 20 NMAC 3.1.5.524, 5/19/2002]

20.3.5.26 SPECIAL REQUIREMENTS FOR RADIOGRAPHY EMPLOYING RADIATION MACHINES:

A. Shielded room radiography. Shielded room radiography (as defined in Subsection AK of 20.3.5.7 NMAC) using radiation machines shall be exempt from other requirements of this Part; however:

(1) no registrant shall permit any individual to operate a radiation machine for shielded room radiography until such individual has received a copy of, and instruction in, and demonstrated an understanding of operating procedures of the unit, and has demonstrated competence in its use;

(2) each registrant shall supply appropriate personnel monitoring equipment to, and shall require the use of such equipment by, every individual who operates, makes "set-ups", or performs maintenance on a radiation machine for shielded room radiography; and

(3) a physical radiation survey shall be conducted to determine that the radiation machine is "off" prior to each entry into the shielded room. Such surveys shall be made with a radiation measuring instrument which is capable of measuring radiation of the energies and at the exposure rates to be encountered, which is in good working order, and which has been properly calibrated within the preceding three months or following the last instrument servicing, whichever is later.

B. Other radiography using radiation machines. Other radiography using machines shall be exempt from 20.3.5.17 NMAC, 20.3.5.21 NMAC, 20.3.5.22 NMAC, and 20.3.5.24 NMAC; however:

(1) A physical radiation survey shall be conducted to determine that the radiation machine is "off" prior to each entry into the radiographic exposure area. Such surveys shall be made with a radiation measuring instrument capable of measuring radiation of the energies and at the exposure rates to be encountered, which is in good working order, and which has been properly calibrated within the preceding three months or following the last instrument servicing, whichever is later. Survey results and records of boundary locations shall be maintained and kept available for inspection; and

(2) Mobile or portable radiation machines shall be physically secured to prevent removal by unauthorized personnel.

[20.3.5.26 NMAC - Rp, 20 NMAC 3.1.5.525, 5/19/2002]

20.3.5.27 REPORTING REQUIREMENTS:

A. In addition to the reporting requirements specified in Part 3 and under other sections of 20.3 NMAC, each licensee or registrant (as appropriate) shall provide a written report to the department within 30 days of the occurrence of any of the following incidents involving radiographic equipment:

(1) Unintentional disconnection of the source assembly from the control cable;

(2) Inability to retract the source assembly to its fully shielded position and secure it in this position; or

(3) Failure of any component (critical to safe operation of the device) to properly perform its intended function.

B. The licensee or registrant shall include the following information in each report submitted under Subsection A of 20.3.5.27 NMAC:

(1) A description of the equipment problem;

(2) Cause of each incident, if known;

(3) Manufacturer and model number of equipment involved in the incident;

(4) Place, time and date of the incident;

(5) Actions taken to establish normal operations;

(6) Corrective actions taken or planned to prevent recurrence; and

(7) Qualifications of personnel involved in the incident.

C. Any licensee or registrant conducting radiographic operations, or storing radioactive material or radiation machine(s), at any location not listed on the license for a period in excess of 180 days in a calendar year, shall notify the Department in writing prior to exceeding the 180 days.

[20.3.5.27 NMAC - Rp, 20 NMAC 3.1.5.507, 5/19/2002]

20.3.5.28 INVENTORY ACCOUNTING REQUIREMENTS:

A. Receipt and Transfer of Sealed Sources.

(1) Each licensee shall maintain records showing the receipts and transfers of sealed sources, radiation machines, and devices using DU for shielding and retain each record for three years after it is made.

(2) These records must include the date, the name of the individual making the record, radionuclide, number of becquerels (curies) or mass (for DU), and manufacturer, model, and serial number of each sealed source, radiation machine, or device, as appropriate.

B. Quarterly Inventories.

(1) Quarterly physical inventories shall be conducted by licensees and registrants to account for all sealed sources, radiography exposure devices, radiation machines, and devices containing depleted uranium received or in their possession. Inventory records shall be maintained for three years from the date of the inventory for inspection by the Department.

(2) Each record must include the date of the inventory, name of the individual conducting the inventory, quantities of radiation machines, radionuclide, number of becquerels (curies) or mass (for DU) in each device, location of sealed source and/or devices, and manufacturer, model, and serial number of each sealed source, radiation machines, and/or device, as appropriate.

[20.3.5.28 NMAC - Rp, 20 NMAC 3.1.5.511, 5/19/2002]

20.3.5.29 OPERATING AND EMERGENCY PROCEDURES:

A. Operating and emergency procedures must include, as a minimum, instructions in the following:

(1) Appropriate handling and use of licensed sealed sources and radiographic exposure devices so that no person is likely to be exposed to radiation doses in excess of the limits established in Part 4 of 20.3 NMAC;

(2) Methods and occasions for conducting radiation surveys;

(3) Methods for controlling access to radiographic areas;

(4) Methods and occasions for locking and securing radiographic exposure devices, transport and storage containers and sealed sources;

(5) Personnel monitoring and the use of personnel monitoring equipment;

(6) Transporting sealed sources to field locations, including packing of radiographic exposure devices and storage containers in the vehicles, placarding of vehicles when needed, and control of the sealed sources during transportation (refer to 49 CFR parts 171-173);

(7) The inspection, maintenance, and operability checks of radiographic exposure devices, survey instruments, transport containers, and storage containers;

(8) Steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale or an alarm ratemeter alarms unexpectedly;

(9) The procedure for notifying proper persons in the event of an accident;

(10) Minimizing exposure of persons in the event of an accident;

(11) Source recovery procedure if licensee will perform source recovery;

(12) Maintenance of records.

B. Each licensee or registrant shall maintain a copy of current operating and emergency procedures until the Department terminates the license or registration. Superseded material must be retained for three years after the change is made.

[20.3.5.29 NMAC - Rp, 20 NMAC 3.1.5.516, 5/19/2002]

20.3.5.30 DOCUMENTS AND RECORDS REQUIRED AT TEMPORARY JOB SITES: Each licensee or registrant shall also maintain copies of the following documents and records sufficient to demonstrate compliance at each applicable field station and each temporary jobsite:

A. Appropriate license or certificate of registration or equivalent document;

B. Operating and emergency procedures;

C. A copy of Parts 4, 5, and 10 of 20.3 NMAC;

D. Survey records required pursuant to 20.3.5.17 NMAC and area survey records required pursuant to Part 4 of 20.3 NMAC for the period of operation at the site;

E. Daily pocket dosimeter records for the period of operation at the site;

F. The latest instrument calibration and leak test records for specific devices and sealed sources in use at the site. Acceptable records include tags or labels which are affixed to the device or survey meter;

G. Utilization records for each radiographic exposure device dispatched from that location as required by Subsection J of 20.3.5.18 NMAC;

H. Records of equipment problems identified in daily checks of equipment as required by Subsection A of 20.3.5.23 NMAC;

I. Records of alarm system and entrance control checks required by Subsection B of 20.3.5.19 NMAC, if applicable;

J. Evidence of the latest calibrations of alarm ratemeters and operability checks of pocket dosimeters and/or electronic personal dosimeters as required by Subsection H of 20.3.5.15 NMAC; and,

K. The shipping papers for the transportation of radioactive materials required by 10 CFR 71.5.

L. When operating under reciprocity pursuant to Part 3 of 20.3 NMAC, a copy of the Agreement State license authorizing the use of licensed materials.

[20.3.5.30 NMAC - Rp, 20 NMAC 3.1.5.522, 5/19/2002]

HISTORY OF 20.3.5 NMAC:

Pre-NMAC History:

Material in this part was derived from that previously filed with the commission of public records - state records center and archives:

EIB 73-2, Regulations For Governing The Health And Environment Aspects Of Radiation, filed 7/9/1973;

EIB RP,R-1, Radiation Protection Regulations, filed 4/21/1980;

EIB RP,R 1, Radiation Protection Regulations, filed 3/10/1989.

History of Repealed Material: 20 NMAC 3.1, Subpart 5, Radiation Safety Requirements For Industrial Radiographic Operations, repealed effective 5/19/2002.

Other History:

EIB RP,R 1, Radiation Protection Regulations, filed 3/10/1989 was **renumbered** into first version of the New Mexico Administrative Code as 20 NMAC 3.1, Radioactive Materials And Radiation Machines, filed 7/3/1995;

20 NMAC 3.1, Radioactive Materials And Radiation Machines, filed 7-3-95 was **replaced** by 20 NMAC 3.1, Radioactive Materials And Radiation Machines, filed 6/17/1999;

20 NMAC 3.1, Subpart 5, Radiation Safety Requirements For Industrial Radiographic Operations, filed 6/17/1999 **replaced by** 20.3.5 NMAC, Radiation Safety Requirements For Industrial Radiographic Operations, effective 5/19/2002.

Exhibit 2B

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 3 RADIATION PROTECTION
PART 12 LICENSES AND RADIATION SAFETY REQUIREMENTS FOR WELL LOGGING

20.3.12.1 ISSUING AGENCY: Environmental Improvement Board.
[20.3.12.1 NMAC - Rp, 20.3.12.1 NMAC, 6/30/2011]

20.3.12.2 SCOPE: The regulations in this part apply to all licensees who use sources of radiation for well logging service operations, radioactive markers or subsurface tracer studies in oil, gas, mineral, groundwater or geological exploration.
[20.3.12.2 NMAC - Rp, 20.3.12.2 NMAC, 6/30/2011]

20.3.12.3 STATUTORY AUTHORITY: Sections 74-1-9, 74-3-5, and 74-3-9 NMSA 1978.
[20.3.12.3 NMAC - Rp, 20.3.12.3 NMAC, 6/30/2011]

20.3.12.4 DURATION: Permanent.
[20.3.12.4 NMAC - Rp, 20.3.12.4 NMAC, 6/30/2011]

20.3.12.5 EFFECTIVE DATE: June 30, 2011, unless a later date is cited at the end of a section.
[20.3.12.5 NMAC - Rp, 20.3.12.5 NMAC, 6/30/2011]

20.3.12.6 OBJECTIVE:

A. This part prescribes requirements for the issuance of a license authorizing the use of licensed materials including sealed sources, radioactive tracers, radioactive markers and uranium sinker bars in well logging in a single well. This part also prescribes radiation safety requirements for persons using licensed materials in these operations. The provisions and requirements of this part are in addition to, and not in substitution for, other requirements of this chapter. In particular, the provisions of 20.3.1 NMAC, 20.3.3 NMAC, 20.3.4 NMAC and 20.3.10 NMAC apply to applicants and licensees subject to this part.

B. The requirements set out in this part do not apply to the issuance of a license authorizing the use of licensed material in tracer studies involving multiple wells, such as field flooding studies, or to the use of sealed sources auxiliary to well logging but not lowered into wells.
[20.3.12.6 NMAC- Rp, 20.3.12.6 NMAC, 6/30/2011]

20.3.12.7 DEFINITIONS: As used in this part, the following definitions apply.

A. "Energy compensation source" (ECS) means a small sealed source, with an activity not exceeding 100 microcuries (3.7 megabecquerels), used within a logging tool, or other tool components, to provide a reference standard to maintain the tool's calibration when in use.

B. "Field station" means a facility where radioactive sources may be stored or used and from which equipment is dispatched to temporary job sites.

C. "Fresh water aquifer" means a geologic formation that is capable of yielding fresh water to a well or spring.

D. "Injection tool" means a device used for controlled subsurface injection of radioactive tracer material.

E. "Irretrievable well logging source" means any sealed source containing licensed material that is pulled off or not connected to the wireline that suspends the source in the well and for which all reasonable effort at recovery has been expended.

F. "Licensed material" means byproduct, source, or special nuclear material received, processed, used or transferred under a license issued by the department under this chapter.

G. "Logging assistant" means any individual who, under the personal supervision of a logging supervisor, handles sealed sources or tracers that are not in logging tools or shipping containers or who performs surveys required by 20.3.12.14 NMAC.

H. "Logging supervisor" means the individual who uses licensed material or provides personal supervision in the use of licensed material at a temporary jobsite and who is responsible to the licensee for assuring compliance with the requirements of the department's regulations and the conditions of the license.

I. "Logging tool" means a device used subsurface to perform well logging.

Exhibit 2C

J. "Personal supervision" means guidance and instruction by a logging supervisor, who is physically present at a temporary job site, who is in personal contact with logging assistants and who can give immediate assistance.

K. "Radioactive marker" means licensed material used for depth determination or direction orientation. For the purposes of this part, this term includes radioactive collar markers and radioactive iron nails.

L. "Safety review" means a periodic review provided by the licensee for its employees on radiation safety aspects of well logging. The review may include, as appropriate, the results of internal inspections, new procedures or equipment, accidents or errors that have been observed and opportunities for employees to ask safety questions.

M. "Sealed source" means any licensed material that is encased in a capsule designed to present leakage or escape of the licensed material.

N. "Source holder" means a housing or assembly into which a sealed source is placed for the purpose of facilitating the handling and use of the source in well logging operations.

O. "Subsurface tracer study" means the release of unsealed licensed material or a substance labeled with licensed material in a single well for the purpose of tracing the movement or position of the material or substance in the well or adjacent formation.

P. "Surface casing for protecting fresh water aquifers" means a pipe or tube used as a lining in a well to isolate fresh water aquifers from the well.

Q. "Temporary job site" means a location where licensed materials are present for the purpose of performing well logging or subsurface tracer studies.

R. "Tritium neutron generator target source" means a tritium source used within a neutron generator tube to produce neutrons for use in well logging applications.

S. "Uranium sinker bar" means a weight containing depleted uranium used to pull a logging tool toward the bottom of a well.

T. "Well" means a drilled hole, in which well logging may be performed. As used in this part, "well" includes drilled holes for the purpose of oil, gas, mineral, groundwater or geological exploration.

U. "Well logging" means all operations involving the lowering and raising of measuring devices or tools which may contain licensed material or are used to detect licensed materials in wells for the purpose of obtaining information about the well or adjacent formations which may be used in oil, gas, mineral, groundwater or geological exploration.

[20.3.12.7 NMAC - Rp, 20.3.12.7 NMAC, 6/30/2011]

20.3.12.8 APPLICATION FOR A SPECIAL LICENSE: A person, as defined in 20.3.1.7 NMAC, shall file an application in duplicate for a specific license authorizing the use of licensed material in well logging on a department prescribed form pursuant to 20.3.3.307 NMAC. The application must be sent to the department for review and approval.

[20.3.12.8 NMAC - N, 6/30/2011]

20.3.12.9 SPECIFIC LICENSES FOR WELL LOGGING: The department will approve an application for a specific license for the use of licensed material in well logging if the applicant meets the following requirements.

A. The applicant shall satisfy the general requirements specified in 10 CFR 30.33 for byproduct material, 10 CFR 40.32 for source material and in 10 CFR 70.23 for special nuclear material and in 20.3.3.308 NMAC and any special requirements contained in this part.

B. An application for a specific license of category 1 and category 2 quantities of radioactive material shall comply with 10 CFR 37. The licensee shall comply with 10 CFR 37 except as follows:

(1) any reference to the commission or NRC shall be deemed a reference to the department;

(2) 10 CFR 37.5 definitions of agreement state, byproduct material, commission and person shall not be applicable;

(3) 10 CFR 37.7, 10 CFR 37.9, 37.11(a) and (b), 10 CFR 37.13, 10 CFR 37.71, 10 CFR 37.105, and 10 CFR 37.107 shall not be applicable;

(4) for any reporting or notification requirements that the licensee must follow in 10 CFR 37.45, 10 CFR 37.57, 10 CFR 37.77(a) through (d), and 10 CFR 37.81, the licensee shall use the following address when applicable: New Mexico Environment Department/RCB, P.O. Box 5469, Santa Fe, NM 87502-5469 address information.

C. The applicant shall develop a program for training logging supervisors and logging assistants and submit to the department a description of this program which specifies the:

(1) initial training;

(2) on-the-job training;

(3) annual safety reviews provided by the licensee;

(4) means the applicant will use to demonstrate the logging supervisor's knowledge and understanding of and ability to comply with the department's regulations and licensing requirements and the applicant's operating and emergency procedures; and

(5) means the applicant will use to demonstrate the logging assistant's knowledge and understanding of and ability to comply with the applicant's operating and emergency procedures.

D. The applicant shall submit to the department written operating and emergency procedures as described in 20.3.12.12 NMAC or an outline or summary of the procedures that includes the important radiation safety aspects of the procedures.

E. The applicant shall establish and submit to the department its program for annual inspections of the job performance of each logging supervisor to ensure that the department's regulations, license requirements and the applicant's operating and emergency procedures are followed. Inspection records must be retained for three years after each internal inspection.

F. The applicant shall submit a description of its overall organizational structure as it applies to the radiation safety responsibilities in well logging, including specified delegations of authority and responsibility.

G. If an applicant wants to perform leak testing of sealed sources, the applicant shall identify the manufacturers and the model numbers of the leak test kits to be used. If the applicant wants to analyze its own wipe samples, the applicant shall establish procedures to be followed and submit a description of these procedures to the department. The description must include the:

(1) instruments to be used;

(2) methods of performing the analysis; and

(3) pertinent experience of the person who will analyze the wipe samples.

[20.3.12.9 NMAC- N, 6/30/2011; A, 06/13/2017; A, 02/14/2023]

20.3.12.10 RETRIEVAL OR ABANDONMENT OF SEALED SOURCES:

A. Agreement with well owner or operator.

(1) A licensee may perform well logging with a sealed source only after the licensee has a written agreement with the employing well owner or operator. This written agreement shall identify who will meet the requirements of Subsections B and C of this section and who will meet the following requirements:

(a) the radiation monitoring requirements of Subsection A of 20.3.12.15 NMAC shall be performed; and

(b) if the environment, any equipment or personnel are contaminated with licensed material, they shall be decontaminated before release from the site or release for unrestricted use.

(2) Recordkeeping. The licensee shall retain a copy of the written agreement for three[3] years after the completion of the well logging operation.

(3) A written agreement between the licensee and the well owner or operator is not required if the licensee and the well owner or operator are part of the same corporate structure or otherwise similarly affiliated. However, the licensee shall still otherwise meet the requirements of Subsections B and C of this section.

B. Retrieval of lodged sealed sources.

(1) If a sealed source becomes lodged in the well, a reasonable effort shall be made to recover it.

(2) A person may not attempt to recover a sealed source in a manner which, in the licensee's opinion, could result in its rupture.

C. Irretrievable sealed sources. If the sealed source is classified as irretrievable after reasonable efforts at recovery have been expended, the licensee shall implement the requirements of this subsection within 30 days.

(1) Each irretrievable well logging source shall be immobilized and sealed in place with a cement plug.

(2) The licensee shall implement means to prevent inadvertent intrusion on the source, unless the source is not accessible to any subsequent drilling operations.

(3) The licensee shall install a permanent identification plaque, constructed of long lasting material such as stainless steel, brass, bronze or monel, shall be mounted at the surface of the well, unless the

mounting of the plaque is not practical. The size of the plaque shall be at least 17 centimeters (seven inches) square and three millimeters (one-eighth inch) thick. The plaque shall contain:

(a) the word "caution";

(b) the radiation symbol (the color requirement in Subsection A of 20.3.4.427 NMAC need not be met);

(c) the date the source was abandoned;

(d) the name of the well owner or well operator, as appropriate;

(e) the well name and well identification number(s) or other designation;

(f) an identification of the sealed source(s) by radionuclide and quantity;

(g) the depth of the source and depth to the top of the plug; and

(h) an appropriate warning, such as, "do not re-enter this well."

D. A licensee may apply, pursuant to Subsection A of 20.3.1.107 NMAC, for department approval, on a case-by-case basis, of proposed procedures to abandon an irretrievable well logging source in a manner not otherwise authorized in this subsection.

[20.3.12.10 NMAC - Rp, 20.3.12.1203 NMAC, 6/30/2011]

20.3.12.11 TRAINING:

A. Logging supervisor. The licensee may not permit an individual to act as a logging supervisor until that person has met all of the following requirements:

(1) the person has completed training in the subjects outlined in Subsection E of this section;

(2) the person has received copies of, and instruction in:

(a) the department rules contained in the applicable sections of 20.3.4 NMAC, 20.3.10 NMAC and 20.3.12 NMAC;

(b) the department license under which the logging supervisor will perform well logging; and

(c) the licensee's operating and emergency procedures required by 20.3.12.12 NMAC;

(3) the person has completed on-the-job training and demonstrated competence in the use of licensed materials, remote handling tools and radiation survey instruments by a field evaluation; and

(4) the person has demonstrated understanding of the requirements in Paragraphs (1) and (2) of this subsection by successfully completing a written test.

B. Logging assistant. The licensee may not permit an individual to act as a logging assistant until that person has met the following requirements:

(1) the person has received instruction in applicable sections of 20.3.4 NMAC, 20.3.10 NMAC and 20.3.12 NMAC;

(2) the person has received copies of, and instruction in, the licensee's operating and emergency procedures required by 20.3.12.12 NMAC;

(3) the person has demonstrated understanding of the materials listed in Paragraphs (1) and (2) of this subsection by successfully completing a written or oral test; and

(4) the person has received instruction in the use of licensed materials, remote handling tools and radiation survey instruments, as appropriate for the logging assistant's intended job responsibilities.

C. The licensee shall provide safety reviews for logging supervisors and logging assistants at least once during each calendar year.

D. Recordkeeping. The licensee shall maintain a record on each logging supervisor's and logging assistant's training and annual safety review. The training records must include copies of written tests and dates of oral tests. The training records must be retained until three years following the termination of employment. Records of annual safety reviews must list the topics discussed and be retained for 3 years.

E. The licensee shall include the following subjects in the training required in Paragraph (1) of Subsection A of this section.

(1) Fundamentals of radiation safety including:

(a) characteristics of radiation;

(b) units of radiation dose and quantity of radioactivity;

(c) hazards of exposure to radiation;

(d) levels of radiation from licensed material;

(e) methods of controlling radiation dose (time, distance, and shielding); and

(f) radiation safety practices, including prevention of contamination, and methods of decontamination.

(2) Radiation detection instruments including:

(a) use, operation, calibration and limitations of radiation survey instruments;

(b) survey techniques; and

(c) use of personnel monitoring equipment.

(3) Equipment to be used including:

(a) operation of equipment, including source handling equipment and remote handling tools;

(b) storage, control and disposal of licensed material; and

(c) maintenance of equipment.

(4) The requirements of pertinent department regulations.

(5) Case histories of accidents in well logging.

[20.3.12.11 NMAC - Rp, 20.3.12.1214 and 20.3.12.1225 NMAC, 6/30/2011]

20.3.12.12 OPERATING AND EMERGENCY PROCEDURES: Each licensee shall develop and follow written operating and emergency procedures that cover the following topics:

A. the handling and use of licensed materials including the use of sealed sources in wells without surface casing for protecting fresh water aquifers, if appropriate;

B. the use of remote handling tools for handling sealed sources and radioactive tracer material except low-activity calibration sources;

C. methods and occasions for conducting radiation surveys, including surveys for detecting contamination, as required by Subsections C through E of 20.3.12.14 NMAC;

D. minimizing personnel exposure including exposures from inhalation and ingestion of licensed tracer materials;

E. methods and occasions for locking and securing stored licensed materials;

F. personnel monitoring and the use of personnel monitoring equipment;

G. transportation of licensed materials to field stations or temporary jobsites, packaging of licensed materials for transport in vehicles, placarding of vehicles when needed, and physically securing licensed materials in transport vehicles during transportation to prevent accidental loss, tampering or unauthorized removal;

H. picking up, receiving and opening packages containing licensed materials, in accordance with 20.3.4.432 NMAC;

I. for the use of tracers, decontamination of the environment, equipment, and personnel;

J. maintenance of records generated by logging personnel at temporary jobsites;

K. the inspection and maintenance of sealed sources, source holders, logging tools, injection tools, source handling tools, storage containers, transport containers and uranium sinker bars as required by 20.3.12.22 NMAC;

L. actions to be taken if a sealed source is lodged in a well;

M. notifying proper persons in the event of an accident; and

N. actions to be taken if a sealed source is ruptured including actions to prevent the spread of contamination and minimize inhalation and ingestion of licensed materials and actions to obtain suitable radiation survey instruments as required by Subsection B of 20.3.12.17 NMAC.

[20.3.12.12 NMAC - Rp, 20.3.12.1215 and 20.3.12.1218 NMAC, 6/30/2011]

20.3.12.13 PERSONNEL MONITORING:

A. The licensee may not permit an individual to act as a logging supervisor or logging assistant unless that person wears, at all times during the handling of licensed radioactive materials, a personnel dosimeter [~~that is processed and evaluated by an accredited national voluntary laboratory accreditation program (NVLAP) processor~~]. Each personnel dosimeter shall be assigned to and worn by only one individual. Film badges shall be replaced at least monthly and other personnel dosimeters [~~replaced~~] evaluated at least quarterly. [~~After replacement, each personnel dosimeter shall be promptly processed.~~]

B. The licensee shall provide bioassay services to individuals using licensed radioactive materials in subsurface tracer studies if required by the license.

C. Recordkeeping. The licensee shall retain records of personnel dosimeters required by Subsection A of this section and bioassay results for inspection until the department authorizes disposition of the records.

[20.3.12.13 NMAC - Rp, 20.3.12.1216 NMAC, 6/30/2011, XX/XX/24]

20.3.12.14 RADIATION SURVEYS:

A. The licensee shall make radiation surveys, including but not limited to the surveys required under Subsections B through E of this section, of each area where licensed materials are used and stored.

B. Before transporting licensed materials, the licensee shall make a radiation survey of the position occupied by each individual in the vehicle and of the exterior of each vehicle used to transport the licensed materials.

C. If the sealed source assembly is removed from the logging tool before departure from the temporary jobsite, the licensee shall confirm that the logging tool is free of contamination by energizing the logging tool detector or by using a survey meter.

D. If the licensee has reason to believe that, as a result of any operation involving a sealed source, the encapsulation of the sealed source could be damaged by the operation, the licensee shall conduct a radiation survey, including a contamination survey, during and after the operation.

E. The licensee shall make a radiation survey at the temporary jobsite before and after each subsurface tracer study to confirm the absence of contamination.

F. Recordkeeping. The results of surveys required under Subsections A through E of this section must be recorded and must include the date of the survey, the name of the individual making the survey, the identification of the survey instrument used, and the location of the survey. The licensee shall retain records of surveys for inspection by the department for 3 years after they are made.

[20.3.12.14 NMAC - Rp, 20.3.12.1221 NMAC, 6/30/2011]

20.3.12.15 RADIOACTIVE CONTAMINATION CONTROL:

A. If the licensee detects evidence that a sealed source has ruptured or licensed materials have caused contamination, the licensee shall initiate immediately the emergency procedures required by 20.3.12.12 NMAC.

B. If contamination results from the use of licensed material in well logging, the licensee shall decontaminate all work areas, equipment and unrestricted areas.

C. During efforts to recover a sealed source lodged in the well, the licensee shall continuously monitor, with an appropriate radiation detection instrument or a logging tool with a radiation detector, the circulating fluids from the well, if any, to check for contamination resulting from damage to the sealed source.

[20.3.12.15 NMAC - N, 6/30/2011]

20.3.12.16 LABELS, SECURITY AND TRANSPORT PRECAUTIONS:

A. Labels.

(1) The licensee may not use a source, source holder or logging tool that contains licensed material unless the smallest component that is transported as a separate piece of equipment with the licensed material inside bears a durable, legible and clearly visible marking or label. The marking or label must contain the radiation symbol specified in 20.3.4.427 NMAC, without the conventional color requirements, and the wording "Danger (or Caution) radioactive material."

(2) The licensee may not use a container to store licensed material unless the container has securely attached to it a durable, legible and clearly visible label. The label must contain the radiation symbol specified in 20.3.4.427 NMAC and the wording "Danger (or Caution), radioactive material, notify civil authorities (or name of company)."

(3) The licensee may not transport licensed material unless the material is packaged, labeled, marked and accompanied with appropriate shipping papers in accordance with regulations set out in 20.3.3.306 NMAC, incorporating 10 CFR Part 71.

B. Security precautions during storage and transportation.

(1) The licensee shall store each source containing licensed material in a storage container or transportation package. The container or package must be locked and physically secured to prevent tampering or removal of licensed material from storage by unauthorized personnel. The licensee shall store licensed material in a manner which will minimize danger from explosion or fire.

(2) The licensee shall lock and physically secure the transport package containing licensed material in the transporting vehicle to prevent accidental loss, tampering or unauthorized removal of the licensed material from the vehicle.

[20.3.12.16 NMAC - Rp, 20.3.12.1205, 20.3.12.1206, and 20.3.12.1212 NMAC, 6/30/2011]

20.3.12.17 RADIATION SURVEY INSTRUMENTS:

A. The licensee shall keep a calibrated and operable radiation survey instrument capable of detecting beta and gamma radiation at each field station and temporary jobsite to make the radiation surveys required by this part and by 20.3.4 NMAC. To satisfy this requirement, the radiation survey instrument must be capable of measuring 0.001 millisievert (0.1 millirem) per hour through at least 0.5 millisievert (50 millirems) per hour.

B. The licensee shall have available additional calibrated and operable radiation detection instruments sensitive enough to detect the low radiation and contamination levels that could be encountered if a sealed source ruptured. The licensee may own the instruments or may have a procedure to obtain them quickly from a second party.

C. The licensee shall have each radiation survey instrument required under this section calibrated:

(1) at intervals not to exceed six months and after each instrument servicing;

(2) for linear scale instruments, at two points located approximately one-third and two-third of full-scale on each scale; for logarithmic scale instruments, and mid-range of each decade, and at two points of at least one decade; and for digital instruments, at appropriate points; and

(3) so that an accuracy within plus or minus 20 percent of the calibration standard can be demonstrated on each scale.

D. Recordkeeping. The licensee shall retain calibration records for a period of three years after the date of calibration for inspection by the department.

[20.3.12.17 NMAC - Rp, 20.3.12.1207 NMAC, 6/30/2011]

20.3.12.18 LEAK TESTING OF SEALED SOURCES:

A. Testing and recordkeeping requirements. Each licensee who uses a sealed source of radioactive material shall have the source tested for leakage periodically. Records of leak tests results shall be kept in units of microcuries and maintained for inspection by the department for three years after the leak test is performed.

B. Method of testing. The wipe of a sealed source shall be performed using a leak test kit or method approved by the department, NRC or an agreement state. The wipe sample shall be taken from the nearest accessible point to the sealed source where contamination might accumulate. The wipe sample shall be analyzed for radioactive contamination. The analysis shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of radioactive material on the test sample and shall be performed by a person approved by the department, NRC or an agreement state to perform the analysis.

C. Test frequency.

(1) Each sealed source (except an energy compensation source (ECS)) shall be tested at intervals not to exceed six months. In the absence of a certificate from a transferor that a test has been made within the 6 months before the transfer, the sealed source may not be used until tested.

(2) Each energy compensation source (ECS) that is not exempt from testing in accordance with Subsection E of this section shall be tested at intervals not to exceed three[3] years. In the absence of a certificate from a transferor that a test has been made within the three years before the transfer, the energy compensation source (ECS) may not be used until tested.

D. Removal of leaking source from service.

(1) If the test conducted pursuant to Subsections A and B of this section reveals the presence of 0.005 microcurie (185 becquerels) or more of removable radioactive material, the licensee shall remove the sealed source from service immediately and have it decontaminated, repaired or disposed of by a department, NRC or an agreement state licensee that is authorized to perform these functions. The licensee shall check the equipment associated with the leaking source for radioactive contamination and, if contaminated, have it decontaminated or disposed of by a department, NRC or an agreement state licensee that is authorized to perform these functions.

(2) The licensee shall submit a report to the department within five days of receiving the test result. The report must describe the equipment involved in the leak, the test results, any contamination which resulted from the leaking source and the corrective actions taken up to the time the report was made.

E. Exemptions. The following sealed sources are exempt from the periodic leak test requirements set out in Subsections A through D of this section:

(1) hydrogen-3 (tritium) sources;

(2) sources containing licensed material with a half-life of 30 days or less;

(3) sealed sources containing licensed material in gaseous form;

(4) sources of beta- or gamma-emitting radioactive material with an activity of 100 microcuries (3.7 megabecquerels) or less; and

(5) sources of alpha- or neutron-emitting radioactive material with an activity of 10 microcuries (0.370 megabecquerel) or less.

[20.3.12.18 NMAC - Rp, 20.3.12.1208 NMAC, 6/30/2011]

20.3.12.19 PHYSICAL INVENTORY: Each licensee shall conduct a semi-annual physical inventory to account for all licensed material received and possessed under the license. The licensee shall retain records of the inventory for 3 years from the date of the inventory for inspection by the department. The inventory must indicate the quantity and kind of licensed material, the location of the licensed material, the date of the inventory and the name of the individual conducting the inventory. Physical inventory records may be combined with leak test records.

[20.3.12.19 NMAC - Rp, 20.3.12.1209 NMAC, 6/30/2011]

20.3.12.20 RECORDS OF MATERIAL USE:

A. Each licensee shall maintain records for each use of licensed material showing:

(1) the make, model number and serial number or a description of each sealed source used;

(2) in the case of unsealed licensed material used for subsurface tracer studies, the radionuclide and quantity of activity used in a particular well and the disposition of any unused tracer materials;

(3) the identity of the logging supervisor who is responsible for the licensed material and the identity of logging assistants present; and

(4) the location and date of use of the licensed material.

B. Recordkeeping. The licensee shall make the records required by Subsection A of this section available for inspection by the department. The licensee shall retain the records for 3 years from the date of the recorded event.

[20.3.12.20 NMAC - Rp, 20.3.12.1210 NMAC, 6/30/2011]

20.3.12.21 DESIGN AND PERFORMANCE CRITERIA FOR SEALED SOURCES:

A. A licensee may use a sealed source for use in well logging applications if:

(1) the sealed source is doubly encapsulated;

(2) the sealed source contains licensed material whose chemical and physical forms are as insoluble and nondispersible as practical; and

(3) meets the requirements of Subsections B, C and D of this section.

B. For a sealed source manufactured on or before July 14, 1989, a licensee may use the sealed source, for use in well logging applications if it meets the requirements of USASI N5.10-1968, classification of sealed radioactive sources, or the requirements in Subsections C and D of this section.

C. For a sealed source manufactured after July 14, 1989, a licensee may use the sealed source, for use in well logging applications if it meets the oil well logging requirements of ANSI/HPS N43.6-1997, sealed radioactive sources - classification.

D. For a sealed source manufactured after July 14, 1989, a licensee may use the sealed source, for use in well logging applications, if the sealed source's prototype has been tested and found to maintain its integrity after each of the tests in Paragraphs (1) through (5) of this subsection.

(1) Temperature. The test source shall be held at -40 degrees celsius for 20 minutes, 600 degrees celsius for 1 hour, and then be subject to a thermal shock test with a temperature drop from 600 degrees celsius to 20 degrees celsius within 15 seconds.

(2) Impact test. A 5-kilogram steel hammer, 2.5 centimeters in diameter, shall be dropped from a height of 1 meter onto the test source.

(3) Vibration test. The test source shall be subject to a vibration from 25 hertz to 500 hertz at 5 g (g meaning the acceleration due to gravity) amplitude for 30 minutes.

(4) Puncture test. A 1 gram hammer and pin, 0.3 centimeter pin diameter, shall be dropped from a height of 1 meter onto the test source.

(5) Pressure test. The test source shall be subject to an external pressure of 1.695x107 pascals (24,600 pounds per square inch absolute).

E. The requirements in Subsections A, B, C and D of this section do not apply to sealed sources that contain licensed material in gaseous form.

F. The requirements in Subsections A, B, C and D of this section do not apply to energy compensation sources (ECS). ECSs shall be registered with the sealed source and device registry (see definition in 20.3.1.7 NMAC) upon an approval by the NRC under 10 CFR 32.210 or an agreement state equivalent regulations.

[20.3.12.21 NMAC - Rp, 20.3.12.1211 NMAC, 6/30/2011]

20.3.12.22 INSPECTION, MAINTENANCE AND OPENING OF A SOURCE OR SOURCE HOLDER:

A. Each licensee shall visually check source holders, logging tools and source handling tools, for defects before each use to ensure that the equipment is in good working condition and that required labeling is present. If defects are found, the equipment must be removed from service until repaired, and a record must be made listing: the date of check, name of inspector, equipment involved, defects found and repairs made. These records must be retained for three years after the defect is found.

B. Each licensee shall have a program for semiannual visual inspection and routine maintenance of source holders, logging tools, injection tools, source handling tools, storage containers, transport containers and uranium sinker bars to ensure that the required labeling is legible and that no physical damage is visible. If defects are found, the equipment must be removed from service until repaired, and a record must be made listing: date, equipment involved, inspection and maintenance operations performed, any defects found and any actions taken to correct the defects. These records must be retained for three years after the defect is found.

C. Removal of a sealed source from a source holder or logging tool, and maintenance on sealed sources or holders in which sealed sources are contained may not be performed by the licensee unless a written operating procedure is developed and has been approved either by the department, NRC or an agreement state.

D. If a sealed source is stuck in the source holder, the licensee may not perform any operation, such as drilling, cutting or chiseling, on the source holder unless the licensee is specifically approved by the department, NRC or an agreement state to perform this operation.

E. The opening, repair or modification of any sealed source must be performed by persons specifically approved to do so by the department, NRC or an agreement state.

[20.3.12.22 NMAC - Rp, 20.3.12.1213 NMAC, 6/30/2011]

20.3.12.23 SUBSURFACE TRACER STUDIES:

A. The licensee shall require all personnel handling radioactive tracer material to use protective gloves and, if required by the license, other protective clothing and equipment. The licensee shall take precautions to avoid ingestion or inhalation of radioactive tracer material and to avoid contamination of field stations and temporary jobsites.

B. A licensee shall not knowingly inject licensed material into fresh water aquifers unless specifically authorized to do so by the department.

[20.3.12.23 NMAC - Rp, 20.3.12.1219 NMAC, 6/30/2011]

20.3.12.24 RADIOACTIVE MARKERS: The licensee may use radioactive markers in wells only if the individual markers contain quantities of licensed material not exceeding the exempt quantities specified in 20.3.3.330 NMAC. The use of markers is subject only to the requirements of physical inventory in 20.3.12.19 NMAC.

[20.3.12.24 NMAC - N, 6/30/2011]

20.3.12.25 URANIUM SINKER BARS: The licensee may use a uranium sinker bar in well logging applications only if it is legibly impressed with the words ”Caution - radioactive - depleted uranium” and “Notify civil authorities (or name of company) if found.”

[20.3.12.25 NMAC - Rp, 20.3.12.1200 NMAC, 6/30/2011]

20.3.12.26 USE OF A SEALED SOURCE IN A WELL WITHOUT A SURFACE CASING: The licensee may use a sealed source in a well without a surface casing for protecting fresh water aquifers only if the licensee follows a procedure for reducing the probability of the source becoming lodged in the well. The procedure must be approved by the department pursuant to Subsection C of 20.3.12.9 NMAC, the NRC or an agreement state.

[20.3.12.26 NMAC - N, 6/30/2011]

20.3.12.27 ENERGY COMPENSATION SOURCE:

A. The licensee may use an energy compensation source (ECS) which is contained within a logging tool or other tool components, only if the ECS contains quantities of licensed material not exceeding 100 microcuries (3.7 megabecquerels).

B. For well logging applications with a surface casing for protecting fresh water aquifers, use of the ECS is only subject to the requirements of 20.3.12.18 NMAC, 20.3.12.19 NMAC and 20.3.12.20 NMAC.

Exhibit 2C

C. For well logging applications without a surface casing for protecting fresh water aquifers, use of the ECS is only subject to the requirements of 20.3.12.10 NMAC, 20.3.12.18 NMAC, 20.3.12.19 NMAC, 20.3.12.20 NMAC, 20.3.12.26 NMAC and 20.3.12.32 NMAC.
[20.3.12.27 NMAC - Rp, 20.3.12.1201 NMAC, 6/30/2011]

20.3.12.28 TRITIUM NEUTRON GENERATOR TARGET SOURCE:

A. Use of a tritium neutron generator target source, containing quantities not exceeding 30 curies (1,110 megabecquerels) and in a well with a surface casing to protect fresh water aquifers, is subject to the requirements of this part except 20.3.12.10 NMAC, 20.3.12.21 NMAC and 20.3.12.32 NMAC.

B. Use of a tritium neutron generator target source, containing quantities exceeding 30 curies (1,110 megabecquerels) or in a well without a surface casing to protect fresh water aquifers, is subject to the requirements of this part except 20.3.12.21 NMAC.
[20.3.12.28 NMAC - Rp, 20.3.12.1202 NMAC, 6/30/2011]

20.3.12.29 SECURITY DURING USE OF LICENSED MATERIAL:

A. A logging supervisor must be physically present at a temporary jobsite whenever licensed materials are being handled or are not stored and locked in a vehicle or storage place. The logging supervisor may leave the jobsite in order to obtain assistance if a source becomes lodged in a well.

B. During well logging, except when radiation sources are below ground or in shipping or storage containers, the logging supervisor or other individual designated by the logging supervisor shall maintain direct surveillance of the operation to prevent unauthorized entry into a restricted area, as defined in 20.3.4.7 NMAC.
[20.3.12.29 NMAC - Rp, 20.3.12.1217 NMAC, 6/30/2011]

20.3.12.30 DOCUMENTS AND RECORDS REQUIRED AT FIELD STATIONS: Each licensee shall maintain the following documents and records at the field station:

A. a copy of 20.3.4 NMAC, 20.3.10 NMAC and 20.3.12 NMAC;

B. the license authorizing the use of licensed material;

C. operating and emergency procedures required by 20.3.12.12 NMAC;

D. the record of radiation survey instrument calibrations required by 20.3.12.17 NMAC;

E. the record of leak test results required by 20.3.12.18 NMAC;

F. physical inventory records required by 20.3.12.19 NMAC;

G. utilization records required by 20.3.12.20 NMAC;

H. records of inspection and maintenance required by 20.3.12.22 NMAC;

I. training records required by 20.3.12.11 NMAC; and

J. survey records required by 20.3.12.14 NMAC.
[20.3.12.30 NMAC - Rp, 20.3.12.1222 NMAC, 6/30/2011]

20.3.12.31 DOCUMENTS AND RECORDS REQUIRED AT TEMPORARY JOBSITES: Each licensee conducting operations at a temporary jobsite shall maintain the following documents and records at the temporary jobsite until the well logging operation is completed:

A. operating and emergency procedures required by 20.3.12.12 NMAC;

B. evidence of latest calibration of the radiation survey instruments in use at the site required by 20.3.12.17 NMAC;

C. latest survey records required by 20.3.12.14 NMAC;

D. the shipping papers for the transportation of radioactive materials required by 20.3.3.306 NMAC, incorporating 10 CFR 71.5; and

E. when operating under reciprocity pursuant to 20.3.3.324 NMAC, a copy of the NRC or agreement state license authorizing use of licensed materials.
[20.3.12.31 NMAC - Rp, 20.3.12.1223 NMAC, 6/30/2011]

20.3.12.32 NOTIFICATION OF INCIDENTS AND LOST SOURCES; ABANDONMENT PROCEDURES FOR IRRETRIEVABLE SOURCES:

A. The licensee shall immediately notify the department by telephone and subsequently, within 30 days, by confirmation in writing, if the licensee knows or has reason to believe that a sealed source has been ruptured. The written confirmation must designate the well or other location, describe the magnitude and extent of

the escape of licensed materials, assess the consequences of the rupture, and explain efforts planned or being taken to mitigate these consequences.

B. The licensee shall notify the department of the theft or loss of radioactive materials, radiation overexposures, excessive levels and concentrations of radiation and certain other accidents as required by 20.3.4.451 NMAC, 20.3.4.452 NMAC, 20.3.4.453 NMAC and 20.3.3.325 NMAC.

C. If a sealed source becomes lodged in a well, and when it becomes apparent that efforts to recover the sealed source will not be successful, the licensee shall:

(1) notify the department by telephone of the circumstances that resulted in the inability to retrieve the source; and

(a) obtain department approval to implement abandonment procedures; or

(b) that the licensee implemented abandonment before department approval because the licensee believed there was an immediate threat to public health and safety; and

(2) advise the well owner or operator, as appropriate, of the abandonment procedures under Subsection A or D of 20.3.12.10 NMAC; and

(3) either ensure that abandonment procedures are implemented within 30 days after the sealed source has been classified as irretrievable or request an extension of time if unable to complete the abandonment procedures.

D. The licensee shall, within 30 days after a sealed source has been classified as irretrievable, make a report in writing to the department. The licensee shall send a copy of the report to each appropriate local, state or federal agency that issued permits or otherwise approved of the drilling operation. The report must contain the following information:

(1) date of occurrence;

(2) a description of the irretrievable well logging source involved including the radionuclide and its quantity, chemical and physical form;

(3) surface location and identification of the well;

(4) results of efforts to immobilize and seal the source in place;

(5) a brief description of the attempted recovery effort;

(6) depth of the source;

(7) depth of the top of the cement plug;

(8) depth of the well;

(9) the immediate threat to public health and safety justification for implementing abandonment if prior department approval was not obtained in accordance with Subparagraph (b) of Paragraph (1) of Subsection C of this section;

(10) any other information, such as a warning statement, contained on the permanent identification plaque; and

(11) local, state and federal agencies receiving copy of this report.

[20.3.12.32 NMAC - Rp, 20.3.12.1224 NMAC, 6/30/2011]

HISTORY OF 20.3.12 NMAC:

Pre-NMAC History: The material in this part was derived from that previously filed as follows:
EIB 73-2, Regulations for Governing the Health and Environmental Aspects of Radiation filed on 7/9/1973;
EIB 73-2, Amendment 1, Regulations for Governing the Health and Environmental Aspects of Radiation filed on 4-17-78;
EIB RPR-1, Radiation Protection Regulations filed on 4/21/1980;
EIB RPR-1, Amendment 1, Radiation Protection Regulations filed on 10/13/1981;
EIB RPR-1, Amendment 2, Radiation Protection Regulations filed on 12/15/1982; and
EIB RPR-1, Radiation Protection Regulations filed on 3/10/1989.

History of Repealed Material: 20.3.12 NMAC, Radiation Safety Requirements for Wireline Service Operations and Subsurface Tracer Studies, filed 3/15/2004 is repealed effective 6/30/2011 and replaced by 20.3.12 NMAC, Licenses and Radiation Safety Requirements for Well Logging, effective 6/30/2011.

Other History: EIB RPR 1, Radiation Protection Regulations, filed 3/10/1989 renumbered and reformatted to 20 NMAC 3.1; Radioactive Materials and Radiation Machines, effective 5/3/1995;
20 NMAC 3.1; Radioactive Materials and Radiation Machines (filed 4/3/1995) internally renumbered, reformatted and replaced by 20 NMAC 3.1, Radioactive Materials and Radiation Machines, effective 7/30/1999.

20 NMAC 3.1.Subpart 12, Radiation Safety Requirements For Wireline Service Operations And Subsurface Tracer Studies (filed 6/17/1999) reformatted, amended and replaced by 20.3.12 NMAC, Radiation Safety Requirements for Wireline Service Operations and Subsurface Tracer Studies, effective 4/15/2004.

20.3.12 NMAC, Radiation Safety Requirements for Wireline Service Operations and Subsurface Tracer Studies, filed 3/15/2004 is repealed effective 6/30/2011 and replaced by 20.3.12 NMAC, Licenses and Radiation Safety Requirements for Well Logging, effective 6/30/2011.

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 3 RADIATION PROTECTION
PART 15 LICENSES AND RADIATION SAFETY REQUIREMENTS FOR IRRADIATORS

20.3.15.1 ISSUING AGENCY: Environmental Improvement Board.
[5/3/1995; 20.3.15.1 NMAC - Rn, 20 NMAC 3.1.1.100, 4/15/2004]

20.3.15.2 SCOPE:

A. The requirements of this part (20.3.15 NMAC) are in addition to other requirements in these regulations. In particular, the provisions of Parts 3, 4 and 10 (20.3.3 NMAC, 20.3.4 NMAC, and 20.3.10 NMAC) apply to applications and licenses subject to this part (20.3.15 NMAC). Nothing in this part (20.3.15 NMAC) relieves the licensee from complying with other applicable federal, state and local regulations governing the siting, zoning, land use and building code requirements for industrial facilities.

B. The regulations in this part (20.3.15 NMAC) apply to panoramic irradiators that have either dry or wet storage of the radioactive sealed sources and to under water irradiators in which both the source and the product being irradiated are under water. Irradiators whose dose rates exceed five grays (500 rads) per hour at one meter from the radioactive sealed sources in air or in water, as applicable for the irradiator type, are covered by this part (20.3.15 NMAC).

C. The regulations in this part (20.3.15 NMAC) do not apply to self-contained dry-source storage irradiators (those in which both the source and the area subject to irradiation are contained within a device and are not accessible by personnel), medical radiology or teletherapy, radiography (the irradiation of materials for nondestructive testing purposes), gauging, or open-field (agricultural) irradiations.
[5/3/1995; 20.3.15.2 NMAC - Rn, 20 NMAC 3.1.15.1500, 4/15/2004]

20.3.15.3 STATUTORY AUTHORITY: Sections 74-1-9, 74-3-5, and 74-3-9 NMSA 1978.
[5/3/1995; 20.3.15.3 NMAC - Rn, 20 NMAC 3.1.1.102, 4/15/2004]

20.3.15.4 DURATION: Permanent.
[5/3/1995; 20.3.15.4 NMAC - Rn, 20 NMAC 3.1.1.103, 4/15/2004]

20.3.15.5 EFFECTIVE DATE: May 3, 1995, unless a later date is cited at the end of a section.
[5/3/1995, 8-2-95, A, 7-30-99; 20.3.3.5 NMAC - Rn, 20 NMAC 3.1.1.104, 4/15/2004]

20.3.15.6 OBJECTIVE: This part (20.3.15 NMAC) contains requirements for the issuance of a license authorizing the use of sealed sources containing radioactive materials in irradiators used to irradiate objects or materials using gamma radiation. This part (20.3.15 NMAC) also contains radiation safety requirements for operating irradiators.
[5/3/1995; 20.3.15.2 NMAC - Rn, 20 NMAC 3.1.15.1500.A, 4/15/2004]
[Refer to the purpose and scope promulgated by the board as specified in 20.3.15.2 NMAC.]

20.3.15.7 DEFINITIONS:

A. **"Annually"** means either:

(1) at intervals not to exceed one year; or

(2) once per year, at about the same time each year (plus or minus 1 month).

B. **"Doubly encapsulated sealed source"** means a sealed source in which the radioactive material is sealed within a capsule and that capsule is sealed within another capsule.

C. **"Irradiator"** means a facility that uses radioactive sealed sources for the irradiation of objects or materials and in which radiation dose rates exceeding five grays (500 rads) per hour exist at one meter from the sealed radioactive sources in air or water, as applicable for the irradiator type, but does not include irradiators in which both the sealed source and the area subject to irradiation are contained within a device and are not accessible to personnel.

D. **"Irradiator operator"** means an individual who has successfully completed the training and testing described in 20.3.15.1517 NMAC and is authorized by the terms of the license to operate the irradiator without a supervisor present.

E. **"Panoramic dry-source-storage irradiator"** means an irradiator in which the irradiations occur in air in areas potentially accessible to personnel and in which the sources are stored in shields made of solid

materials. The term includes beam-type dry-source-storage irradiators in which only a narrow beam of radiation is produced for performing irradiations.

F. "Panoramic irradiator" means an irradiator in which the irradiations are done in air in areas potentially accessible to personnel. The term includes beam-type irradiators.

G. "Panoramic wet-source-storage irradiator" means an irradiator in which the irradiations occur in air in areas potentially accessible to personnel and in which the sources are stored under water in a storage pool.

H. "Pool irradiator" means any irradiator at which the sources are stored or used in a pool of water, including panoramic wet-source-storage irradiators and under water irradiators.

I. "Product conveyor system" means a system for moving the product to be irradiated to, from and within the area where irradiation takes place.

J. "Radiation room" means a shielded room in which irradiations take place. Under water irradiators do not have radiation rooms.

K. "Radiation safety officer" means an individual with responsibility for the overall radiation safety program at the facility.

L. "Sealed source" means any byproduct material that is used as a source of radiation and is encased in a capsule designed to prevent leakage or escape of the byproduct material.

M. "Seismic area" means any area where the probability of a horizontal acceleration in rock of more than 0.3 times the acceleration of gravity in 250 years is greater than 10 percent, as designated by the U.S. geological survey.

N. "Underwater irradiator" means an irradiator in which the sources always remain shielded under water and humans do not have access to the sealed sources or the space subject to irradiation without entering the pool.

[5/3/1995; 20.3.15.7 NMAC - Rn, 20 NMAC 3.1.15.1500, 4/15/2004]

20.3.15.8 through 20.3.15.1500 [RESERVED]

20.3.15.1501 APPLICATION FOR A SPECIFIC LICENSE. A person, as defined in 20.3.1 NMAC of these regulations, may file an application for a specific license authorizing the use of sealed sources in an irradiator on forms provided by the department, in accordance with 20.3.3.307 NMAC.

[5/3/1995; 20.3.15.1501 NMAC - Rn, 20 NMAC 3.1.15.1501, 4/15/2004]

20.3.15.1502 SPECIFIC LICENSES FOR IRRADIATORS: The department will approve an application for a specific license for the use of licensed material in an irradiator if the applicant meets the requirements contained in this section.

A. The applicant shall satisfy the general requirements specified in 20.3.3 NMAC and the requirements contained in this part (20.3.15 NMAC).

B. An application for a specific license of category 1 and category 2 quantities of radioactive material shall comply with 10 CFR 37. The licensee shall comply with 10 CFR 37 except as follows:

(1) any reference to the commission or NRC shall be deemed a reference to the department;

(2) 10 CFR 37.5 definitions of agreement state, byproduct material, commission and person shall not be applicable;

(3) 10 CFR 37.7, 10 CFR 37.9, 10 CFR 37.11(a) and (b), 10 CFR 37.13, 10 CFR 37.71, 10 CFR 37.105, and 10 CFR 37.107 shall not be applicable;

(4) for any reporting or notification requirements that the licensee must follow in 10 CFR 37.45, 10 CFR 37.57, 10 CFR 37.77(a) through (d), 10 CFR 37.81, the licensee shall use, when applicable, New Mexico Environment Department/RCB, P.O. Box 5469, Santa Fe, NM 87502-5469 address information.

C. The application must describe the training provided to irradiator operators including:

(1) classroom training;

(2) on-the-job or simulator training;

(3) safety reviews;

(4) means employed by the applicant to test each operator's understanding of these regulations and licensing requirements, and the irradiator operating and emergency procedures; and

(5) minimum training and experience of personnel who may provide training.

D. The application must include an outline of the written operating and emergency procedures listed in 20.3.15.1518 NMAC that describes the radiation safety aspects of the procedures.

E. The application must describe the organizational structure for managing the irradiator, specifically

the radiation safety responsibilities and authorities of the radiation safety officer, and those management personnel who have important radiation safety responsibilities or authorities. In particular, the application must specify who within the management structure has the authority to stop unsafe operations. The application must also describe the training and experience required for the position of radiation safety officer.

F. The application must include a description of the access control system required by 20.3.15.1507 NMAC, the radiation monitors required by 20.3.15.1510 NMAC, the method of detecting leaking sources required by 20.3.15.1521 NMAC including the sensitivity of the method, and a diagram of the facility that shows the locations of all required interlocks and radiation monitors.

G. If the applicant intends to perform leak testing of dry-source-storage sealed sources, the applicant shall establish procedures for leak testing and submit a description of these procedures to the department. The description must include the:

(1) instruments to be used;

(2) methods of performing the analysis; and

(3) pertinent experience of the individual who analyzes the samples.

H. If licensee personnel are to load or unload sources, the applicant shall describe the qualifications and training of the personnel and the procedures to be used. If the applicant intends to contract for source loading or unloading at its facility, the loading or unloading must be done by an organization specifically authorized by the department to load or unload irradiator sources.

I. The applicant shall describe the inspection and maintenance checks, including the frequency of the checks required by 20.3.15.1522 NMAC.

[05/03/95; 20.3.15.1502 NMAC - Rn, 20 NMAC 3.1.15.1502, 04/15/2004; A, 06/13/2017; A, 02/14/2023]

20.3.15.1503 START OF CONSTRUCTION: The applicant may not begin construction of a new irradiator prior to the submission to the department an application for a license for the irradiator. As used in this section, the term "construction" includes the construction of any portion of the permanent irradiator structure on the site, but does not include engineering and design work, purchase of a site, site surveys or soil testing, site preparation, site excavation, construction of warehouse or auxiliary structures, and other similar tasks. Any activities undertaken prior to the issuance of a license are entirely at the risk of the applicant and have no bearing on the issuance of a license.

[5/3/1995; 20.3.15.1503 NMAC - Rn, 20 NMAC 3.1.15.1503, 4/15/2004]

20.3.15.1504 APPLICATIONS FOR EXEMPTIONS:

A. The department may, upon application of any interested person or upon its own initiative, grant any exemptions from the requirements in this part (20.3.15 NMAC) that it determines are authorized by law and will not endanger life or property or the common defense and security, and are otherwise in the public interest.

B. Any application for a license or for amendment of a license authorizing use of teletherapy-type unit for irradiation of materials or objects may include proposed alternatives for the requirements of this part (20.3.15 NMAC). The department will approve the proposed alternatives if the applicant provides adequate rationale for the proposed alternatives and demonstrates that they are likely to provide an adequate level of safety for workers and the public.

[5/3/1995; 20.3.15.1504 NMAC - Rn, 20 NMAC 3.1.15.1504, 4/15/2004]

20.3.15.1505 REQUEST FOR WRITTEN STATEMENTS:

A. After the filing of the original application, the department may request further information necessary to enable the department to determine whether the application should be granted or denied.

B. Each license is issued with the condition that the licensee will, at any time before expiration of the license, upon the department's request, submit written statements to enable the department to determine whether the license should be modified, suspended or revoked.

[5/3/1995; 20.3.15.1505 NMAC - Rn, 20 NMAC 3.1.15.1505, 4/15/2004]

20.3.15.1506 PERFORMANCE CRITERIA FOR SEALED SOURCES:

A. Requirements. Sealed sources installed after July 1, 1993:

(1) must be doubly encapsulated;

(2) must use radioactive material that is as non-dispersible as practical and that is as insoluble as practical if the source is used in a wet-source-storage or wet-source-change irradiator;

(3) must be encapsulated in a material resistant to general corrosion and to localized

corrosion, such as 316L stainless steel or other material with equivalent resistance if the sources are for use in irradiator pools; and

(4) in prototype testing of the sealed source, must have been leak tested and found leak-free after each of the tests described in Subsections B through G of 20.3.15.1506 NMAC.

B. Temperature. The test source must be held at -40 degrees C for 20 minutes, 600 degrees C for one hour, and then be subject to a thermal shock test with a temperature drop from 600 degrees C to 20 degrees C within 15 seconds.

C. Pressure. The test source must be twice subjected for at least five minutes to an external pressure (absolute) of 2 million newtons per square meter.

D. Impact. A 2-kilogram steel weight, 2.5 centimeters in diameter, must be dropped from a height of 1 meter onto the test source.

E. Vibration. The test source must be subjected three times for 10 minutes each to vibrations sweeping from 25 hertz to 500 hertz, with a peak amplitude of 5 times the acceleration of gravity. In addition, each test source must be vibrated for 30 minutes at each resonant frequency found.

F. Puncture. A 50-gram weight and pin, 0.3-centimeter pin diameter, must be dropped from a height of 1 meter onto the test source.

G. Bend. If the length of the source is more than 15 times larger than the minimum cross-sectional dimension, the test source must be subjected to a force of 2000 newtons at its center equidistant from two support cylinders, the distance between which is 10 times the minimum cross-sectional dimension of the source.

[5/3/1995; 20.3.15.1506 NMAC - Rn, 20 NMAC 3.1.15.1506, 4/15/2004; A, 6/13/2017]

20.3.15.1507 ACCESS CONTROL:

A. Each entrance to a radiation room at a panoramic irradiator must have a door or other physical barrier to prevent inadvertent entry of personnel if the sources are not in the shielded position. Product conveyer systems may serve as barriers as long as they reliably and consistently function as a barrier. It must not be possible to move the sources out of their shielded position if the door or barrier is open. Opening the door or barrier while the sources are exposed must cause the sources to return promptly to their shielded position. The personnel entrance door or barrier must have a lock that is operated by the same key used to move the source. The doors and barriers must not prevent any individual in the radiation room from leaving.

B. In addition, each entrance to a radiation room at a panoramic irradiator must have an independent backup access control to detect personnel entry while the sources are exposed. Detection of entry while the sources are exposed must cause the sources to return to their fully shielded position, and must also activate a visible and audible alarm to make the individual entering the room aware of the hazard. The alarm must also alert at least one other individual who is on-site of the entry. That individual shall be trained on how to respond to the alarm and prepared to promptly render or summon assistance.

C. A radiation monitor must be provided to detect the presence of high radiation levels in the radiation room of a panoramic irradiator before personnel entry. The monitor must be integrated with personnel access door locks to prevent room access when radiation levels are high. Attempted personnel entry while the monitor measures high radiation levels must activate the alarm described in Subsection B of 20.3.15.1507 NMAC. The monitor may be located in the entrance (normally referred to as the maze), but not in the direct radiation beam.

D. Before the sources move from their shielded position in a panoramic irradiator, the source control must automatically activate conspicuous visible and audible alarms to alert people in the radiation room that the sources will be moved from their shielded position. The alarms must give individuals enough time to leave the room before the sources leave the shielded position.

E. Each radiation room at a panoramic irradiator must have a clearly visible and readily accessible control that would allow an individual in the room to make the sources return to their fully shielded position.

F. Each radiation room of a panoramic irradiator must contain a control that prevents the sources from moving from the shielded position, unless the control has been activated and the door or barrier to the radiation room has been closed within a preset time after activation of the control.

G. Each entrance to the radiation room of a panoramic irradiator and each entrance to the area within the personnel access barrier of an underwater irradiator must be posted as required by 20.3.4.428 NMAC. Radiation postings for panoramic irradiators must comply with the posting requirements of 20.3.4.428 NMAC, except that signs may be removed, covered, or otherwise made inoperative when the sources are fully shielded.

H. If the radiation room of a panoramic irradiator has roof plugs or other movable shielding, it must not be possible to operate the irradiator unless the shielding is in its proper location. This requirement may be met by interlocks that prevent operation if shielding is not placed properly or by an operating procedure requiring

inspection of shielding before operating.

I. Underwater irradiators must have a personnel access barrier around the pool which must be locked to prevent access when the irradiator is not attended. Only operators and facility management may have access to keys to the personnel access barrier. There must be an intrusion alarm to detect unauthorized entry when the personnel access barrier is locked. Activation of the intrusion alarm must alert an individual (not necessarily onsite) who is prepared to respond or summon assistance.

[5/3/1995; 20.3.15.1507 NMAC - Rn, 20 NMAC 3.1.15.1507 & A, 4/15/2004]

20.3.15.1508 SHIELDING:

A. The radiation dose rate in areas that are normally occupied during operation of a panoramic irradiator may not exceed 0.02 millisievert (two millirems) per hour at any location 30 centimeters or more from the wall of the room when the sources are exposed. The dose rate must be averaged over an area not to exceed 100 square centimeters having no linear dimension greater than 20 cm. Areas where the radiation dose rate exceeds 0.02 millisievert (two millirems) per hour must be locked, roped off or posted.

B. The radiation dose at 30 centimeters over the edge of the pool of a pool irradiator may not exceed 0.02 millisievert (two millirems) per hour when the sources are in the fully shielded position.

C. The radiation dose rate at one meter from the shield of a dry-source-storage panoramic irradiator when the source in shielded may not exceed 0.02 millisievert (two millirems) per hour and at five centimeters from the shield may not exceed 0.2 millisievert (20 millirems) per hour.

[5/3/1995; 20.3.15.1508 NMAC - Rn, 20 NMAC 3.1.15.1508, 4/15/2004]

20.3.15.1509 FIRE PROTECTION:

A. The radiation room at a panoramic irradiator must have heat and smoke detectors. The detectors must activate an audible alarm. The alarm must be capable of alerting a person who is prepared to summon assistance promptly. The sources must automatically become fully shielded if a fire is detected.

B. The radiation room at a panoramic irradiator must be equipped with a fire extinguishing system capable of extinguishing a fire without the entry of personnel into the room. The system for the radiation room must have a shut-off valve to control flooding into unrestricted areas.

[5/3/1995; 20.3.15.1509 NMAC - Rn, 20 NMAC 3.1.15.1509, 4/15/2004]

20.3.15.1510 RADIATION MONITORS:

A. Irradiators with automatic product conveyor systems must have a radiation monitor with an audible alarm located to detect loose radioactive sources that are carried toward the product exit. If the monitor detects a source, an alarm must sound, and product conveyors must stop automatically. The alarm must be capable of alerting an individual in the facility who is prepared to summon assistance. Underwater irradiators in which the product moves within an enclosed stationary tube are exempt from the requirements of this subsection.

B. Underwater irradiators that are not in a shielded radiation room must have a radiation monitor over the pool to detect abnormal radiation levels. The monitor must have an audible alarm and a visible indicator at entrances to the personnel access barrier around the pool. The audible alarm may have a manual shut-off. The alarm must be capable of alerting an individual who is prepared to respond promptly.

[5/3/1995; 20.3.15.1510 NMAC - Rn, 20 NMAC 3.1.15.1510, 4/15/2004]

20.3.15.1511 CONTROL OF SOURCE MOVEMENT:

A. The mechanism that moves the sources of a panoramic irradiator must require a key to actuate. Actuation of the mechanism must cause an audible signal to indicate that the sources are leaving the shielded position. Only one key may be in use at any time, and only operators or facility management may possess it. The key must be attached to a portable radiation survey meter by a chain or cable. The lock for source control must be designed so that the key may not be removed if the sources are in an unshielded position. The door to the radiation room must require the same key.

B. The console of a panoramic irradiator must have a source position indicator that indicates when the sources are in the fully shielded position, when they are in transit and when the sources are exposed.

C. The control console of a panoramic irradiator must have a control that promptly returns the sources to the shielded position.

D. Each control for a panoramic irradiator must be clearly marked as to its function.

[5/3/1995; 20.3.15.1511 NMAC - Rn, 20 NMAC 3.1.15.1511, 4/15/2004]

20.3.1512 IRRADIATOR POOLS:

A. For licenses initially issued after July 1, 1993, irradiator pools must either:

(1) have a water-tight stainless steel liner or a liner metallurgically compatible with other components in the pool; or

(2) be constructed so that there is a low likelihood of substantial leakage and have a surface designed to facilitate decontamination; and

(3) in either case, the licensee shall have a method to safely store the sources during repairs of the pool.

B. For licenses initially issued after July 1, 1993, irradiator pools must have no outlets more than 0.5 meter below the normal low water level that could allow water to drain out of the pool. Pipes that have intakes more than 0.5 meter below the normal low water level and that could act as siphons must have siphon breakers to prevent the siphoning of pool water.

C. A means must be provided to replenish water losses from the pool.

D. A visible indicator must be provided in a clearly visible location to indicate if the pool water level is below the normal low water level or above the normal high water level.

E. Irradiator pools must be equipped with a purification system designed to be capable of maintaining the water during normal operation at a conductivity of 20 microsiemens per centimeter or less and with a clarity so that the sources can be seen clearly.

F. A physical barrier, such as a railing or cover, must be used around or over irradiator pools during normal operation to prevent personnel from accidentally falling into the pool. The barrier may be removed during maintenance, inspection and service operations.

G. If long-handled tools or poles are used in irradiator pools, the radiation dose rate on the handling areas of the tools may not exceed 0.02 millisievert (two millirems) per hour.

[5/3/1995; 20.3.15.1512 NMAC - Rn, 20 NMAC 3.1.15.1512, 4/15/2004]

20.3.15.1513 SOURCE RACK PROTECTION: If the product to be irradiated moves on a product conveyor system, the source rack and the mechanism that moves the rack must be protected by a barrier or guides to prevent products and product carriers from hitting or touching the rack or mechanism.

[5/3/1995; 20.3.15.1513 NMAC - Rn, 20 NMAC 3.1.15.1513. 4/15/2004]

20.3.15.1514 POWER FAILURES:

A. If electrical power at a panoramic irradiator is lost for longer than 10 seconds, the source must automatically return to the shielded position.

B. The lock on the door of the radiation room of a panoramic irradiator may not be deactivated by a power failure.

C. During a power failure, the area of any irradiator where sources are located may be entered only when using an operable and calibrated radiation survey meter.

[5/3/1995; 20.3.15.1514 NMAC - Rn, 20 NMAC 3.1.15.1514, 4/15/2004]

20.3.15.1515 DESIGN REQUIREMENTS: Irradiators whose construction begins after July 1, 1993, must meet the design requirements of this section.

A. Shielding. For panoramic irradiators, the licensee shall design shielding walls to meet generally accepted building code requirements for reinforced concrete, and design the walls, wall penetrations and entrance ways to meet the radiation shielding requirements of 20.3.15.1508 NMAC. If the irradiator will use more than 2 x 10^{17} becquerels (five million curies) of activity, the licensee shall evaluate the effects of heating of the shielding walls by the irradiator sources.

B. Foundations. For panoramic irradiators, the licensee shall design the foundation, with consideration given to soil characteristics, to ensure it is adequate to support the weight of the facility shield walls.

C. Pool integrity. For pool irradiators, the licensee shall design the pool to assure that it is leak resistant, that is strong enough to bear the weight of the pool water and shipping casks, that a dropped cask would not fall on sealed sources, that all outlets or pipes meet the requirements of Subsection B of 20.3.15.1512 NMAC, and that metal components are metallurgically compatible with other components in the pool.

D. Water handling system. For pool irradiators, the licensee shall verify that the design of the water purification system is adequate to meet the requirements of Subsection E of 20.3.15.1512 NMAC. The system must be designed so that water leaking from the system does not drain to unrestricted areas without being monitored.

E. Radiation monitors. For all irradiators, the licensee shall evaluate the location and sensitivity of

the monitor to detect sources carried by the product conveyor system as required by Subsection A of 20.3.15.1510 NMAC. The licensee shall verify that the product conveyor is designed to stop before a source on the product conveyor would cause a radiation overexposure to any person. For pool irradiators, if the licensee uses radiation monitors to detect contamination under Subsection B of 20.3.15.1521 NMAC, the licensee shall verify that the design of radiation monitoring systems to detect pool contamination includes sensitive detectors located close to where contamination is likely to concentrate.

F. Source rack. For pool irradiators, the licensee shall verify that there are no crevices on the source or between the source and source holder that would promote corrosion on a critical area of the source. For panoramic irradiators, the licensee shall determine that source rack drops due to loss of power will not damage the source rack and that source rack drops due to failure of cables (or alternate means of support) will not cause loss of integrity of sealed sources. For panoramic irradiators, the licensee shall review the design of the mechanism that moves the sources to assure that the likelihood of a stuck source is low and that, if the rack sticks, a means exists to free it with minimal risk to personnel.

G. Access control. For panoramic irradiators, the licensee shall verify from the design and logic diagram that the access control system will meet the requirements of 20.3.15.1507 NMAC.

H. Fire protection. For panoramic irradiators, the licensee shall verify that the number, location and spacing of the smoke and heat detectors are appropriate to detect fires, and that the detectors are protected from mechanical and radiation damage. The licensee shall verify that the design of the fire extinguishing system provides the necessary discharge patterns, densities and flow characteristics for complete coverage of the radiation room, and that the system is protected from mechanical and radiation damage.

I. Source return. For panoramic irradiators, the licensee shall verify that the source rack will automatically return to the fully shielded position if off-site power is lost for more than 10 seconds.

J. Seismic. For panoramic irradiators to be built in seismic areas, the licensee shall design the reinforced concrete radiation shields to retain their integrity in the event of an earthquake by designing to the seismic requirements of an appropriate source such as American concrete institute standard ACI 318-89, "Building Code Requirements for Reinforced Concrete," Chapter 21, "Special Provisions for Seismic Design," or local building codes, if current.

K. Wiring. For panoramic irradiators, the licensee shall verify that electrical wiring and electrical equipment in the radiation room are selected to minimize failures due to prolonged exposure to radiation.

[5/3/1995; 20.3.15.1515 NMAC - Rn, 20 NMAC 3.1.15.1515, 4/15/2004; A, 6/13/2017]

20.3.15.1516 CONSTRUCTION MONITORING AND ACCEPTANCE TESTING: The requirements of this section must be met for irradiators whose construction begins after July 1, 1993. The requirements must be met prior to loading sources.

A. Shielding. For panoramic irradiators, the licensee shall monitor the construction of the shielding to verify that its construction meets design specifications and generally accepted building code requirements for reinforced concrete.

B. Foundations. For panoramic irradiators, the licensee shall monitor the construction of the foundations to verify that their construction meets design specifications.

C. Pool integrity. For pool irradiators, the licensee shall verify that the pool meets design specifications and shall test the integrity of the pool. The licensee shall verify that outlets and pipes meet the requirements of Subsection B of 20.3.15.1512 NMAC.

D. Water handling system. For pool irradiators, the licensee shall verify that the water purification system, the conductivity meter and the water level indicators operate properly.

E. Radiation monitors. For all irradiators, the licensee shall verify the proper operation of the monitor to detect sources carried on the product conveyor system, and the related alarms and interlocks required by Subsection A of 20.3.15.1510 NMAC. For pool irradiators, the licensee shall verify the proper operation of the radiation monitors and the related alarm, if used, to meet Subsection B of 20.3.15.1521 NMAC. For underwater irradiators, the licensee shall verify the proper operation of the over-the-pool monitor, alarms and interlocks required by Subsection B of 20.3.15.1510 NMAC.

F. Source rack. For panoramic irradiators, the licensee shall test the movement of the source racks for proper operation prior to source loading; testing must include source rack lowering due to simulated loss of power. For all irradiators with product conveyor systems, the licensee shall observe and test the operation conveyor system to assure that the requirements in 20.3.15.1513 NMAC are met for protection of the source rack and the mechanism that moves the rack; testing must include tests of any limit switches and interlocks used to protect the source rack and mechanism that moves the rack from moving product carriers.

G. Access control. For panoramic irradiators, the licensee shall test the completed access control system to assure that it functions as designed, and that all alarms, controls and interlocks work properly.

H. Fire protection. For panoramic irradiators, the licensee shall test the ability of the heat and smoke detectors to detect a fire, to activate alarms and to cause the source rack to automatically become fully shielded. The licensee shall test the operability of the fire extinguishing system.

I. Source return. For panoramic irradiators, the licensee shall demonstrate that the source racks can be returned to their fully shielded positions without offsite power.

J. Computer systems. For panoramic irradiators that use a computer system to control the access control system, the licensee shall verify that the access control system will operate properly if offsite power is lost, and shall verify that the computer has security features that prevent an irradiator operator from commanding the computer to override the access control system when it is required to be operable.

K. Wiring. For panoramic irradiators, the licensee shall verify that the electrical wiring and electrical equipment that were installed meet the design specifications.

[5/3/1995; 20.3.15.1516 NMAC - Rn, 20 NMAC 3.1.15.1516, 4/15/2004]

20.3.15.1517 TRAINING:

A. Before an individual is permitted to operate an irradiator without a supervisor present, the individual must be instructed in:

(1) the fundamentals of radiation protection applied to irradiators (including the differences between external radiation and radioactive contamination, units of radiation dose, dose limits, why large radiation doses must be avoided, how shielding and access controls as provided in these regulations prevent large doses, how an irradiator is designed to prevent contamination, the proper use of survey meters and personnel dosimeters, other radiation safety features of an irradiator, and the basic function of the irradiator);

(2) the requirements of 20.3.10 NMAC and 20.3.15 NMAC that are relevant to the irradiator;

(3) the operation of the irradiator;

(4) those operating and emergency procedures listed in 20.3.15.1518 NMAC that the individual is responsible for performing; and

(5) case histories of accidents or problems involving irradiators.

B. Before an individual is permitted to operate an irradiator without a supervisor present, the individual shall pass a written test on the instruction received, consisting primarily of questions based on the licensee's operating and emergency procedures that the individual is responsible for performing and other operations necessary to safely operate the irradiator without supervision.

C. Before an individual is permitted to operate an irradiator without a supervisor present, the individual must have received on-the-job training or simulator training in the use of the irradiator as described in the license application. The individual shall also demonstrate the ability to perform those portions of the operating and emergency procedures that the individual is to perform.

D. The licensee shall conduct safety reviews for irradiator operators at least annually. The licensee shall give each operator a brief written test on the information. Each safety review must include, to the extent appropriate, each of the following:

(1) changes in operating and emergency procedures since the last review, if any;

(2) changes in regulations and license conditions since the last review, if any;

(3) reports on recent accidents, mistakes or problems that have occurred at irradiators, if any;

(4) relevant results of inspections of operator safety performance;

(5) relevant results of the facility's inspection and maintenance checks; and

(6) a drill to practice an emergency or abnormal event procedure.

E. The licensee shall evaluate the safety performance of each irradiator operator at least annually to ensure that regulations, license conditions, and operating and emergency procedures are followed. The licensee shall discuss the results of the evaluation with the operator, and shall instruct the operator on how to correct any mistakes or deficiencies observed.

F. Individuals who will be permitted unescorted access to the radiation room of the irradiator or the area around the pool of an underwater irradiator, but who have not received the training required for operators and the radiation safety officer, shall be instructed and tested in any precautions they should take to avoid radiation exposure, any procedures or parts of procedures listed in 20.3.15.1518 NMAC that they are expected to perform or comply with, and their proper response to alarms required in this part (20.3.15 NMAC). Tests may be oral.

G. Individuals who must be prepared to respond to alarms required by Subsection B of 20.3.15.1507

NMAC, Subsection I of 20.3.15.1507 NMAC, Subsection A of 20.3.15.1509 NMAC, Subsections A and B of 20.3.15.1510 NMAC, and Subsection B of 20.3.15.1521 NMAC shall be trained and tested on how to respond. Each individual shall be retested at least once a year. Tests may be oral.
[5/3/1995; 20.3.15.1517 NMAC - Rn, 20 NMAC 3.1.15.1517, 4/15/2004]

20.3.15.1518 OPERATING AND EMERGENCY PROCEDURES:

A. The licensee shall have and follow written operating procedures for:

(1) operation of the irradiator, including entering and leaving the radiation room;

(2) use of personnel dosimeters;

(3) surveying the shielding of panoramic irradiators;

(4) monitoring pool water for contamination while the water is in the pool and before release of pool water to unrestricted areas;

(5) leak testing of sources;

(6) inspection and maintenance checks required by 20.3.15.1522 NMAC;

(7) loading, unloading and repositioning sources, if the operations will be performed by the licensee; and

(8) inspection of movable shielding required by Subsection H of 20.3.15.1507 NMAC; if applicable.

B. The licensee shall have and follow emergency or abnormal event procedures, appropriate for the irradiator type, for:

(1) sources stuck in the unshielded position;

(2) personnel overexposures;

(3) a radiation alarm from the product exit portal monitor or pool monitor;

(4) detection of leaking sources, pool contamination or alarm caused by contamination of pool water;

(5) a low or high water level indicator, an abnormal water loss or leakage from the source storage pool;

(6) a prolonged loss of electrical power;

(7) a fire alarm or explosion in the radiation room;

(8) an alarm indicating unauthorized entry into the radiation room, area around pool or another alarmed area;

(9) natural phenomena, including an earthquake, a tornado, flooding, or other phenomena as appropriate for the geographical location of the facility; and

(10) the jamming of automatic conveyor systems.

C. The licensee may revise operating and emergency procedures without department approval only if all of the following conditions are met:

(1) the revisions do not reduce the safety of the facility;

(2) the revisions are consistent with the outline or summary of procedures submitted with the license application;

(3) the revisions have been reviewed and approved by the radiation safety officer; and

(4) the users or operators are instructed and tested on the revised procedures before they are put into use.

[5/3/1995; 20.3.15.1518 NMAC - Rn, 20 NMAC 3.1.15.1518, 4/15/2004; A, 6/13/2017]

20.3.15.1519 PERSONNEL MONITORING:

A. Irradiator operators shall wear a personnel dosimeter [~~that is processed and evaluated by an accredited national voluntary laboratory accreditation program (NVLAP) processor~~] while operating a panoramic irradiator, or while in the area around the pool of an underwater irradiator. The personnel dosimeter processor must be [~~accredited for~~] capable of detecting high-energy photons in the normal and accident dose ranges (see Subsection C of 20.3.4.416 NMAC). Each personnel dosimeter must be assigned to and worn by only one individual. Film badges must be [~~processed~~] replaced at least monthly, and all other personnel dosimeters that require replacement must be [~~processed~~] at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.

B. Other individuals who enter the radiation room of a panoramic irradiator shall wear a dosimeter, which may be a pocket dosimeter. For groups of visitors, only two people who enter the radiation room are required to wear dosimeters. If pocket dosimeters are used to meet the requirements of this subsection, a check of their

response to radiation must be done at least annually. Acceptable dosimeters must read within plus or minus 30 percent of the true radiation dose.
[5/3/1995; 20.3.15.1519 NMAC - Rn, 20 NMAC 3.1.15.1519, 4/15/2004; A, 8/31/2005, XX/XX/24]

20.3.15.1520 RADIATION SURVEYS:

A. A radiation survey of the area outside the shielding of the radiation room of a panoramic irradiator must be conducted with the sources in the exposed position before the facility starts to operate. A radiation survey of the area above the pool of pool irradiators must be conducted after the sources are loaded, but before the facility starts to operate. Additional radiation surveys of the shielding must be performed at intervals not to exceed three years and before resuming operation after addition of new sources or any modification to the radiation room shielding or structure that might increase dose rates.

B. If the radiation levels specified in 20.3.15.1508 NMAC are exceeded, the facility must be modified to comply with the requirements in 20.3.15.1508 NMAC.

C. Portable radiation survey meters must be calibrated at least annually to an accuracy of +20 percent for the gamma energy of the sources in use. The calibration must be done at two points on each scale, or for digital instruments at one point per decade over the range that will be used. Portable radiation survey meters must be of a type that does not saturate and read zero at high radiation dose rates.

D. Water from the irradiator pool, other potentially contaminated liquids and sediments from pool vacuuming must be monitored for radioactive contamination before release to unrestricted areas. Radioactive concentrations must not exceed those specified in 20.3.4 NMAC, column 2 of table II, or table III of 20.3.4.461 NMAC, "annual limits on intake (ALIs) and derived air concentrations (DACs) of radionuclides for occupational exposure; effluent concentration; concentrations for release to sewerage".

E. Before releasing resins for unrestricted use, they must be monitored before release in an area with a background level less than 0.5 microsievert (0.05 millirem) per hour. The resins may be released only if the survey does not detect radiation levels above background radiation levels. The survey meter used must be capable of detecting radiation levels of 0.5 microsievert (0.05 millirem) per hour.
[5/3/1995; 20.3.15.1520 NMAC - Rn, 20 NMAC 3.1.15.1520, 4/15/2004]

20.3.15.1521 DETECTION OF LEAKING SOURCES:

A. Each dry-source-storage sealed source must be tested for leakage at intervals not to exceed 6 months using a leak test kit or method approved by the department. In the absence of a certificate from a transferor that a test has been made within the six months before the transfer, the sealed source may not be used until tested. The test must be capable of detecting the presence of 200 becquerels (0.005 microcurie) of radioactive material and must be performed by a person approved by the department to perform the test.

B. For pool irradiators, sources may not be put into the pool unless the licensee tests the sources for leaks or has a certificate from a transferor that a leak test has been done within the six months before the transfer. Water from the pool must be checked for contamination each day the irradiator operates. The check may be done either by using a radiation monitor on a pool water circulating system or by analysis of a sample of pool water. If a check for contamination is done by analysis of a sample of pool water, the results of the analysis must be available within 24 hours. If the licensee uses a radiation monitor on a pool water circulating system, the detection of above normal radiation levels must activate an alarm. The alarm set-point must be set as low as practical, but high enough to avoid false alarms. The licensee may reset the alarm set point to a higher level if necessary, to operate the pool water purification system to clean up contamination in the pool if specifically provided for in written emergency procedures.

C. If a leaking source is detected, the licensee shall arrange to remove the leaking source from service and have it decontaminated, repaired or disposed of by a department licensee that is authorized to perform these functions. The licensee shall promptly check its personnel, equipment, facilities and irradiated product for radioactive contamination. No product may be shipped until the product has been checked and found free of contamination. If a product has been shipped that may have been inadvertently contaminated, the licensee shall arrange to locate and survey that product for contamination. If any personnel are found to be contaminated, decontamination must be performed promptly. If contaminated equipment, facilities or products are found, the licensee shall arrange to have them decontaminated or disposed of by a department licensee that is authorized to perform these functions. If a pool is contaminated, the licensee shall arrange to clean the pool until the contamination levels do not exceed the appropriate concentration in column 2 of table II, 20.3.4.461 NMAC. (See 20.3.3.325 NMAC for reporting requirements.)
[5/3/1995; 20.3.15.1521 NMAC - Rn, 20 NMAC 3.1.15.1521, 4/15/2004; A, 4/30/2009]

20.3.15.1522 INSPECTION AND MAINTENANCE:

A. The licensee shall perform inspection and maintenance checks that include, as a minimum, each of the following at the frequency specified in the license or license application:

(1) operability of each aspect of the access control system required by 20.3.15.1507 NMAC;

(2) functioning of the source position indicator required by Subsection B of 20.3.15.1511 NMAC;

(3) operability of the radiation monitor for radioactive contamination in pool water required by Subsection B of 20.3.15.1521 NMAC, using a radiation check source, if applicable;

(4) operability of the over-pool radiation monitor at underwater irradiator as required by Subsection B of 20.3.15.1510 NMAC;

(5) operability of the product exit monitor required by Subsection A of 20.3.15.1510 NMAC;

(6) operability of the emergency source return control required by Subsection C of 20.3.15.1511 NMAC;

(7) leak-tightness of systems through which pool water circulates (visual inspection);

(8) operability of the heat and smoke detectors and extinguisher system required by 20.3.15.1509 NMAC, but without turning extinguishers on;

(9) operability of the means of pool water replenishment required by Subsection C of 20.3.15.1512 NMAC;

(10) operability of the indicators of high and low pool water levels required by Subsection D of 20.3.15.1512 NMAC;

(11) operability of the intrusion alarm required by Subsection I of 20.3.15.1507 NMAC;

(12) functioning and wear of the system, mechanisms, and cables used to raise and lower sources;

(13) condition of the barrier to prevent products from hitting the sources or source mechanism as required by 20.3.15.1513 NMAC;

(14) amount of water added to the pool to determine if the pool is leaking;

(15) electrical wiring on required safety systems for radiation damage; and

(16) pool water conductivity measurements and analysis as required by Subsection B of 20.3.15.1523 NMAC.

B. Malfunctions and defects found during inspection and maintenance checks must be repaired without undue delay.

[5/3/1995; 20.3.15.1522 NMAC - Rn, 20 NMAC 3.1.15.1522, 4/15/2004]

20.3.15.1523 POOL WATER PURITY:

A. Pool water purification system must be run sufficiently to maintain the conductivity of the pool water below 20 microsiemens per centimeter under normal circumstances. If pool water conductivity rises above 20 microsiemens per centimeter, the licensee shall take prompt actions to lower the pool water conductivity and shall take corrective actions to prevent future recurrences.

B. The licensee shall measure the pool water conductivity frequently enough, but no less than weekly, to assure that the conductivity remains below 20 microsiemens per centimeter. Conductivity meters must be calibrated at least annually.

[5/3/1995; 20.3.15.1523 NMAC - Rn, 20 NMAC 3.1.15.1523, 4/15/2004]

20.3.15.1524 ATTENDANCE DURING OPERATION:

A. Both an irradiator operator, and at least one other individual who is trained on how to respond and prepared to promptly render or summon assistance if the access control alarm sounds, shall be present on-site:

(1) whenever the irradiator is operated using an automatic product conveyor system; and

(2) whenever the product is moved into or out of the radiation room when the irradiator is operated in a batch mode.

B. At a panoramic irradiator at which static irradiations (no movement of the product) are occurring, a person who has received the training on how to respond to alarms described in Subsection G of 20.3.15.1517 NMAC must be onsite.

C. At an underwater irradiator, an irradiator operator must be present at the facility whenever the product is moved into or out of the pool. Individuals who move the product into or out of the pool of an underwater irradiator need not be qualified as irradiator operators; however, they must have received the training described in

Subsections F and G of 20.3.15.1517 NMAC. Static irradiations may be performed without a person present at the facility.
[5/3/1995; 20.3.15.1524 NMAC - Rn, 20 NMAC 3.1.15.1524, 4/15/2004; A, 6/13/2017]

20.3.15.1525 ENTERING AND LEAVING THE RADIATION ROOM:

A. Upon first entering the radiation room of a panoramic irradiator after an irradiation, the irradiator operator shall use a survey meter to determine that the source has returned to its fully shielded position. The operator shall check the functioning of the survey meter with a radiation check source prior to entry.

B. Before exiting from and locking the door to the radiation room of a panoramic irradiator prior to a planned irradiation, the irradiator operator shall:

(1) visually inspect the entire radiation room to verify that no one else is in it; and

(2) activate a control in the radiation room that permits the sources to be moved from the shielded position, only if the door to the radiation room is locked within a preset time after setting the control.

C. During a power failure, the area around the pool of an underwater irradiator may not be entered without using an operable and calibrated radiation survey meter, unless the over-the-pool monitor required by Subsection B of 20.3.15.1510 NMAC is operating with backup power.

[5/3/1995; 20.3.15.1525 NMAC - Rn, 20 NMAC 3.1.15.1525, 4/15/2004]

20.3.15.1526 IRRADIATION OF EXPLOSIVE OR FLAMMABLE MATERIALS:

A. Irradiation of explosive material is prohibited, unless the licensee has received prior written authorization from the department. Authorization will not be granted, unless the licensee can demonstrate that detonation of the explosive would not rupture the sealed sources, injure personnel, damage safety systems or cause radiation overexposures of personnel.

B. Irradiation of more than small quantities of flammable material (flash point below 140 degrees F) is prohibited in panoramic irradiators, unless the licensee has received prior written authorization from the department. Authorization will not be granted, unless the licensee can demonstrate that a fire in the radiation room could be controlled without damage to sealed sources or safety systems and without radiation overexposures of personnel.

[5/3/1995; 20.3.15.1526 NMAC - Rn, 20 NMAC 3.1.15.1526, 4/15/2004]

20.3.15.1527 RECORDS AND RETENTION PERIODS: The licensee shall maintain the following records at the irradiator for the periods specified.

A. A copy of the license, license conditions, documents incorporated into a license by reference, and amendments thereto until superseded by new documents or until the department terminates the license for documents not superseded.

B. Records of each individual's training, tests and safety reviews provided to meet the requirements of Subsections A, B, C, D, F and G of 20.3.15.1517 NMAC, until three years after the individual terminates work.

C. Records of the annual evaluations of the safety performance of irradiator operators required by Subsection E of 20.3.15.1517 NMAC for three years after the evaluation.

D. A copy of the current operating and emergency procedures required by 20.3.15.1518 NMAC, until superseded or the department terminates the license. Records of the radiation safety officer's review and approval of changes in procedures as required by Paragraph (3) of Subsection C of 20.3.15.1518 NMAC retained for three years from the date of the change.

E. Evaluations of personnel dosimeters required by 20.3.15.1519 NMAC until the department terminates the license.

F. Records of radiation surveys required by 20.3.15.1520 NMAC for three years from the date of the survey.

G. Records of radiation survey meter calibrations required by 20.3.15.1520 NMAC, and pool water conductivity meter calibrations required by Subsection B of 20.3.15.1523 NMAC until three years from the date of calibration.

H. Records of the results of leak tests required by Subsection A of 20.3.15.1521 NMAC, and the results of contamination checks required by Subsection B of 20.3.15.1521 NMAC for three years from the date of each test.

I. Records of the results of leak tests required by 20.3.15.1522 NMAC for three years.

J. Records of major malfunctions, significant defects, operating difficulties or irregularities, and major operating problems that involve required radiation safety equipment for three years after repairs are

completed.

K. Records of the receipt, transfer and disposal of all licensed sealed sources as required by 20.3.1.108 NMAC.

L. Records on the design checks required by 20.3.15.1515 NMAC, and the construction control checks as required by 20.3.15.1516 NMAC until the license is terminated. The records must be signed and dated. The title or qualification of the person signing must be included.

M. Records related to decommissioning of the irradiator as required by 20.3.3.311 NMAC.

[5/3/1995; 20.3.15.1527 NMAC - Rn, 20 NMAC 3.1.15.1527, 4/15/2004; A, 8/31/2005]

20.3.15.1528 REPORTS:

A. In addition to the reporting requirements in other parts these regulations (20.3 NMAC), the licensee shall report the following events, if not reported under other parts these regulations (20.3 NMAC):

(1) source stuck in an unshielded position;

(2) any fire or explosion in a radiation room;

(3) damage to the source racks;

(4) failure of the cable or drive mechanism used to move the source racks;

(5) inoperability of the access control system;

(6) detection of radiation source by the product exit monitor;

(7) detection of radioactive contamination attributable to licensed radioactive material;

(8) structural damage to the pool liner or walls;

(9) abnormal water loss or leakage from the source storage pool; and

(10) pool water conductivity exceeding 100 microsiemens (mS) per centimeter.

B. The report must include a telephone report within 24 hours as described in Paragraph (1) of Subsection C of 20.3.3.325 NMAC, and a written report within 30 days as described in Paragraph (2) of Subsection C of 20.3.3.325 NMAC.

[5/3/1995; 20.3.15.1528 NMAC - Rn, 20 NMAC 3.1.15.1528, 4/15/2004; A, 4/30/2009]

HISTORY OF 20.3.15 NMAC:

Pre-NMAC History: The material in this part was derived from that previously filed as follows:
EIB 73-2, Regulations for Governing the Health and Environmental Aspects of Radiation filed on 7/9/1973;
EIB 73-2, Amendment 1, Regulations for Governing the Health and Environmental Aspects of Radiation filed on 4-17-78;
EIB RPR-1, Radiation Protection Regulations filed on 4/21/1980;
EIB RPR-1, Amendment 1, Radiation Protection Regulations filed on 10/13/1981;
EIB RPR-1, Amendment 2, Radiation Protection Regulations filed on 12/15/1982; and
EIB RPR-1, Radiation Protection Regulations filed on 3/10/1989.

History of Repealed Material: [**RESERVED**]

Other History: EIB RPR 1, Radiation Protection Regulations, filed 3/10/1989 renumbered and reformatted to 20 NMAC 3.1; Radioactive Materials and Radiation Machines, effective 5/3/1995;
20 NMAC 3.1; Radioactive Materials and Radiation Machines (filed 4/3/1995) internally renumbered, reformatted and replaced by 20 NMAC 3.1, Radioactive Materials and Radiation Machines, effective 7/30/1999.
20 NMAC 3.1.Subpart 15, Licenses and Radiation Safety Requirements for Irradiators (filed 6/17/1999) reformatted, amended and replaced by 20.3.15 NMAC, Licenses and Radiation Safety Requirements for Irradiators, effective 4/15/2004.

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.5.15 PERSONNEL MONITORING: A. The licensee or registrant may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a [~~combination of~~] direct reading dosimeter, an operating alarm ratemeter, and a [~~NVLAP certified~~] personnel dosimeter. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, the wearing of an alarming ratemeter is not required.	*RATS 2020-1 category - C* **§ 34.47 Personnel monitoring.** (a) The licensee may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a direct reading dosimeter, an operating alarm ratemeter, and a personnel dosimeter. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, the wearing of an alarming ratemeter is not required.	In § 34.47: a. In paragraph (a) introductory text remove the phrase "that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor"; Based on RATS 2020-1 letter dated 3/18/20
20.3.5.15 PERSONNEL MONITORING: **A** (2) Each [~~NVLAP certified~~] personnel dosimeter must be assigned to and worn by only one individual.	*RATS 2020.1 Category C* **§ 34.47 Personnel monitoring.** (2) Each personnel dosimeter must be assigned to and worn only by one individual.	RCB Correction, To align with federal regulations

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.5.15 PERSONNEL MONITORING: **A.** **(3)**Film badges must be replaced [~~at periods not to exceed one month. All other NVLAP certified dosimeters must be replaced at periods not to exceed three months~~] at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent. [~~(4) After replacement, each NVLAP certified dosimeter must be processed as soon as possible.~~]	*RATS 2020-1 category -C* **§ 34.47 Personnel monitoring.** **(a)** **(3)**Film badges must be replaced at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent. **[**~~(4) After replacement, each NVLAP certified dosimeter must be processed as soon as possible~~**.]**	**In § 34.47:** b. Revise paragraph (a)(3); (a) * * * (3) Film badges must be replaced at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent. * * * * * Based on RATS 2020-1 letter dated 3/18/20 In § 34.47: c. Remove paragraph (a)(4) Based on RATS 2020-1

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.5.15 PERSONNEL MONITORING: D. If an individual's pocket [dosimeter] chamber is found to be off-scale, or if his or her electronic personal dosimeter reads greater than two millisieverts (200 millirems), and the possibility of radiation exposure cannot be ruled out as the cause, the individual's [~~NVLAP certified~~] personnel dosimeter must be sent for processing within 24 hours. For personnel dosimeters that do not require processing, evaluation of the dosimeter must be started within 24 hours. In addition, the individual may not resume work associated with [~~radiation~~] license material use until a determination of the individual's radiation [~~exposure~~] dose has been made. This determination must be made by the RSO or the RSO's designee. The results of this determination shall be documented. The documents shall be maintained in accordance with paragraph (4) of Subsection H of 20.3.5.15 NMAC.	*RATS 2020-1 category -C* **§ 34.47 Personnel monitoring.** (d) If an individual's pocket chamber is found to be off-scale, or if his or her electronic personal dosimeter reads greater than 2 millisieverts (200 millirems0, and the possibility of radiation exposure cannot be ruled out as the cause, the individual's personnel dosimeter that requires processing must be sent for processing and evaluation within 24 hours. For personnel dosimeters that do not require processing, evaluation of the dosimeter must be started within 24 hours. In addition, the individual may not resume work associated with licensed material use until a determination of the individual's radiation dose has been made. This determination must be made by the RSO or the RSO's designee. The results of this determination must be included in the records maintained in accordance with § 34.83.	**In § 34.47: Personnel monitoring** To align with federal regulations.

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.5.15 PERSONNEL MONITORING: E. If a[NVLAP certified] personnel dosimeter that is required by Subsection A of 20.3.15 NMAC is lost or damaged, the worker shall cease work immediately until a replacement dosimeter is provided and the exposure is calculated for the time period from issuance to loss or damage of the dosimeter. The results of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged shall be documented. The documents shall be maintained in accordance with paragraph (4) of Subsection H of 20.3.5.15 NMAC.	*RATS 2020-1 category - C* **§ 34.47 Personnel monitoring.** (e) If the personnel dosimeter that is required by paragraph (a) of this section is lost or damaged, the worker shall cease work immediately until a replacement personnel dosimeter meeting the requirements in paragraph (a) is provided and the exposure is calculated for the time period from issuance to loss or damage of the personnel dosimeter. The results of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged must be included in the records maintained in accordance with § 34.83.	RCB Correction, To align with federal regulations
20.3.5.15F NMAC **F. [~~Reports received from~~] [~~d~~] Dosimetry [~~processors~~] results shall be maintained in accordance with paragraph (3) of Subsection H of 20.3.5.15 NMAC.**	*RATS 2020-1RATS 2020-1 category - C* **§ 34.47 Personnel monitoring.** (f) Dosimetry results must be retained in accordance with § 34.83.	***In § 34.47:*** To align with category - C 20.3.5.15 NMAC and federal regulations.

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.5.15 NMAC **H. Personnel Monitoring Records** **(3) Reports received [~~from~~] for personnel dosimetry [~~processors~~] shall be maintained until the Department terminates the license or registration.** **(4) Records of estimates of exposures as a result of: off-scale personal direct reading dosimeters, or lost or damaged [~~external dosimetric device~~] personnel dosimeters, until the Department terminates the license or registration.**	***RATS 2020-1RATS 2020-1 category -C*** (f) Dosimetry results must be retained in accordance with § 34.83. **§ 34.83 Records of personnel monitoring Procedures.** **(c) Personnel dosimeter results until the Commission terminates the license.** **(d) Records of estimates of exposures as a result of: off-scale personal direct reading dosimeters, or lost or damaged personnel dosimeters until the Commission terminates the license.**	In § 34.47: To align with category -C 20.3.5.15 NMAC and federal regulations § 34.83.
20.3.12.13 PERSONNEL MONITORING: A. The licensee may not permit an individual to act as a logging supervisor or logging assistant unless that person wears, at all times during the handling of licensed radioactive materials, a personnel dosimeter [~~that is processed and evaluated by an accredited national voluntary laboratory accreditation program (NVLAP) processor~~]. Each personnel dosimeter shall be assigned to and worn by only one individual. Film badges shall be replaced at least monthly and other personnel dosimeters [~~replaced~~] evaluated at least quarterly. [~~After replacement, each personnel dosimeter shall be promptly processed~~.]	RATS 2020-1 category - C **§ 39.65 Personnel monitoring.** (a) The licensee may not permit an individual to act as a logging supervisor or logging assistant unless that person wears a personnel dosimeter at all times during the handling of licensed radioactive materials. Each personnel dosimeter must be assigned to and worn by only one individual. Film badges must be replaced at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.	**In § 39.65: To align with Category -C 20.3.12 NMAC.**

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.15.1519 PERSONNEL MONITORING: A. Irradiator operators shall wear a personnel dosimeter [~~that is processed and evaluated by an accredited national voluntary laboratory accreditation program (NVLAP) processor~~] while operating a panoramic irradiator, or while in the area around the pool of an underwater irradiator. The personnel dosimeter processor must be [~~accredited for~~] capable of detecting high-energy photons in the normal and accident dose ranges (see Subsection C of 20.3.4.416 NMAC). Each personnel dosimeter must be assigned to and worn by only one individual. Film badges must be [~~processed~~] replaced at least monthly, and other personnel dosimeters that require replacement must be [~~processed~~] replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.	*RATS 2020-1 category - H&S* **§ 36.55 Personnel monitoring.** (a) Irradiator operators shall wear a personnel dosimeter while operating a panoramic irradiator or while in the area around the pool of an underwater irradiator. The personnel dosimeter must be capable of detecting high energy photons in the normal and accident dose ranges. Each personnel dosimeter must be assigned to and worn by only one individual. Film badges must be replaced at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.	**To align with compatibility In § 36.55**
20.3.4.404 RADIATION PROTECTION PROGRAMS: **C. The licensee or registrant shall, at intervals not to exceed 12 months, review the radiation protection program content and implementation** with all employees before beginning their job duties and annually thereafter.	**NMED H & S update**	**To improve the health and safety of all licensees and registrants to ensure all employees receive information on the employers Radiation Protection Program when hired and annually.**

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
20.3.4.455 REPORTS OF TRANSACTIONS INVOLVING NATIONALLY TRACKED SOURCES: The regulations of the NRC set forth in 10 CFR 20.2207 are hereby incorporated by reference. [~~Each licensee who manufactures, transfers, receives, disassembles or disposes of a nationally tracked source (as defined in 20.3.4.7 NMAC) shall complete and submit a national source tracking transaction report as specified in Subsections A through E of this section for each type of transaction.~~ ~~A. 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:~~ ~~(1) the name, address and license number of the reporting licensee;~~ ~~(2) the name of the individual preparing the report;~~ ~~(3) the manufacturer, model and serial number of the source;~~ ~~(4) the radioactive material in the source;~~ ~~(5) the initial source strength in becquerels (curies) at the time of manufacture; and~~ ~~(6) the manufacture date of the source.~~	*RATS 2021-1 category - formerly B* **§ 20.2207 Reports of transactions involving nationally tracked sources. Incorporated by reference.**	(1) The name, address, and license number of the reporting licensee; (2) The name of the individual preparing the report; (3) The manufacturer, model, and serial number of each nationally tracked source or, if not available, other information to uniquely identify the source; (4) The radioactive material in the sealed source; (5) The initial or current source strength in becquerels (curies); and (6) The date for which the source strength is reported. * * * * Based on RATS 2021-1 letter dated 9/8/21

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
continued ~~B. 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:~~ ~~(1) the name, address and license number of the reporting licensee;~~ ~~(2) the name of the individual preparing the report;~~ ~~(3) the name and license number of the recipient facility and the shipping address;~~ ~~(4) the manufacturer, model and serial number of the source or, if not available, other information to uniquely identify the source;~~ ~~(5) the radioactive material in the source;~~ ~~(6) the initial or current source strength in becquerels (curies);~~ ~~(7) the date for which the source strength is reported;~~ ~~(8) the shipping date;~~ ~~(9) the estimated arrival date; and~~ ~~(10) 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.~~	***continued*** *RATS 2021-1 category - formerly B*	***In § 20.2207, is incorporated by reference.***

State Regulation, 20.3 NMAC	Federal Regulation 10 CFR	Comments
continued ~~H. Each licensee that possesses category 1 nationally tracked sources shall report its initial inventory of category 1 nationally tracked sources to the national source tracking system by January 31, 2009. Each licensee that possesses category 2 nationally tracked sources shall report its initial inventory of category 2 nationally tracked sources to the national source tracking system by January 31, 2009. The information may be submitted by using any of the methods identified by Paragraph (1) through (4) of Subsection F of this section. The initial inventory report must include the following information:~~	***continued*** *RATS 2021-1 category - formerly B*	***In § 20.2207, is incorporated by reference.***