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TITLE 33

Health and Consolidated Laboratories, Department of

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CHAPTER 33-10-01

33-10-01-04. Definitions. As used in this article, these terms have the definitions set forth below. Additional definitions used only in a certain section will be found in that section. Terms not defined in this article shall have the meaning given them in North Dakota Century Code chapter 23-20.1.

1. "A₁" means the maximum activity of special form radioactive material permitted in a Type A package. "A₂" means the maximum activity of radioactive material, other than special form radioactive material, permitted in a Type A package. These values are either listed in chapter 33-10-13, appendix A, table I, or may be derived in accordance with the procedure prescribed in chapter 33-10-13 appendix A.
2. "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.
3. "Accelerator" means any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and of discharging the resultant particulate or other radiation into a medium at energies usually in excess of one megaelectronvolt. For purposes of this definition, "particle accelerator" is an equivalent term.
4. "Accelerator produced material" means any material made radioactive by exposing it in a particle accelerator.
- ~~3.~~ 5. "Act" means North Dakota Century Code chapter 23-20.1.

6. "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).
7. "Adult" means an individual eighteen or more years of age.
- 4- 8. "Agreement state" means any state with which the United States nuclear regulatory commission has entered into an effective agreement under section 274(b) of the Atomic Energy Act of 1954, as amended [73 Stat. 688; 42 U.S.C. 2021].
- 5- 9. "Airborne radioactive material" means any radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.
- 6- 10. "Airborne radioactivity area" means-
- a. Any a room, enclosure, or operating area in which airborne radioactive material exists materials exist in concentrations in :
 - a. In excess of the amounts specified in appendix A, table I, column 1, chapter 33-10-04, or derived air concentrations (DACs) specified in appendix B, table I of chapter 33-10-04.1, or
 - b. Any room, enclosure, or operating area in which airborne radioactive material exists in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed twenty-five percent of the amounts specified in appendix A, table I, column 1, chapter 33-10-04. To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of six-tenths percent of the annual limit on intake (ALI) or twelve derived air concentrations-hours.
11. "Alert" means events may occur, are in progress, or have occurred that could lead to a release of radioactive material but that the release is not expected to require a response by an offsite response organization to protect persons offsite.
12. "As low as is reasonably achievable" (ALARA) means making every reasonable effort to maintain exposures to radiation as far below the dose limits in these rules 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.

13. "Background radiation" means radiation from cosmic sources; naturally occurring radioactive materials, including radon, except as a decay product of source or special nuclear material, and including global fallout as it exists in the environment from the testing of nuclear explosive devices. "Background radiation" does not include sources of radiation from radioactive materials regulated by the department.
14. "Becquerel" (Bq) means the SI unit of activity. One becquerel is equal to one disintegration or transformation per second (dps or tps).
15. "Bioassay" 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. For purposes of these rules, "radiobioassay" is an equivalent term.
16. "Brachytherapy" means a method of radiation therapy in which sealed sources are utilized to deliver a radiation dose at a distance of up to a few centimeters, by surface, intracavitary, or interstitial application.
- ~~7-~~ 17. "Byproduct material" means:
 - a. Any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; and
 - b. The tailings or wastes produced by the extraction or concentration of uranium or thorium from ~~any~~ ore processed primarily for its source material content, including discrete surface wastes resulting from uranium or thorium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition.
- ~~8-~~ 18. "Calendar quarter" means not less than twelve consecutive weeks nor more than fourteen consecutive weeks. The first calendar quarter of each year shall begin in January and subsequent calendar quarters shall be so arranged such that no day is included in more than one calendar quarter and no day in any one year is omitted from inclusion within a calendar quarter. No licensee or registrant shall change the method observed by the licensee or registrant of determining calendar quarters for purposes of this article except at the beginning of a ~~calendar~~ year.

- 9- 19. "Calibration" means the determination of:
- a. The response or reading of an instrument relative to a series of known radiation values over the range of the instrument; or
 - b. The strength of a source of radiation relative to a standard.
- ~~10-~~ 20. "CFR" means Code of Federal Regulations.
- ~~11-~~ 21. "Chelating agent" means amine polycarboxylic acids, hydroxycarboxylic acids, gluconic acid, and polycarboxylic acids.
22. "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.
23. "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 fifty-year period following the intake.
24. "Committed effective dose equivalent" ($H_{E,50}$) is the sum of the products of the weighing 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 ($H_{E,50} = \sum W_T H_{T,50}$).
- ~~12-~~ 25. "Curie" means a unit of measurement of radioactivity. One curie (Ci) is that quantity of radioactive material which decays at the rate of 3.7×10^{10} disintegrations per second (dps). Commonly used submultiples of the curie are the millicurie and the microcurie. One millicurie (mCi) = 0.001 curie = 3.7×10^7 dps. One microcurie (uCi) = 0.000001 curie = 3.7×10^4 dps. (See section 33-10-01-14 for the SI equivalent "becquerel".)
26. "Decommission" means to remove (as a facility) safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of license.
27. "Deep dose equivalent" (H_d), which applies to external whole body exposure means the dose equivalent at a tissue depth of one centimeter (or a density thickness of 1000 mg/cm^2). This assumes a tissue density of one gram per cubic centimeter.
- ~~13-~~ 28. "Department" means the state department of health and consolidated laboratories.

- ~~14-~~ 29. "Depleted uranium" means the source material uranium in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material.
- 15- 30. "Dose" means absorbed dose or dose equivalent as appropriate: 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. For purposes of these rules, "radiation dose" is an equivalent term.
- a. "Absorbed dose" is the energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest. The special unit of absorbed dose is the rad. (See "rad".) (See section 33-10-01-14 for the SI equivalent "gray".)
- b. "Dose equivalent" is a quantity that expresses on a common scale for all radiation a measure of the postulated effect on a given organ. It is defined as the absorbed dose in rads times certain modifying factors. The unit of dose equivalent is the rem. (See "rem".) (See section 33-10-01-14 for SI equivalent "sievert".)
31. "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.
32. "Dose limits" means the permissible upper bounds of radiation doses established in accordance with these rules. For purposes of these rules, "limits" is an equivalent term.
- ~~16-~~ "Dose commitment" means the total radiation dose to a part of the body that will result from retention in the body of radioactive material. For purposes of estimating the dose commitment, it is assumed that from the time of intake the period of exposure to retained material will not exceed fifty years.
33. "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 that are irradiated ($H_E = \sum W_T H_T$).
34. "Embryo/fetus" means the developing human organism from conception until the time of birth.
35. "Entrance or access point" means any opening through which an individual or extremity of an individual could gain access to radiation areas or to licensed or registered radioactive materials. This includes entry or exit portals of sufficient

- size to permit human entry, irrespective of their intended use.
- ~~17-~~ 36. "Explosive material" means any chemical compound, mixture, or device which produces a substantial instantaneous release of gas and heat spontaneously or by contact with sparks or flame.
37. "Exposure" means being exposed to ionizing radiation or to radioactive material.
- ~~18-~~ 38. "Exposure" means the quotient of dQ 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 in air. ~~←The special SI unit of exposure is the roentgen (R)→~~ coulomb per kilogram (C/kg). (See section 33-10-01-14 units of exposure, dose, and activity for the SI equivalent "coulomb per kilogram" special unit equivalent "roentgen" (R).)
- ~~19-~~ 39. "Exposure rate" means the exposure per unit of time, such as R/min, mR/h, etc.
40. "External dose" means that portion of the dose equivalent received from any source of radiation outside the body.
41. "Extremity" means hand, elbow, arm below the elbow, foot, knee, and leg below the knee.
42. "Eye dose equivalent" means the external dose equivalent to the lens of the eye at a tissue depth of three-tenths centimeter (or a density thickness of 300 mg/cm^2). This assumes a tissue density of one gram per cubic centimeter.
- ~~20-~~ 43. "Former United States atomic energy commission or United States nuclear regulatory commission licensed facilities" means nuclear reactors, nuclear fuel reprocessing plants, uranium enrichment plants, or critical mass experimental facilities where their atomic energy commission or nuclear regulatory commission licenses have been terminated.
44. "Generally applicable environmental radiation standards" means standards issued by the United States environmental protection agency under the authority of the Atomic Energy Act of 1954, as amended, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material.
45. "Gray" (Gy) means the SI unit of absorbed dose. One gray is equal to an absorbed dose of one joule per kilogram (100 rad).

- ~~21.~~ 46. "Hazardous waste" means those wastes designated as hazardous by United States environmental protection agency regulations in 40 CFR part 261 and article 33-24 of the North Dakota Administrative Code.
- ~~22.~~ 47. "Healing arts" means diagnostic or healing treatment of human and animal maladies including, but not limited to, the following which are duly licensed by the state of North Dakota for the lawful practice of: medicine and its associated specialties, dentistry, veterinary medicine, osteopathy, chiropractic, and podiatry.
- ~~23.~~ 48. "High radiation area" means any area, accessible to individuals, in which ~~there exists~~ radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of one hundred millirems ~~(one millisievert)~~ could result in an individual receiving a dose equivalent in excess of one hundred millirems [one millisievert] in one hour at thirty centimeters from any source of radiation or from any surface that the radiation penetrates.
- ~~24.~~ 49. "Human use" means the internal or external administration of radiation or radioactive material to human beings.
- ~~25.~~ 50. "Individual" means any human being.
51. "Individual monitoring" means the assessment of:
- a. Dose equivalent by the use of individual monitoring devices or by the use of survey data; or
 - b. Committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, that is, derived air concentration-hours. (See the definition of derived air concentration-hours in chapter 33-10-04.1).
52. "Individual monitoring devices" means devices designed to be worn by a single individual for the assessment of dose equivalent. For purposes of these rules, "personnel dosimeter" and "dosimeter" are equivalent terms. Examples of individual monitoring devices are film badges, thermoluminescent dosimeters (TLDs), pocket ionization chambers, and personal air sampling devices.
- ~~26.~~ 53. "Inspection" means an official examination or observation including, but not limited to, tests, surveys, and monitoring to determine compliance with rules, regulations, orders, requirements, and conditions of the department.
- ~~27.~~ 54. "Interlock" means a device arranged or connected such that the occurrence of an event or condition is required before a second event or condition can occur or continue to occur.

55. "Internal dose" means that portion of the dose equivalent received from radioactive material taken into the body.
- ~~28-~~ 56. "License" means a general or specific license issued by the department in accordance with the regulations adopted by the department.
57. "Licensed material" means radioactive material received, possessed, used, transferred, or disposed of under a general or specific license issued by the department.
- ~~29-~~ 58. "Licensee" means any person who is licensed by the department in accordance with this article and North Dakota Century Code chapter 23-20.1.
- ~~30-~~ 59. "Licensing state" means any state with regulations equivalent to the Suggested State Regulations for Control of Radiation relating to, and an effective program for, the regulatory control of NARM and which has been granted final designation by the conference of radiation control program directors, incorporated.
60. "Limits" (see "dose limits").
61. "Lost or missing licensed (or registered) source of radiation" means licensed (or registered) source of radiation whose location is unknown. This definition includes licensed (or registered) material that has been shipped but has not reached its planned destination and whose location cannot be readily traced in the transportation system.
- ~~31-~~ 62. "Major processor" means a user processing, handling, or manufacturing radioactive material exceeding type A quantities as unsealed sources or material, or exceeding four times type B quantities as sealed sources, but does not include nuclear medicine programs, universities, industrial radiographers, or small industrial programs. The terms "type A quantity" and "type B quantity" are defined in chapter 33-10-13.
63. "Member of the public" means any individual except when that individual is receiving an occupational dose.
64. "Minor" means an individual less than eighteen years of age.
65. "Monitoring" means the measurement of radiation, radioactive material concentrations, surface area activities or quantities of radioactive material, and the use of the results of these measurements to evaluate potential exposures and doses. For purposes of these rules, "radiation monitoring" and "radiation protection monitoring" are equivalent terms.

- ~~32.~~ 66. "NARM" means any naturally occurring or accelerator-produced radioactive material. It does not include byproduct, source, or special nuclear material. (Note: For the purpose of meeting the definition of a licensing state by the conference of radiation control program directors, incorporated, naturally occurring or accelerator-produced radioactive material only refers only to discrete sources of naturally occurring or accelerator-produced radioactive material. Diffuse sources of naturally occurring or accelerator-produced radioactive material are excluded from consideration by the conference of radiation control program directors, incorporated, for licensing state designation purposes.)
- ~~33.~~ 67. "Natural radioactivity" means radioactivity of naturally occurring nuclides.
68. "Nuclear regulatory commission (NRC)" means the United States nuclear regulatory commission or its duly authorized representatives.
- ~~34.~~ 69. "Occupational dose" means exposure of an individual to radiation (a) in a restricted area; or (b) in the course of employment in which the individual's duties involve exposure to radiation; provided, that occupational dose shall not be deemed to include any exposure of an individual to radiation for the purpose of diagnosis or therapy of such individual the dose received by an individual in the course of employment, while engaged in activities licensed or registered by the department, in which the individual's assigned duties involve exposure to sources of radiation, whether in the possession of the licensee, registrant, or other person. Occupational dose does not include dose received: from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.
- ~~35.~~ 70. "Ore refineries" means all processors of a radioactive material ore.
- ~~36.~~ 71. "Package" means the packaging together with its radioactive contents as presented for transport.
- ~~37.~~ 72. "Particle accelerator" means any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and of discharging the resultant particulate or other radiation into a medium at energies usually in excess of one megaelectronvolt (see "accelerator").
- ~~38.~~ 73. "Person" means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this state, any other state or political subdivision or agency thereof, and any legal successor, representative, agent, or agency of the foregoing, other than the commission, or any successor thereto

and other than federal government agencies licensed by the commission or any successor thereto.

- ~~39.~~ 74. "Personnel monitoring equipment" means devices, e.g., film badges, pocket dosimeters, and thermoluminescent dosimeters, designed to be worn or carried by an individual for the purpose of estimating the dose received by the individual (see "individual monitoring devices").
- ~~40.~~ 75. "Pharmacist" means an individual licensed by this state to compound and dispense drugs, prescriptions, and poisons.
- ~~41.~~ 76. "Physician" means an individual licensed by this state to dispense drugs in the practice of medicine.
77. "Public dose" means the dose received by a member of the public from exposure to sources of radiation or radioactive material, or both, released by a licensee. It does not include occupational dose, dose received from background radiation, dose received as a patient from medical practices, or dose from voluntary participation in medical research programs.
- ~~42.~~ 78. "Pyrophoric liquid" means any liquid that ignites spontaneously in dry or moist air at or below one hundred thirty degrees Fahrenheit [54.4 degrees Celsius]. A "pyrophoric solid" is 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.
79. "Quality factor" (Q) means the modifying factor, listed in tables I and II of section 33-10-01-14, that is used to derive dose equivalent from absorbed dose.
- ~~43.~~ 80. "Rad" means the special unit of absorbed dose. One rad equals one hundredth of a joule per kilogram of material; for example, if tissue is the material of interest, then one rad equals one hundred ergs per gram of tissue [10 milligrays]. (See section 33-10-01-14 for the SI equivalent "gray".) One rad is equal to an absorbed dose of one hundred erg per gram or one one-hundredths joule per kilogram [0.01 gray].
- ~~44.~~ 81. "Radiation" means ionizing radiation, i.e., gamma rays and X-rays, alpha and beta particles, high speed electrons, neutrons, high speed protons, and other atomic particles alpha particles, beta particles, gamma rays, x-rays, neutrons, high speed electrons, high speed protons, and other particles capable of producing ions. For purposes of these rules,

ionizing radiation is an equivalent term. Radiation, as used in these rules, does not include nonionizing radiation, such as radiowaves or microwaves, visible, infrared, or ultraviolet light.

- ~~45-~~ 82. "Radiation area" means any area, accessible to individuals, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of five millirems [~~0.05~~ millisievert], or in any five consecutive days a dose in excess of one hundred millirems (~~one~~ millisievert) radiation levels could result in an individual receiving a dose equivalent in excess of five millirems [0.05 millisievert] in one hour at thirty centimeters from the source of radiation or from any surface that the radiation penetrates.
83. "Radiation dose" (see "dose").
- ~~46-~~ 84. "Radiation machine" means any device capable of producing radiation except, those which produce radiation only from radioactive material devices with radioactive material as the only source of radiation.
- ~~47-~~ 85. "Radiation safety officer" means a person an individual who has the knowledge and responsibility to apply appropriate radiation protection requirements.
- ~~48-~~ 86. "Radioactive material" means any material (solid, liquid, or gas) which emits radiation spontaneously.
- ~~49-~~ 87. "Radioactivity" means the disintegration of unstable atomic nuclei by the emission of radiation.
88. "Radiobioassay" (see "bioassay").
- ~~50-~~ 89. "Registrant" means any person who is registered with the department and is legally obligated to register with the department pursuant to this article and North Dakota Century Code chapter 23-20.1.
- ~~51-~~ 90. "Registration" means the notification of the department of possession of a source of radiation and the furnishing of information with respect thereto, in accordance with North Dakota Century Code chapter 23-20.
- ~~52-~~ 91. "Regulations of the United States department of transportation" means the regulations in 49 CFR, 100-189.
- ~~53-~~ 92. "Rem" means a special unit of dose equivalent. (See section ~~33-10-01-14~~ for the SI equivalent "sievert".) One millirem (~~mrem~~) = 0.001 rem. For the purpose of this article, any of the following is considered to be equal to one rem:

- a. An exposure of one roentgen of x or gamma radiation.
- b. An absorbed dose of one rad due to x, gamma, or beta radiation.
- c. An absorbed dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye.
- d. An absorbed dose of 0.1 rad due to neutrons or high energy protons. If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron absorbed dose in rads, one rem of neutron radiation may, for purposes of this article, be assumed to be equivalent to fourteen million neutrons per square centimeter incident upon the body, or, if there exists sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to one rem may be estimated from the following table:

Neutron Flux Dose Equivalents

Neutron energy (MeV)	Number of neutrons per square centimeter for a dose equivalent of one rem or ten millisieverts (neutrons/cm ²)	Average flux density to deliver one hundred millirems or one millisievert in forty hours (neutrons/cm ² per second)
Thermal	970 x 10 ⁶	670
0.0001	720 x 10 ⁶	500
0.005	820 x 10 ⁶	570
0.02	400 x 10 ⁶	280
0.1	120 x 10 ⁶	80
0.5	43 x 10 ⁶	30
1.0	26 x 10 ⁶	18
2.5	29 x 10 ⁶	20
5.0	26 x 10 ⁶	18
7.5	24 x 10 ⁶	17
10.0	24 x 10 ⁶	17

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).

- 54. 93. "Research and development" means (a) theoretical analysis, exploration, or experimentation; or (b) the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes. Research and development does not include the internal or external administration of radiation or radioactive material to human beings.
- 55. 94. "Restricted area" ~~(controlled area)~~ means ~~any~~ an area, access to which is ~~controlled~~ limited by the licensee or registrant for ~~purposes~~ the purpose of ~~protection of~~ protecting individuals ~~from exposure to~~ against undue risks from exposure to sources of radiation and radioactive material. "Restricted area" does not include ~~any~~ areas used ~~for~~ as residential quarters, ~~although a~~ but separate ~~room or~~ rooms in a residential building may be set apart as a restricted area.
- 56. 95. "Roentgen" (R) means the special unit of exposure. One roentgen equals 2.58×10^{-4} coulombs per kilogram of air. (See "exposure")
- 57. 96. "Sealed source" means radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions which are likely to be encountered in normal use and handling.
- 97. "Shallow dose equivalent" (H_s), which applies to the external exposure of the skin or an extremity, means the dose equivalent at a tissue depth of seven one-thousandths centimeter (7 mg/cm^2) averaged over an area of one square centimeter.
- 98. "SI" means the abbreviation for the international system of units.
- 99. "Sievert" means 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 Sv = 100 rem).

100. "Site area emergency" means events may occur, are in progress, or have occurred that could lead to a significant release of radioactive material and that could require a response by offsite response organizations to protect persons offsite.
101. "Site boundary" means that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee or registrant.
- ~~58.~~ 102. "Source material" means: (a) uranium or thorium, or any combination thereof, in any physical or chemical form; or (b) ores ~~which~~ that contain by weight one-twentieth of one percent (0.05 percent) or more of ~~(1)~~ uranium, ~~(2)~~ thorium, or ~~(3)~~ any combination ~~thereof~~ of uranium and thorium. Source material does not include special nuclear material.
- ~~59.~~ 103. "Source material milling" means any activity that results in the production of byproduct material as defined in subdivision b of subsection 7 17.
- ~~60.~~ 104. "Source of radiation" means any radioactive material, or any device or equipment emitting or capable of producing radiation.
- ~~61.~~ 105. "Special form radioactive material" means radioactive material ~~which~~ that satisfies the following conditions:
- a. It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule.
 - b. The piece or capsule has at least one dimension not less than five millimeters [~~0.197~~ 0.2 inch].
 - c. It satisfies the test requirements specified by the United States nuclear regulatory commission. A special form encapsulation designed in accordance with the United States nuclear regulatory commission requirements in effect on June 30, 1983, and constructed prior to July 1, 1985, may continue to be used. A special form encapsulation either designed or constructed after June 30, 1985, must meet requirements of this definition applicable at the time of its design or construction.
106. "Special nuclear material" means:
- a. Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the United States nuclear regulatory commission, pursuant to the provisions of section 51 of the Atomic Energy Act of 1954, as amended, determined to be special nuclear material, but does not include source material; or

b. Any material artificially enriched by any of the foregoing but does not include source material.

~~62-~~ 107. "Special nuclear material in quantities not sufficient to form a critical mass" means uranium enriched in the isotope U-235 in quantities not exceeding three hundred fifty grams of contained U-235, uranium-233 in quantities not exceeding two hundred grams; plutonium in quantities not exceeding two hundred grams; or any combination of them in accordance with the following formula: For each kind of special nuclear material, determine the ratio between the quantity of that special nuclear material and the quantity specified above for the same kind of special nuclear material. The sum of such ratios for all of the kinds of special nuclear material in combination shall not exceed "1", i.e., unity. For example, the following quantities in combination would not exceed the limitation and are within the formula:

$$\frac{175 \text{ (grams contained U-235)}}{350} + \frac{50 \text{ (grams U-233)}}{200} + \frac{50 \text{ (grams Pu)}}{200} = 1$$

~~63-~~ 108. "Survey" means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of sources of radiation under a specific set of conditions to determine actual or potential radiation hazards. When appropriate, such evaluation includes, ~~but is not limited to~~ tests, physical examination, and measurements of levels of radiation or concentration of radioactive material present.

~~64-~~ 109. "Test" means a method for determining the characteristics or condition of sources of radiation or components thereof. "Test" may also mean the process of verifying compliance with this article.

~~65-~~ 110. "These rules" means all parts of this article and any subsequent changes or additions thereto.

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

112. "Total organ dose equivalent" (TODE) means the sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in chapter 33-10-04.1 of these rules.

~~66-~~ 113. "United States department of energy" means the department of energy established by Public Law No. 95-91 [91 Stat. 565; 42 U.S.C. 7101 et seq.] to the extent that the department exercises functions formerly vested in the United States atomic energy commission, its chairman, members, officers, and components and transferred to the United States energy

research and development administration and to the administrators thereof pursuant to sections 104(b), (c), and (d) of the Energy Reorganization Act of 1974 [Pub. L. 93-438; 88 Stat. 1237; 42 U.S.C. 5814, effective January 19, 1975] and transferred to the secretary of energy pursuant to subsection 301(a) of the Department of Energy Organization Act [Pub. L. 95-91; 91 Stat. 577-578; 42 U.S.C. 7151, effective October 1, 1977].

- ~~67-~~ 114. "Unrefined and unprocessed ore" means ore in its natural form prior to any processing, such as grinding, roasting, beneficiating, or refining.
- ~~68-~~ 115. "Unrestricted area" ~~(uncontrolled area)~~ means any an area, access to which is not neither limited nor controlled by the licensee or registrant for purposes of protection of individuals from exposure to radiation and radioactive material, and any area used for residential quarters.
- ~~69-~~ 116. "Waste" means those low-level radioactive wastes that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level waste has the same meaning as in the Low-Level Radioactive Waste Policy Act [Pub. L. 96-573; 94 Stat. 3347; 42 U.S.C. 2021b-2021j], as amended by Pub. L. 99-240 [99 Stat. 1842; 42 U.S.C. 2021b-2021j], effective January 15, 1986; that is, radioactive waste:
- a. Not classified as high-level radioactive waste, spent nuclear fuel, or byproduct material as defined in section 11e(2) of the Atomic Energy Act [Pub. L. 95-604; 92 Stat. 3033; 42 U.S.C. 2014(e)(2)] (uranium or thorium tailings and waste); and
 - b. Classified as low-level radioactive waste consistent with existing law and in accordance with subdivision a by the United States nuclear regulatory commission.
- ~~70-~~ 117. "Waste handling licensees" means persons licensed to receive and store radioactive wastes prior to disposal and/or persons licensed to dispose of radioactive waste.
118. "Week" means seven consecutive days starting on Sunday.
119. "Whole body" means, for purposes of external exposure, head, trunk including male gonads, arms above the elbow, or legs above the knee.
- ~~71-~~ 120. "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.

121. "Working level" (WL) means any combination of short-lived radon daughters in one liter of air that will result in the ultimate emission of 1.3E+5 megaelectronvolt 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.
122. "Working level month" (WLM) means an exposure to one working level for one hundred seventy hours - two thousand working hours per year divided by twelve months per year is approximately equal to one hundred seventy hours per month.
123. "Year" means the period of time beginning in January used to determine compliance with the provisions of these rules. 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.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC 28-32-02, 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-01-12. Prohibited uses. The following sources of ionizing radiation are prohibited:

1. ~~Hand-held~~ A hand-held fluoroscopic ~~screens~~ screen shall not be used with x-ray equipment unless it has been listed in the registry of sealed source and devices or accepted for certification by the United States food and drug administration, center for devices and radiological health.
2. Shoe-fitting fluoroscopic devices shall not be used.
3. Those sources of ionizing radiation when found to be detrimental to health and safety or in violation of this article.

History: Amended effective March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-08

33-10-01-14. The international system of units (SI). The Metric Conversion Act of 1975 (Pub. L. 94-168; 89 Stat. 1007; 15 U.S.C. 205a-205k) urged the increasing awareness and use of the international system of units. The generally accepted regulatory values in the narrative portions of this document are followed by the international system of units equivalents in parentheses. Where appropriate,

schedules and appendices are provided with notes concerning conversion factors. The inclusion of the international system of units equivalent is for informational purposes only. Units of exposure, dose, and activity.

1. Absorbed dose. The unit of absorbed dose is the gray (Gy), which is equal to one joule per kilogram. One rad is equal to 1×10^{-2} gray. Submultiples included in this document are the milligray (mGy) and the microgray (μ Gy). As used in these rules, the unit of exposure is the coulomb per kilogram (C/kg) of air. One roentgen is equal to 2.58×10^{-4} coulomb per kilogram of air.

2. Dose equivalent. The unit of dose equivalent is the sievert (Sv) which is equal to one joule per kilogram. One rem is equal to 1×10^{-2} sievert. Submultiples included in this document are the millisievert (mSv) and the microsievert (μ Sv). As used in these rules, the units of dose are:
 - a. Rad is the special unit of absorbed dose. One rad is equal to an absorbed dose of one one-hundred erg per gram or one one-hundredths (1/100) joule per kilogram (0.01 Gy).
 - b. Gray (Gy) is the SI unit of absorbed dose. One gray is equal to an absorbed dose of one joule per kilogram (100 rad).
 - c. 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 Sv).
 - d. 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 Sv = 100 rem).

3. Exposure. The unit of exposure is the coulomb per kilogram (C/kg). One roentgen is equal to 2.58×10^{-4} coulomb per kilogram. Submultiples of this unit are the millicoulomb per kilogram (mC/kg) and the microcoulomb per kilogram (μ C/kg). As used in these rules, the quality factors for converting absorbed dose to dose equivalent are shown in table I.

Table I
QUALITY FACTORS AND ABSORBED DOSE EQUIVALENTS

TYPE OF RADIATION	Quality Factor (Q)	Absorbed Dose Equal to a Unit Dose Equivalent*
X, gamma, or beta radiation and	1	1

high-speed electrons

<u>Alpha particles, multiple-charged particles, fission fragments, and heavy particles of unknown charge</u>	<u>20</u>	<u>0.05</u>
<u>Neutrons of unknown energy</u>	<u>10</u>	<u>0.1</u>
<u>High-energy protons</u>	<u>10</u>	<u>0.1</u>

*Absorbed dose in rad equal to one rem or the absorbed dose in gray equal to one sievert.

4. Radioactivity. The unit of measurement of radioactivity is the becquerel (Bq) and is equal to one transformation per second. One curie is equal to 3.7×10^{10} becquerels. Multiples included in this document are kilobecquerel (kBq), megabecquerel (MBq), gigabecquerel (GBq), and petabecquerel (PBq). If it is more convenient to measure the neutron fluence rate than to determine the neutron dose equivalent rate in rem per hour or sievert per hour, as provided in subsection 3, one one-hundredth sievert [1 rem] of neutron radiation of unknown energies may, for purposes of these rules, be assumed to result from a total fluence of twenty-five 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 II to convert a measured tissue dose in gray or rad to dose equivalent in rem or sievert.

Table II
MEAN QUALITY FACTORS, Q, AND FLUENCE PER UNIT DOSE
EQUIVALENT FOR MONOENERGETIC NEUTRONS

<u>Neutron Energy (MeV)</u>	<u>Quality Factor^a (Q)</u>	<u>Fluence per Unit Dose Equivalent^b (neutrons cm⁻² rem⁻¹)</u>	<u>Fluence per Unit Dose Equivalent^b (neutrons cm⁻² Sv⁻¹)</u>
<u>(thermal)</u>			
<u>2.5E-8</u>	<u>2</u>	<u>980E+6</u>	<u>980E+8</u>
<u>1E-7</u>	<u>2</u>	<u>980E+6</u>	<u>980E+8</u>
<u>1E-6</u>	<u>2</u>	<u>810E+6</u>	<u>810E+8</u>
<u>1E-5</u>	<u>2</u>	<u>810E+6</u>	<u>810E+8</u>
<u>1E-4</u>	<u>2</u>	<u>840E+6</u>	<u>840E+8</u>
<u>1E-3</u>	<u>2</u>	<u>980E+6</u>	<u>980E+8</u>
<u>1E-2</u>	<u>2.5</u>	<u>1010E+6</u>	<u>1010E+8</u>
<u>1E-1</u>	<u>7.5</u>	<u>170E+6</u>	<u>170E+8</u>
<u>5E-1</u>	<u>11</u>	<u>39E+6</u>	<u>39E+8</u>
<u>1</u>	<u>11</u>	<u>27E+6</u>	<u>27E+8</u>
<u>2.5</u>	<u>9</u>	<u>29E+6</u>	<u>29E+8</u>

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

a Value of quality factor (Q) at the point where the dose equivalent is maximum in a 30-centimeter diameter cylinder tissue-equivalent phantom.

b Monoenergetic neutrons incident normally on a 30-centimeter diameter cylinder tissue-equivalent phantom.

5. For purposes of these rules, activity is expressed in the special unit of curie (Ci) or in the international system (SI) unit of becquerel (Bq), or their multiples, or disintegrations or transformations per unit of time.

a. One curie (Ci) = 3.7E+10 disintegrations or transformations per second (dps or tps) = 3.7E+10 becquerel (Bq) = 2.22E+12 disintegrations or transformations per minute (dpm or tpm).

b. One becquerel (Bq) = one disintegration or transformation per second (dps or tps).

6. SI numerical prefix conversions. See table below for a listing of numerical prefixes to convert SI units or **English special** units by appropriate multiples:

SI Numerical Prefix Conversion Table

Multiplication Factors	Prefix	Symbol
1 000 000 000 000 000 000 = 10 ¹⁸	exa	E
1 000 000 000 000 000 = 10 ¹⁵	peta	P
1 000 000 000 000 = 10 ¹²	tera	T
1 000 000 000 = 10 ⁹	giga	G
1 000 000 = 10 ⁶	mega	M
1 000 = 10 ³	kilo	k
100 = 10 ²	hecto	h

$\phi 10 = 10^1$	deka	da
$0.1 = 10^{-1}$	deci	d
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000\ 001 = 10^{-6}$	micro	u
$0.000\ 000\ 001 = 10^{-9}$	nano	n
$0.000\ 000\ 000\ 001 = 10^{-12}$	pico	p
$0.000\ 000\ 000\ 000\ 001 = 10^{-15}$	femto	f
$0.000\ 000\ 000\ 000\ 000\ 001 = 10^{-18}$	atto	a

History: Effective June 1, 1992; amended effective March 1, 1994.
 General Authority: NDCC 28-32-02
 Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03

CHAPTER 33-10-02

33-10-02-03. Application for registration of radiation machine facilities. Each person having a radiation machine facility shall:

1. Apply for registration of such facility with the department ~~within thirty days following the effective date of this chapter or thereafter~~ prior to the operation of a radiation machine facility. Application for registration shall be completed on forms furnished by the department and shall contain all the information required by the form and accompanying instructions.
2. Designate on the application form an individual to be responsible for radiation protection.
3. Each registrant shall prohibit any person from furnishing radiation machine servicing or services as described in subsection 4 of section 33-10-02-05, to the registrant's radiation machine facility until such person provides evidence that the service person has been registered with the department as a provider of services in accordance with section ~~33-10-02-05~~ 33-10-02-04.
4. Each application for registration shall be accompanied by the fee prescribed in chapter 33-10-11.

History: Amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04.5

33-10-02-04. Application for registration of servicing and services.

1. Each person who is engaged in the business of installing or offering to install radiation machines or is engaged in the business of furnishing or offering to furnish radiation machine servicing or services in this state shall apply for registration of such services with the department ~~within thirty days following the effective date of this chapter or thereafter~~ prior to furnishing or offering to furnish any such services.
2. Application for registration shall be completed on forms furnished by the department and shall contain all information required by the department as indicated on the forms and accompanying instructions.
3. Each person applying for registration under this chapter shall specify:

- a. That the person has read and understands the requirements of this article.
 - b. The services for which the person is applying for registration.
 - c. The training and experience that qualify the person to discharge the services for which the person is applying for registration.
 - d. The type of measurement instrument to be used, frequency of calibration, and source of calibration.
 - e. The type of personnel dosimeters supplied, frequency of reading, and replacement or exchange schedule.
4. For the purpose of this section, services may include, but shall not be limited to:
 - a. Installation or servicing, or both, of radiation machines and associated radiation machine components.
 - b. Calibration of radiation machines or radiation measurement instruments or devices.
 - c. Radiation protection or health physics consultations or surveys.
 - d. Personnel dosimetry services.
 5. No individual may perform services which are not specifically stated for that individual on the notice of registration issued by the department.
 6. Each application for registration shall be accompanied by the fee prescribed in chapter 33-10-11. The fee will cover the period from June first, through May thirty-first of each year, regardless of the application date.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-04, 23-20.1-04.5

33-10-02-07. Renewal of notice of registration.

1. Application for renewal of registration shall be filed in accordance with section 33-10-02-03 or 33-10-02-04. Each application for registration shall be accompanied by the fee prescribed in chapter 33-10-11.
2. In any case in which a registrant not less than thirty days prior to the expiration of this existing notice of

registration has filed an application in proper form for renewal, such existing notice of registration shall not expire until the application status has been finally determined by the department.

History: Amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

CHAPTER 33-10-03

33-10-03-01. Purpose and scope.

1. This chapter and chapters 33-10-07 and 33-10-13 provide for the licensing of radioactive material. No person shall receive, possess, use, transfer, own, or acquire radioactive material except as authorized pursuant to this chapter or chapters 33-10-07 and 33-10-13, or as otherwise provided in these chapters.
2. In addition to the requirements of this chapter, all licensees are subject to the requirements of chapters 33-10-01, ~~33-10-04~~ 33-10-04.1, 33-10-10, and 33-10-13. Furthermore, licensees engaged in industrial radiographic operations are subject to the requirements of chapter 33-10-05, licensees using radionuclides in the healing arts are subject to the requirements of chapter 33-10-07, and licensees engaged in wireline and subsurface tracer studies are subject to the requirements of chapter 33-10-12.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-03-04. General licenses.

1. General licenses - source material.

- a. A general license is hereby issued authorizing commercial and industrial firms, research, educational and medical institutions, and state and local government agencies to use and transfer not more than fifteen pounds [6.82 kilograms] of source material at any one time for research, development, educational, commercial, or operational purposes. A person authorized to use or transfer source material, pursuant to this general license, may not receive more than a total of one hundred fifty pounds [68.2 kilograms] of source material in any one calendar year.
- b. Persons who receive, possess, use, or transfer source material pursuant to the general license issued in subdivision a are exempt from the provisions of chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10 to the extent that such receipt, possession, use, or transfer is within the terms of such general license; provided, however, that this exemption shall not be deemed to apply to any such person who is also in possession of source material under a specific license issued pursuant to this chapter.

- c. Persons who receive, possess, use, or transfer source material pursuant to the general license in subdivision a are prohibited from administering source material, or the radiation therefrom, either externally or internally, to human beings except as may be authorized by the department in a specific license.
- d. A general license is hereby issued authorizing the receipt of title to source material without regard to quantity. This general license does not authorize any person to receive, possess, use, or transfer source material.
- e. Depleted uranium in industrial products and devices.
 - (1) A general license is hereby issued to receive, acquire, possess, use, or transfer, in accordance with paragraphs 2, 3, 4, and 5, depleted uranium contained in industrial products or devices for the purpose of providing a concentrated mass in a small volume of a product or device.
 - (2) The general license in paragraph 1 applies only to industrial products or devices which have been manufactured either in accordance with a specific license issued to the manufacturer of the products or devices pursuant to subdivision a of subsection 5 of section 33-10-03-05 or in accordance with a specific license issued to the manufacturer by the United States nuclear regulatory commission or an agreement state which authorizes manufacture of the products or devices for distribution to persons generally licensed by the United States nuclear regulatory commission or an agreement state.
 - (3) (a) Persons who receive, acquire, possess, or use depleted uranium pursuant to the general license established by paragraph 1 shall file form RAD 811 "registration certificate - use of depleted uranium under general license" with the department. The form shall be submitted within thirty days after the first receipt or acquisition of such depleted uranium. The registrant shall furnish the following information and such other information as may be required by that form:
 - [1] Name and address of the registrant.
 - [2] A statement that the registrant has developed and will maintain procedures designed to establish physical control over the depleted uranium described in paragraph 1 and designed to prevent transfer of such

depleted uranium in any form, including metal scrap, to persons not authorized to receive the depleted uranium.

- [3] Name and title, address, and telephone number of the individual duly authorized to act for and on behalf of the registrant in supervising the procedures identified in item 2 of subparagraph a.
- (b) The registrant possessing or using depleted uranium under the general license established by paragraph 1 shall report in writing to the department any changes in information furnished by the registrant in form RAD 811 "registration certificate - use of depleted uranium under general license". The report shall be submitted within thirty days after the effective date of such change.
- (4) A person who receives, acquires, possesses, or uses depleted uranium pursuant to the general license established by paragraph 1:
- (a) May not introduce such depleted uranium, in any form, into a chemical, physical, or metallurgical treatment or process, except a treatment or process for repair or restoration of any plating or other covering of the depleted uranium.
- (b) May not abandon such depleted uranium.
- (c) Shall transfer or dispose of such depleted uranium only by transfer in accordance with subsection 12 of section 33-10-03-05. In the case where the transferee receives the depleted uranium pursuant to the general license established by paragraph 1, the transferor shall furnish the transferee a copy of this article and a copy of form RAD 811. In the case where the transferee receives the depleted uranium pursuant to a general license contained in the United States nuclear regulatory commission's or agreement state's regulation equivalent to paragraph 1, the transferor shall furnish the transferee a copy of this article and a copy of form RAD 811 accompanied by a note explaining that use of the product or device is regulated by the United States nuclear regulatory commission or agreement state under requirements substantially the same as those in this article.

- (d) Within thirty days of any transfer, shall report in writing to the department the name and address of the person receiving the depleted uranium pursuant to such transfer.
 - (e) May not export such depleted uranium except in accordance with a license issued by the United States nuclear regulatory commission pursuant to 10 CFR 110.
- (5) Any person receiving, acquiring, possessing, using, or transferring depleted uranium pursuant to the general license established by paragraph 1 is exempt from the requirements of chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10 with respect to the depleted uranium covered by that general license.
2. General licenses - radioactive material other than source material.
- a. Certain devices and equipment. A general license is hereby issued to transfer, receive, acquire, own, possess, and use radioactive material incorporated in the following devices or equipment which have been manufactured, tested, and labeled by the manufacturer in accordance with a specific license issued to the manufacturer by the United States nuclear regulatory commission for use pursuant to 10 CFR 31.3. This general license is subject to the provisions of sections 33-10-01-06 through 33-10-01-11, paragraph 2 of subdivision a of subsection 2 of section 33-10-03-02, subsections 7, 12, and 13 of section 33-10-03-05, and chapters ~~33-10-04~~ 33-10-04.1, 33-10-10, and 33-10-13. (Attention is directed particularly to the provisions of chapter ~~33-10-04~~ 33-10-04.1 which relate to the labeling of containers.)
 - (1) Static elimination device. Devices designed for use as static eliminators which contain, as a sealed source or sources, radioactive material consisting of a total of not more than five hundred microcuries [18.5 megabecquerels] of polonium-210 per device.
 - (2) Ion generating tube. Devices designed for ionization of air which contain, as a sealed source or sources, radioactive material consisting of a total of not more than five hundred microcuries [18.5 megabecquerels] of polonium-210 per device or a total of not more than fifty millicuries [1.85 gigabecquerels] of hydrogen-3 (tritium) per device.
 - b. Certain measuring, gauging, and controlling devices.

- (1) A general license is hereby issued to commercial and industrial firms and to research, educational, and medical institutions, individuals in the conduct of their business, and state or local government agencies to own, receive, acquire, possess, use, or transfer in accordance with the provisions of paragraphs 2, 3, and 4, radioactive material, excluding special nuclear material, contained in devices designed and manufactured for the purpose of detecting, measuring, gauging, or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.
- (2) The general license in paragraph 1 applies only to radioactive material contained in devices which have been manufactured and labeled in accordance with the specifications contained in a specific license issued by the department pursuant to subdivision d of subsection 5 of section 33-10-03-05 or in accordance with the specifications contained in a specific license issued by the United States nuclear regulatory commission, an agreement state, or a licensing state which authorizes distribution of devices to persons generally licensed by the nuclear regulatory commission, an agreement state, or a licensing state. (Regulations under the Federal Food, Drug, and Cosmetic Act authorizing the use of radioactive control devices in food production require certain additional labeling thereon which is found in 21 CFR 179.21.)
- (3) Any person who owns, receives, acquires, possesses, uses, or transfers radioactive material in a device pursuant to the general license in paragraph 1:
 - (a) Shall assure that all labels affixed to the device at the time of receipt, and bearing a statement that removal of the label is prohibited, are maintained thereon and shall comply with all instructions and precautions provided by such labels.
 - (b) Shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as are specified in the label; however:

[1] Devices containing only krypton need not be tested for leakage of radioactive material.

- [2] Devices containing only tritium or not more than one hundred microcuries [3.7 megabecquerels] of other beta or gamma emitting material or ten microcuries [0.37 megabecquerels] of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose.
- (c) Shall assure that other testing, installation, servicing, and removal from installation involving the radioactive materials, its shielding or containment, are performed:
- [1] In accordance with the instructions provided by the labels; or
- [2] By a person holding a specific license from the department, the United States nuclear regulatory commission, an agreement state, or a licensing state to perform such activities.
- (d) Shall maintain records showing compliance with the requirements of subparagraphs b and c. The records shall show the results of tests. The records also shall show the dates of performance of, and the names of persons performing, testing, installation servicing and removal from installation concerning the radioactive material, its shielding or containment. Records of tests for leakage of radioactive material required by subparagraph b must be maintained for two years after the required leak test is performed. Records of tests of the on-off mechanism and indicator required by subparagraph b must be maintained for two years after the required test of the on-off mechanism and indicator is performed. Records which are required by subparagraph c must be maintained for a period of two years from the date of the recorded event.
- (e) Upon the occurrence of a failure of or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of five-thousandths microcurie [185 becquerels] or more removable radioactive material, shall immediately suspend operation of the device until it has been repaired by the manufacturer or other person

holding a specific license from the department, the United States nuclear regulatory commission, an agreement state, or a licensing state to repair such devices, or disposed of by transfer to a person authorized by a specific license to receive the radioactive material contained in the device and, within thirty days, furnish to the department a report containing a brief description of the event and the remedial action taken.

(f) Shall not abandon the device containing radioactive material.

(g) Except as provided in subparagraph h, shall transfer or dispose of the device containing radioactive material only by transfer to a specific licensee of the department, the United States nuclear regulatory commission, an agreement state, or a licensing state whose specific license authorizes the person to receive the device and within thirty days after transfer of a device to a specific licensee shall furnish to the department a report containing identification of the device by manufacturer's name and model number and the name and address of the person receiving the device. No report is required if the device is transferred to the specific licensee in order to obtain a replacement device.

(h) Shall transfer the device to another general licensee only:

[1] Where the device remains in use at a particular location. In such case the transferor shall give the transferee a copy of this chapter and any safety documents identified in the label on the device and within thirty days of the transfer, report to the department the manufacturer's name and model number of device transferred, the name and address of the transferee, and the name or position of an individual who may constitute a point of contact between the department and the transferee; or

[2] Where the device is held in storage in the original shipping container at its intended location of use prior to initial use by a general licensee.

- (i) Shall comply with the provisions of subsections ~~2 and 3 of section 33-10-04-05~~ 1, 2, 3, and 5 of section 33-10-04.1-16 for reporting radiation incidents, theft, or loss of licensed material, but shall be exempt from the other requirements of chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10.
 - (4) The general license in paragraph 1 does not authorize the manufacture of devices containing radioactive material.
 - (5) The general license provided in paragraph 1 is subject to the provisions of sections 33-10-01-06 through 33-10-01-11, subsections 7, 12, and 13 of section 33-10-03-05, and chapter 33-10-13.
- c. Luminous safety devices for aircraft.
- (1) A general license is hereby issued to own, receive, acquire, possess, and use tritium or promethium-147 contained in luminous safety devices for use in aircraft, provided all of the following are met:
 - (a) Each device contains not more than ten curies [370 gigabecquerels] of tritium or three hundred millicuries [11.1 gigabecquerels] of promethium-147.
 - (b) Each device has been manufactured, assembled, or imported in accordance with a specific license issued by the United States nuclear regulatory commission, or each device has been manufactured or assembled in accordance with the specifications contained in a specific license issued by the department or any agreement state to the manufacturer or assembler of such device pursuant to licensing requirements equivalent to those in 10 CFR 32.53 of the regulations of the United States nuclear regulatory commission.
 - (2) Persons who own, receive, acquire, possess, or use luminous safety devices pursuant to paragraph 1 ~~are exempt from the requirements of chapters 33-10-04 and 33-10-10 except that they~~ shall comply with the provisions of subsections ~~2 and 3 of section 33-10-04-05~~ 1, 2, 3, and 5 of section 33-10-04.1-16 for reporting radiation incidents, theft, or loss of licensed material, but shall be exempt from the other requirements of chapters ~~33-10-04.1~~ and 33-10-10.
 - (3) This general license does not authorize the manufacture, assembly, or repair of luminous safety devices containing tritium or promethium-147.

- (4) This general license does not authorize the ownership, receipt, acquisition, possession, or use of promethium-147 contained in instrument dials.
 - (5) This general license is subject to the provisions of sections 33-10-01-06 through 33-10-01-11, subsections 7, 12, and 13 of section 33-10-03-05, and chapter 33-10-13.
- d. Ownership of radioactive material. A general license is hereby issued to own radioactive material without regard to quantity. Notwithstanding any other provisions of this chapter, this general license does not authorize the manufacture, production, transfer, receipt, possession, or use of radioactive material.
- e. Calibration and reference sources.
- (1) A general license is hereby issued to those persons listed below to own, receive, acquire, possess, use, and transfer, in accordance with the provisions of paragraphs 4 and 5, americium-241 in the form of calibration or reference sources:
 - (a) Any person who holds a specific license issued by the department which authorizes the person to receive, possess, use, and transfer radioactive material.
 - (b) Any person who holds a specific license issued by the United States nuclear regulatory commission which authorizes the person to receive, possess, use, and transfer special nuclear material.
 - (2) A general license is hereby issued to own, receive, possess, use, and transfer plutonium in the form of calibration or reference sources in accordance with the provisions of paragraphs 4 and 5 to any person who holds a specific license issued by the department which authorizes the person to receive, possess, use, and transfer radioactive material.
 - (3) A general license is hereby issued to own, receive, possess, use, and transfer radium-226 in the form of calibration or reference sources in accordance with the provisions of paragraphs 4 and 5 to any person who holds a specific license issued by the department which authorizes the person to receive, possess, use, and transfer radioactive material.
 - (4) The general licenses in paragraphs 1, 2, and 3 apply only to calibration or reference sources which have

been manufactured in accordance with the specifications contained in a specific license issued to the manufacturer or importer of the sources by the United States nuclear regulatory commission pursuant to 10 CFR 32.57 or 10 CFR 70.39 or which have been manufactured in accordance with the specifications contained in a specific license issued to the manufacturer by the department, any agreement state or licensing state pursuant to licensing requirements equivalent to those contained in 10 CFR 32.57 or 10 CFR 70.39 of the regulations of the United States nuclear regulatory commission.

- (5) The general licenses provided in paragraphs 1, 2, and 3 are subject to the provisions of sections 33-10-01-06 through 33-10-01-11, subsections 7, 12, and 13 of section 33-10-03-05, and chapters ~~33-10-04~~ 33-10-04.1, 33-10-10, and 33-10-13. In addition, persons who own, receive, acquire, possess, use, or transfer one or more calibration or reference sources pursuant to these general licenses:

(a) Shall not possess at any one time, at any one location of storage or use, more than five microcuries [185 kilobecquerels] of americium-241, five microcuries [185 kilobecquerels] of plutonium, or five microcuries [185 kilobecquerels] of radium-226 in such sources.

(b) Shall not receive, possess, use, or transfer such source unless the source, or the storage container, bears a label which includes the following statement or a substantially similar statement which contains the information called for in the following statement:

[1] The receipt, possession, use, and transfer of this source, Model _____, Serial No. _____, are subject to a general license and the regulations of the United States nuclear regulatory commission or of a state with which the commission has entered into an agreement for the exercise of regulatory authority. Do not remove this label.

CAUTION - RADIOACTIVE MATERIAL - THIS SOURCE CONTAINS (AMERICIUM-241). (PLUTONIUM) (Showing only the name of the appropriate material.) DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

Name of manufacturer or importer

- [2] The receipt, possession, use, and transfer of this source, Model _____, Serial No. _____, are subject to a general license and the regulations of any licensing state. Do not remove this label.

CAUTION - RADIOACTIVE MATERIAL - THIS SOURCE CONTAINS RADIUM-226. DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

Name of manufacturer or importer

- (c) Shall not transfer, abandon, or dispose of such source except by transfer to a person authorized by a license from the department, the United States nuclear regulatory commission, an agreement state, or a licensing state to receive the source.
 - (d) Shall store such source, except when the source is being used, in a closed container adequately designed and constructed to contain americium-241, plutonium, or radium-226 which might otherwise escape during storage.
 - (e) Shall not use such source for any purpose other than the calibration of radiation detectors or the standardization of other sources.
- (6) These general licenses do not authorize the manufacture of calibration or reference sources containing americium-241, plutonium, or radium-226.
- f. General license for use of radioactive material for certain in vitro clinical or laboratory testing. (The new drug provisions of the Federal Food, Drug, and Cosmetic Act also govern the availability and use of any specific diagnostic drugs in interstate commerce.)
- (1) A general license is hereby issued to any physician, veterinarian, clinical laboratory, or hospital to receive, acquire, possess, transfer, or use, for any of the following stated tests, in accordance with the

provisions of paragraphs 2, 3, 4, 5, and 6, the following radioactive materials in prepackaged units for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals:

- (a) Carbon-14, in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (b) Cobalt-57, in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (c) Hydrogen-3 (tritium), in units not exceeding fifty microcuries [1.85 megabecquerels] each.
 - (d) Iodine-125, in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (e) Mock iodine-125 reference or calibration sources, in units not exceeding five-hundredths microcurie [185 becquerels] of iodine-129 and five-thousandths microcurie [185 becquerels] of americium-241 each.
 - (f) Iodine-131, in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (g) Iron-59, in units not exceeding twenty microcuries [740 kilobecquerels] each.
 - (h) Selenium-75, in units not exceeding ten microcuries [370 kilobecquerels] each.
- (2) No person shall receive, acquire, possess, use, or transfer radioactive material pursuant to the general license established by paragraph 1 until the person has filed Department Form RAD 732, "Certificate - In Vitro Testing with Radioactive Material Under General License", with the department and received from the department a validated copy of Department Form RAD 732 with certification number assigned. The physician, veterinarian, clinical laboratory, or hospital shall furnish on Department Form RAD 732 the following information and such other information as may be required by that form:
- (a) Name and address of the physician, veterinarian, clinical laboratory, or hospital.
 - (b) The location of use.

- (c) A statement that the physician, veterinarian, clinical laboratory, or hospital has appropriate radiation measuring instruments to carry out in vitro clinical or laboratory tests with radioactive material as authorized under the general license in paragraph 1 and that such tests will be performed only by personnel competent in the use of such instruments and in the handling of the radioactive material.
- (3) A person who receives, acquires, possesses, or uses radioactive material pursuant to the general license established by paragraph 1 shall comply with the following:
- (a) The general licensee shall not possess at any one time, pursuant to the general license in paragraph 1, at any one location of storage or use, a total amount of iodine-125, iodine-131, selenium-75, iron-59, or cobalt-57 in excess of two hundred microcuries [7.4 megabecquerels].
 - (b) The general licensee shall store the radioactive material, until used, in the original shipping container or in a container providing equivalent radiation protection.
 - (c) The general licensee shall use the radioactive material only for the uses authorized by paragraph 1.
 - (d) The general licensee shall not transfer the radioactive material to a person who is not authorized to receive it pursuant to a license issued by the department, the United States nuclear regulatory commission, any agreement state, or a licensing state, nor transfer the radioactive material in any manner other than in the unopened, labeled shipping container as received from the supplier.
 - (e) The general licensee shall dispose of the mock iodine-125 reference or calibration sources described in subparagraph e of paragraph 1 as required by subsection 1 of section ~~33-10-04-04~~ 33-10-04.1-14.
- (4) The general licensee shall not receive, acquire, possess, or use radioactive material pursuant to paragraph 1:
- (a) Except as prepackaged units which are labeled in accordance with the provisions of a specific

license issued by the United States nuclear regulatory commission, any agreement state, or a licensing state which authorizes the manufacture and distribution of iodine-125, iodine-131, carbon-14, hydrogen-3 (tritium), iron-59, selenium-75, cobalt-57, or mock iodine-125 to persons generally licensed under this subdivision or its equivalent; and

- (b) Unless one of the following statements, as appropriate, or a substantially similar statement which contains the information called for in one of the following statements, appears on a label affixed to each prepackaged unit or appears in a leaflet or brochure which accompanies the package:

[1] This radioactive material may be received, acquired, possessed, and used only by physicians, veterinarians, clinical laboratories, or hospitals and only for in vitro clinical or laboratory tests not involving internal or external administration of the material, or the radiation therefrom, to human beings or animals. Its receipt, acquisition, possession, use, and transfer are subject to this article and a general license of the United States nuclear regulatory commission or of a state with which the commission has entered into an agreement for the exercise of regulatory authority.

Name of manufacturer

[2] This radioactive material shall be received, acquired, possessed, and used only by physicians, veterinarians, clinical laboratories, or hospitals and only for in vitro clinical or laboratory tests not involving internal or external administration of the material, or the radiation therefrom, to human beings or animals. Its receipt, acquisition, possession, use, and transfer are subject to this article and a general license of a licensing state.

Name of manufacturer

- (5) The physician, veterinarian, clinical laboratory, or hospital possessing or using radioactive material under the general license of paragraph 1 shall report, in writing, to the department, any changes in the information furnished by the physician, veterinarian, clinical laboratory, or hospital in the "Certificate - In Vitro Testing with Radioactive Material Under General License", Department Form RAD 732. The report shall be furnished within thirty days after the effective date of such change.
- (6) Any person using radioactive material pursuant to the general license of paragraph 1 is exempt from the requirements of chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10 with respect to radioactive material covered by that general license. However, persons using mock iodine-125 reference or calibration sources described in subparagraph e of paragraph 1 shall comply with the provisions of subsection 1 of section ~~33-10-04-04~~ 33-10-04.1-14 and subsections ~~2 and 3~~ 2 and 3 of section ~~33-10-04-05~~ 1, 2, 3, and 5 of section 33-10-04.1-16.

g. Ice detection devices.

- (1) A general license is hereby issued to own, receive, acquire, possess, use, and transfer strontium-90 contained in ice detection devices, provided each device contains not more than fifty microcuries [1.85 megabecquerels] of strontium-90 and each device has been manufactured or imported in accordance with a specific license issued by the United States nuclear regulatory commission or each device has been manufactured in accordance with the specifications contained in a specific license issued by the department or any agreement state to the manufacturer of such device pursuant to licensing requirements equivalent to those in 10 CFR 32.61.
- (2) Persons who own, receive, acquire, possess, use, or transfer strontium-90 contained in ice detection devices pursuant to the general license in paragraph 1:
 - (a) Shall, upon occurrence of visually observable damage, such as a bend or crack or discoloration from overheating to the device, discontinue use of the device until it has been inspected, tested for leakage and repaired by a person holding a specific license from the United States nuclear regulatory commission or an agreement state to manufacture or service such devices; or shall dispose of the device pursuant

to the provisions of subsection 1 of section ~~33-10-04-04~~ 33-10-04.1-14.

- (b) Shall assure that all labels affixed to the device at the time of receipt, and which bear a statement which prohibits removal of the labels, are maintained thereon.
 - (c) Are exempt from the requirements of chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10 except that such persons shall comply with the provisions of subsection 1 of section ~~33-10-04-04~~ 33-10-04.1-14, and subsections ~~2 and 3 of section 33-10-04-05~~ 1, 2, 3, and 5 of section 33-10-04.1-16.
- (3) This general license does not authorize the manufacture, assembly, disassembly, or repair of strontium-90 in ice detection devices.
 - (4) This general license is subject to the provisions of sections 33-10-01-06 through 33-10-01-11, subsections 7, 12, and 13 of section 33-10-03-05, and chapter 33-10-13.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-03-05. Specific licenses.

1. Filing application for specific licenses.

- a. Applications for specific licenses shall be filed on a form prescribed by the department.
- b. The department may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the department to determine whether the application should be granted or denied or whether a license should be modified or revoked.
- c. Each application shall be signed by the applicant or licensee or a person duly authorized to act for and on the applicant's behalf.
- d. An application for a license may include a request for a license authorizing one or more activities.

- e. In the application, the applicant may incorporate by reference information contained in previous applications, statements, or reports filed with the department provided such references are clear and specific.
 - f. Applications and documents submitted to the department shall be made available for public inspection except that the department may withhold any document or part thereof which is protected from disclosure by state and federal law or rule, including protection of trade secrets and individual medical records, as afforded by North Dakota Century Code section 23-20.1-09.1 from public inspection if disclosure of its content is not required in the public interest and would adversely affect the interest of a person concerned.
 - g. Each application for a specific license shall be accompanied by the fee prescribed in chapter 33-10-11.
2. General requirements for the issuance of specific licenses. A license application will be approved if the department determines all of the following:
- a. The applicant is qualified by reason of training and experience to use the material in question for the purpose requested in accordance with this article in such a manner as to minimize danger to public health and safety or property.
 - b. The applicant has a permanent in-state office.
 - c. The applicant's proposed equipment, facilities, and procedures are adequate to minimize danger to public health and safety or property.
 - d. The issuance of the license will not be inimical to the health and safety of the public.
 - e. The applicant satisfies any applicable special requirements in subsections 3, 4, ~~or~~ 5, or 14, and in chapters 33-10-05, 33-10-07, and 33-10-12.
 - f. Environmental report, commencement of construction. In the case of an application for a license to receive and possess radioactive material for commercial waste disposal by land burial, source material milling, or for the conduct of any other activity which the department determines will significantly affect the quality of the environment, the department, before commencement of construction of the plant or facility in which the activity will be conducted, has concluded, after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available

alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such conclusion shall be grounds for denial of a license to receive and possess radioactive material in such plant or facility. As used in this paragraph the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, necessary roads for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.

g. Financial surety arrangements for site reclamation.

(1) Pursuant to ~~subsection 2 of~~ North Dakota Century Code section ~~23-20.1-04~~ 23-20.1-04.2 and as otherwise provided, financial surety arrangements for site reclamation which may consist of surety bonds, cash deposits, certificates of deposit, deposits of government securities, letters or lines of credit, or any combination of the above for the categories of licensees listed in paragraph 4 shall be established to ensure the protection of the public health and safety in the event of abandonment, default, or other inability of the licensee to meet the requirements of the North Dakota Century Code and this article.

(a) The amount of funds to be ensured by such surety arrangements shall be based on department-approved cost estimates.

(b) Self-insurance, or any arrangement which essentially constitutes self-insurance, will not satisfy the surety requirement since this provides no additional assurance other than that which already exists through license requirements.

(2) The arrangements required in paragraph 1 shall be established prior to issuance of the license to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the facility.

(3) The following specific licensees are required to make financial surety arrangements:

(a) Major processors.

- (b) Waste handling licensees.
 - (c) Former United States atomic energy commission or United States nuclear regulatory commission licensed facilities.
 - (d) Source material milling operations.
 - (e) All others except persons exempt pursuant to paragraph 5.
- (4) For source material milling operations, the amount of funds to be ensured by such surety arrangements shall be based on department-approved cost estimates in an approved plan for (a) decontamination and decommissioning of mill buildings and the milling site to levels which would allow unrestricted use of these areas upon decommissioning, and (b) the reclamation of tailings or waste disposal areas in accordance with the technical criteria delineated in chapter 33-10-03. The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and evaluates alternatives for mitigating these impacts. In addition, the surety shall cover the payment of the charge for long-term surveillance and control required by the department. In establishing specific surety arrangements, the licensee's cost estimates shall take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work. In order to avoid unnecessary duplication and expense, the department may accept financial sureties that have been consolidated with financial or surety arrangements established to meet requirements of other federal or state agencies or local governing bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance, provided such arrangements are considered adequate to satisfy these requirements and that portion of the surety which covers the decommission and reclamation of the mill, mill tailings site and associated areas, and the long-term funding charge are clearly identified. The licensee's surety mechanism will be reviewed annually by the department to assure that sufficient funds will be available for completion of the reclamation plan if the work had to be performed by an independent contractor. The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed,

and any other conditions affecting costs. Regardless of whether reclamation is phased through the life of the operation or takes place at the end of operations, an appropriate portion of surety liability shall be retained until final compliance with the reclamation plan is determined. This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance could be provided with a surety instrument which is written for a specified period of time, e.g., five years, yet which must be automatically renewed unless the surety notifies the beneficiary (the department) and the principal (the licensee) some reasonable time, e.g., ninety days, prior to the renewal date of their intention not to renew. In such a situation the surety requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief period of time to allow at least sixty days for the department to collect.

- (5) The following persons are exempt from the requirements of paragraph 1:
 - (a) All state, local, or other government agencies, unless they are subject to subparagraph b of paragraph 3.
 - (b) Persons authorized to possess no more than one thousand times the quantity specified in Schedule B, exempt quantities, or combination of radioactive material listed therein as given in Schedule B.
 - (c) Persons authorized to possess hydrogen-3 contained as hydrogen gas in a sealed source.
 - (d) Persons authorized to possess radioactive noble gases in sealed sources with no radioactive daughter product with half-life greater than thirty days.
- (6) As provided by subsection 14 of section 33-10-03-05, certain applications for specific licenses must contain a proposed decommissioning funding plan or a certificate of financial assurance for decommissioning. In the case of renewal applications submitted before January 1, 1994, this submittal may

follow the renewal application but must be submitted on or before January 1, 1994.

- h. Long-term care requirements. Pursuant to North Dakota Century Code section ~~23-20.1-04~~ 23-20.1-04.2, and as otherwise provided, a long-term care trust fund shall be established by the following specific licensees prior to the issuance of the license. (Long-term care funding may also be required for former United States atomic energy commission or United States nuclear regulatory commission licensed facilities.)
 - (1) Waste handling licensees.
 - (2) Source material milling licensees.
- i. Continued surveillance requirements for source material mills.
 - (1) The final disposition of tailings or wastes at source material milling sites should be such that the need for ongoing active maintenance is not necessary to preserve isolation. As a minimum, annual site inspections shall be conducted by the department retaining ultimate custody of the site where tailings or wastes are stored to confirm the integrity of the stabilized tailings or waste systems and to determine the need, if any, for maintenance or monitoring. Results of the inspection shall be reported to the United States nuclear regulatory commission within sixty days following each inspection, if, on the basis of a site-specific evaluation, such a need appears necessary due to the features of a particular tailings or waste disposal system.
 - (2) A minimum charge of two hundred fifty thousand dollars (1978 dollars) to cover the costs of long-term surveillance shall be paid by each mill operator to the department prior to the termination of a uranium or thorium mill license. If site surveillance or control requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in paragraph 1, e.g., if fencing is determined to be necessary, variance in funding requirements may be specified by the department. The total charge to cover the costs of long-term surveillance shall be such that, with an assumed one percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The charge will be adjusted annually prior to actual payments to recognize inflation. The inflation rate

to be used is that indicated by the change in the consumer price index published by the United States department of labor, bureau of labor statistics.

3. Special requirements for issuance of certain specific licenses for radioactive material - .

a. Use of sealed sources in industrial radiography. In addition to the requirements set forth in subsection 2, a specific license for use of sealed sources in industrial radiography will be issued if all of the following are met:

~~a.~~ (1) The applicant will have an adequate program for training radiographic personnel and submits to the department a schedule or description of such program which specifies the:

~~↔~~ (a) Initial training.

~~↔~~ (b) Periodic training.

~~↔~~ (c) On-the-job training.

~~↔~~ (d) Means to be used by the licensee to determine the radiographic personnel's knowledge and understanding of and ability to comply with this article and licensing requirements, and the operating and emergency procedures of the applicant.

~~b.~~ (2) The applicant has established and submits to the department satisfactory written operating and emergency procedures described in subsection 2 of section 33-10-05-06.

~~c.~~ (3) The applicant will have an internal inspection system adequate to assure that this article, license provisions, and the applicant's operating and emergency procedures are followed by radiographic personnel; the inspection system must include the performance of internal inspections at intervals not to exceed three months and the retention of records of such inspections for two years.

~~d.~~ (4) The applicant submits to the department a description of the applicant's overall organizational structure pertaining to the industrial radiography program, including specified delegations of authority and responsibility for operation of the program.

~~e.~~ (5) The applicant who desires to conduct the applicant's own leak tests has established adequate procedures to

be followed in testing sealed sources for possible leakage and contamination and submits to the department a description of such procedures including:

- ~~(1)~~ (a) Instrumentation to be used.
- ~~(2)~~ (b) Method of performing tests.
- ~~(3)~~ (c) Pertinent experience of the individual who will perform the test.

f. (6) The licensee shall conduct a program for inspection and maintenance of radiographic exposure devices and storage containers to assure proper functioning of components important to safety.

b. Possession of radioactive materials in unsealed form on foils or plated sources or sealed in glass in excess of the quantities in Schedule E "quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release". In addition to the requirements set forth in subsection 2, a specific license for the possession of large quantities of radioactive materials in unsealed form on foils or plated sources or sealed in glass will be issued if either of the following are submitted and approved by the department:

- (1) An evaluation showing that the maximum dose to a person offsite due to a release of radioactive materials should not exceed one rem effective dose equivalent or five rems to the thyroid; or
- (2) An emergency plan for responding to a release of radioactive material.
- (3) One or more of the following factors may be used to support an evaluation submitted under paragraph 1:
 - (a) The radioactive material is physically separated so that only a portion could be involved in an accident;
 - (b) All or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;
 - (c) The release fraction in the respirable size range would be lower than the release fraction shown in Schedule E due to the chemical or physical form of material;

- (d) The solubility of the radioactive material would reduce the dose received;
 - (e) Facility design or engineered safety features in the facility would cause the release fraction to be lower than shown in Schedule E;
 - (f) Operating restrictions or procedures would prevent a release fraction as large as that shown in Schedule E; or
 - (g) Other factors appropriate for the specific facility.
- (4) An emergency plan for responding to a release of radioactive material submitted under paragraph 2 must include the following information:
- (a) Facility description. A brief description of the licensee's facility and area near the site.
 - (b) Types of accidents. An identification of each type of radioactive materials accident for which protective actions may be needed.
 - (c) Classification of accidents. A classification system for classifying accidents as alerts or site area emergencies.
 - (d) Detection of accidents. Identification of the means of detecting each type of accident in a timely manner.
 - (e) Mitigation of consequences. A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.
 - (f) Assessment of releases. A brief description of the methods and equipment to assess releases of radioactive materials.
 - (g) Responsibilities. A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying offsite response organizations and the department; also responsibilities for developing, maintaining, and updating the plan.

- (h) Notification and coordination. A commitment to a brief description of the means to promptly notify offsite response organizations and request offsite assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point must be established. The notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the department immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency.
- (i) Information to be communicated. A brief description of the type of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to offsite response organizations and to the department.
- (j) Training. A brief description of the frequency, performance objectives, and plans for the training that the licensee will provide workers on how to respond to an emergency including any special instructions and orientation tours the licensee would offer to fire, police, medical, and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.
- (k) Safe shutdown. A brief description of the means of restoring the facility to a safe condition after an accident.
- (l) Exercises. Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with offsite response organizations must include the check and update of all necessary telephone numbers. The licensee shall invite offsite response organizations to participate in the biennial exercises. Participation of offsite response

organizations in biennial exercises although recommended is not required. Exercises must use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises must evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques must be corrected.

(m) Hazardous chemicals. A certification that the applicant has met its responsibilities under the Emergency Planning and Community Right-to-Know Act of 1986, title III, Pub. L. 99-499, if applicable to the applicant's activities at the proposed place of use of the byproduct material.

(5) The licensee shall allow the offsite response organizations expected to respond in case of an accident sixty days to comment on the licensee's emergency plan before submitting it to the department. The licensee shall provide any comments received within the sixty days to the department with the emergency plan.

4. Special requirements for specific licenses of broad scope. This subsection prescribes requirements for the issuance of specific licenses of broad scope for radioactive material and certain rules governing holders of such licenses. (Authority to transfer possession or control by the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing byproduct material whose subsequent possession, use, transfer, and disposal by all other persons are exempted from regulatory requirements may be obtained only from the United States nuclear regulatory commission, Washington, D.C. 20555.)

a. The different types of broad licenses are set forth below:

(1) A "type A specific license of broad scope" is a specific license authorizing receipt, acquisition, ownership, possession, use, and transfer of any chemical or physical form of the radioactive material specified in the license, but not exceeding quantities specified in the license, for any authorized purpose. The quantities specified are usually in the multicurie range.

- (2) A "type B specific license of broad scope" is a specific license authorizing receipt, acquisition, ownership, possession, use, and transfer of any chemical or physical form of radioactive material specified in Schedule C, for any authorized purpose. The possession limit for a type B license of broad scope, if only one radionuclide is possessed thereunder, is the quantity specified for that radionuclide in Schedule C, column I. If two or more radionuclides are possessed thereunder, the possession limit for each is determined as follows: For each radionuclide, determine the ratio of the quantity possessed to the applicable quantity specified in Schedule C, column I, for that radionuclide. The sum of the ratios for all radionuclides possessed under the license shall not exceed unity.
 - (3) A "type C specific license of broad scope" is a specific license authorizing receipt, acquisition, ownership, possession, use, and transfer of any chemical or physical form of radioactive material specified in Schedule C, for any authorized purpose. The possession limit for a type C license of broad scope, if only one radionuclide is possessed thereunder, is the quantity specified for that radionuclide in Schedule C, column II. If two or more radionuclides are possessed thereunder, the possession limit is determined for each as follows: For each radionuclide determine the ratio of the quantity possessed to the applicable quantity specified in Schedule C, column II, for that radionuclide. The sum of the ratios for all radionuclides possessed under the license shall not exceed unity.
- b. An application for a type A specific license of broad scope will be approved if all of the following are met:
- (1) The applicant satisfies the general requirements specified in subsection 2.
 - (2) The applicant has engaged in a reasonable number of activities involving the use of radioactive material.
 - (3) The applicant has established administrative controls and provisions relating to organization and management, procedures, recordkeeping, material control and accounting, and management review that are necessary to assure safe operations, including:
 - (a) The establishment of a radiation safety committee composed of such persons as a

radiation safety officer, a representative of management, and persons trained and experienced in the safe use of radioactive material.

(b) The appointment of a radiation safety officer who is qualified by training and experience in radiation protection, and who is available for advice and assistance on radiation safety matters.

(c) The establishment of appropriate administrative procedures to assure:

[1] Control of procurement and use of radioactive material.

[2] Completion of safety evaluations of proposed uses of radioactive material which take into consideration such matters as the adequacy of facilities and equipment, training and experience of the user, and the operating or handling procedures.

[3] Review, approval, and recording by the radiation safety committee of safety evaluation of proposed uses prepared in accordance with item 2 of this subparagraph prior to use of the radioactive material.

c. An application for a type B specific license of broad scope will be approved if all of the following are met:

(1) The applicant satisfies the general requirements specified in subsection 2.

(2) The applicant has established administrative controls and provisions relating to organization and management, procedures, recordkeeping, material control and accounting, and management review that are necessary to assure safe operations, including:

(a) The appointment of a radiation safety officer who is qualified by training and experience in radiation protection, and who is available for advice and assistance on radiation safety matters.

(b) The establishment of appropriate administrative procedures to assure:

[1] Control of procurement and use of radioactive material.

[2] Completion of safety evaluations of proposed uses of radioactive material which take into consideration such matters as the adequacy of facilities and equipment, training and experience of the user, and the operating or handling procedures.

[3] Review, approval, and recording by the radiation safety officer of safety evaluations of proposed uses prepared in accordance with item 2 of this subparagraph prior to use of the radioactive material.

d. An application for a type C specific license of broad scope will be approved if all of the following are met:

(1) The applicant satisfies the general requirements specified in subsection 2.

(2) The applicant submits a statement that radioactive material will be used only by, or under the direct supervision of, individuals who have received all of the following:

(a) A college degree at the bachelor level, or equivalent training and experience, in the physical or biological sciences or in engineering.

(b) At least forty hours of training and experience in the safe handling of radioactive material, and in the characteristics of ionizing radiation, units of radiation dose and quantities, radiation detection instrumentation, and biological hazards of exposure to radiation appropriate to the type and forms of radioactive material to be used.

(3) The applicant has established administrative controls and provisions relating to procurement of radioactive material, procedures, recordkeeping, material control and accounting, and management review necessary to assure safe operations.

e. Specific licenses of broad scope are subject to the following conditions:

(1) Unless specifically authorized, persons licensed pursuant to this subsection shall not:

(a) Conduct tracer studies in the environment involving direct release of radioactive material.

- (b) Receive, acquire, own, possess, use, or transfer devices containing one hundred thousand curies [3.7 petabecquerels] or more of radioactive material in sealed sources used for irradiation of materials.
 - (c) Conduct activities for which a specific license issued by the department under subsection 3 or 5 subdivision a of subsection 3, subsection 5, or chapter 33-10-07, is required.
 - (d) Add or cause the addition of radioactive material to any food, beverage, cosmetic, drug, or other product designed for ingestion or inhalation by, or application to, a human being.
- (2) Each type A specific license of broad scope issued under this subsection shall be subject to the condition that radioactive material possessed under the license may only be used by, or under the direct supervision of, individuals approved by the licensee's radiation safety committee.
 - (3) Each type B specific license of broad scope issued under this subsection shall be subject to the condition that radioactive material possessed under the license may only be used by, or under the direct supervision of, individuals approved by the licensee's radiation safety officer.
 - (4) Each type C specific license of broad scope issued under this subsection shall be subject to the condition that radioactive material possessed under the license may only be used by, or under the direct supervision of, individuals who satisfy the requirements of subdivision d.
5. Special requirements for specific license to manufacture, assemble, repair, or distribute commodities, products, or devices which contain radioactive material.
- a. Licensing the introduction of radioactive material into products in exempt concentrations.
 - (1) In addition to the requirements set forth in subsection 2, a specific license authorizing the introduction of radioactive material into a product or material owned by or in the possession of the licensee or another to be transferred to persons exempt under paragraph 1 of subdivision a of subsection 2 of section 33-10-03-02 will be issued if:

(a) The applicant submits a description of the product or material into which the radioactive material will be introduced, intended use of the radioactive material and the product or material into which it is introduced, method of introduction, initial concentration of the radioactive material in the product or material, control methods to assure that no more than the specified concentration is introduced into the product or material, estimated time interval between introduction and transfer of the product or material, and estimated concentration of the radioactive material in the product or material at the time of transfer.

(b) The applicant provides reasonable assurance that the concentrations of radioactive material at the time of transfer will not exceed the concentrations in Schedule A, that reconcentration of the radioactive material in concentrations exceeding those in Schedule A is not likely, that use of lower concentrations is not feasible, and that the product or material is not likely to be incorporated in any food, beverage, cosmetic, drug or other commodity or product designed for ingestion or inhalation by, or application to, a human being.

(2) Each person licensed under this subsection shall file an annual report with the department which shall identify the type and quantity of each product or material into which radioactive material has been introduced during the reporting period; name and address of the person who owned or possessed the product or material, into which radioactive material has been introduced, at the time of introduction; the type and quantity of radionuclide introduced into each such product or material; and the initial concentrations of the radionuclide in the product or material at time of transfer of the radioactive material by the licensee. If no transfers of the radioactive material have been made pursuant to this subdivision during the reporting period, the report shall so indicate. The report shall cover the year ending June thirtieth, and shall be filed within thirty days thereafter.

b. Licensing the distribution of radioactive material in exempt quantities. (Authority to transfer possession or control by the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing byproduct material whose subsequent possession, use, transfer, and disposal by all other persons are exempted

from regulatory requirements may be obtained only from the United States nuclear regulatory commission, Washington, D.C. 20555.)

- (1) An application for a specific license to distribute naturally occurring and accelerator-produced radioactive material to persons exempted from this article pursuant to subdivision b of subsection 2 of section 33-10-03-02 will be approved if all of the following are met:
 - (a) The radioactive material is not contained in any food, beverage, cosmetic, drug, or other commodity designed for ingestion or inhalation by, or application to, a human being.
 - (b) The radioactive material is in the form of processed chemical elements, compounds, or mixtures, tissue samples, bioassay samples, counting standards, plated or encapsulated sources, or similar substances, identified as radioactive and to be used for its radioactive properties, but is not incorporated into any manufactured or assembled commodity, product, or device intended for commercial distribution.
 - (c) The applicant submits copies of prototype labels and brochures and the department approves such labels and brochures.
- (2) The license issued under paragraph 1 is subject to the following conditions:
 - (a) No more than ten exempt quantities shall be sold or transferred in any single transaction. However, an exempt quantity may be composed of fractional parts of one or more of the exempt quantity provided the sum of the fractions shall not exceed unity.
 - (b) Each exempt quantity shall be separately and individually packaged. No more than ten such packaged exempt quantities shall be contained in any outer package for transfer to persons exempt pursuant to subdivision b of subsection 2 of section 33-10-03-02. The outer package shall be such that the dose rate at the external surface of the package does not exceed one-half millirem [5 microsieverts] per hour.
 - (c) The immediate container of each quantity or separately packaged fractional quantity of radioactive material shall bear a durable,

legible label which (1) identifies the radionuclide and the quantity of radioactivity, and (2) bears the words "radioactive material".

(d) In addition to the labeling information required by subparagraph c, the label affixed to the immediate container, or an accompanying brochure, shall (1) state that the contents are exempt from licensing state requirements; (2) bear the words "radioactive material - not for human use - introduction into foods, beverages, cosmetics, drugs, or medicinals, or into products manufactured for commercial distribution is prohibited - exempt quantities should not be combined"; and (3) set forth appropriate additional radiation safety precautions and instructions relating to the handling, use, storage, and disposal of the radioactive material.

(3) Each person licensed under this subdivision shall maintain records identifying, by name and address, each person to whom radioactive material is transferred for use under subdivision b of subsection 2 of section 33-10-03-02 or the equivalent regulations of a licensing state, and stating the kinds and quantities of radioactive material transferred. An annual summary report stating the total quantity of each radionuclide transferred under the specific license shall be filed with the department. Each report shall cover the year ending June thirtieth, and shall be filed within thirty days thereafter. If no transfers of radioactive material have been made pursuant to this subdivision during the reporting period, the report shall so indicate.

c. Licensing the incorporation of naturally occurring and accelerator-produced radioactive material into gas and aerosol detectors. An application for a specific license authorizing the incorporation of naturally occurring and accelerator-produced radioactive material into gas and aerosol detectors to be distributed to persons exempt under paragraph 3 of subdivision c of subsection 2 of section 33-10-03-02 will be approved if the application satisfies requirements equivalent to those contained in 10 CFR 32.26. The maximum quantity of radium-226 in each device may not exceed one-tenth microcurie [3.7 kilobecquerels].

d. Licensing the manufacture and distribution of devices to persons generally licensed under subdivision b of subsection 2 of section 33-10-03-04.

(1) An application for a specific license to manufacture or distribute devices containing radioactive material, excluding special nuclear material, to persons generally licensed under subdivision b of subsection 2 of section 33-10-03-04 or equivalent regulations of the United States nuclear regulatory commission, an agreement state, or a licensing state will be approved if:

(a) The applicant satisfies the general requirements of subsection 2 of this section.

(b) The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control, labels, proposed uses, installation, servicing, leak testing, operating and safety instructions, and potential hazards of the device to provide reasonable assurance that:

[1] The device can be safely operated by persons not having training in radiological protection.

[2] Under ordinary conditions of handling, storage, and use of the device, the radioactive material contained in the device will not be released or inadvertently removed from the device, and it is unlikely that any person will receive in any period of one calendar quarter year a dose in excess of ten percent of the limits specified in the table of subdivision a of subsection 1 of section ~~33-10-04-02~~ 33-10-04.1-06.

[3] Under accident conditions such as fire and explosion associated with handling, storage, and use of the device, it is unlikely that any person would receive an external radiation dose or dose commitment in excess of the following organ doses:

- [a] Whole body; head and trunk; active blood-forming organs; gonads; or lens of eye 15 rems [150 milli-sieverts]
- [b] Hands and forearms; feet and ankles; localized areas of skin averaged over areas no larger than one square centimeter 200 rems [2 sieverts]
- [c] Other organs 50 rems [500 milli-sieverts]

(c) Each device bears a durable, legible, clearly visible label or labels approved by the department, which contain in a clearly identified and separate statement:

- [1] Instructions and precautions necessary to assure safe installation, operation, and servicing of the device; documents such as operating and service manuals may be identified in the label and used to provide this information.
- [2] The requirement, or lack of requirement, for leak testing, or for testing any on-off mechanism and indicator, including the maximum time interval for such testing, and the identification of radioactive material by isotope, quantity of radioactivity, and date of determination of the quantity.
- [3] The information called for in one of the following statements, as appropriate, in the same or substantially similar form:
 - [a] The receipt, possession, use, and transfer of this device Model _____, Serial No. _____, are subject to a general license or the equivalent and the regulations of the United States nuclear regulatory commission or a state with which the United States nuclear regulatory commission has entered into an agreement for the exercise of regulatory authority. (The model, serial number, and name of manufacturer or distributor may be

omitted from this label provided the information is elsewhere specified in labeling affixed to the device.) This label shall be maintained on the device in a legible condition. Removal of this label is prohibited.

CAUTION-RADIOACTIVE MATERIAL

(name of manufacturer or distributor)

- [b] The receipt, possession, use, and transfer of this device Model _____, Serial No. _____, are subject to a general license or the equivalent and the regulations of a licensing state. (The model, serial number, and name of manufacturer or distributor may be omitted from this label provided the information is elsewhere specified in labeling affixed to the device.) This label shall be maintained on the device in a legible condition. Removal of this label is prohibited.

CAUTION-RADIOACTIVE MATERIAL

(name of manufacturer or distributor)

- (2) In the event the applicant desires that the device be required to be tested at intervals longer than six months, either for proper operation of the on-off mechanism and indicator, if any, or for leakage of radioactive material or for both, the applicant shall include in the application sufficient information to demonstrate that such longer interval is justified by performance characteristics of the device or similar devices and by design features which have a significant bearing on the probability or consequences of leakage of radioactive material from the device or failure of the on-off mechanism and indicator. In determining the acceptable interval for the test for leakage of radioactive material, the department will consider information which includes, but is not limited to:
- (a) Primary containment or source capsule.
 - (b) Protection of primary containment.
 - (c) Method of sealing containment.

- (d) Containment construction materials.
 - (e) Form of contained radioactive material.
 - (f) Maximum temperature withstood during prototype test.
 - (g) Maximum pressure withstood during prototype tests.
 - (h) Maximum quantity of contained radioactive material.
 - (i) Radiotoxicity of contained radioactive material.
 - (j) Operating experience with identical devices or similarly designed and constructed devices.
- (3) In the event the applicant desires that the general licensee under subdivision b of subsection 2 of section 33-10-03-04, or under equivalent regulations of the United States nuclear regulatory commission, an agreement state, or a licensing state, be authorized to install the device, collect the sample to be analyzed by a specific licensee for leakage of radioactive material, service the device, test the on-off mechanism and indicator, or remove the device from installation, the applicant shall include in the application written instructions to be followed by the general licensee, estimated calendar quarter doses associated with such activity or activities, and basis for such estimates. The submitted information shall demonstrate that performance of such activity or activities by an individual untrained in radiological protection, in addition to other handling, storage, and use of devices under the general license, is unlikely to cause that individual to receive a calendar ~~quarter~~ year dose in excess of ten percent of the limits specified in ~~the table in subdivision a of subsection 1 of section 33-10-04-02~~ 33-10-04.1-06.
- (4) Each person licensed under subdivision d to distribute devices to generally licensed persons shall:
- (a) Furnish a copy of the general license contained in subdivision b of subsection 2 of section 33-10-03-04 to each person to whom the person directly or through an intermediate person transfers radioactive material in a device for use pursuant to the general license contained in

subdivision b of subsection 2 of section 33-10-03-04.

- (b) Furnish a copy of the general license contained in the United States nuclear regulatory commission's, agreement state's, or licensing state's regulation equivalent to subdivision b of subsection 2 of section 33-10-03-04, or alternatively, furnish a copy of the general license contained in subdivision b of subsection 2 of section 33-10-03-04 to each person to whom the person directly or through an intermediate person transfers radioactive material in a device for use pursuant to the general license of the United States nuclear regulatory commission, the agreement state, or the licensing state. If a copy of the general license in subdivision b of subsection 2 of section 33-10-03-04 is furnished to such a person, it shall be accompanied by a note explaining that the use of the device is regulated by the United States nuclear regulatory commission, agreement state or licensing state under requirements substantially the same as those in subdivision b of subsection 2 of section 33-10-03-04.
- (c) Report to the department all transfers of such devices to persons for use under the general license in subdivision b of subsection 2 of section 33-10-03-04. Such report shall identify each general licensee by name and address, an individual by name or position who may constitute a point of contact between the department and the general licensee, the type and model number of device transferred, and the quantity and type of radioactive material contained in the device. If one or more intermediate persons will temporarily possess the device at the intended place of use prior to its possession by the user, the report shall include identification of each intermediate person by name, address, contact, and relationship to the intended user. If no transfers have been made to persons generally licensed under subdivision b of subsection 2 of section 33-10-03-04 during the reporting period, the report shall so indicate. The report shall cover each calendar quarter and shall be filed within thirty days thereafter.
- (d) Furnish reports to other agencies.

- [1] Report to the United States nuclear regulatory commission all transfers of such devices to persons for use under the United States nuclear regulatory commission general license in 10 CFR 31.5.
 - [2] Report to the responsible state agency all transfers of devices manufactured and distributed pursuant to subdivision d for use under a general license in that state's regulations equivalent to subdivision b of subsection 2 of section 33-10-03-04.
 - [3] Such reports shall identify each general licensee by name and address, an individual by name or position who may constitute a point of contact between the department and the general licensee, the type and model of the device transferred, and the quantity and type of radioactive material contained in the device. If one or more intermediate persons will temporarily possess the device at the intended place of use prior to its possession by the user, the report shall include identification of each intermediate person by name, address, contact, and relationship to the intended user. The report shall be submitted within thirty days after the end of each calendar quarter in which such a device is transferred to the generally licensed person.
 - [4] If no transfers have been made to United States nuclear regulatory commission licensees during the reporting period, this information shall be reported to the United States nuclear regulatory commission.
 - [5] If no transfers have been made to general licensees within a particular state during the reporting period, this information shall be reported to the responsible state agency upon request of the agency.
- (e) Keep records showing the name, address, and the point of contact for each general licensee to whom the licensee directly or through an intermediate person transfers radioactive material in devices for use pursuant to the general license provided in subdivision b of subsection 2 of section 33-10-03-04, or equivalent regulations of the United States

nuclear regulatory commission or an agreement state or a licensing state. The records should show the date of each transfer, the radionuclide and the quantity of radioactivity in each device transferred, the identity of any intermediate person, and compliance with the report requirements of this paragraph.

- e. Special requirements for the manufacture, assembly, or repair of luminous safety devices for use in aircraft. An application for a specific license to manufacture, assemble, or repair luminous safety devices containing tritium or promethium-147 for use in aircraft, for distribution to persons generally licensed under subdivision c of subsection 2 of section 33-10-03-04 will be approved if:
 - (1) The applicant satisfies the general requirements specified in subsection 2 of this section.
 - (2) The applicant satisfies the requirements of 10 CFR 32.53, 32.54, 32.55, 32.56, and 32.101 or their equivalent.

- f. Special requirements for license to manufacture calibration sources containing americium-241, plutonium, or radium-226 for distribution to persons generally licensed under subdivision e of subsection 2 of section 33-10-03-04. An application for a specific license to manufacture calibration and reference sources containing americium-241, plutonium, or radium-226 to persons generally licensed under subdivision e of subsection 2 of section 33-10-03-04 will be approved if:
 - (1) The applicant satisfies the general requirement of subsection 2 of this section.
 - (2) The applicant satisfies the requirements of 10 CFR 32.57, 32.58, 32.59, and 32.102 and 10 CFR 70.39 or their equivalent.

- g. Manufacture and distribution of radioactive material for certain in vitro clinical or laboratory testing under general license. An application for a specific license to manufacture or distribute radioactive material for use under the general license of subdivision f of subsection 2 of section 33-10-03-04 will be approved if:
 - (1) The applicant satisfies the general requirements specified in subsection 2 of this section.
 - (2) The radioactive material is to be prepared for distribution in prepackaged units of:

- (a) Carbon-14 in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (b) Cobalt-57 in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (c) Hydrogen-3 (tritium) in units not exceeding fifty microcuries [1.85 megabecquerels] each.
 - (d) Iodine-125 in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (e) Mock iodine-125 in units not exceeding five-hundredths microcurie [1.85 kilobecquerels] of iodine-129 and five-thousandths microcurie [185 becquerels] of americium-241 each.
 - (f) Iodine-131 in units not exceeding ten microcuries [370 kilobecquerels] each.
 - (g) Iron-59 in units not exceeding twenty microcuries [740 kilobecquerels] each.
 - (h) Selenium-75 in units not exceeding ten microcuries [370 kilobecquerels] each.
- (3) Each prepackaged unit bears a durable, clearly visible label:
- (a) Identifying the radioactive contents as to chemical form and radionuclide, and indicating that the amount of radioactivity does not exceed ten microcuries [370 kilobecquerels] of iodine-125, iodine-131, carbon-14, cobalt-57, or selenium-75; fifty microcuries [1.85 megabecquerels] of hydrogen-3 (tritium); twenty microcuries [740 kilobecquerels] of iron-59; or mock iodine-125 in units not exceeding five-hundredths microcurie [1.85 kilobecquerels] of iodine-129 and five-thousandths microcurie [185 becquerels] of americium-241 each.
 - (b) Displaying the radiation caution symbol described in ~~paragraph~~ ~~of~~ subdivision a of subsection ~~3~~ 1 of section ~~33-10-04-03~~ 33-10-04.1-13 and the words, "CAUTION, RADIOACTIVE MATERIAL", and "Not for Internal or External Use in Humans or Animals".
- (4) One of the following statements, as appropriate, or a substantially similar statement which contains the information called for in the following statements, appears on a label affixed to each prepackaged unit

or appears in a leaflet or brochure which accompanies the package:

- (a) This radioactive material may be received, acquired, possessed, and used only by physicians, veterinarians, clinical laboratories, or hospitals and only for in vitro clinical or laboratory tests not involving internal or external administration of the material, or the radiation therefrom, to human beings or animals. Its receipt, acquisition, possession, use, and transfer are subject to this article and a general license of the United States nuclear regulatory commission or of a state with which the commission has entered into an agreement for the exercise of regulatory authority.

Name of manufacturer

- (b) This radioactive material may be received, acquired, possessed, and used only by physicians, veterinarians, clinical laboratories, or hospitals and only for in vitro clinical or laboratory tests not involving internal or external administration of the material, or the radiation therefrom, to human beings or animals. Its receipt, acquisition, possession, use, and transfer are subject to this article and a general license of a licensing state.

Name of manufacturer

- (5) The label affixed to the unit, or the leaflet or brochure which accompanies the package, contains adequate information as to the precautions to be observed in handling and storing such radioactive material. In the case of the mock iodine-125 reference or calibration source, the information accompanying the source must also contain directions to the licensee regarding the waste disposal requirements set out in subsection 1 of section ~~33-10-04-04~~ 33-10-04.1-14.

- h. Licensing the manufacture and distribution of ice detection devices. An application for a specific license to manufacture and distribute ice detection devices to persons generally licensed under subdivision g of subsection 2 of section 33-10-03-04 will be approved if:
- (1) the applicant satisfies the general requirements of

subsection 2 of this section and, (2) the criteria of 10 CFR 32.61, 32.62, and 32.103 are met.

i. Manufacture and distribution of radiopharmaceuticals containing radioactive material for medical use under group licenses.

(1) An application for a specific license to manufacture and distribute radiopharmaceuticals containing radioactive material for use by persons licensed pursuant to this chapter for the uses listed in subsection 1 of section 33-10-07-06, subsection 1 of section 33-10-07-07, or subsection 1 of section 33-10-07-08 will be approved if:

(a) The applicant satisfies the general requirements specified in subsection 2.

(b) The applicant submits evidence that:

[1] The radiopharmaceutical containing radioactive material will be manufactured, labeled, and packed in accordance with the Federal Food, Drug, and Cosmetic Act or the Public Health Service Act, such as a new drug application approved by the United States food and drug administration or a "Notice of Claimed Investigational Exemption for a New Drug" that has been accepted by the United States food and drug administration; or

[2] The manufacture and distribution of the radiopharmaceutical containing radioactive material is not subject to the Federal Food, Drug, and Cosmetic Act and the Public Health Service Act.

(c) The applicant submits information on the radionuclide, chemical and physical form, packaging including maximum activity per package, and shielding provided by the packaging of the radioactive material which is appropriate for safe handling and storage of radiopharmaceuticals by group licensees.

(d) [1] The label affixed to each package of the radiopharmaceutical contains information on the radionuclide, quantity, and date of assay and the label affixed to each package, or the leaflet or brochure which accompanies each package, contains a statement that the radiopharmaceutical is

licensed by the department for distribution to persons licensed pursuant to this chapter for the uses listed in subsection 1 of section 33-10-07-06, subsection 1 of section 33-10-07-07, and subsection 1 of section 33-10-07-08, or under equivalent licenses of the United States nuclear regulatory commission, an agreement state, or a licensing state.

[2] The labels, leaflets, or brochures required by this subparagraph are in addition to the labeling required by the United States food and drug administration and they may be separate from or, with the approval of the United States food and drug administration, may be combined with the labeling required by the United States food and drug administration.

- j. Manufacture and distribution of generators or reagent kits for preparation of radiopharmaceuticals containing radioactive material. An application for a specific license to manufacture and distribute generators or reagent kits containing radioactive material for preparation of radiopharmaceuticals by persons licensed pursuant to this chapter for the uses listed in subsection 1 of section 33-10-07-07 will be approved if:
- (1) The applicant satisfies the general requirements specified in subsection 2.
 - (2) The applicant submits evidence that:
 - (a) The generator or reagent kit is to be manufactured, labeled, and packaged in accordance with the Federal Food, Drug, and Cosmetic Act or the Public Health Service Act, such as a new drug application approved by the United States food and drug administration, or a "Notice of Claimed Investigational Exemption for a New Drug" that has been accepted by the United States food and drug administration; or
 - (b) The manufacture and distribution of the generator or reagent kit are not subject to the Federal Food, Drug, and Cosmetic Act and the Public Health Service Act.
 - (3) The applicant submits information on the radionuclide, chemical and physical form, packaging including maximum activity per package, and shielding

provided by the packaging of the radioactive material contained in the generator or reagent kit.

- (4) The label affixed to the generator or reagent kit contains information on the radionuclide, quantity, and date of assay.
- (5) The label affixed to the generator or reagent kit, or the leaflet or brochure which accompanies the generator or reagent kit, contains:
 - (a) Adequate information, from a radiation safety standpoint, on the procedures to be followed and the equipment and shielding to be used in eluting the generator or processing radioactive material with the reagent kit.
 - (b) A statement that this generator or reagent kit (as appropriate) is approved for use by persons licensed by the department pursuant to subsection 1 of section 33-10-07-07 or under equivalent licenses of the United States nuclear regulatory commission, an agreement state, or a licensing state. The labels, leaflets, or brochures required by this subdivision are in addition to the labeling required by the United States food and drug administration and they may be separate from or, with the approval of the United States food and drug administration, may be combined with the labeling required by the United States food and drug administration.

Note: Although the department does not regulate the manufacture and distribution of reagent kits that do not contain radioactive material, it does regulate the use of such reagent kits for the preparation of radiopharmaceuticals containing radioactive material as part of its licensing and regulation of the users of radioactive material. Any manufacturer of reagent kits that do not contain radioactive material who desires to have the reagent kits approved by the department for use by persons licensed pursuant to subsection 1 of section 33-10-07-07 may submit the pertinent information specified in this subdivision.

- k. Manufacture and distribution of sources or devices containing radioactive material for medical use. An application for a specific license to manufacture and distribute sources and devices containing radioactive material to persons licensed pursuant to chapter 33-10-07 for use as a calibration or reference source or for the uses listed in subsection 1 of section 33-10-07-09 and subsection 1 of section 33-10-07-10 will be approved if:

- (1) The applicant satisfies the general requirements in subsection 2.
- (2) The applicant submits sufficient information regarding each type of source or device pertinent to an evaluation of its radiation safety, including:
 - (a) The radioactive material contained, its chemical and physical form, and amount.
 - (b) Details of design and construction of the source or device.
 - (c) Procedures for, and results of, prototype tests to demonstrate that the source or device will maintain its integrity under stresses likely to be encountered in normal use and accidents.
 - (d) For devices containing radioactive material, the radiation profile of a prototype device.
 - (e) Details of quality control procedures to assure that production sources and devices meet the standards of the design and prototype tests.
 - (f) Procedures and standards for calibrating sources and devices.
 - (g) Legend and methods for labeling sources and devices as to their radioactive content.
 - (h) Instructions for handling and storing the source or device from the radiation safety standpoint; these instructions are to be included on a durable label attached to the source or device or attached to a permanent storage container for the source or device; provided, that instructions which are too lengthy for such label may be summarized on the label and printed in detail on a brochure which is referenced on the label.
- (3) The label affixed to the source or device, or to the permanent storage container for the source or device, contains information on the radionuclide, quantity, and date of assay, and a statement that the source or device is licensed by the department for distribution to persons licensed pursuant to chapter 33-10-07, subsection 1 of section 33-10-07-09, and subsection 1 of section 33-10-07-10, or under equivalent licenses of the United States nuclear regulatory commission, an agreement state, or a licensing state; provided, that such labeling for sources which do not require

long-term storage may be on a leaflet or brochure which accompanies the source.

- (4) If the applicant desires that the source or device be required to be tested for leakage of radioactive material at intervals longer than six months, the applicant shall include in the application sufficient information to demonstrate that such longer interval is justified by performance characteristics of the source or device or similar sources or devices and by design features that have a significant bearing on the probability or consequences of leakage of radioactive material from the source.
 - (5) In determining the acceptable interval for test of leakage of radioactive material, the department will consider information that includes, but is not limited to:
 - (a) Primary containment or source capsule.
 - (b) Protection of primary containment.
 - (c) Method of sealing containment.
 - (d) Containment construction materials.
 - (e) Form of contained radioactive material.
 - (f) Maximum temperature withstood during prototype tests.
 - (g) Maximum pressure withstood during prototype tests.
 - (h) Maximum quantity of contained radioactive material.
 - (i) Radiotoxicity of contained radioactive material.
 - (j) Operating experience with identical sources or devices or similarly designed and constructed sources or devices.
1. Requirements for license to manufacture and distribute industrial products containing depleted uranium for mass-volume applications.
 - (1) An application for a specific license to manufacture industrial products and devices containing depleted uranium for use pursuant to subdivision e of subsection 1 of section 33-10-03-04 or equivalent

regulations of the United States nuclear regulatory commission or an agreement state will be approved if:

- (a) The applicant satisfies the general requirements specified in subsection 2 of this section.
 - (b) The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control procedures, labeling or marking, proposed uses, and potential hazards of the industrial product or device to provide reasonable assurance that possession, use, or transfer of the depleted uranium in the product or device is not likely to cause any individual to receive in any period of one calendar ~~quarter~~ year a radiation dose in excess of ten percent of the limits specified in ~~the table in subdivision a of subsection 1 of section 33-10-04-02~~ 33-10-04.1-06.
 - (c) The applicant submits sufficient information regarding the industrial product or device and the presence of depleted uranium for a mass-volume application in the product or device to provide reasonable assurance that unique benefits will accrue to the public because of the usefulness of the product or device.
- (2) In the case of an industrial product or device whose unique benefits are questionable, the department will approve an application for a specific license under this subdivision only if the product or device is found to combine a high degree of utility and low probability of uncontrolled disposal and dispersal of significant quantities of depleted uranium into the environment.
 - (3) The department may deny any application for a specific license under this subdivision if the end uses of the industrial product or device cannot be reasonably foreseen.
 - (4) Each person licensed pursuant to paragraph 1 shall:
 - (a) Maintain the level of quality control required by the license in the manufacture of the industrial product or device, and in the installation of the depleted uranium into the product or device.
 - (b) Label or mark each unit to:

- [1] Identify the manufacturer of the product or device and the number of the license under which the product or device was manufactured, the fact that the product or device contains depleted uranium, and the quantity of depleted uranium in each product or device; and
 - [2] State that the receipt, possession, use, and transfer of the product or device are subject to a general license or the equivalent and the regulations of the United States nuclear regulatory commission or of an agreement state.
- (c) Assure that the depleted uranium before being installed in each product or device has been impressed with the following legend clearly legible through any plating or other covering: "Depleted Uranium".
- (d) [1] Furnish a copy of the general license contained in subdivision e of subsection 1 of section 33-10-03-04 and a copy of department Form RAD 811 to each person to whom the licensee transfers depleted uranium in a product or device for use pursuant to the general license contained in subdivision e of subsection 1 of section 33-10-03-04; or
- [2] Furnish a copy of the general license contained in the United States nuclear regulatory commission's or agreement state's regulation equivalent to subdivision e of subsection 1 of section 33-10-03-04 and a copy of the United States nuclear regulatory commission's or agreement state's certificate, or alternatively, furnish a copy of the general license contained in subdivision e of subsection 1 of section 33-10-03-04 and a copy of department Form RAD 811 to each person to whom the licensee transfers depleted uranium in a product or device for use pursuant to the general license of the United States nuclear regulatory commission or an agreement state, with a note explaining that use of the product or device is regulated by the United States nuclear regulatory commission or an agreement state under requirements substantially the same as those in

subdivision e of subsection 1 of section 33-10-03-04.

- (e) Report to the department all transfers of industrial products or devices to persons for use under the general licensee in subdivision e of subsection 1 of section 33-10-03-04. Such report must identify each general licensee by name and address, an individual by name and position who may constitute a point of contact between the department and the general licensee, the type and model number of device transferred, and the quantity of depleted uranium contained in the product or device. The report shall be submitted within thirty days after the end of each calendar quarter in which such a product or device is transferred to the generally licensed person. If no transfers have been made to persons generally licensed under subdivision e of subsection 1 of section 33-10-03-04 during the reporting period, the report shall so indicate.
- (f)
 - [1] Report to the United States nuclear regulatory commission all transfers of industrial products or devices to persons for use under the United States nuclear regulatory commission general license in 10 CFR 40.25.
 - [2] Report to the responsible state agency all transfers of devices manufactured and distributed pursuant to this subdivision for use under a general license in that state's regulations equivalent to subdivision e of subsection 1 of section 33-10-03-04.
 - [3] Such report shall identify each general licensee by name and address, an individual by name and position who may constitute a point of contact between the department and the general licensee, the type and model number of the device transferred, and the quantity of depleted uranium contained in the product or device. The report shall be submitted within thirty days after the end of each calendar quarter in which such product or device is transferred to the generally licensed person.
 - [4] If no transfers have been made to United States nuclear regulatory commission

licensees during the reporting period, this information shall be reported to the United States nuclear regulatory commission.

[5] If no transfers have been made to general licensees within a particular agreement state during the reporting period, this information shall be reported to the responsible agreement state agency upon the request of that agency.

(g) Keep records showing the name, address, and point of contact for each general licensee to whom the licensee transfers depleted uranium in industrial products or devices for use pursuant to the general license provided in subdivision e of subsection 1 of section 33-10-03-04 or equivalent regulations of the United States nuclear regulatory commission or of an agreement state. The records shall be maintained for a period of two years and shall show the date of each transfer, the quantity of depleted uranium in each product or device transferred, and compliance with the report requirements of this subsection.

m. Special requirements for issuance of specific licenses for source material milling. In addition to the requirements set forth in subsection 2, a specific license for source material milling will be issued if the applicant submits to the department a satisfactory application as described herein and meets the other conditions specified below:

(1) An application for a license to receive title to, receive, possess, and use source material for milling or byproduct material shall address the following:

(a) Description of the proposed project or action.

(b) Area/site characteristics including geology, topography, hydrology, and meteorology.

(c) Radiological and nonradiological impacts of the proposed project or action, including waterway and ground water impacts.

(d) Environmental effects of accidents.

(e) Long-term impacts including decommissioning, decontamination, and reclamation.

(f) Site and project alternatives.

(Note: In this paragraph, "byproduct material" means the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.)

- (2) Pursuant to subdivision f of subsection 2, the applicant may not commence construction of the project until the department has weighed the environmental, economic, technical, and other benefits against the environmental costs and has concluded that the issuance of the license is appropriate.
- (3) At least one full year prior to any major site construction, a preoperational monitoring program shall be conducted to provide complete baseline data on a milling site and its environs. Throughout the construction and operating phases of the mill, an operational monitoring program shall be conducted to measure or evaluate performance of control systems and procedures; to evaluate environmental impacts of operation; and to detect potential long-term effects.
- (4) Prior to issuance of the license, the mill operator shall establish financial surety arrangements consistent with the requirements of subdivision g of subsection 2.
 - (a) The amount of funds to be ensured by financial surety arrangements shall be based on department-approved cost estimates in an approved plan for decontamination and decommissioning of mill buildings and the milling site to levels which would allow unrestricted use of these areas upon decommissioning, and the reclamation of tailings and/or waste disposal areas. The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and that evaluates alternatives for mitigating these impacts. In establishing specific surety arrangements, the licensee's cost estimates shall take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work. In order to avoid unnecessary duplication and expense, the department may accept financial sureties that have been consolidated with financial surety arrangements established to meet requirements of other federal or state agencies and/or local governing

bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance, provided such arrangements are considered adequate to satisfy these requirements and that portion of the surety which covers the decommissioning and reclamation of the mill, mill tailings site and associated areas, and the long-term funding charge are clearly identified. The licensee's surety mechanism will be reviewed annually by the department to assure that sufficient funds will be available for completion of the reclamation plan if the work had to be performed by an independent contractor. The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs. Regardless of whether reclamation is phased through the life of the operation or takes place at the end of operations, an appropriate portion of surety liability shall be retained until final compliance with the reclamation plan is determined. This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning, decontamination, and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance could be provided with a surety instrument which is written for a specified period of time, e.g., five years, which must be automatically renewed unless the surety agent notifies the beneficiary (the state regulatory agency) and the principal (the licensee) some reasonable time, e.g., ninety days, prior to the renewal date of their intention not to renew. In such a situation, the surety requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief period of time to allow at least sixty days for the regulatory agency to collect.

- (b) The total amount of funds for reclamation or long-term surveillance and control shall be transferred to the United States if title and custody of such material and its disposal site is transferred to the United States upon termination of a license. Such funds include, but are not limited to, sums collected for

long-term surveillance and control. Such funds do not, however, include moneys held as surety where no default has occurred, and the reclamation or other bonded activity has been performed.

- (5) The applicant shall provide procedures describing the means employed to meet the following requirements during the operational phase of any project.
 - (a) Milling operations shall be conducted so that all effluent releases are reduced to as low as is reasonably achievable below the limits of chapter ~~33-10-04~~ 33-10-04.1.
 - (b) The mill operator shall conduct daily inspection of any tailings or waste retention systems. Records of such inspections shall be maintained for review by the department.
 - (c) The mill operator shall immediately notify the department of the following:
 - [1] Any failure in a tailings or waste retention system which results in a release of tailings or waste into unrestricted areas.
 - [2] Any unusual conditions (conditions not contemplated in the design of the retention system) which if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas.
- (6) Continued surveillance requirements for source material mills having reclaimed residues.
 - (a) The final disposition of tailings or wastes at source material milling sites should be such that the need for ongoing active maintenance is not necessary to preserve isolation. As a minimum, annual site inspections shall be conducted by the government agency retaining ultimate custody of the site where tailings or wastes are stored to confirm the integrity of the stabilized tailings or waste systems and to determine the need, if any, for maintenance and/or monitoring. Results of the inspection shall be reported to the United States nuclear regulatory commission within sixty days following each inspection. The United States nuclear regulatory commission may require more

frequent site inspections, if, on the basis of a site-specific evaluation, such a need appears necessary due to the features of a particular tailings or waste disposal system.

(b) A minimum charge of two hundred fifty thousand dollars in 1978 dollars to cover the costs of long-term surveillance shall be paid by each mill operator to the department prior to the termination of a uranium or thorium mill license. If site surveillance or control requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in subparagraph a, additional funding requirements may be specified by the department. The total charge to cover the costs of long-term surveillance shall be such that, with an assumed one percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The charge will be reviewed annually to recognize or adjust for inflation.

(7) An application for a license to own, receive, possess, and use byproduct material as defined in section 33-10-01-04 shall contain proposed specifications relating to the emissions control and disposition of the byproduct material to achieve the requirements and objectives set forth in the criteria listed in Schedule D of chapter 33-10-03.

6. Issuance of specific licenses.

a. Upon a determination that an application meets the requirements of North Dakota Century Code chapter 23-20.1 and this article, the department will issue a specific license authorizing the proposed activity in such form and containing such conditions and limitations as it deems appropriate or necessary.

b. The department may incorporate in any license at the time of issuance, or thereafter by appropriate rule or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of radioactive material subject to this chapter as it deems appropriate or necessary in order to:

(1) Minimize danger to public health and safety or property.

- (2) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be appropriate or necessary.
- (3) Prevent loss or theft of material subject to this chapter.

7. Specific terms and conditions of licenses.

- a. Each license issued pursuant to this chapter shall be subject to all the provisions of North Dakota Century Code chapter 23-20.1, now or hereafter in effect, and to all applicable rules and orders of the department.
- b. No license issued or granted under this chapter and no right to possess or utilize radioactive material granted by any license issued pursuant to this chapter shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person unless the department shall, after securing full information find that the transfer is in accordance with the provisions of North Dakota Century Code chapter 23-20.1, now or hereafter in effect, and to all valid rules and orders of the department, and shall give its consent in writing.
- c. Each person licensed by the department pursuant to this chapter shall confine use and possession of the material licensed to the locations and purposes authorized in the license.
- d. Licensees required to submit emergency plans under subdivision b of subsection 3 shall follow the emergency plan approved by the department. The licensee may change the proved plan without department approval only if the changes do not decrease the effectiveness of the plan. The licensee shall furnish the change to the department and to affected onsite response organizations within six months after the change is made. Proposed changes that decrease or potentially decrease the effectiveness of the approved emergency plan may not be implemented without prior application to and prior approval by the department.
- e. Each licensee shall notify the department in writing when the licensee decides to permanently discontinue all activities involving materials authorized under the license.
- ~~e.~~ f. Each licensee shall notify the department, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of

title 11 (bankruptcy) of the United States Code by or against:

- (1) The licensee;
- (2) An entity (as that term is defined in 11 U.S.C. 101(14) [Pub. L. 95-598; 92 Stat. 2549]) controlling the licensee or listing the license or licensee as property of the estate; or
- (3) An affiliate (as that term is defined in 11 U.S.C. 101(2) [Pub.L. 95-598; 92 Stat. 2549]) of the licensee.

This notification must indicate the bankruptcy court in which the petition for bankruptcy was filed and the date of the filing of the petition.

8. Expiration and termination of licenses.

- a. Except as provided in subdivision b of subsection 9, each specific license shall expire at the end of the specified day, in the month and year stated therein.
- b. Each licensee shall notify the department immediately, in writing, and request termination of the license when the licensee decides to terminate all activities involving radioactive material authorized under the license. This notification and request for termination of the license must include the required statement and radiation survey report specified in paragraph 1 of subdivision d and a plan for completion of decommissioning if required by license condition or by paragraph 4 of subdivision d.
- c. No less than thirty days before the expiration date specified in the license, the licensee shall either:
 - (1) Submit an application for license renewal under subsection 9; or
 - (2) Notify the department, in writing, if the licensee decides not to renew the license.
- d. (1) If a licensee does not submit an application for license renewal under subsection 9, the licensee shall, on or before the expiration date specified in the license:
 - (a) Terminate use of radioactive material;
 - (b) Remove radioactive contamination to the extent practicable;

- (c) Properly dispose of radioactive material;
- (d) Submit a statement certifying proper disposition of radioactive material using RCP Form 1; and
- (e) Submit a radiation survey report to confirm the absence of radioactive material or to establish the levels of residual radioactive contamination, unless the licensee demonstrates the absence of residual radioactive contamination in some other manner. The licensee shall, as appropriate:

[1] Report levels of radiation in units of microrads per hour of beta and gamma radiation at one centimeter and gamma radiation at one meter from surfaces and report levels of radioactivity, including alpha, in units of transformations per minute (or microcuries) for one hundred square centimeters removable and fixed on surfaces, microcuries per milliliter in water, and picocuries per gram in contaminated solids such as soils or concrete; and

[2] Specify the instrumentation used and certify that each instrument was properly calibrated and tested.

- (2) If no residual radioactive contamination attributable to activities conducted under the license is detected, the licensee shall submit a certification that no detectable radioactive contamination was found. The department will notify the licensee, in writing, of the termination of the license.
- (3) (a) If detectable levels of residual radioactive contamination attributable to activities conducted under the license are found, the license continues in effect beyond the expiration date, if necessary, with respect to possession of residual radioactive material present as contamination until the department notifies the licensee, in writing, that the license is terminated. During this time the licensee is subject to the provisions of subdivision e.
- (b) In addition to the required statement and radiation survey report submitted under subdivision d, the licensee shall submit a plan for decontamination, if required, as regards

residual radioactive contamination remaining at the time the license expires.

(4) (a) In addition to the information required under subparagraphs d and e of paragraph 1, the licensee shall submit a plan for completion of decommissioning if the procedures necessary to carry out decommissioning have not been previously approved by the department and could increase potential health and safety impacts to workers or to the public such as in any of the following cases:

[1] Procedures would involve techniques not applied routinely during cleanup or maintenance operations;

[2] Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation;

[3] Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

[4] Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

(b) Procedures with potential health and safety impacts may not be carried out prior to approval of the decommissioning plan.

(c) The proposed decommissioning plan, if required by subparagraph a or by license condition, must include:

[1] Description of planned decommissioning activities;

[2] Description of methods used to assure protection of workers and the environment against radiation hazards during decommissioning;

[3] A description of the planned final radiation survey;

[4] The information required in paragraph 3 of subdivision g of subsection 14, and any other information required by subdivision g of subsection 14 that is considered necessary to support the adequacy of the decommissioning plan for approval; and

[5] An updated detailed cost estimate for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and plan for assuring the availability of adequate funds for completion of decommissioning.

(d) The proposed decommissioning plan will be approved by the department if the information therein demonstrates that the decommissioning will be completed as soon as is reasonable and that the health and safety of workers and the public will be adequately protected.

(5) Upon approval of the decommissioning plan by the department, the licensee shall complete decommissioning in accordance with the approved plan. As a final step in decommissioning, the licensee shall again submit the information required in subparagraph e of paragraph 1, shall certify the disposition of accumulated wastes from decommissioning, and shall include a list containing the location and description of all equipment to remain onsite after license termination that was contaminated when final decommissioning was initiated.

e. Each licensee who possesses residual radioactive material under paragraph 3 of subdivision d, following the expiration date specified in the license shall:

(1) Limit actions involving radioactive material to those related to decontamination and other activities related to preparation for release for unrestricted use; and

(2) Continue to control entry to restricted areas until they are suitable for release for unrestricted use and the department notifies the licensee in writing that the license is terminated.

9. Renewal of licenses.

a. Applications for renewal of specific licenses shall be filed in accordance with subsection 1.

- b. In any case in which a licensee, not less than thirty days prior to expiration of the licensee's existing license, has filed an application in proper form for renewal or for a new license authorizing the same activities, such existing license shall not expire until final action by the department.
10. Amendment of licenses at request of licensee. Applications for amendment of a license shall be filed in accordance with subsection 1 and shall specify the respects in which the licensee desires the license to be amended and the grounds for such amendment.
11. Department action on applications to renew or amend. In considering an application by a licensee to renew or amend the license, the department will apply the criteria set forth in subsection 2, 3, 4, ~~or~~ 5, or 14, and chapters 33-10-05, 33-10-07, or 33-10-12, as applicable.
12. Transfer of material.
- a. No licensee shall transfer radioactive material except as authorized pursuant to this subsection.
 - b. Except as otherwise provided in one's license and subject to the provisions of subdivisions c and d, any licensee may transfer radioactive material:
 - (1) To the department. (A licensee may transfer material to the department only after receiving prior approval from the department.)
 - (2) To the United States department of energy.
 - (3) To any person exempt from this article to the extent permitted under such exemption.
 - (4) To any person authorized to receive such material under terms of a general license or its equivalent, or a specific license or equivalent licensing document, issued by the department, the United States nuclear regulatory commission, any agreement state, or any licensing state, or to any person otherwise authorized to receive such material by the federal government or any agency thereof, the department, an agreement state, or a licensing state.
 - (5) As otherwise authorized by the department in writing.
 - c. Before transferring radioactive material to a specific licensee of the department, the United States nuclear regulatory commission, an agreement state, or a licensing state, or to a general licensee who is required to

register with the department, the United States nuclear regulatory commission, an agreement state, or a licensing state prior to receipt of the radioactive material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred.

- d. Any of the following methods for the verification required by subdivision c is acceptable:
- (1) The transferor may possess and read, a current copy of the transferee's specific license or registration certificate.
 - (2) The transferor may possess a written certification by the transferee that the transferee is authorized by license or registration certificate to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or registration certificate number, issuing agency, and expiration date.
 - (3) For emergency shipments, the transferor may accept oral certification by the transferee that the transferee is authorized by license or registration certificate to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or registration certificate number, issuing agency, and expiration date; provided, that the oral certification is confirmed, in writing, within ten days.
 - (4) The transferor may obtain other information compiled by a reporting service from official records of the department, the United States nuclear regulatory commission, an agreement state, or a licensing state regarding the identity of licensees and the scope and expiration dates of licenses and registration.
 - (5) When none of the methods of verification described in paragraphs 1 through 4 are readily available or when a transferor desires to verify that information received by one of such methods is correct or up-to-date, the transferor may obtain and record confirmation from the department, the United States nuclear regulatory commission, an agreement state, or a licensing state that the transferee is licensed to receive the radioactive material.
- e. Shipment and transport of radioactive material shall be in accordance with the provisions of chapter 33-10-13.

13. Modification and revocation of licenses.

- a. The terms and conditions of all licenses shall be subject to amendment, revision, or modification or the license may be suspended or revoked by reason of amendments to North Dakota Century Code chapter 23-20.1, or by reason of this article, and orders issued by the department.
- b. Any license may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application or any statement of fact required under provisions of North Dakota Century Code chapter 23-20.1, or because of conditions revealed by such application or statement of fact or any report, record, or inspection or other means which would warrant the department to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and conditions of North Dakota Century Code chapter 23-20.1, or of the license, or of this article, or any order of the department.
- c. Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended, or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee, in writing, and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

14. Financial assurance and recordkeeping for decommissioning.

- a. Each applicant for a specific license authorizing the possession and use of unsealed radioactive material of half-life greater than one hundred twenty days and in quantities exceeding one hundred thousand times the applicable quantities set forth in Schedule F of this chapter shall submit a decommissioning funding plan as described in subdivision e. The decommissioning funding plan must also be submitted when a combination of isotopes is involved if R divided by one hundred thousand is greater than one (unity rule), where R is defined here as the sum of the ratios of the quantity of each isotope to the applicable value in Schedule F of this chapter.
- b. Each applicant for a specific license authorizing possession and use of radioactive material of half-life greater than one hundred twenty days and in quantities specified in subdivision d shall either:
 - (1) Submit a decommissioning funding plan as described in subdivision e; or

(2) Submit a certification that financial assurance for decommissioning has been provided in the amount prescribed by subdivision d using one of the methods described in subdivision f. For an applicant, this certification may state that the appropriate assurance will be obtained after the application has been approved and the license issued but prior to the receipt of licensed material. As part of the certification, a copy of the financial instrument obtained to satisfy the requirements of subdivision f is to be submitted to the department.

c. (1) Each holder of a specific license issued on or after January 1, 1994, which is of a type described in subdivision a or b, shall provide financial assurance for decommissioning in accordance with the criteria set forth in this subsection.

(2) Each holder of a specific license issued before January 1, 1994, and of a type described in subdivision a shall submit, on or before January 1, 1994, a decommissioning funding plan or a certification of financial assurance for decommissioning in an amount at least equal to seven hundred fifty thousand dollars in accordance with the criteria set forth in this subsection. If the licensee submits the certification of financial assurance rather than a decommissioning funding plan at this time, the licensee shall include a decommissioning funding plan in any application for license renewal.

(3) Each holder of a specific license issued before January 1, 1994, and of a type described in subdivision b shall submit, on or before January 1, 1994, a certification of financial assurance for decommissioning or a decommissioning funding plan in accordance with the criteria set forth in this subsection.

d. Table of required amounts of financial assurance for decommissioning by quantity of material.

Greater than ten thousand but less than or equal to one hundred thousand times the applicable quantities of Schedule F in unsealed form. (For a combination of isotopes, if R, as defined in subdivision a, divided by ten thousand is greater than one but R divided by one hundred thousand is less than or equal to one)

\$750,000

Greater than one thousand but less than or equal to ten thousand times the applicable quantities of Schedule F in unsealed form. (For a combination of isotopes, if R, as defined in subdivision a, divided by one thousand is greater than one but R divided by ten thousand is less than or equal to one)

\$150,000

Greater than ten billion times the applicable quantities of Schedule F in sealed sources or plated foils. (For a combination of isotopes, if R, as defined in subdivision a, divided by ten billion is greater than one)

\$75,000

e. Each decommissioning funding plan must contain a cost estimate for decommissioning and a description of the method of assuring funds for decommissioning from subdivision f, including means of adjusting cost estimates and associated funding levels periodically over the life of the facility.

f. Financial assurance for decommissioning must be provided by one or more of the following methods:

(1) Prepayment. Prepayment is the deposit prior to the start of operation into an account segregated from licensee assets and outside the licensee's administrative control of cash or liquid assets such that the amount of funds would be sufficient to pay decommissioning costs. Prepayment may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities.

(2) A surety method, insurance, or other guarantee method. These methods guarantee that decommissioning costs will be paid should the licensee default. A surety method may be in the form of a surety bond, letter of credit, or line of credit. A parent company guarantee of funds for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in Schedule G. A parent company guarantee may not be used in combination with other financial methods to satisfy the requirements of this subsection. Any surety method or insurance used to provide financial assurance for decommissioning must contain the following conditions:

- (a) The surety method or insurance must be open-ended or, if written for a specified term, such as five years, must be renewed automatically unless ninety days or more prior to the renewal date, the issuer notifies the department, the beneficiary, and the licensee of its intention not to renew. The surety method or insurance must also provide that the full face amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the department within thirty days after receipt of notification of cancellation.
- (b) The surety method or insurance must be payable to a trust established for decommissioning costs. The trustee and trust must be acceptable to the department. An acceptable trustee includes an appropriate state or federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a federal or state agency.
- (c) The surety method or insurance must remain in effect until the department has terminated the license.
- (3) An external sinking fund in which deposits are made at least annually, coupled with a surety method or insurance, the value of which may decrease by the amount being accumulated in the sinking fund. An external sinking fund is a fund established and maintained by setting aside funds periodically in an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities. The surety or insurance provisions must be as stated in paragraph 2 of subdivision f.
- (4) In the case of state or local government licensees, a statement of intent containing a cost estimate for decommissioning or an amount based on the table in subdivision d, and indicating that funds for decommissioning will be obtained when necessary.

g. Each person licensed shall keep records of information important to the safe and effective decommissioning of the facility in an identified location until the license is terminated by the department. If records of relevant information are kept for other purposes, reference to these records and their locations may be used. Information the department considers important to decommissioning consists of:

- (1) Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site. These records may be limited to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records must include any known information on identification of involved nuclides, quantities, forms, and concentrations.
- (2) As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used or stored, and of locations of possible inaccessible contamination such as buried pipes which may be subject to contamination. If required drawings are referenced, each relevant document need not be indexed individually. If drawings are not available, the licensee shall substitute appropriate records of available information concerning these areas and locations.
- (3) Except for areas containing only sealed sources (provided the sources have not leaked or no contamination remains after any leak) or radioactive materials having only half-lives of less than sixty-five days, a list contained in a single document and updated every two years, of the following:
 - (a) All areas designated and formerly designated as restricted areas as defined in section 33-10-01-04;
 - (b) All areas outside of restricted areas that require documentation under paragraph 1 of subdivision g;
 - (c) All areas outside of restricted areas where current and previous wastes have been buried as documented under subsection 9 of section 33-10-04.1-15; and

(d) All areas outside of restricted areas which contain material such that, if the license expired, the licensee would be required to either decontaminate the area to unrestricted release levels or apply for approval for disposal under subsection 2 of section 33-10-04.1-14.

(4) Records of the cost estimate performed for the decommissioning funding plan or of the amount certified for decommissioning, and records of the funding method used for assuring funds if either a funding plan or certification is used.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04, 23-20.1-04.1,
23-20.1-04.2

SCHEDULE D
CRITERIA RELATED TO THE DISPOSITION OF
URANIUM MILL TAILINGS OR WASTES

INTRODUCTION - As required by subdivision m of subsection 5 of section 33-10-03-05, each applicant for a license to possess and use source material in conjunction with uranium or thorium milling, or byproduct material at sites formerly associated with such milling, is required to include in a license application proposed specifications relating to milling operations and the disposition of tailings or waste resulting from such milling activities. This schedule establishes technical, financial, ownership, and long-term site surveillance criteria relating to the siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located. As used in this schedule the term "as low as is reasonably achievable" has the same meaning as in subsection 2 of section ~~33-10-04-01~~ 33-10-04.1-05.

In many cases, flexibility is provided in the criteria to allow achieving an optimum tailings disposal program on a site-specific basis. However, in such cases the objectives, technical alternatives, and concerns which must be taken into account in developing a tailings program are identified. Applications for licenses must clearly demonstrate how the criteria have been addressed.

The specifications shall be developed considering the expected full capacity of tailings or waste systems and the lifetime of mill operations. Where later expansions of systems or operations may be likely (for example, where large quantities of ore now marginally uneconomical may be stockpiled), the amendability of the disposal system to accommodate increased capacities without degradation in long-term stability and other performance factors shall be evaluated.

Detailed programs meeting the technical and financial criteria in this schedule including appropriate supporting data, analyses, and alternatives, shall be developed by existing uranium milling licensees and filed, in connection with license renewal applications or within nine months from the effective date of this schedule whichever occurs first.

CRITERION 1 - In selecting among alternative tailings disposal sites or judging the adequacy of existing tailings sites, the following site features, which will determine the extent to which a program meets the broad objective of isolating the tailings and associated contaminants from man and the environment during operations and for thousands of years thereafter without ongoing active maintenance, shall be considered:

- . remoteness from populated areas;
- . hydrologic and other natural conditions as they contribute to continued immobilization and isolation of contaminants from usable ground water sources; and

- . potential of minimizing erosion, disturbance, and dispersion by natural forces over the long term.

The site selection process shall be an optimization to the maximum extent reasonably achievable in terms of these features.

In the selection of disposal sites, primary emphasis shall be given to isolation of tailings or wastes, a matter having long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs. While isolation of tailings will be a function of both site characteristics and engineering design, overriding consideration shall be given to siting features given the long-term nature of the tailings hazards.

Tailings shall be disposed of in a manner such that no active maintenance is required to preserve the condition of the site.

CRITERION 2 - To avoid proliferation of small waste disposal sites, byproduct material from insite extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote aboveground extraction operations shall preferably be disposed of at existing large mill tailings disposal sites; unless, considering the nature of the wastes, such as their volume and specific activity and the costs and environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations.

CRITERION 3 - The "prime option" for disposal of tailings is placement below grade, either in mines or specially excavated pits (that is, when the need for any specially constructed retention structure is eliminated). The evaluation of alternative sites and disposal methods performed by mill operators in support of their proposed tailings disposal program (provided in applicants' environmental reports) shall reflect serious consideration of this disposal mode. In some instances, below-grade disposal may not be the most environmentally sound approach, such as might be the case if a high quality ground water formation is relatively close to the surface or not very well isolated by overlying soils and rock. Also, geologic topographic conditions might make full, below-grade burial impracticable; for example, bedrock may be sufficiently near the surface that blasting would be required to excavate a disposal pit at excessive cost, and more suitable alternate sites are not available. Where full below-grade burial is not practicable, the size of retention structures, and size and steepness of slopes of associated exposed embankments, shall be minimized by excavation to the maximum extent reasonably achievable or appropriate given the geologic and hydrogeologic conditions at a site. In these cases, it must be demonstrated that an above-grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

CRITERION 4 - The following site and design criteria shall be adhered to whether tailings or wastes are disposed of above or below grade:

- (a) Upstream rainfall catchment areas must be minimized to decrease erosion potential and the size of the maximum possible flood which could erode or wash out sections of the tailings disposal area.
- (b) Topographic features shall provide good wind protection.
- (c) Embankment and cover slopes shall be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as possible to those which would be provided if tailings were disposed of below grade; this could, for example, lead to slopes of about ten horizontal to one vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided, and compensating factors and conditions which make such slopes acceptable should be identified.
- (d) A full self-sustaining vegetative cover shall be established or rock cover employed to reduce wind and water erosion to negligible levels.

Where a full vegetative cover is not likely to be self-sustaining due to climatic conditions, such as in semiarid and arid regions, rock cover shall be employed on slopes of the impoundment system. The staff will consider relaxing this requirement for extremely gentle slopes such as those which may exist on the top of the pile.

The following factors shall be considered in establishing the final rock cover design to avoid displacement of rock particles by human and animal traffic or by natural processes, and to preclude undercutting and piping:

- . shape, size, composition, gradation of rock particles (excepting bedding material, average particle size shall be at least cobble size or greater);
- . rock cover thickness and zoning of particle by size; and
- . steepness of underlying slopes.

Individual rock fragments shall be dense, sound, and resistant to abrasion, and shall be free from cracks, seams, and other defects that would tend to unduly increase their destruction by water and frost actions. Weak, friable, or laminated aggregate shall not be used. Shale, rock, laminated with shale, and cherts shall not be used.

Rock covering of slopes may not be required where top covers are very thick (on the order of eighteen meters or greater); impoundment slopes are very gentle (on the order of 10h:1v or less); bulk cover materials have inherently favorable erosion resistance characteristics; and there is negligible drainage catchment area upstream of the pile, and there is good wind protection as described in points (a) and (b) of this criterion.

Furthermore, all impoundment surfaces shall be contoured to avoid areas of concentrated surface runoff or abrupt or sharp changes in slope gradient. In addition to rock cover on slopes, areas toward which surface runoff might be directed shall be well protected with substantial rock cover (riprap). In addition to providing for stability of the impoundment systems itself, overall stability, erosion potential, and geomorphology of surrounding terrain shall be evaluated to assure that there are no ongoing or potential processes, such as gully erosion, which would lead to impoundment instability.

- (e) The impoundment shall not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in this criterion, the term "capable fault" has the same meaning as defined in Section III (g) of Appendix A of 10 CFR 100. The term "maximum credible earthquake" means that earthquake which would cause the maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material.
- (f) The impoundment, where feasible, should be designed to incorporate features which will promote deposition. For example, design features which promote deposition of sediment suspended in any runoff which flows into the impoundment area might be utilized; the object of such a design feature would be to enhance the thickness of cover over time.

CRITERION 5 - Steps shall be taken to reduce seepage of toxic materials into ground water to the maximum extent reasonably achievable. Any seepage which does occur shall not result in deterioration of existing ground water supplies from their current or potential use. The following shall be considered to accomplish this:

- installation of low permeability bottom liners (where synthetic liners are used, a leakage detection system shall be installed immediately below the liner to ensure major failures are detected if they occur. This is in addition to the ground water monitoring program conducted as provided in Criterion 7. Where clay liners are proposed or relatively thin insite clay soils are to be relied upon for seepage control, tests shall be conducted with representative tailings solutions and clay

materials to confirm that no significant deterioration of permeability or stability properties will occur with continuous exposure of clay to tailings solutions. Tests shall be run for a sufficient period of time to reveal any effects if they are going to occur (in some cases, deterioration has been observed to occur rather rapidly after about nine months of exposure).

- . mill process design which provides the maximum practicable recycle of solutions and conservation of water to reduce the net input of liquid to the tailings impoundment.
- . dewatering of tailings by process devices or in-situ drainage system. At new sites, tailings shall be dewatered by a drainage system installed at the bottom of the impoundment to lower the phreatic surface and reduce the driving head for seepage, unless tests show tailings are not amenable to such a system. Where in-situ dewatering is to be conducted, the impoundment bottom shall be graded to assure that the drains are at a low point. The drains shall be protected by suitable filter materials to assure that drains remain free running. The drainage system shall also be adequately sized to assure good drainage.
- . neutralization to promote immobilization of toxic substances.

Where ground water impacts are occurring at an existing site due to seepage, action shall be taken to alleviate conditions that lead to excessive seepage impacts and restore ground water quality to its potential use before milling operations began to the maximum extent practicable. The specific seepage control and ground water protection method, or combination of methods, to be used must be worked out on a site-specific basis. Technical specifications shall be prepared to control installation of seepage control systems. A quality assurance, testing and inspection program, which includes supervision by a qualified engineer or geologist, shall be established to assure that specification is met.

While the primary method of protecting ground water shall be isolation of tailings and tailings solutions, disposal involving contact with ground water will be considered provided supporting tests and analysis are presented demonstrating that the proposed disposal and treatment methods will not degrade ground water from current or potential uses.

Furthermore, steps shall be taken during stockpiling of ore to minimize penetration of radionuclides into underlying soils; suitable methods include lining or compaction of ore storage areas.

In support of a tailings disposal system proposal, the applicant/operator shall supply information concerning the following:

- . The chemical and radioactive characteristics of the waste solutions.

- . The characteristics of the underlying soil and geologic formations particularly the extent to which they will control transport of contaminants and solutions. This shall include detailed information concerning extent, thickness, uniformity, shape, and orientation of underlying strata. Hydraulic gradients and conductivities of the various formations shall be determined.

This information shall be gathered by borings and field survey methods taken within the proposed impoundment area and in surrounding areas where contaminants might migrate to usable ground water. The information gathered on boreholes shall include both geologic and geophysical logs in sufficient number and degree of sophistication to allow determining significant discontinuities, fractures, and channeled deposits which are of high hydraulic conductivity. If field survey methods are used, they should be in addition to and calibrated with borehole logging. Hydrologic parameters such as permeability shall not be determined on the basis of laboratory analysis of samples alone; a sufficient amount of field testing (e.g. pump tests) shall be conducted to assure actual field properties are adequately understood. Testing shall be conducted to allow estimating chemi-sorption attenuation properties of underlying soil and rock.

- . Location, extent, quality, and capacity of any ground water at and near the site.

CRITERION 6 - Sufficient earth cover, but not less than three meters, shall be placed over tailings or wastes at the end of milling operations to result in a calculated reduction in surface exhalation of radon emanating from the tailings or wastes to less than two picocuries per square meter per second. In computing required tailings cover thickness, moisture in soils in excess of amounts found normally in similar soils in similar circumstances shall not be considered. Direct gamma exposure from the tailings or wastes should be reduced to background levels. The effects of any thin synthetic layer shall not be taken into account in determining the calculated radon exhalation level. If nonsoil materials are proposed to reduce tailings covers to less than three meters, it must be demonstrated that such materials will not crack or degrade by differential settlement, weathering, or other mechanism over long-term time intervals. Near surface materials, i.e., within the top three meters, shall not include mine waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding soils.

CRITERION 7 - Milling operations shall be conducted so that all airborne effluent releases are reduced to as low as is reasonably achievable. The primary means of accomplishing this shall be by means of emission controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed to ensure that offsite exposure limits are met, but only after all practicable measures have been taken

to control emissions at the source. Notwithstanding the existence of individual dose standards, strict control of emissions is necessary to assure that population exposures are reduced to the maximum extent reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not covered by tailings solution and emissions from yellowcake drying and packaging operations. Checks shall be made and logged hourly of all parameters, e.g., differential pressure and scrubber water flow rate, which determine the efficiency of yellowcake stack emission control equipment operation. It shall be determined whether or not conditions are within a range prescribed to ensure that the equipment is operating consistently near peak efficiency; corrective action shall be taken when performance is outside of prescribed ranges. Effluent control devices shall be operative at all times during drying and packaging operations and whenever air is exhausting from the yellowcake stack.

Drying and packaging operations shall terminate when controls are inoperative. When checks indicate the equipment is not operating within the range prescribed for peak efficiency, actions shall be taken to restore parameters to the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging operations shall cease as soon as practicable.

Operations may not be restarted after cessation due to off-normal performance until needed corrective actions have been identified and implemented. All such cessations, corrective actions, and restarts shall be reported to the department in writing, within ten days of the subsequent restart.

To control dusting from tailings, that portion not covered by standing liquids shall be wetted or chemically stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where they are disposed of below grade and the tailings surface is not exposed to wind. Consideration shall be given in planning tailings disposal programs to methods which would allow phased covering and reclamation of tailings impoundments since this will help in controlling particulate and radon emissions during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic controls do not apply, operators shall develop written operating procedures specifying the methods of control which will be utilized.

CRITERION 8 - These criteria relating to ownership of tailings and their disposal sites become effective on November 8, 1981, and apply to all licenses terminated, issued, or renewed after that date.

Any uranium or thorium milling license or tailings license shall contain such terms and conditions as the United States nuclear regulatory commission determines necessary to assure that prior to termination of the license, the licensee will comply with ownership requirements of this criterion for sites used for tailings disposal.

Title to the byproduct material license pursuant to subdivision m of subsection 5 of section 33-10-03-05 and land, including any interests therein (other than land owned by the United States or by a state) which is used for the disposal of any such byproduct material, or is essential to ensure the long-term stability of such disposal site, shall be transferred to the United States or the state in which such land is located, at the option of such state. In view of the fact that physical isolation must be the primary means of long-term control, and government land ownership is a desirable supplementary measure, ownership of certain severable subsurface interests, e.g., mineral rights, may be determined to be unnecessary to protect the public health and safety and the environment. In any case, however, the applicant/operator must demonstrate a serious effort to obtain such subsurface rights, and must, in the event that certain rights cannot be obtained, provide notification in local public land records of the fact that the land is being used for the disposal of radioactive material and is subject to either a United States nuclear regulatory commission general or specific license prohibiting the disruption and disturbance of the tailings. In some rare cases, such as may occur with deep burial where no ongoing site surveillance will be required, surface land ownership transfer requirements may be waived. For licenses issued before November 8, 1981, the department may take into account the status of the ownership of such land, and interests therein, and the ability of a licensee to transfer title and custody thereof to the United States or the state.

If the United States nuclear regulatory commission subsequent to title transfer determines that use of the surface or subsurface estates, or both, of the land transferred to the United States or to the state will not endanger the public health, safety, welfare, or environment, the United States nuclear regulatory commission may permit the use of the surface or subsurface estates, or both, of such land in a manner consistent with the provisions provided in these criteria. If the United States nuclear regulatory commission permits such use of such land, it will provide the person who transferred such land with the right of first refusal with respect to such use of such land.

Material and land transferred to the United States or the state in accordance with this criterion shall be transferred without cost to the United States or the state other than administrative and legal costs incurred in carrying out such transfer.

The provisions of chapter 33-10-03 respecting transfer of title and custody to land and tailings and waste shall not apply in the case of lands held in trust by the United States for any Indian tribe or lands owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the case of such lands which are used for disposal of byproduct material, as defined in section 33-10-01-04, the licensee shall enter into arrangements with the United States nuclear regulatory commission as may be appropriate to assure the long-term surveillance of such lands by the United States.

History: Effective October 1, 1982; amended effective June 1, 1986; June 1, 1992; March 1, 1994.

SCHEDULE E
 QUANTITIES OF RADIOACTIVE MATERIALS REQUIRING
 CONSIDERATION OF THE NEED FOR AN EMERGENCY
 PLAN FOR RESPONDING TO A RELEASE

<u>Radioactive Material</u> ¹	<u>Release</u> <u>Fraction</u>	<u>Quantity</u> <u>(curies)</u>
<u>Actinium-228</u>	0.001	4,000
<u>Americium-241</u>	.001	2
<u>Americium-242</u>	.001	2
<u>Americium-243</u>	.001	2
<u>Antimony-124</u>	.01	4,000
<u>Antimony-126</u>	.01	6,000
<u>Barium-133</u>	.01	10,000
<u>Barium-140</u>	.01	30,000
<u>Bismuth-207</u>	.01	5,000
<u>Bismuth-210</u>	.01	600
<u>Cadmium-109</u>	.01	1,000
<u>Cadmium-113</u>	.01	80
<u>Calcium-45</u>	.01	20,000
<u>Californium-252</u>	.001	9(20mg)
<u>Carbon-14</u>	.01	50,000
	Non CO	
<u>Cerium-141</u>	.01	10,000
<u>Cerium-144</u>	.01	300
<u>Cesium-134</u>	.01	2,000
<u>Cesium-137</u>	.01	3,000
<u>Chlorine-36</u>	.5	100
<u>Chromium-51</u>	.01	300,000
<u>Colbalt-60</u>	.001	5,000
<u>Copper-64</u>	.01	200,000
<u>Curium-242</u>	.001	60
<u>Curium-243</u>	.001	3
<u>Curium-244</u>	.001	4
<u>Curium-245</u>	.001	2
<u>Europium-152</u>	.01	500
<u>Europium-154</u>	.01	400
<u>Europium-155</u>	.01	3,000
<u>Germanium-68</u>	.01	2,000
<u>Gadolinium-153</u>	.01	5,000
<u>Gold-198</u>	.01	30,000
<u>Hafnium-172</u>	.01	400
<u>Hafnium-181</u>	.01	7,000
<u>Holmium-166m</u>	.01	100
<u>Hydrogen-3</u>	.5	20,000
<u>Iodine-125</u>	.5	10
<u>Iodine-131</u>	.5	10
<u>Indium-144m</u>	.01	1,000
<u>Indium-192</u>	.001	40,000
<u>Iron-55</u>	.01	40,000
<u>Iron-59</u>	.01	7,000

<u>Krypton-85</u>	<u>1.0</u>	<u>6,000,000</u>
<u>Lead-210</u>	<u>.01</u>	<u>8</u>
<u>Manganese-56</u>	<u>.01</u>	<u>60,000</u>
<u>Mercury-203</u>	<u>.01</u>	<u>10,000</u>
<u>Molybdenum-99</u>	<u>.01</u>	<u>30,000</u>
<u>Neptunium-237</u>	<u>.001</u>	<u>2</u>
<u>Nickel-63</u>	<u>.01</u>	<u>20,000</u>
<u>Niobium-94</u>	<u>.01</u>	<u>300</u>
<u>Phosphorus-32</u>	<u>.5</u>	<u>100</u>
<u>Phosphorus-33</u>	<u>.5</u>	<u>1,000</u>
<u>Polonium-210</u>	<u>.01</u>	<u>10</u>
<u>Potassium-42</u>	<u>.01</u>	<u>9,000</u>
<u>Promethium-145</u>	<u>.01</u>	<u>4,000</u>
<u>Promethium-147</u>	<u>.01</u>	<u>4,000</u>
<u>Ruthenium-106</u>	<u>.01</u>	<u>200</u>
<u>Samarium-151</u>	<u>.01</u>	<u>4,000</u>
<u>Scandium-46</u>	<u>.01</u>	<u>3,000</u>
<u>Selenium-75</u>	<u>.01</u>	<u>10,000</u>
<u>Silver-110m</u>	<u>.01</u>	<u>1,000</u>
<u>Sodium-22</u>	<u>.01</u>	<u>9,000</u>
<u>Sodium-24</u>	<u>.01</u>	<u>10,000</u>
<u>Strontium-89</u>	<u>.01</u>	<u>3,000</u>
<u>Strontium-90</u>	<u>.01</u>	<u>90</u>
<u>Sulfur-35</u>	<u>.5</u>	<u>900</u>
<u>Technetium-99</u>	<u>.01</u>	<u>10,000</u>
<u>Technetium-99m</u>	<u>.01</u>	<u>400,000</u>
<u>Tellurium-127m</u>	<u>.01</u>	<u>5,000</u>
<u>Tellurium-129m</u>	<u>.01</u>	<u>5,000</u>
<u>Terbium-160</u>	<u>.01</u>	<u>4,000</u>
<u>Thulium-170</u>	<u>.01</u>	<u>4,000</u>
<u>Tin-113</u>	<u>.01</u>	<u>10,000</u>
<u>Tin-123</u>	<u>.01</u>	<u>3,000</u>
<u>Tin-126</u>	<u>.01</u>	<u>1,000</u>
<u>Titanium-44</u>	<u>.01</u>	<u>100</u>
<u>Vanadium-48</u>	<u>.01</u>	<u>7,000</u>
<u>Xenon-133</u>	<u>1.0</u>	<u>900,000</u>
<u>Yttrium-91</u>	<u>.01</u>	<u>2,000</u>
<u>Zinc-65</u>	<u>.01</u>	<u>5,000</u>
<u>Zirconium-93</u>	<u>.01</u>	<u>400</u>
<u>Zirconium-95</u>	<u>.01</u>	<u>5,000</u>
<u>Any other beta-gamma emitter</u>	<u>.01</u>	<u>10,000</u>
<u>Mixed fission products</u>	<u>.01</u>	<u>1,000</u>
<u>Mixed corrosion products</u>	<u>.01</u>	<u>10,000</u>
<u>Contaminated equipment beta-gamma</u>	<u>.001</u>	<u>10,000</u>
<u>Irradiated material, any form other than solid noncombustible</u>	<u>.01</u>	<u>1,000</u>
<u>Irradiated material, solid noncombustible</u>	<u>.001</u>	<u>10,000</u>
<u>Mixed radioactive waste, beta-gamma</u>	<u>.01</u>	<u>1,000</u>
<u>Packaged mixed waste, beta-gamma</u>	<u>.001</u>	<u>10,000</u>
<u>Any other alpha emitter</u>	<u>.0001</u>	<u>2</u>
<u>Contaminated equipment, alpha</u>	<u>.0001</u>	<u>20</u>
<u>Packaged waste, alpha²</u>	<u>.0001</u>	<u>20</u>
<u>Combinations of radioactive materials</u>		

listed above¹

¹ For combinations of radioactive materials, consideration of the need for any emergency plan is required if the sum of the ratios of the quantity of each radioactive material authorized to the quantity listed for that material in schedule E exceeds one.

² Waste packaged in type B containers does not require an emergency plan.

History: Effective March 1, 1994.

SCHEDULE F
 CRITERIA RELATED TO FINANCIAL ASSURANCE AND
 DECOMMISSIONING
 (SUBSECTION 14 OF SECTION 33-10-03-05)

Radioactive Material	Microcuries
Americium-241 (Am 241)	0.01
Antimony-122 (Sb 122)	100
Antimony-124 (Sb 124)	10
Antimony-125 (Sb 125)	10
Arsenic-73 (As 73)	100
Arsenic-74 (As 74)	10
Arsenic-76 (As 76)	10
Arsenic-77 (As 77)	100
Barium-131 (Ba 131)	10
Barium-133 (Ba 133)	10
Barium-140 (Ba 140)	10
Bismuth-210 (Bi 210)	1
Bromine-82 (Br 82)	10
Cadmium-109 (Cd 109)	10
Cadmium-115m (Cd 115m)	10
Cadmium-115 (Cd 115)	100
Calcium-45 (Ca-45)	10
Calcium-47 (Ca 47)	10
Carbon-14 (C 14)	100
Cerium-141 (Ce 141)	100
Cerium-143 (Ce 143)	100
Cerium-144 (Ce 144)	1
Cesium-129 (Cs 129)	100
Cesium-131 (Cs 131)	1,000
Cesium-134m (Cs 134m)	100
Cesium-134 (Cs 134)	1
Cesium-135 (Cs 135)	10
Cesium-136 (Cs 136)	10
Cesium-137 (Cs 137)	10
Chlorine-36 (Cl 36)	10
Chlorine-38 (Cl 38)	10
Chromium-51 (Cr 51)	1,000
Cobalt-57 (Co 57)	100
Cobalt-58m (Co 58m)	10
Cobalt-58 (Co 58)	10
Cobalt-60 (Co 60)	1
Copper-64 (Cu 64)	100
Dysprosium-165 (Dy 165)	10
Dysprosium-166 (Dy 166)	100
Erbium-169 (Er 169)	100
Erbium-171 (Er 171)	100
Europium-152 (Eu 152)9.2h	100
Europium-152 (Eu 152)13 yr	1
Europium-154 (Eu 154)	1
Europium-155 (Eu 155)	10

<u>Fluorine-18 (F 18)</u>	<u>1,000</u>
<u>Gadolinium-153 (Gd 153)</u>	<u>10</u>
<u>Gadolinium-159 (Gd 159)</u>	<u>100</u>
<u>Gallium-67 (Ga 67)</u>	<u>100</u>
<u>Gallium-72 (Ga 72)</u>	<u>10</u>
<u>Germanium-68 (Ge 68)</u>	<u>10</u>
<u>Germanium-71 (Ge 71)</u>	<u>100</u>
<u>Gold-195 (Au 195)</u>	<u>10</u>
<u>Gold-198 (Au 198)</u>	<u>100</u>
<u>Gold-199 (Au 199)</u>	<u>100</u>
<u>Hafnium-181 (Hf 181)</u>	<u>10</u>
<u>Holmium-166 (Ho 166)</u>	<u>100</u>
<u>Hydrogen-3 (H 3)</u>	<u>1,000</u>
<u>Indium-111 (In 111)</u>	<u>100</u>
<u>Indium-113m (In 113m)</u>	<u>100</u>
<u>Indium-114m (In 114m)</u>	<u>10</u>
<u>Indium-115m (In 115m)</u>	<u>100</u>
<u>Indium-115 (In 115)</u>	<u>10</u>
<u>Iodine-123 (I 123)</u>	<u>100</u>
<u>Iodine-125 (I 125)</u>	<u>1</u>
<u>Iodine-126 (I 126)</u>	<u>1</u>
<u>Iodine-129 (I 129)</u>	<u>0.1</u>
<u>Iodine-131 (I 131)</u>	<u>1</u>
<u>Iodine-132 (I 132)</u>	<u>10</u>
<u>Iodine-133 (I 133)</u>	<u>1</u>
<u>Iodine-134 (I 134)</u>	<u>10</u>
<u>Iodine-135 (I 135)</u>	<u>10</u>
<u>Iridium-192 (Ir 192)</u>	<u>10</u>
<u>Iridium-194 (Ir 194)</u>	<u>100</u>
<u>Iron-52 (Fe 52)</u>	<u>10</u>
<u>Iron-55 (Fe 55)</u>	<u>100</u>
<u>Iron-59 (Fe 59)</u>	<u>10</u>
<u>Krypton-85 (Kr 85)</u>	<u>100</u>
<u>Krypton-87 (Kr 87)</u>	<u>10</u>
<u>Lanthanum-140 (La 140)</u>	<u>10</u>
<u>Lutetium-177 (Lu 177)</u>	<u>100</u>
<u>Manganese-52 (Mn 52)</u>	<u>10</u>
<u>Manganese-54 (Mn 54)</u>	<u>10</u>
<u>Manganese-56 (Mn 56)</u>	<u>10</u>
<u>Mercury-197m (Hg 197m)</u>	<u>100</u>
<u>Mercury-197 (Hg 197)</u>	<u>100</u>
<u>Mercury-203 (Hg 203)</u>	<u>10</u>
<u>Molybdenum-99 (Mo 99)</u>	<u>100</u>
<u>Neodymium-147 (Nd 147)</u>	<u>100</u>
<u>Neodymium-149 (Nd 149)</u>	<u>100</u>
<u>Nickel-59 (Ni 59)</u>	<u>100</u>
<u>Nickel-63 (Ni 63)</u>	<u>10</u>
<u>Nickel-65 (Ni 65)</u>	<u>100</u>
<u>Niobium-93m (Nb 93m)</u>	<u>10</u>
<u>Niobium-95 (Nb 95)</u>	<u>10</u>
<u>Niobium-97 (Nb 97)</u>	<u>10</u>
<u>Osmium-185 (Os 185)</u>	<u>10</u>
<u>Osmium-191m (Os 191m)</u>	<u>100</u>

<u>Osmium-191 (Os 191)</u>	<u>100</u>
<u>Osmium-193 (Os 193)</u>	<u>100</u>
<u>Palladium-103 (Pd 103)</u>	<u>100</u>
<u>Palladium-109 (Pd 109)</u>	<u>100</u>
<u>Phosphorus-32 (P 32)</u>	<u>10</u>
<u>Platinum-191 (Pt 191)</u>	<u>100</u>
<u>Platinum-193m (Pt 193m)</u>	<u>100</u>
<u>Platinum-193 (Pt 193)</u>	<u>100</u>
<u>Platinum-197m (Pt 197m)</u>	<u>100</u>
<u>Platinum-197 (Pt 197)</u>	<u>100</u>
<u>Plutonium-239 (Pu 239)</u>	<u>0.01</u>
<u>Polonium-210 (Po 210)</u>	<u>0.1</u>
<u>Potassium-42 (K 42)</u>	<u>10</u>
<u>Potassium-43 (K 43)</u>	<u>10</u>
<u>Praseodymium-142 (Pr 142)</u>	<u>100</u>
<u>Praseodymium-143 (Pr 143)</u>	<u>100</u>
<u>Promethium-147 (Pm 147)</u>	<u>10</u>
<u>Promethium-149 (Pm 149)</u>	<u>10</u>
<u>Radium-226 (Ra 226)</u>	<u>0.01</u>
<u>Rhenium-186 (Re 186)</u>	<u>100</u>
<u>Rhenium-188 (Re 188)</u>	<u>100</u>
<u>Rhodium-103m (Rh 103m)</u>	<u>100</u>
<u>Rhodium-105 (Rh 105)</u>	<u>100</u>
<u>Rubidium-81 (Rb 81)</u>	<u>10</u>
<u>Rubidium-86 (Rb 86)</u>	<u>10</u>
<u>Rubidium-87 (Rb 87)</u>	<u>10</u>
<u>Ruthenium-97 (Ru 97)</u>	<u>100</u>
<u>Ruthenium-103 (Ru 103)</u>	<u>10</u>
<u>Ruthenium-105 (Ru 105)</u>	<u>10</u>
<u>Ruthenium-106 (Ru 106)</u>	<u>1</u>
<u>Samarium-151 (Sm 151)</u>	<u>10</u>
<u>Samarium-153 (Sm 153)</u>	<u>100</u>
<u>Scandium-46 (Sc 46)</u>	<u>10</u>
<u>Scandium-47 (Sc 47)</u>	<u>100</u>
<u>Scandium-48 (Sc 48)</u>	<u>10</u>
<u>Selenium-75 (Se 75)</u>	<u>10</u>
<u>Silicon-31 (Si 31)</u>	<u>100</u>
<u>Silver-105 (Ag 105)</u>	<u>10</u>
<u>Silver-110m (Ag 110m)</u>	<u>1</u>
<u>Silver-111 (Ag 111)</u>	<u>100</u>
<u>Sodium-22 (Na 22)</u>	<u>10</u>
<u>Sodium-24 (Na 24)</u>	<u>10</u>
<u>Strontium-85 (Sr 85)</u>	<u>10</u>
<u>Strontium-89 (Sr 89)</u>	<u>1</u>
<u>Strontium-90 (Sr 90)</u>	<u>0.1</u>
<u>Strontium-91 (Sr 91)</u>	<u>10</u>
<u>Strontium-92 (Sr 92)</u>	<u>10</u>
<u>Sulfur-35 (S 35)</u>	<u>100</u>
<u>Tantalum-182 (Ta 182)</u>	<u>10</u>
<u>Technetium-96 (Tc 96)</u>	<u>10</u>
<u>Technetium-97m (Tc 97m)</u>	<u>100</u>
<u>Technetium-97 (Tc 97)</u>	<u>100</u>
<u>Technetium-99m (Tc 99m)</u>	<u>100</u>

<u>Technetium-99 (Tc 99)</u>	<u>10</u>
<u>Tellurium-125m (Te 125m)</u>	<u>10</u>
<u>Tellurium-127m (Te 127m)</u>	<u>10</u>
<u>Tellurium-127 (Te 127)</u>	<u>100</u>
<u>Tellurium-129m (Te 129m)</u>	<u>10</u>
<u>Tellurium-129 (Te 129)</u>	<u>100</u>
<u>Tellurium-131m (Te 131m)</u>	<u>10</u>
<u>Tellurium-132 (Te 132)</u>	<u>10</u>
<u>Terbium-160 (Tb 160)</u>	<u>10</u>
<u>Thallium-200 (Tl 200)</u>	<u>100</u>
<u>Thallium-201 (Tl 201)</u>	<u>100</u>
<u>Thallium-202 (Tl 202)</u>	<u>100</u>
<u>Thallium-204 (Tl 204)</u>	<u>10</u>
<u>Thorim (natural)¹</u>	<u>100</u>
<u>Thulium-170 (Tm 170)</u>	<u>10</u>
<u>Thulium-171 (Tm 171)</u>	<u>10</u>
<u>Tin-113 (Sn 113)</u>	<u>10</u>
<u>Tin-125 (Sn 125)</u>	<u>10</u>
<u>Tungsten-181 (W 181)</u>	<u>10</u>
<u>Tungsten-185 (W 185)</u>	<u>10</u>
<u>Tungsten-187 (W 187)</u>	<u>100</u>
<u>Uranium (natural)²</u>	<u>100</u>
<u>Uranium-233 (U 233)</u>	<u>0.01</u>
<u>Uranium-234 - Uranium-235</u>	<u>0.01</u>
<u>Vanadium-48 (V 48)</u>	<u>10</u>
<u>Xenon-131m (Xe 131m)</u>	<u>1,000</u>
<u>Xenon-133 (Xe 133)</u>	<u>100</u>
<u>Xenon-135 (Xe 135)</u>	<u>100</u>
<u>Ytterbium-175 (Yb 175)</u>	<u>100</u>
<u>Yttrium-87 (Y 87)</u>	<u>10</u>
<u>Yttrium-88 (Y 88)</u>	<u>10</u>
<u>Yttrium-90 (Y 90)</u>	<u>10</u>
<u>Yttrium-91 (Y 91)</u>	<u>10</u>
<u>Yttrium-92 (Y 92)</u>	<u>100</u>
<u>Yttrium-93 (Y 93)</u>	<u>100</u>
<u>Zinc-65 (Zn 65)</u>	<u>10</u>
<u>Zinc-69m (Zn 69m)</u>	<u>100</u>
<u>Zinc-69 (Zn 69)</u>	<u>1,000</u>
<u>Zirconium-93 (Zr 93)</u>	<u>10</u>
<u>Zirconium-95 (Zr 95)</u>	<u>10</u>
<u>Zirconium-97 (Zr 97)</u>	<u>10</u>

Any alpha-emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition 0.01

Any radionuclide other than alpha emitting radionuclides, not listed above or mixtures of beta emitters of unknown composition 0.1

¹ Based on alpha disintegration rate of Th-232, Th-230, and their daughter products.

2 Based on alpha disintegration rate of U-238, U-234,
and U-235.

History: Effective March 1, 1994.

SCHEDULE G
CRITERIA RELATING TO USE OF FINANCIAL
TESTS AND PARENT COMPANY GUARANTEES FOR
PROVIDING REASONABLE ASSURANCE OF
FUNDS FOR DECOMMISSIONING
(SUBSECTION 14 of SECTION 33-10-03-05)

I. INTRODUCTION

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on obtaining a parent company guarantee that funds will be available for decommissioning costs and on a demonstration that the parent company passes a financial test. This appendix establishes criteria for passing the financial test and for obtaining the parent company guarantee.

II. FINANCIAL TEST

A. To pass the financial test, the parent company must meet the criteria of either paragraph A.1 or A.2 of this section:

1. The parent company must have:

- a. Two of the following three ratios: A ratio of total liabilities to net worth less than 2.0; a ratio of the sum of net income plus depreciation, depletion, and amortization to total liabilities greater than 0.1; and a ratio of current assets to current liabilities greater than 1.5; and
- b. Net working capital and tangible net worth each at least six times the current decommissioning cost estimates (or prescribed amount if a certification is used); and
- c. Tangible net worth of at least \$10 million; and
- d. Assets located in the United States amounting to at least ninety percent of total assets or at least six times the current decommissioning cost estimates (or prescribed amount if a certification is used).

2. The parent company must have:

- a. A current rating for its most recent bond issuance of AAA, AA, A, or BBB as issued by Standards and Poor's or Aaa, Aa, A, or Baa as issued by Moody's; and
- b. Tangible net worth at least six times the current decommissioning cost estimate (or prescribed amount if a certification is used); and
- c. Tangible net worth of at least \$10 million; and

d. Assets located in the United States amounting to at least ninety percent of total assets or at least six times the current decommissioning cost estimates (or prescribed amount if certification is used).

B. The parent company's independent certified public accountant must have compared the data used by the parent company in the financial test, which is derived from the independently audited, yearend financial statements for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure the licensee shall inform the department within ninety days of any matters coming to the auditor's attention which cause the auditor to believe that the data specified in the financial test should be adjusted and that the company no longer passes the test.

C. 1. After the initial financial test, the parent company must repeat the passage of the test within ninety days after the close of each succeeding fiscal year.

2. If the parent company no longer meets the requirements of paragraph A of this section, the licensee must send notice to the department of intent to establish alternate financial assurance as specified in the department's rules. The notice must be sent by certified mail within ninety days after the end of the fiscal year for which the yearend financial data show that the parent company no longer meets the financial test requirements. The licensee must provide alternate financial assurance within one hundred twenty days after the end of such fiscal year.

III. PARENT COMPANY GUARANTEE

The terms of a parent company guarantee which an applicant or licensee obtains must provide that:

A. The parent company guarantee will remain in force unless the guarantor sends notice of cancellation by certified mail to the licensee and the department. Cancellation may not occur, however, during the one hundred twenty days beginning on the date of receipt of the notice of cancellation by both the licensee and the department, as evidenced by the return receipts.

B. If the licensee fails to provide alternate financial assurance as specified in the department's rules within ninety days after receipt by the licensee and the department of a notice of cancellation of the parent company guarantee from the guarantor, the guarantor will provide such alternative financial assurance in the name of the licensee.

C. The parent company guarantee and financial test provisions must remain in effect until the department has terminated the license.

D. If a trust is established for decommissioning costs, the trustee and trust must be acceptable to the department. An acceptable trustee includes an appropriate state or federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a federal or state agency.

History: Effective March 1, 1994.

CHAPTER 33-10-04
STANDARDS FOR PROTECTION AGAINST RADIATION

[Repealed effective March 1, 1994]

STAFF COMMENT: Chapter 33-10-04.1 contains all new material but is not underscored so as to improve readability.

CHAPTER 33-10-04.1
STANDARDS FOR PROTECTION AGAINST RADIATION - GENERAL PROVISIONS

Section	
33-10-04.1-01	Purpose
33-10-04.1-02	Scope
33-10-04.1-03	Definitions
33-10-04.1-04	Implementation
33-10-04.1-05	Radiation Protection Programs
33-10-04.1-06	Occupational Dose Limits
33-10-04.1-07	Radiation Dose Limits for Individual Members of the Public
33-10-04.1-08	Testing for Leakage or Contamination of Sealed Sources
33-10-04.1-09	Survey and Monitoring
33-10-04.1-10	Control of Exposure from External Sources in Restricted Areas
33-10-04.1-11	Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas
33-10-04.1-12	Storage and Control of Licensed or Registered Sources of Radiation
33-10-04.1-13	Precautionary Procedures
33-10-04.1-14	Waste Disposal
33-10-04.1-15	Records
33-10-04.1-16	Reports
33-10-04.1-17	Additional Requirements - Vacating Premises

33-10-04.1-01. Purpose.

1. This chapter establishes standards for protection against ionizing radiation resulting from activities conducted pursuant to licenses or registrations issued by the department.
2. The requirements of this chapter are designed to control the receipt, possession, use, transfer, and disposal of sources of radiation by any licensee or registrant so the total dose to an individual, including doses resulting from all sources of radiation other than background radiation, does not exceed the standards for protection against radiation prescribed in this chapter. However, nothing in this chapter shall be construed as limiting actions that may be necessary to protect health and safety.

History: Effective March 1, 1994.
General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-02. Scope. This chapter applies to persons licensed or registered by the department to receive, possess, use, transfer, or dispose of sources of radiation. The limits in this chapter do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose of medical diagnosis or therapy, or to voluntary participation in medical research programs.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-03. Definitions. As used in this chapter:

1. "Annual limit on intake" (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. Annual limit on intake 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 five-hundredths sievert [5 rem] or a committed dose equivalent of five-tenths sievert [50 rem] to any individual organ or tissue. Annual limit on intake values for intake by ingestion and by inhalation of selected radionuclides are given in table I, columns 1 and 2, of appendix B.
2. "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 ten days, for class W, weeks, from ten to one hundred days, and for class Y, years, of greater than one hundred days. "Lung class" and "inhalation class" are equivalent terms.
3. "Declared pregnant woman" means a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.
4. "Derived air concentration" (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of two thousand hours under conditions of light work, results in an intake of one annual limit on intake. The condition of light work is an inhalation rate of 1.2 cubic meters of air per hour for two thousand hours in a year. Derived air concentration values are given in table I, column 3, of appendix B.
5. "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 two thousand derived air concentration-hours to represent one annual limit on intake, equivalent to a committed effective dose equivalent of five-hundredths sievert [5 rem].

6. "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.
7. "Inhalation class" [see "class"].
8. "Lung class" [see "class"].
9. "Nonstochastic effect" means a health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect. "Deterministic effect" is an equivalent term.
10. "Planned special exposure" means an infrequent exposure to radiation, separate from and in addition to the annual occupational dose limits.
11. "Quarter" means a period of time equal to one-fourth of the year observed by the licensee, approximately thirteen 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.
12. "Reference man" means a hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of the reference man is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man".
13. "Respiratory protective equipment" means an apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials.
14. "Sanitary sewerage" means a system of public sewers for carrying off wastewater and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee or registrant.

15. "Stochastic effect" means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects. "Probabilistic effect" is an equivalent term.
16. "Very high radiation area" means an area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of five gray [500 rad] in one hour at one meter from a source of radiation or from any surface that the radiation penetrates. (At very high doses received at high dose rates, units of absorbed dose, gray and rad, are appropriate, rather than units of dose equivalent, sievert and rem.).
17. "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:

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 ^a
Whole body	1.00 ^b

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

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

History: Effective March 1, 1994.
 General Authority: NDCC 28-32-02
 Law Implemented: NDCC 23-20.1-03

33-10-04.1-04. Implementation. This chapter shall go into effect on March 1, 1994, and all licensees and registrants must comply by that date except for the following:

1. Any existing license or registration condition that is in place prior to implementation of this chapter and is more restrictive than this chapter remains in force until there is an amendment or renewal of the license or registration.
2. If a license or registration condition exempts a licensee or registrant from a provision of this chapter in effect on or before March 1, 1994, it also exempts the licensee or registrant from the corresponding provision of this chapter.
3. If a license or registration condition cites provisions of this chapter in effect prior to March 1, 1994, which do not correspond to any provisions of this chapter, the license or registration condition remains in force until there is an amendment or renewal of the license or registration that modifies or removes this condition.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-05. Radiation protection programs.

1. Each licensee or registrant shall develop, document, and implement a radiation protection program sufficient to ensure compliance with the provisions of this chapter. See subsection 2 of section 33-10-04.1-15 for recordkeeping requirements relating to these programs.
2. To the extent practicable, the licensee or registrant shall use procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA).
3. At intervals not to exceed twelve months, the licensee or registrant shall review the radiation protection program content and implementation.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-06. Occupational dose limits.

1. Occupational dose limits for adults.

- a. The licensee or registrant shall control the occupational dose to individual adults, except for planned special exposures pursuant to subsection 6, to the following dose limits:
 - (1) An annual limit, which is the more limiting of:
 - (a) The total effective dose equivalent being equal to five-hundredths sievert [5 rem]; 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 five-tenths sievert [50 rem].
 - (2) The annual limits to the lens of the eye, to the skin, and to the extremities which are:
 - (a) An eye dose equivalent of fifteen-hundredths sievert [15 rem]; and
 - (b) A shallow dose equivalent of five-tenths sievert [50 rem] to the skin or to any extremity.
- b. Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime. See paragraphs 1 and 2 of subdivision e of subsection 6.
- c. The assigned deep dose equivalent and shallow dose equivalent shall be for the portion of the body receiving the highest exposure determined as follows:
 - (1) The deep dose equivalent, eye 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) Reserved.
- d. Derived air concentration and annual limit on intake values are presented in table I of appendix B and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits. See subsection 7 of section 33-10-04.1-15.

- e. Notwithstanding the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to ten milligrams in a week in consideration of chemical toxicity. See footnote 3 of appendix B.
- f. The licensee or registrant shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person. See subdivision e of subsection 5.
2. Compliance with requirements for summation of external and internal doses.
- a. If the licensee or registrant is required to monitor pursuant to both subdivision a and subdivision b of subsection 2 of section 33-10-04.1-09, 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 subdivision a of subsection 2 of section 33-10-04.1-09 or only pursuant to subdivision b of subsection 2 of section 33-10-04.1-09, 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 subdivision b, subdivision c, and subdivision d. The dose equivalents for the lens of the eye, the skin, and the extremities are not included in the summation, but are subject to separate limits.
- b. Intake by inhalation. If the only intake of radionuclides is by inhalation, the total effective dose equivalent limit is not exceeded if the sum of the deep dose equivalent divided by the total effective dose equivalent limit, and one of the following, does not exceed unity:
- (1) The sum of the fractions of the inhalation annual limit on intake for each radionuclide, or
 - (2) The total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by two thousand, 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 ten 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 also receives an intake of radionuclides by oral ingestion greater than ten percent of the applicable oral annual limit on intake, 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 derived air concentration for hydrogen-3 and does not need to be evaluated or accounted for pursuant to this subdivision.
3. 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, eye dose equivalent, and shallow dose equivalent from external exposure to the radioactive cloud. See appendix B, footnotes 1 and 2.
 - b. Airborne radioactivity measurements and derived air concentration 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.
4. 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 subsection 2 of section 33-10-04.1-09, take suitable and timely measurements of:
 - (1) Concentrations of radioactive materials in air in work areas;
 - (2) Quantities of radionuclides in the body;

- (3) Quantities of radionuclides excreted from the body;
or
 - (4) Combinations of these measurements.
- b. Unless respiratory protective equipment is used, as provided in subsection 3 of section 33-10-04.1-11, 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 derived air concentration or annual limit on intake values to reflect the actual physical and chemical characteristics of airborne radioactive material, for example, aerosol size distribution or density; and
 - (3) Separately assess the contribution of fractional intakes of class D, W, or Y compounds of a given radionuclide to the committed effective dose equivalent. See appendix B.
- d. If the licensee or registrant chooses to assess intakes of class Y material using the measurements given in paragraph 2 or 3 of subdivision a, the licensee or registrant may delay the recording and reporting of the assessments for periods up to seven months, unless otherwise required by subsection 2 or 3 of section 33-10-04.1-16. 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 derived air concentration applicable to the mixture for use in calculating derived air concentration-hours shall be either:
- (1) The sum of the ratios of the concentration to the appropriate derived air concentration value, that is, D, W, or Y, from appendix B for each radionuclide in the mixture; or

- (2) The ratio of the total concentration for all radionuclides in the mixture to the most restrictive derived air concentration 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 derived air concentration for the mixture shall be the most restrictive derived air concentration 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 subsection 1 and in complying with the monitoring requirements in subdivision b of subsection 2 of section 33-10-04.1-09, and
 - (2) The concentration of any radionuclide disregarded is less than ten percent of its derived air concentration, and
 - (3) The sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed thirty 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 annual limit on intake, or an exposure of two thousand derived air concentration-hours, results in a committed effective dose equivalent of five-hundredths sievert [5 rem] for radionuclides that have their annual limit on intakes or derived air concentrations based on the committed effective dose equivalent.
 - (2) For an annual limit on intake and the associated derived air concentration determined by the nonstochastic organ dose limit of five-tenths sievert [50 rem], the intake of radionuclides that would result in a committed effective dose equivalent of five-hundredths sievert [5 rem], that is, the stochastic annual limit on intake, is listed in parentheses in table I of appendix B. As a simplifying assumption, the licensee or registrant may use the stochastic annual limit on intake to

determine committed effective dose equivalent. However, if the licensee or registrant uses the stochastic annual limit on intake, the licensee or registrant shall also demonstrate that the limit in subparagraph 2 of paragraph 1 of subdivision a of subsection 1 is met.

5. Determination of prior occupational dose.

- a. For each individual who is likely to receive, in a year, an occupational dose requiring monitoring pursuant to subsection 2 of section 33-10-04.1-09, the licensee or registrant shall:
 - (1) Determine the occupational radiation dose received during the current year; and
 - (2) Attempt to obtain the records of cumulative occupational radiation dose.
- b. Prior to permitting an individual to participate in a planned special exposure, the licensee or registrant shall determine:
 - (1) The internal and external doses from all previous planned special exposures;
 - (2) All doses in excess of the limits, including doses received during accidents and emergencies, received during the lifetime of the individual; and
 - (3) All lifetime cumulative occupational radiation dose.
- c. In complying with the requirements of subdivision a, a licensee or registrant may:
 - (1) Accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual received during the current year;
 - (2) Accept, as the record of cumulative radiation dose, an up-to-date department's occupational radiation exposure history form (SFN 19443) or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant; and

- (3) Obtain reports of the individual's dose equivalent from the most recent employer for work involving radiation exposure, or the individual's current employer, if the individual is not employed by the licensee or registrant, by telephone, telegram, facsimile, or letter. The licensee or registrant shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.
- d.
- (1) The licensee or registrant shall record the exposure history, as required by subdivision a, on the department's occupational radiation exposure history form (SFN 19443), or other clear and legible record, of all the information required on that form. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee or registrant obtains reports, the licensee or registrant shall use the dose shown in the report in preparing the department's occupational radiation exposure history form (SFN 19443) 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 the department's occupational radiation exposure history form (SFN 19443) or equivalent indicating the periods of time for which data are not available.
 - (2) Licensees or registrants are not required to reevaluate the separate external dose equivalents and internal committed dose equivalents or intakes of radionuclides assessed pursuant to the rules in chapter 33-10-04 in effect before January 1, 1994. Further, occupational exposure histories obtained and recorded on the department's occupational radiation exposure history form (SFN 19443) or equivalent before January 1, 1994, would not have included effective dose equivalent, but may be used in the absence of specific information on the intake of radionuclides by the individual.
- 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 subdivision f of subsection 1 for the current year, that the allowable dose limit for the individual is reduced by twelve and five-tenths millisieverts [1.25

rem] 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 the department's occupational radiation exposure history form (SFN 19443) or equivalent until the department terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing the department's occupational radiation exposure history form (SFN 19443) or equivalent for three years after the record is made.
6. 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 subsection 1 provided that each of the following conditions is satisfied:
- a. The licensee or registrant authorizes a planned special exposure only in an exceptional situation when alternatives that might avoid the higher exposure 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 as low as reasonably achievable 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 subdivision b of subsection 5 during the lifetime of the individual for each individual involved.

- e. Subject to subdivision b of subsection 1, 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 subdivision a of subsection 1 in any year; and
 - (2) Five times the annual dose limits in subdivision a of subsection 1 during the individual's lifetime.
 - f. The licensee or registrant maintains records of the conduct of a planned special exposure in accordance with subsection 6 of section 33-10-04.1-15 and submits a written report in accordance with subsection 4 of section 33-10-04.1-16.
 - 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 thirty 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 subdivision a of subsection 1 but shall be included in evaluations required by subdivisions d and e.
7. Occupational dose limits for minors. The annual occupational dose limits for minors are ten percent of the annual occupational dose limits specified for adult workers in subsection 1.
8. Dose to an embryo or fetus.
- a. The licensee or registrant shall ensure that the dose to an embryo or fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed five millisievert [0.5 rem]. See subsection 7 of section 33-10-04.1-15 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 subdivision a (the national council on radiation protection and measurements recommended in NCRP report No. 91 "Recommendations on Limits for Exposure to Ionizing Radiation" (June 1, 1987) that no more than five-tenths millisievert [0.05 rem] to the embryo or fetus be received in any one month).
 - c. The dose to an embryo or fetus shall be taken as the sum of:

- (1) The deep dose equivalent to the declared pregnant woman; and
 - (2) The dose to the embryo or fetus from radionuclides in the embryo or fetus and radionuclides in the declared pregnant woman.
- d. If by the time the woman declares pregnancy to the licensee or registrant, the dose to the embryo or fetus has exceeded four and five-tenths millisievert [0.45 rem], the licensee or registrant shall be deemed to be in compliance with subdivision a of subsection 8 of section 33-10-04.1-06 if the additional dose to the embryo or fetus does not exceed five-tenths millisievert [0.05 rem] during the remainder of the pregnancy.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-07. Radiation dose limits for individual members of the public.

1. 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 one millisievert [0.1 rem] in a year, exclusive of the dose contribution from the licensee's or registrant's disposal of radioactive material into sanitary sewerage in accordance with subsection 3 of section 33-10-04.1-14. Retrofit shall not be required for locations within facilities where only radiation machines existed prior to January 1, 1994, and met the previous requirements of five millisievert [0.5 rem] in a year; and
 - (2) The dose in any unrestricted area from external sources does not exceed two-hundredths millisievert [0.002 rem] in any one hour.
- b. If the licensee or registrant permits members of the public to have access to restricted 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 five millisievert [0.5 rem]. 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 subdivision a;
 - (2) The licensee's or registrant's program to assess and control dose within the five millisievert [0.5 rem] annual limit; and
 - (3) The procedures to be followed to maintain the dose as low as reasonably achievable.
- d. In addition to the requirements of this chapter, a licensee or registrant subject to the provisions of the United States environmental protection agency'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.

2. 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 areas and radioactive materials in effluents released to unrestricted areas to demonstrate compliance with the dose limits for individual members of the public in subsection 1.
- b. A licensee or registrant shall show compliance with the annual dose limit in subsection 1 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 appendix B; and

- (b) If an individual were continuously present in an unrestricted area, the dose from external sources would not exceed two-hundredths millisievert [0.002 rem] in an hour and five-tenths millisievert [0.05 rem] in a year.
- c. Upon approval from the department, the licensee or registrant may adjust the effluent concentration values in appendix B, table II, 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.

History: Effective March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-08. Testing for leakage or contamination of sealed sources.

1. Testing for leakage or contamination of sealed sources.
 - a. The licensee or registrant in possession of any sealed source shall assure that:
 - (1) Each sealed source, except as specified in subdivision b of subsection 1, is tested for leakage or contamination and the test results are received before the sealed source is put into use unless the licensee or registrant has a certificate from the transferor indicating that the sealed source was tested within six months before transfer to the licensee or registrant.
 - (2) Each sealed source that is not designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed six months or at alternative intervals approved by the department, after evaluation of information specified by paragraphs 4 and 5 of subdivision k of subsection 5 of section 33-10-03-05, an agreement state, a licensing state, or the United States nuclear regulatory commission.
 - (3) Each sealed source that is designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed three months or at alternative intervals approved by the department, after evaluation of information specified by paragraphs 4 and 5 of subdivision k of subsection 5 of section 33-10-03-05, an agreement state, a

licensing state, or the United States nuclear regulatory commission.

- (4) For each sealed source that is required to be tested for leakage or contamination, at any other time there is reason to suspect that the sealed source might have been damaged or might be leaking, the licensee or registrant 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 one hundred eighty-five becquerels [0.005 μ Ci] 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 thirty-seven becquerels [0.001 μ Ci] of radon-222 in a twenty-four-hour period when the collection efficiency for radon-222 and its daughters has been determined with respect to collection method, volume, and time.
 - (7) Tests for contamination from radium daughters shall be taken on the interior surface of brachytherapy source storage containers and shall be capable of detecting the presence of one hundred eighty-five becquerels [0.005 μ Ci] of a radium daughter which has a half-life greater than four days.
- b. A licensee or registrant need not perform test for leakage or contamination on the following sealed sources:
- (1) Sealed sources containing only radioactive material with a half-life of less than thirty days;
 - (2) Sealed sources containing only radioactive material as a gas;
 - (3) Sealed sources containing three and seven-tenths megabecquerels [100 μ Ci] or less of beta or photon-emitting material or three hundred seventy kilobecquerels [10 μ Ci] or less of alpha-emitting material;

- (4) Sealed sources containing only hydrogen-3;
 - (5) Seeds of iridium-192 encased in nylon ribbon; and
 - (6) Sealed sources, except teletherapy and brachytherapy sources, which are stored, not being used and identified as in storage. The licensee or registrant shall, however, test each such sealed source for leakage or contamination and receive the test results before any use or transfer unless it has been tested for leakage or contamination within six months before the date of use or transfer.
- c. Tests for leakage or contamination from sealed sources shall be performed by persons specifically authorized by the department, an agreement state, a licensing state, or the United States nuclear regulatory commission to perform such services.
 - d. Test results shall be kept in units of becquerel or microcurie and maintained for inspection by the department.
 - e. The following shall be considered evidence that a sealed source is leaking:
 - (1) The presence of one hundred eighty-five becquerels (0.005 μ Ci) or more of removable contamination on any test sample.
 - (2) Leakage of thirty-seven becquerels [0.001 μ Ci] of radon-222 per twenty-hour hours for brachytherapy sources manufactured to contain radium.
 - (3) The presence of removable contamination resulting from the decay of one hundred eighty-five becquerels [0.005 μ Ci] or more of radium.
 - f. The licensee or registrant shall immediately withdraw a leaking sealed source from use and shall take action to prevent the spread of contamination. The leakage sealed source shall be repaired or disposed of in accordance with this section.
 - g. Reports of test results for leaking or contaminated sealed sources shall be made pursuant to subsection 8 of section 33-10-04.1-16.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-09. Survey and monitoring.

1. General.

- a. Each licensee or registrant shall make, or cause to be made, surveys that:
 - (1) Are necessary for the licensee or registrant to comply with this chapter; and
 - (2) Are necessary under the circumstances to evaluate:
 - (a) Radiation levels;
 - (b) Concentrations or quantities of radioactive material; and
 - (c) The potential radiological hazards that could be present.
- b. The licensee or registrant shall ensure that instruments and equipment used for quantitative radiation measurements, for example, dose rate and effluent monitoring, are calibrated at intervals not to exceed twelve months for the radiation measured.
- c. All personnel dosimeters, except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to any extremity, that require processing to determine the radiation dose and that are used by licensees and registrants to comply with subsection 1 of section 33-10-04.1-06, with other provisions of this article, or with conditions specified in a license or registration shall be processed and evaluated by a dosimetry processor:
 - (1) Holding current personnel dosimetry accreditation from the national voluntary laboratory accreditation program (NVLAP) of the national institute of standards and technology; and
 - (2) Approved in this accreditation process for the type of radiation or radiations included in the national voluntary laboratory accreditation 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.

2. 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 chapter. At a minimum:
 - a. Each licensee or registrant shall monitor occupational exposure to radiation and shall supply and require the use of individual monitoring devices by:
 - (1) Adults likely to receive, in one year from sources external to the body, a dose in excess of ten percent of the limits in subdivision a of subsection 1 of section 33-10-04.1-06;
 - (2) Minors and declared pregnant women likely to receive, in one year from sources external to the body, a dose in excess of ten percent of any of the applicable limits in subsections 7 or 8 of section 33-10-04.1-06; and
 - (3) Individuals entering a high or very high radiation area.
 - (4) Reserved.
 - b. Each licensee or registrant shall monitor, to determine compliance with subsection 4 of section 33-10-04.1-06, the occupational intake of radioactive material by and assess the committed effective dose equivalent to:
 - (1) Adults likely to receive, in one year, an intake in excess of ten percent of the applicable annual limit on intake in table I, columns 1 and 2, of appendix B; and
 - (2) Minors and declared pregnant women likely to receive, in one year, a committed effective dose equivalent in excess of five-tenths millisievert [0.05 rem].

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-10. Control of exposure from external sources in restricted areas.

1. 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 one millisievert [0.1 rem] in one hour at thirty centimeters from the source of radiation or from any surface that the radiation penetrates;
 - (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 subdivision a of subsection 1 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 subdivisions a and c of subsection 1 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 rules of the United States department of transportation provided that:
- (1) The packages do not remain in the area longer than three days; and
 - (2) The dose rate at one meter from the external surface of any package does not exceed one-tenth millisievert [0.01 rem] 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 chapter and to operate within the as low as is reasonably achievable provisions of the licensee's or registrant's radiation protection program.

- g. The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a high radiation area as described in subsection 1 if the registrant has met all the specific requirements for access and control specified in other applicable parts of this article, such as, chapter 33-10-05 for industrial radiography, chapter 33-10-06 for x-rays in the healing arts, and chapter 33-10-09 for particle accelerators.

2. Control of access to very high radiation areas.

- a. In addition to the requirements in subsection 1, 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 five gray [500 rad] or more in one hour at one meter from a source of radiation or any surface through which the radiation penetrates. This requirement does not apply to rooms or areas in which diagnostic x-ray systems are the only source of radiation, or to nonself-shielded irradiators.
- b. The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a very high radiation area as described in subdivision a if the registrant has met all the specific requirements for access and control specified in other applicable parts of this article, such as, chapter 33-10-05 for industrial radiography, chapter 33-10-06 for x-rays in the healing arts, and chapter 33-10-09 for particle accelerators.

3. Control of access to very high radiation areas - irradiators.

- a. This subsection applies to licensees or registrants with sources of radiation in nonself-shielded irradiators. This subsection does not apply to sources of radiation that are used in teletherapy, in industrial radiography, or in completely self-shielded irradiators in which the source of radiation is both stored and operated within the same shielding radiation barrier and, in the designed configuration of the irradiator, is always physically inaccessible to any individual and cannot create high levels of radiation in an area that is accessible to any individual.
- b. Each area in which there may exist radiation levels in excess of five gray [500 rad] in one hour at one meter

from a source of radiation that is used to irradiate materials shall meet the following requirements:

- (1) Each entrance or access point shall be equipped with entry control devices which:
 - (a) Function automatically to prevent any individual from inadvertently entering a very high radiation area;
 - (b) Permit deliberate entry into the area only after a control device is actuated that causes the radiation level within the area, from the source of radiation, to be reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour; and
 - (c) Prevent operation of the source of radiation if it would produce radiation levels in the area that could result in a deep dose equivalent to an individual in excess of one millisievert [0.1 rem] in one hour.
- (2) Additional control devices shall be provided so that, upon failure of the entry control devices to function as required by paragraph 1:
 - (a) The radiation level within the area, from the source of radiation, is reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour; and
 - (b) Conspicuous visible and audible alarm signals are generated to make an individual attempting to enter the area aware of the hazard and at least one other authorized individual, who is physically present, familiar with the activity, and prepared to render or summon assistance, aware of the failure of the entry control devices.
- (3) The licensee or registrant shall provide control devices so that, upon failure or removal of physical radiation barriers other than the sealed source's shielded storage container:
 - (a) The radiation level from the source of radiation is reduced below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour; and

- (b) Conspicuous visible and audible alarm signals are generated to make potentially affected individuals aware of the hazard and the licensee or registrant or at least one other individual, who is familiar with the activity, and prepared to render or summon assistance, aware of the failure or removal of the physical barrier.
- (4) When the shield for stored sealed sources is a liquid, the licensee or registrant shall provide means to monitor the integrity of the shield and to signal, automatically, loss of adequate shielding.
- (5) Physical radiation barriers that comprise permanent structural components, such as walls, that have no credible probability of failure or removal in ordinary circumstances need not meet the requirements of paragraphs 3 and 4.
- (6) Each area shall be equipped with devices that will automatically generate conspicuous visible and audible alarm signals to alert personnel in the area before the source of radiation can be put into operation and in time for any individual in the area to operate a clearly identified control device, which must be installed in the area and which can prevent the source of radiation from being put into operation.
- (7) Each area shall be controlled by use of such administrative procedures and such devices as are necessary to ensure that the area is cleared of personnel prior to each use of the source of radiation.
- (8) Each area shall be checked by a radiation measurement to ensure that, prior to the first individual's entry into the area after any use of the source of radiation, the radiation level from the source of radiation in the area is below that at which it would be possible for an individual to receive a deep dose equivalent in excess of one millisievert [0.1 rem] in one hour.
- (9) The entry control devices required in paragraph 1 shall be tested for proper functioning. See subsection 10 of section 33-10-04.1-15 for recordkeeping requirements.
 - (a) Testing shall be conducted prior to initial operation with the source of radiation on any day, unless operations were continued uninterrupted from the previous day;

- (b) Testing shall be conducted prior to resumption of operation of the source of radiation after any unintentional interruption; and
 - (c) The licensee or registrant shall submit and adhere to a schedule for periodic tests of the entry control and warning systems.
- (10) The licensee or registrant shall not conduct operations, other than those necessary to place the source of radiation in safe condition or to effect repairs on controls, unless control devices are functioning properly.
- (11) Entry and exit portals that are used in transporting materials to and from the irradiation area, and that are not intended for use by individuals, shall be controlled by such devices and administrative procedures as are necessary to physically protect and warn against inadvertent entry by any individual through these portals. Exit portals for irradiated materials shall be equipped to detect and signal the presence of any loose radioactive material that is carried toward such an exit and automatically to prevent loose radioactive material from being carried out of the area.
- c. Licensees, registrants, or applicants for licenses or registrations for sources of radiation within the purview of subdivision b which will be used in a variety of positions or in locations, such as open fields or forests, that make it impracticable to comply with certain requirements of subdivision b, such as those for the automatic control of radiation levels, may apply to the department for approval of alternative safety measures. Alternative safety measures shall provide personnel protection at least equivalent to those specified in subdivision b. At least one of the alternative measures shall include an entry-preventing interlock control based on a measurement of the radiation that ensures the absence of high radiation levels before an individual can gain access to the area where such sources of radiation are used.
- d. The entry control devices required by subdivisions b and c shall be established in such a way that no individual will be prevented from leaving the area.

History: Effective March 1, 1994.
General Authority: NDCC 23-20.1-04
Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-11. Respiratory protection and controls to restrict internal exposure in restricted areas.

1. 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 or ventilation, to control the concentrations of radioactive material in air.
2. Use of other controls. When it is not practicable to apply process or other engineering controls to control the concentrations of radioactive material in air to values below those that define an airborne radioactivity area, the licensee or registrant, consistent with maintaining the total effective dose equivalent as low as is reasonably achievable, shall increase monitoring and limit intakes by one or more of the following means:
 - a. Control of access;
 - b. Limitation of exposure times;
 - c. Use of respiratory protection equipment; or
 - d. Other controls.
3. Use of individual respiratory protection equipment.
 - a. If the licensee or registrant uses respiratory protection equipment to limit intakes pursuant to subsection 2:
 - (1) Except as provided in paragraph 2, the licensee or registrant shall use only respiratory protection equipment that is tested and certified or had certification extended by the national institute for occupational safety and health and the mine safety and health administration.
 - (2) If the licensee or registrant wishes to use equipment that has not been tested or certified by the national institute for occupational safety and health and the mine safety and health administration has not had certification extended by the national institute for occupational safety and health and the mine safety and health administration, or for which there is no schedule for testing or certification, the licensee or registrant shall submit an application for authorized use of that equipment, including a demonstration by testing, or a demonstration on the basis of reliable test information, that the material and performance characteristics of the equipment are capable of providing the proposed degree of protection under anticipated conditions of use.

- (3) The licensee or registrant shall implement and maintain a respiratory protection program that includes:
 - (a) Air sampling sufficient to identify the potential hazard, permit proper equipment selection, and estimate exposures;
 - (b) Surveys and bioassays, as appropriate, to evaluate actual intakes;
 - (c) Testing of respirators for operability immediately prior to each use;
 - (d) Written procedures regarding selection, fitting, issuance, maintenance, and testing of respirators, including testing for operability immediately prior to each use; supervision and training of personnel; monitoring, including air sampling and bioassays; and recordkeeping; and
 - (e) Determination by a physician prior to initial fitting of respirators, and at least every twelve months thereafter, that the individual user is physically able to use the respiratory protection equipment.
- (4) The licensee or registrant shall issue a written policy statement on respirator usage covering:
 - (a) The use of process or other engineering controls, instead of respirators;
 - (b) The routine, nonroutine, and emergency use of respirators; and
 - (c) The length of periods of respirator use and relief from respirator use.
- (5) 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.
- (6) The licensee or registrant shall use respiratory protection equipment within the equipment manufacturer's expressed limitations for type and mode of use and shall provide proper visual, communication, and other special capabilities, such as adequate skin protection, when needed.

- b. When estimating exposure of individuals to airborne radioactive materials, the licensee or registrant may make allowance for respiratory protection equipment used to limit intakes pursuant to subsection 2, provided that the following conditions, in addition to those in subdivision a are satisfied:
- (1) The licensee or registrant selects respiratory protection equipment that provides a protection factor, specified in appendix A, greater than the multiple by which peak concentrations of airborne radioactive materials in the working area are expected to exceed the values specified in appendix B, table I, column 3. However, if the selection of respiratory protection equipment with a protection factor greater than the peak concentration is inconsistent with the goal specified in subsection 2 of keeping the total effective dose equivalent as low as is reasonably achievable, the licensee or registrant may select respiratory protection equipment with a lower protection factor provided that such a selection would result in a total effective dose equivalent that is as low as is reasonably achievable. The concentration of radioactive material in the air that is inhaled when respirators are worn may be initially estimated by dividing the average concentration in air, during each period of uninterrupted use, by the protection factor. If the exposure is later found to be greater than initially estimated, the corrected value shall be used; if the exposure is later found to be less than initially estimated, the corrected value may be used.
 - (2) The licensee or registrant shall obtain authorization from the department before assigning respiratory protection factors in excess of those specified in appendix A. The department may authorize a licensee or registrant to use higher protection factors on receipt of an application that:
 - (a) Describes the situation for which a need exists for higher protection factors; and
 - (b) Demonstrates that the respiratory protection equipment provides these higher protection factors under the proposed conditions of use.
- c. In an emergency, the licensee or registrant shall use as emergency equipment only respiratory protection equipment that has been specifically certified or had certification extended for emergency use by the national institute for

occupational safety and health and the mine safety and health administration.

- d. The licensee or registrant shall notify the department in writing at least twenty days before the date that respiratory protection equipment is first used pursuant to either subdivision a or subdivision b.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-12. Storage and control of licensed or registered sources of radiation.

1. Security of stored sources of radiation. The licensee or registrant shall secure from unauthorized removal or access licensed or registered sources of radiation that are stored in unrestricted areas.
2. Control of sources of radiation not in storage.
 - a. The licensee or registrant shall control and maintain constant surveillance of licensed or registered radioactive material that is in an unrestricted area and that is not in storage or in a patient who has been released in accordance with the patient release criteria in subsection 12 of section 33-10-07-05.
 - b. The registrant shall maintain control of radiation machines that are in a controlled or unrestricted area and that are not in storage.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

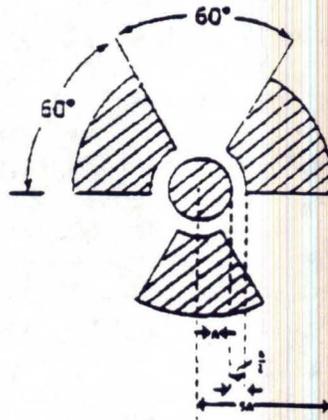
33-10-04.1-13. Precautionary procedures.

1. Caution signs.
 - a. Standard radiation symbol. Unless otherwise authorized by the department, the symbol prescribed by this subsection shall use the colors magenta, or purple, or black on yellow background. The symbol prescribed is the three-bladed design as follows:

RADIATION SYMBOL

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

(2) The background is to be yellow.



- b. Exception to color requirements for standard radiation symbol. Notwithstanding the requirements of subdivision a, licensees or registrants are authorized to label sources, source holders, or device components containing sources of radiation that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without a color requirement.
 - c. Additional information on signs and labels. In addition to the contents of signs and labels prescribed in this chapter, 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.
2. 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 ten times the quantity of such material specified in appendix C with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)".
3. 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 eight 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 chapter; 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 subsection 2 provided that the patient could be released from confinement pursuant to chapter 33-10-07.
 - 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 thirty centimeters from the surface of the sealed source container or housing does not exceed five hundredths millisievert [0.005 rem] per hour.
 - d. A room or area is not required to be posted with a caution sign because of the presence of radiation machines used solely for diagnosis in the healing arts.
4. 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.
5. Exemptions to labeling requirements. A licensee or registrant is not required to label:
- a. Containers holding licensed or registered material in quantities less than the quantities listed in appendix C;
 - b. Containers holding licensed or registered material in concentrations less than those specified in table III of appendix B;
 - c. Containers attended by an individual who takes the precautions necessary to prevent the exposure of individuals in excess of the limits established by this chapter;
 - d. Containers when they are in transport and packaged and labeled in accordance with the rules of the United States department of transportation (Labeling of packages containing radioactive materials is required by the United States department of transportation if the amount and type of radioactive material exceeds the limits for an excepted quantity or article as defined and limited by United States department of transportation rules 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.

6. Procedures for receiving and opening packages.

a. Each licensee or registrant who expects to receive a package containing quantities of radioactive material in excess of a type A quantity, as defined in section 33-10-13-02 and appendix A of chapter 33-10-13, 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 or registrant shall:

(1) Monitor the external surfaces of a labeled package for radioactive contamination unless the package contains only radioactive material in the form of gas or in special form as defined in section 33-10-01-04. Labeled package means posted with a radioactive white I, yellow II, or yellow III label as specified in United States department of transportation rules 49 CFR 172.403 and 172.436-440;

(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 section 33-10-13-02 and appendix A to chapter 33-10-13. Labeled package means posted with a radioactive white I, yellow II, or yellow III label as specified in United States department of transportation rules 49 CFR 172.403 and 172.436-440; 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 or registrant shall perform the monitoring required by subdivision b as soon as practicable after receipt of the package, but not later than three hours after the package is received at the licensee's or

registrant's facility if it is received during the licensee's or registrant's normal working hours, or not later than three hours from the beginning of the next working day if it is received after working hours.

- d. The licensee or registrant shall immediately notify the final delivery carrier and, by telephone and telegram, mailgram, or facsimile, the department when:
 - (1) Removable radioactive surface contamination exceeds the limits of subsection 8 of section 33-10-13-15; or
 - (2) External radiation levels exceed the limits of subsections 9 and 10 of section 33-10-13-15.
- e. Each licensee or registrant 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 or registrants transferring special form sources in vehicles owned or operated by the licensee or registrant to and from a worksite are exempt from the contamination monitoring requirements of subdivision b, but are not exempt from the monitoring requirement in subdivision b for measuring radiation levels that ensures that the source is still properly lodged in its shield.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-14. Waste disposal.

1. General requirements.

- a. A licensee or registrant shall dispose of licensed or registered material only:
 - (1) By transfer to an authorized recipient as provided in subsection 6 or in chapter 33-10-03, or to the United States department of energy;
 - (2) By decay in storage;
 - (3) By release in effluents within the limits in subsection 1 of section 33-10-04.1-07; or

- (4) As authorized pursuant to subsection 2, 3, 4, or 5.
 - b. A person shall be specifically licensed or registered to receive waste containing licensed or registered 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 10 CFR 61; or
 - (5) Storage until transferred to a storage or disposal facility authorized to receive the waste.
2. Method for obtaining approval of proposed disposal procedures. A licensee or registrant or applicant for a license or registration may apply to the department for approval of proposed procedures, not otherwise authorized in this article, to dispose of licensed or registered material generated in the licensee's or registrant's operations. Each application shall include:
- a. A description of the waste containing licensed or registered material to be disposed of, including the physical and chemical properties that have an impact on risk evaluation, and the proposed manner and conditions of waste disposal;
 - b. An analysis and evaluation of pertinent information on the nature of the environment;
 - c. The nature and location of other potentially affected facilities; and
 - d. Analyses and procedures to ensure that doses are maintained as low as is reasonably achievable and within the dose limits in this chapter.
3. Disposal by release into sanitary sewerage.
- a. A licensee or registrant may discharge licensed or registered 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 registered radioactive material that the licensee or registrant releases

into the sewer in one month divided by the average monthly volume of water released into the sewer by the licensee or registrant does not exceed the concentration listed in table III of appendix B;

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

(a) The licensee or registrant shall determine the fraction of the limit in table III of appendix B 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 appendix B; and

(b) The sum of the fractions for each radionuclide required by subparagraph a does not exceed unity; and

(4) The total quantity of licensed or registered radioactive material that the licensee or registrant releases into the sanitary sewerage in a year does not exceed one hundred eighty-five gigabecquerels [5 Ci] of hydrogen-3, thirty-seven gigabecquerels [1 Ci] of carbon-14, and 37 gigabecquerels [1 Ci] 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 subdivision a.

4. Treatment or disposal by incineration. A licensee or registrant may treat or dispose of licensed or registered material by incineration only in the amounts and forms specified in subsection 5 or as specifically approved by the department pursuant to subsection 2.

5. Disposal of specific wastes.

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

(1) One and eighty-five one-hundredths kilobecquerels [0.05 μ Ci], or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and

(2) One and eighty-five one-hundredths kilobecquerels [0.05 μ Ci], or less, of hydrogen-3 or carbon-14 per

gram of animal tissue, averaged over the weight of the entire animal.

- b. A licensee or registrant shall not dispose of tissue pursuant to paragraph 2 of subdivision a in a manner that would permit its use either as food for humans or as animal feed.
- c. The licensee or registrant shall maintain records in accordance with subsection 9 of section 33-10-04.1-15.

6. Transfer for disposal and manifests.

- a. The requirements of this subsection and appendix D are designed to control transfers of low-level radioactive waste intended for disposal at a licensed low-level radioactive waste disposal facility, establish a manifest tracking system, and supplement existing requirements concerning transfers and recordkeeping for those wastes.
- b. Each shipment of radioactive waste designated for disposal at a licensed low-level radioactive waste disposal facility shall be accompanied by a shipment manifest as specified in section I of appendix D.
- c. Each shipment manifest shall include a certification by the waste generator as specified in section II of appendix D.
- d. Each person involved in the transfer of waste for disposal or in the disposal of waste, including the waste generator, waste collector, waste processor, and disposal facility operator, shall comply with the requirements specified in section III of appendix D.

7. Compliance with environmental and health protection rules. Nothing in subsection 1, 2, 3, 4, 5, or 6 relieves the licensee or registrant from complying with other applicable federal, state, and local rules governing any other toxic or hazardous properties of materials that may be disposed of in accordance with subsection 1, 2, 3, 4, 5, or 6.

History: Effective March 1, 1994.
General Authority: NDCC 23-20.1-04
Law Implemented: NDCC 23-20.1-04.1

33-10-04.1-15. Records.

1. General provisions.

- a. Each licensee or registrant shall use the international system units becquerel, gray, sievert, and coulomb per

kilogram, or the special units curie, rad, rem, and roentgen, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by this chapter.

- b. The licensee or registrant shall make a clear distinction among the quantities entered on the records required by this chapter, such as, total effective dose equivalent, total organ dose equivalent, shallow dose equivalent, eye dose equivalent, deep dose equivalent, or committed effective dose equivalent.

2. 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 subdivision a 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 subdivision a for three years after the record is made.

3. Records of surveys.

- a. Each licensee or registrant shall maintain records showing the results of surveys and calibrations required by subsection 1 of section 33-10-04.1-09 and subdivision b of subsection 6 of section 33-10-04.1-13. The licensee or registrant shall retain these records for three 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 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 subdivision a of subsection 3 of section 33-10-04.1-11; and
 - (4) Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.
 - c. Upon termination of the license or registration, the licensee or registrant shall permanently store records on the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
4. Records of tests for leakage or contamination of sealed sources. Records of tests for leakage or contamination of sealed sources (required by subsection 1 of section 33-10-04.1-08) shall be kept in units of becquerel or microcurie and maintained for inspection by the department for five years after the records are made.
5. Records of prior occupational dose.
 - a. The licensee or registrant shall retain the records of prior occupational dose and exposure history as specified in subsection 5 of section 33-10-04.1-06 on the department's occupational radiation exposure history form (SFN 19443) or equivalent until the department terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing the department's occupational radiation exposure history form (SFN 19443) or equivalent for three years after the record is made.
 - b. Upon termination of the license or registration, the licensee or registrant shall permanently store records on the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
6. Records of planned special exposures.
 - a. For each use of the provisions of subsection 6 of section 33-10-04.1-06 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 as low as is reasonably achievable;
 - (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 the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.

7. Records of individual monitoring results.

- a. Recordkeeping requirement. Each licensee or registrant shall maintain records of doses received by all individuals for whom monitoring was required pursuant to subsection 2 of section 33-10-04.1-09, 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 January 1, 1994, need not be changed. These records shall include, when applicable:
- (1) The deep dose equivalent to the whole body, eye dose equivalent, shallow dose equivalent to the skin, and shallow dose equivalent to the extremities;
 - (2) The estimated intake of radionuclides, see subsection 2 of section 33-10-04.1-06;
 - (3) The committed effective dose equivalent assigned to the intake of radionuclides;
 - (4) The specific information used to calculate the committed effective dose equivalent pursuant to subdivision c of subsection 4 of section 33-10-04.1-06;
 - (5) The total effective dose equivalent when required by subsection 2 of section 33-10-04.1-06; and

- (6) The total of the deep dose equivalent and the committed dose to the organ receiving the highest total dose.
 - b. Recordkeeping frequency. The licensee or registrant shall make entries of the records specified in subdivision a at intervals not to exceed one year.
 - c. Recordkeeping format. The licensee or registrant shall maintain the records specified in subdivision a on the department's current occupational radiation exposure form (SFN 8416), in accordance with the instructions for the department's current occupational radiation exposure form (SFN 8416), or in clear and legible records containing all the information required by the department's current occupational radiation exposure form (SFN 8416).
 - d. The licensee or registrant shall maintain the records of dose to an embryo or 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 the department's occupational radiation exposure history form (SFN 19443) or equivalent, or shall make provision with the department for transfer to the department.
8. 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 subsection 1 of section 33-10-04.1-07.
 - b. The licensee or registrant shall retain the records required by subdivision a until the department terminates each pertinent license or registration requiring the record.
 9. Records of waste disposal.
 - a. Each licensee or registrant shall maintain records of the disposal of licensed or registered materials made pursuant to subsection 2, 3, 4, or 5 of section 33-10-04.1-14, chapter 33-10-03, or disposal by burial in soil, including burials authorized before October 1, 1982.

- b. The licensee or registrant shall retain the records required by subdivision a until the department terminates each pertinent license or registration requiring the record.
- 10. Records of testing entry control devices for very high radiation areas.
 - a. Each licensee or registrant shall maintain records of tests made pursuant to paragraph 9 of subdivision b of subsection 3 of section 33-10-04.1-10 on entry control devices for very high radiation areas. These records must include the date, time, and results of each such test of function.
 - b. The licensee or registrant shall retain the records required by subdivision a for three years after the record is made.
- 11. Form of records. Each record required by this chapter 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 shall maintain adequate safeguards against tampering with and loss of records.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04, 23-20.1-09.1

33-10-04.1-16. Reports.

- 1. Reports of stolen, lost, or missing licensed or registered sources of radiation.
 - a. Telephone reports. Each licensee or registrant shall report to the department by telephone as follows:
 - (1) Immediately after its occurrence becomes known to the licensee or registrant, stolen, lost, or missing licensed or registered radioactive material in an aggregate quantity equal to or greater than one thousand times the quantity specified in appendix C under such circumstances that it appears to the

licensee or registrant that an exposure could result to individuals in unrestricted areas; or

- (2) Within thirty days after its occurrence becomes known to the licensee or registrant, lost, stolen, or missing licensed or registered radioactive material in an aggregate quantity greater than ten times the quantity specified in appendix C that is still missing.
 - (3) Immediately after its occurrence becomes known to the registrant, a stolen, lost, or missing radiation machine.
- b. Written reports. Each licensee or registrant required to make a report pursuant to subdivision a, within thirty days after making the telephone report, shall 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 thirty 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 subsection so that

names of individuals who may have received exposure to radiation are stated in a separate and detachable portion of the report.

2. 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 twenty-five one-hundredths sievert [25 rem] or more;

(b) An eye dose equivalent of seventy-five one-hundredths sievert [75 rem] or more; or

(c) A shallow dose equivalent to the skin or extremities or a total organ dose equivalent of two and five-tenths gray [250 rad] or more; or

(2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for twenty-four hours, the individual could have received an intake five times the annual limit on intake. 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, within twenty-four hours of discovery of the event, shall 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 twenty-four hours:

(a) A total effective dose equivalent exceeding five-hundredths sievert [5 rem];

(b) An eye dose equivalent exceeding fifteen-hundredths sievert [15 rem]; or

- (c) A shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding five-tenths sievert [50 rem]; or
- (2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for twenty-four hours, the individual could have received an intake in excess of one annual limit on intake. 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 subsection so that names of individuals who have received exposure to sources of radiation are stated in a separate and detachable portion of the report.
- d. Licensees or registrants shall make the reports required by subdivisions a and b to the department by telephone, telegram, mailgram, or facsimile to the department.
- e. The provisions of this subsection 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 subsection 4.
- 3. Reports of exposures, radiation levels, and concentrations of radioactive material exceeding the limits.
 - a. Reportable events. In addition to the notification required by subsection 2, each licensee or registrant shall submit a written report within thirty days after learning of any of the following occurrences:
 - (1) Incidents for which notification is required by subsection 2; or
 - (2) Doses in excess of any of the following:
 - (a) The occupational dose limits for adults in subsection 1 of section 33-10-04.1-06;
 - (b) The occupational dose limits for a minor in subsection 7 of section 33-10-04.1-06;
 - (c) The limits for an embryo or fetus of a declared pregnant woman in subsection 8 of section 33-10-04.1-06;

- (d) The limits for an individual member of the public in subsection 1 of section 33-10-04.1-07; or
 - (e) Any applicable limit in the license or registration; 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 ten times the applicable limit set forth in this chapter or in the license or registration, whether or not involving exposure of any individual in excess of the limits in subsection 1 of section 33-10-04.1-07; or
- (4) For licensees subject to the provisions of United States environmental protection agency's generally applicable environmental radiation standards in 40 CFR 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

b. Contents of reports.

- (1) Each report required by subdivision a 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, generally applicable environmental standards, and associated license or registration conditions.
- (2) Each report filed pursuant to subdivision a shall include for each individual exposed: the name, social security account number, and date of birth. With respect to the limit for the embryo or fetus in subsection 8 of section 33-10-04.1-06, the

identifiers should be those of the declared pregnant woman. The report shall be prepared so that this information is stated in a separate and detachable portion of the report.

- c. All licensees or registrants who make reports pursuant to subdivision a shall submit the report in writing to the department.
4. Reports of planned special exposures. The licensee or registrant shall submit a written report to the department within thirty days following any planned special exposure conducted in accordance with subsection 6 of section 33-10-04.1-06, informing the department that a planned special exposure was conducted and indicating the date the planned special exposure occurred and the information required by subsection 6 of section 33-10-04.1-15.
5. Reporting requirements.
 - a. Immediate report. Each licensee shall notify the department as soon as possible but not later than four hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).
 - b. Twenty-four-hour report. Each licensee shall notify the department within twenty-four hours after the discovery of any of the following events involving licensed material:
 - (1) An unplanned contamination event that:
 - (a) Requires access to the contaminated area, by workers or the public, to be restricted for more than twenty-four hours by imposing additional radiological controls or by prohibiting entry into the area;
 - (b) Involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of this chapter for the material; and
 - (c) Has access to the area restricted for a reason other than to allow isotopes with a half-life of less than twenty-four hours to decay prior to decontamination.
 - (2) An event in which equipment is disabled or fails to function as designed when:

- (a) The equipment is required by rule or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;
 - (b) The equipment is required to be available and operable when it is disabled or fails to function; and
 - (c) No redundant equipment is available and operable to perform the required safety function.
- (3) An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.
- (4) An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:
- (a) The quantity of material involved is greater than five times the lowest annual limit on intake specified in appendix B of this chapter for the material; and
 - (b) The damage affects the integrity of the licensed material or its container.
- c. Preparation and submission of reports. Reports made by licensees in response to the requirements of this section must be made as follows:
- (1) Licensees shall make reports required by subdivisions a and b by telephone to the department. To the extent that the information is available at the time of notification, the information provided in these reports must include:
- (a) The caller's name and callback telephone number;
 - (b) A description of the event, including date and time;
 - (c) The exact location of the event;
 - (d) The isotopes, quantities, and chemical and physical form of the licensed material involved; and
 - (e) Any personnel radiation exposure data available.

(2) Written report. Each licensee who makes a report required by subdivisions a and b shall submit a written followup report within thirty days of the initial report. Written reports prepared pursuant to other rules may be submitted to fulfill this requirement if the reports contain all of the necessary information and the appropriate distribution is made.

- (a) A description of the event, including the probable cause and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;
- (b) The exact location of the event;
- (c) The isotopes, quantities, and chemical and physical form of the licensed material involved;
- (d) Date and time of the event;
- (e) Corrective actions taken or planned and the results of any evaluations or assessments; and
- (f) The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.

6. 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 chapters 33-10-03 and 33-10-05;
- (2) Receive radioactive waste from other persons for disposal pursuant to chapter 33-10-03; or
- (3) Possess or use at any time, for processing or manufacturing for distribution pursuant to chapter 33-10-03 or 33-10-07, radioactive material in quantities exceeding any one of the following quantities:

Radionuclide	Activity ^a	
	Ci	GBq
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

- ^a The department may require as a license condition, or by rule, or order pursuant to this section, reports from licensees or registrants who are licensed or registered 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 subdivision a 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 subsection 2 of section 33-10-04.1-09 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 the department's current occupational radiation exposure form (SFN 8416) or equivalent or electronic media containing all the information required by the department's current occupational radiation exposure form (SFN 8416).
- c. The licensee or registrant shall file the report required by subdivision b, covering the preceding year, on or before April thirtieth of each year. The licensee or registrant shall submit the report to the department.
7. **Notifications and reports to individuals.**
- a. Requirements for notification and reports to individuals of exposure to radiation or radioactive material are specified in subsection 3 of section 33-10-10-02.
- b. When a licensee or registrant is required pursuant to subsection 3 to report to the department any exposure of an individual to radiation or radioactive material, the licensee or registrant shall also notify the individual. Such notice shall be transmitted at a time not later than the transmittal to the department, and shall comply with the provisions of subdivision a of subsection 3 of section 33-10-10-02.
8. **Reports of leaking or contaminated sealed sources.** The licensee or registrant shall file a report within five days with the department if the test for leakage or contamination required pursuant to subsection 1 of section 33-10-04.1-08 indicates a sealed source is leaking or contaminated. The

report shall include the equipment involved, the test results, and the corrective action taken.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04

33-10-04.1-17. Additional requirements - Vacating premises. Each specific licensee or registrant shall, no less than thirty 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 accordance with the following or in such other manner as the department may specify.

1. Premises. Each licensee before vacating any premises, or transferring the premises shall permanently decontaminate such premises below or equal to the standards specified in appendix F. A survey shall be made after such decontamination and the department and the landlord or subsequent tenant or transferee shall be provided with a copy of such survey no less than thirty days before vacating or relinquishing possession or control of premises. No such premises may be vacated, sold, or transferred until the decontamination survey has been verified and accepted by the department.
2. Equipment. No machinery, instruments, laboratory equipment, or any other property used in contact with, or close proximity to radioactive material at a licensed premises may be assigned, sold, leased, or transferred to an unlicensed person unless such property has been permanently decontaminated below or equal to the standards specified in appendix F. A survey shall be made after such decontamination and the department and subsequent transferee or owner shall be provided with a copy of such survey. No such equipment may be assigned, sold, leased, or transferred until such documentation survey has been verified and accepted by the department.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04, 23-20.1-04.1

**APPENDIX A
PROTECTION FACTORS FOR RESPIRATORS¹**

Description	Modes ³	Protection Factors ⁴		Tested & Certified Equipment National Institute for Occupational Safety and Health & Mine Safety and Health Administration tests for permissibility
		Particu- ates only	Particu- lates, gases & vapors	
(1) AIR-PURIFYING RESPIRATORS⁶				
Facepiece, half-mask ⁷	NP	10		30 CFR 11, Subpart K.
Facepiece, full	NP	50		
Facepiece, half-mask full, or hood	PP	1000		
(2) ATMOSPHERE-SUPPLYING RESPIRATORS				
1. Air-line respirator				
Facepiece, half-mask	CF		1000	30 CFR 11, Subpart J.
Facepiece, half-mask	D		5	
Facepiece, full	CF		2000	
Facepiece, full	D		5	
Facepiece, full	PD		2000	
Hood	CF		^{9,10}	
Suit	CF			
2. Self-contained breathing apparatus (SCBA)				
Facepiece, full	D		50	30 CFR 11, Subpart H.
Facepiece, full	PD		10,000 ¹¹	
Facepiece, full	RD		50	
Facepiece, full	RP		5,000 ¹²	
(3) COMBINATION RESPIRATORS				
Any combination of air-purifying and atmosphere-supplying respirators			Protection factor for type and mode of operation as listed above.	30 CFR 11, Sec. 11.63(b).

FOOTNOTES

1. For use in the selection of respiratory protective equipment to be used only where the contaminants have been identified and the concentrations, or possible concentrations, are known.
2. Only for shaven faces and where nothing interferes with the seal of tight-fitting facepieces against the skin. Hoods and suits are excepted.
3. The mode symbols are defined as follows:
 - CF = continuous flow
 - D = demand
 - NP = negative pressure, that is, negative phase during inhalation
 - PD = pressure demand, that is, always positive pressure
 - PP = positive pressure
 - RD = demand, recirculating or closed circuit
 - RP = pressure demand, recirculating or closed circuit
4. a. The protection factor is a measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of airborne radioactive material outside the respiratory protective equipment to that inside the equipment, usually inside the facepiece, under conditions of use. It is applied to the ambient airborne concentration to estimate the concentrations inhaled by the wearer according to the following formula:
Concentration inhaled = $\frac{\text{Ambient airborne concentration}}{\text{Protection factor}}$
- b. The protection factors apply:
 - (1) Only for individuals trained in using respirators and wearing properly fitted respirators that are used and maintained under supervision in a well-planned respiratory protective program.
 - (2) For air-purifying respirators only when high efficiency particulate filters, above ninety-nine and ninety-seven hundredths percent removal efficiency by thermally generated three-tenths micron dioctyl phthalate (DOP) test or equivalent, are used in atmospheres not deficient in oxygen and not containing radioactive gas or vapor respiratory hazards.
 - (3) No adjustment is to be made for the use of sorbents against radioactive material in the form of gases or vapors.
 - (4) For atmosphere-supplying respirators only when supplied with adequate respirable air. Respirable air shall be provided of the quality and quantity required in accordance with the national institute for occupational safety and health and the mine safety and health administration

certification described in 30 CFR 11. Oxygen and air shall not be used in the same apparatus.

5. Excluding radioactive contaminants that present an absorption or submersion hazard. For tritium oxide, approximately one-third of the intake occurs by absorption through the skin so that an overall protection factor of less than two is appropriate when atmosphere--supplying respirators are used to protect against tritium oxide. If the protection factor for respiratory protective equipment is five, the effective protection factor for tritium is about one and four tenths; with protection factors of ten, the effective factor for tritium oxide is about one and seven tenths; and with protection factors of one hundred or more, the effective factor for tritium oxide is about one and nine tenths. Air-purifying respirators are not suitable for protection against tritium oxide. See also footnote 9 concerning supplied-air suits.
6. Canisters and cartridges shall not be used beyond service-life limitations.
7. Under-chin type only. This type of respirator is not satisfactory for use where it might be possible, such as, if an accident or emergency were to occur, for the ambient airborne concentrations to reach instantaneous values greater than 10 times the pertinent values in table I, column 3 of appendix B of chapter 33-10-04.1. This type of respirator is not suitable for protection against plutonium or other high-toxicity materials. The mask is to be tested for fit prior to use, each time it is donned.
8. a. Equipment shall be operated in a manner that ensures that proper air flow-rates are maintained. A protection factor of no more than one thousand may be utilized for tested-and-certified supplied-air hoods when a minimum air flow of six cubic feet per minute ($0.17 \text{ m}^3/\text{min}$) is maintained and calibrated air line pressure gauges or flow measuring devices are used. A protection factor of up to two thousand may be used for tested and certified hoods only when the air flow is maintained at the manufacturer's recommended maximum rate for the equipment, this rate is greater than six cubic feet per minute ($0.17 \text{ m}^3/\text{min}$) and calibrated air line pressure gauges or flow measuring devices are used.
- b. The design of the supplied-air hood or helmet, with a minimum flow of six cubic feet per minute ($0.17 \text{ m}^3/\text{min}$) of air, may determine its overall efficiency and the protection it provides. For example, some hoods aspirate contaminated air into the breathing zone when the wearer works with hands-over-head. This aspiration may be overcome if a short cape-like extension to the hood is worn under a coat or overalls. Other limitations specified by the approval agency shall be considered before using a hood in certain types of atmospheres. See footnote 9.

9. Appropriate protection factors shall be determined, taking into account the design of the suit and its permeability to the contaminant under conditions of use. There shall be a standby rescue person equipped with a respirator or other apparatus appropriate for the potential hazards and communications equipment whenever supplied-air suits are used.
10. No approval schedules are currently available for this equipment. Equipment is to be evaluated by testing or on the basis of reliable test information.
11. This type of respirator may provide greater protection and be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure, such as skin absorption, must be taken into account in such circumstances.
12. Quantitative fit testing shall be performed on each individual, and no more than two hundredths percent leakage is allowed with this type of apparatus. Perceptible outward leakage of gas from this or any positive pressure self-contained breathing apparatus is unacceptable because service life will be reduced substantially. Special training in the use of this type of apparatus shall be provided to the wearer.

Note 1: Protection factors for respirators approved by the U.S. bureau of mines and the national institute for occupational safety and health, according to applicable approvals for respirators for type and mode of use to protect against airborne radionuclides, may be used to the extent that they do not exceed the protection factors listed in this table. The protection factors listed in this table may not be appropriate to circumstances where chemical or other respiratory hazards exist in addition to radioactive hazards. The selection and use of respirators for such circumstances should take into account applicable approvals of the U.S. bureau of mines and the national institute for occupational safety and health.

Note 2: Radioactive contaminants, for which the concentration values in table I, column 3 of appendix B of chapter 33-10-04.1 are based on internal dose due to inhalation, may present external exposure hazards at higher concentrations. Under these circumstances, limitations on occupancy may have to be governed by external dose limits.

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

Introduction

For each radionuclide, table I indicates the chemical form which is to be used for selecting the appropriate annual limit on intake or derived air concentration value. The annual limit on intakes and derived air concentrations for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of one μm , micron, and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times of less than ten days for D, from ten to one hundred days for W, and of greater than one hundred days for Y. The class (D, W, Y) given in the column headed "class" applies only to the inhalation annual limit on intakes and derived air concentrations given in table I columns 2 and 3. Table II provides concentration limits for airborne and liquid effluents released to the general environment. Table III provides concentration limits for discharges to sanitary sewerage.

Note:

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

Table I "Occupational Values"

Note that the columns in table I of this appendix captioned "oral ingestion annual limit on intake," "inhalation annual limit on intake," and "derived air concentration," are applicable to occupational exposure to radioactive material.

The annual limit on intakes in this appendix are the annual intakes of given radionuclide by "reference man" which would result in either (1) a committed effective dose equivalent of five hundredths sieverts (five rem), stochastic annual limit on intake, or (2) a committed dose equivalent of five tenths sieverts (fifty rem) to an organ or tissue, non-stochastic annual limit on intake. The stochastic annual limit on intakes 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 five hundredths sieverts (five rem). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, w_T . This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is

irradiated uniformly. The values of w_T are listed under the definition of weighting factor in section 33-10-04.1-03. The non-stochastic annual limit on intakes were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

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

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

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

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

The use of the annual limit on intakes listed first, the more limiting of the stochastic and non-stochastic annual limit on intakes, 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 annual limit on intake is limiting, use of that non-stochastic annual limit on intake is considered unduly conservative, the licensee may use the stochastic annual limit on intake to determine the committed effective dose equivalent. However, the licensee shall also ensure that the five tenths sievert (fifty rem) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose equivalent to that organ, not the effective dose. For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic annual limit on intakes (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is, $\sum (\text{intake (in } \mu\text{Ci) of each radionuclide}/ALI_{ns}) \leq \text{one}$. 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 $\leq \text{one}$.

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

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

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

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

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

The values of annual limit on intake and derived air concentration 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 subsection 2 of section 33-10-04.1-06. When an individual is exposed to radioactive materials which fall under several of the translocation classifications of the same radionuclide, such as, class D, class W, or class Y, the exposure may be evaluated as if it were a mixture of different radionuclides.

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

Table II "Effluent Concentrations"

The columns in table II of this appendix captioned "effluent concentrations," "air" and "water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of subsection 2 of section 33-10-04.1-07. 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 five tenths millisievert (0.05 rem).

Consideration of non-stochastic limits has not been included in deriving the air and water effluent concentration limits because non-stochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the non-stochastic limit was governing in deriving the occupational derived

air concentration, the stochastic annual limit on intake was used in deriving the corresponding airborne effluent limit in table II. For this reason, the derived air concentration and airborne effluent limits are not always proportional as they were in appendix A of the 1992 revision of chapter 33-10-04.1.

The air concentration values listed in table II, column 1 were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation annual limit on intake was divided by 2.4×10^9 ml, relating the inhalation annual limit on intake to the derived air concentration, as explained above, and then divided by a factor of three hundred. The factor of three hundred includes the following components: a factor of fifty to relate the five hundredths sievert (5 rem) annual occupational dose limit to the one-tenth rem limit for members of the public, a factor of three 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 two to adjust the occupational values, derived for adults, so that they are applicable to other age groups.

For those radionuclides for which submersion, that is external dose, is limiting, the occupational derived air concentration in table I, column 3 was divided by two hundred nineteen. The factor of two hundred nineteen is composed of a factor of fifty, as described above, and a factor of four and thirty-eight hundredths relating occupational exposure for two thousand hours per year to full-time exposure (8,760 hours per year). Note that an additional factor of two for age considerations is not warranted in the submersion case.

The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion annual limit on intake and dividing by 7.3×10^7 . The factor of 7.3×10^7 (ml) includes the following components: the factors of fifty and two described above and a factor of 7.3×10^5 (ml) which is the annual water intake of reference man.

Note 2 of this appendix provides groupings of radionuclides which are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation annual limit on intakes and derived air concentrations, 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 either from knowledge of the radionuclide composition of the source or from actual measurements.

Table III "Releases to Sewers"

The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in subsection 3 of section 33-10-04.1-14. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion annual limit on intake and dividing by 7.3×10^6 (ml). The factor of 7.3×10^6 (ml) is composed of a factor of 7.3×10^5 (ml), the annual water intake by reference man, and a factor of

10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a reference man during a year, would result in a committed effective dose equivalent of five tenths rem.

LIST OF ELEMENTS

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{m}^3$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}^3$)	Air ($\mu\text{Ci}/\text{m}^3$)	Water ($\mu\text{Ci}/\text{m}^3$)	
12	Magnesium-28	D, all compounds except those given for W W, oxides, hydroxides, carbides, halides, and nitrates	7E+2 -	2E+3 1E+3	7E-7 5E-7	2E-9 2E-9	9E-6 -	9E-5 -
13	Aluminum-26	D, all compounds except those given for W W, oxides, hydroxides, carbides, halides, and nitrates	4E+2 -	6E+1 9E+1	3E-8 4E-8	9E-11 1E-10	6E-6 -	6E-5 -
14	Silicon-31	D, all compounds except those given for W and Y W, oxides, hydroxides, carbides, and nitrates Y, aluminosilicate glass	9E+3 - -	3E+4 3E+4 3E+4	1E-5 1E-5 1E-5	4E-8 5E-8 4E-8	1E-4 - -	1E-3 - -
14	Silicon-32	D, see ^{31}Si W, see ^{31}Si Y, see ^{31}Si	2E+3 LLI wall (3E+3) - -	2E+2 - 1E+2 5E+0	1E-7 - 5E-8 2E-9	3E-10 - 2E-10 7E-12	- 4E-5 - -	- 4E-4 - -
15	Phosphorus-32	D, all compounds except phosphates given for W W, phosphates of Zn^{2+} , S^{2-} , Mg^{2+} , Fe^{3+} , Bi^{3+} , and lanthanides	6E+2 -	9E+2 4E+2	4E-7 2E-7	1E-9 5E-10	9E-6 -	9E-5 -
15	Phosphorus-33	D, see ^{32}P W, see ^{32}P	6E+3 -	8E+3 3E+3	4E-6 1E-6	1E-8 4E-9	8E-5 -	8E-4 -
16	Sulfur-35	Vapor D, sulfides and sulfates except those given for W	1E+4 1E+4 LLI wall (8E+3)	6E-6 2E+4 -	2E-8 7E-6 -	- 2E-8 -	- - 1E-4	- - 1E-3

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
19	Potassium-44 ²	D, all compounds	2E+4 St wall (4E+4)	7E+4	3E-5	9E-8	-	-
19	Potassium-45 ²	D, all compounds	3E+4 St wall (5E+4)	1E+5	5E-5	2E-7	-	-
20	Calcium-41	W, all compounds	3E+3 Bone surf (4E+3)	4E+3 Bone surf (4E+3)	2E-6	-	-	-
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	-	-
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 ₃	3E+2	1E+1	5E-9	2E-11	4E-6	4E-5
			-	3E+1	1E-8	4E-11	-	-
			-	6E+0	2E-9	8E-12	-	-

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
27	Cobalt-56	W, see ^{56}Co	5E+2	3E+2	1E-7	4E-10	6E-6	6E-5
		Y, see ^{56}Co	4E+2	2E+2	8E-8	3E-10	-	-
27	Cobalt-57	W, see ^{56}Co	8E+3	3E+3	1E-6	4E-9	6E-5	6E-4
		Y, see ^{56}Co	4E+3	7E+2	3E-7	9E-10	-	-
27	Cobalt-58m	W, see ^{56}Co	6E+4	9E+4	4E-5	1E-7	8E-4	8E-3
		Y, see ^{56}Co	-	6E+4	3E-5	9E-8	-	-
27	Cobalt-58	W, see ^{56}Co	2E+3	1E+3	5E-7	2E-9	2E-5	2E-4
		Y, see ^{56}Co	1E+3	7E+2	3E-7	1E-9	-	-
27	Cobalt-60m ²	W, see ^{56}Co	1E+6	4E+6	2E-3	6E-6	-	-
		Y, see ^{56}Co	St wall (1E+6)	-	-	-	2E-2	2E-1
27	Cobalt-60	W, see ^{56}Co	5E+2	2E+2	7E-8	2E-10	3E-6	3E-5
		Y, see ^{56}Co	2E+2	3E+1	1E-8	5E-11	-	-
27	Cobalt-61 ²	W, see ^{56}Co	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{56}Co	2E+4	6E+4	2E-5	8E-8	-	-
27	Cobalt-62m ²	W, see ^{56}Co	4E+4	2E+5	7E-5	2E-7	-	-
		Y, see ^{56}Co	St wall (5E+4)	-	-	-	7E-4	7E-3
28	Nickel-56	D, all compounds except those given for W	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		W, oxides, hydroxides, and carbides	-	1E+3	5E-7	2E-9	-	-
		Vapor	-	1E+3	5E-7	2E-9	-	-
28	Nickel-57	D, see ^{56}Ni	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	6E+3	3E-6	9E-9	-	-

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
30	Zinc-63 ²	Y, all compounds	2E+4 St wall (3E+4)	7E+4	3E-5	9E-8	-	-
30	Zinc-65	Y, all compounds	4E+2	3E+2	1E-7	4E-10	5E-6	5E-5
30	Zinc-69m	Y, all compounds	4E+3	7E+3	3E-6	1E-8	6E-5	6E-4
30	Zinc-69 ²	Y, all compounds	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
30	Zinc-71m	Y, all compounds	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
30	Zinc-72	Y, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
31	Gallium-65 ²	D, all compounds except those given for W	5E+4 St wall (6E+4)	2E+5	7E-5	2E-7	-	-
		W, oxides, hydroxides, carbides, halides, and nitrates	-	2E+5	8E-5	3E-7	9E-4	9E-3
31	Gallium-66	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	1E+3 -	4E+3 3E+3	1E-6 1E-6	5E-9 4E-9	1E-5 -	1E-4 -
31	Gallium-67	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	7E+3 -	1E+4 1E+4	6E-6 4E-6	2E-8 1E-8	1E-4 -	1E-3 -
31	Gallium-68 ²	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	2E+4 -	4E+4 5E+4	2E-5 2E-5	6E-8 7E-8	2E-4 -	2E-3 -
31	Gallium-70 ²	D, see ⁶⁵ Ga	5E+4 St wall (7E+4)	2E+5	7E-5	2E-7	-	-
		W, see ⁶⁵ Ga	-	2E+5	8E-5	3E-7	1E-3	1E-2
31	Gallium-72	D, see ⁶⁵ Ga W, see ⁶⁵ Ga	1E+3 -	4E+3 3E+3	1E-6 1E-6	5E-9 4E-9	2E-5 -	2E-4 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
31	Gallium-73	D, see ^{68}Ga W, see ^{68}Ga	5E+3 -	2E+4 2E+4	6E-6 6E-6	2E-8 2E-8	7E-5 -	7E-4 -
32	Germanium-66	D, all compounds except those given for W W, oxides, sulfides, and halides	2E+4 -	3E+4 2E+4	1E-5 8E-6	4E-8 3E-8	3E-4 -	3E-3 -
32	Germanium-67 ²	D, see ^{68}Ge W, see ^{68}Ge	3E+4 St wall (4E+4) -	9E+4 - 1E+5	4E-5 - 4E-5	1E-7 - 1E-7	- 6E-4 -	- 6E-3 -
32	Germanium-68	D, see ^{68}Ge W, see ^{68}Ge	5E+3 -	4E+3 1E+2	2E-6 4E-8	5E-9 1E-10	6E-5 -	6E-4 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
32	Germanium-69	D, see ^{66}Ge W, see ^{66}Ge	1E+4 -	2E+4 8E+3	6E-6 3E-6	2E-8 1E-8	2E-4 -	2E-3 -
32	Germanium-71	D, see ^{66}Ge W, see ^{66}Ge	5E+5 -	4E+5 4E+4	2E-4 2E-5	6E-7 6E-8	7E-3 -	7E-2 -
32	Germanium-75 ²	D, see ^{66}Ge W, see ^{66}Ge	4E+4 St wall (7E+4) -	8E+4 -	3E-5 -	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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
33	Arsenic-78 ²	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34	Selenium-70 ²	D, all compounds except those given for W	2E+4	4E+4	2E-5	5E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and elemental Se	1E+4	4E+4	2E-5	6E-8	-	-
34	Selenium-73m ²	D, see ⁷⁶ Se	6E+4	2E+5	6E-5	2E-7	4E-4	4E-3
		W, see ⁷⁶ Se	3E+4	1E+5	6E-5	2E-7	-	-
34	Selenium-73	D, see ⁷⁶ Se	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
		W, see ⁷⁶ Se	-	2E+4	7E-6	2E-8	-	-
34	Selenium-75	D, see ⁷⁶ Se	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
		W, see ⁷⁶ Se	-	6E+2	3E-7	8E-10	-	-
34	Selenium-79	D, see ⁷⁶ Se	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
		W, see ⁷⁶ Se	-	6E+2	2E-7	8E-10	-	-
34	Selenium-81m ²	D, see ⁷⁶ Se	4E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, see ⁷⁶ Se	2E+4	7E+4	3E-5	1E-7	-	-
34	Selenium-81 ²	D, see ⁷⁶ Se	6E+4	2E+5	9E-5	3E-7	-	-
		St wall (8E+4)	-	-	-	-	1E-3	1E-2
		W, see ⁷⁶ Se	-	2E+5	1E-4	3E-7	-	-
34	Selenium-83 ²	D, see ⁷⁶ Se	4E+4	1E+5	5E-5	2E-7	4E-4	4E-3
		W, see ⁷⁶ 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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
35	Bromine-83	D, see ^{76}Br	5E+4 St wall (7E+4)	6E+4	3E-5	9E-8	-	-
		W, see ^{76}Br	-	6E+4	3E-5	9E-8	9E-4	9E-3
35	Bromine-84 ²	D, see ^{76}Br	2E+4 St wall (3E+4)	6E+4	2E-5	8E-8	-	-
		W, see ^{76}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	Krypton-85m	Submersion ¹	-	-	2E-5	1E-7	-	-
36	Krypton-85	Submersion ¹	-	-	1E-4	7E-7	-	-
36	Krypton-87 ²	Submersion ¹	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion ¹	-	-	2E-6	9E-9	-	-
37	Rubidium-79 ²	D, all compounds	4E+4 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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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 SrTiO ₃	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble compounds and SrTiO ₃	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81 ²	D, see ⁸⁰ Sr	3E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ⁸⁰ Sr	2E+4	8E+4	3E-5	1E-7	-	-
38	Strontium-82	D, see ⁸⁰ Sr	3E+2 LLI wall (2E+2)	4E+2	2E-7	6E-10	-	-
		Y, see ⁸⁰ Sr	2E+2	9E+1	4E-8	1E-10	3E-6	3E-5
38	Strontium-83	D, see ⁸⁰ Sr	3E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ⁸⁰ Sr	2E+3	4E+3	1E-6	5E-9	-	-
38	Strontium-85m ²	D, see ⁸⁰ Sr	2E+5	6E+5	3E-4	9E-7	3E-3	3E-2
		Y, see ⁸⁰ Sr	-	8E+5	4E-4	1E-6	-	-
38	Strontium-85	D, see ⁸⁰ Sr	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
		Y, see ⁸⁰ Sr	-	2E+3	6E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
38	Strontium-87m	D, see ^{87}Sr Y, see ^{87}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 ^{89}Sr Y, see ^{89}Sr	6E+2 LLI wall (6E+2) 5E+2	- 1E+2	- 6E-8	1E-9 2E-10	- 8E-6	- 8E-5
38	Strontium-90	D, see ^{90}Sr Y, see ^{90}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 ^{91}Sr Y, see ^{91}Sr	2E+3 -	6E+3 4E+3	2E-6 1E-6	8E-9 5E-9	2E-5 -	2E-4 -
38	Strontium-92	D, see ^{92}Sr Y, see ^{92}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 ^{86}Y Y, see ^{86}Y	1E+3 -	3E+3 3E+3	1E-6 1E-6	5E-9 5E-9	2E-5 -	2E-4 -
39	Yttrium-87	W, see ^{87}Y Y, see ^{87}Y	2E+3 -	3E+3 3E+3	1E-6 1E-6	5E-9 5E-9	3E-5 -	3E-4 -
39	Yttrium-88	W, see ^{88}Y Y, see ^{88}Y	1E+3 -	3E+2 2E+2	1E-7 1E-7	3E-10 3E-10	1E-5 -	1E-4 -
39	Yttrium-90m	W, see ^{90}Y Y, see ^{90}Y	8E+3 -	1E+4 1E+4	5E-6 5E-6	2E-8 2E-8	1E-4 -	1E-3 -
39	Yttrium-90	W, see ^{90}Y Y, see ^{90}Y	4E+2 LLI wall (5E+2) -	7E+2 - 6E+2	3E-7 - 3E-7	9E-10 - 9E-10	- 7E-6 -	- 7E-5 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}$)	Air ($\mu\text{Ci}/\text{m}$)	Water ($\mu\text{Ci}/\text{m}$)	
39	Yttrium-91m ²	W, see ^{91m} Y Y, see ^{91m} Y	1E+5 -	2E+5 2E+5	1E-4 7E-5	3E-7 2E-7	2E-3 -	2E-2 -
39	Yttrium-91	W, see ⁹¹ Y Y, see ⁹¹ 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 ⁹² Y Y, see ⁹² Y	3E+3 -	9E+3 8E+3	4E-6 3E-6	1E-8 1E-8	4E-5 -	4E-4 -
39	Yttrium-93	W, see ⁹³ Y Y, see ⁹³ 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 ⁹⁴ Y Y, see ⁹⁴ 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 ⁹⁵ Y Y, see ⁹⁵ 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 ⁸⁸ Zr W, see ⁸⁸ Zr Y, see ⁸⁸ 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 ⁸⁹ Zr W, see ⁸⁹ Zr Y, see ⁸⁹ 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 - -

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
41	Niobium-93m	W, see ^{93}Nb	9E+3 LLI wall (1E+4)	2E+3	8E-7	3E-9	-	-
		Y, see ^{93}Nb	-	2E+2	7E-8	2E-10	2E-4	2E-3
41	Niobium-94	W, see ^{94}Nb	9E+2	2E+2	8E-8	3E-10	1E-5	1E-4
		Y, see ^{94}Nb	-	2E+1	6E-9	2E-11	-	-
41	Niobium-95m	W, see ^{95}Nb	2E+3 LLI wall (2E+3)	3E+3	1E-6	4E-9	-	-
		Y, see ^{95}Nb	-	2E+3	9E-7	3E-9	3E-5	3E-4
41	Niobium-95	W, see ^{95}Nb	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		Y, see ^{95}Nb	-	1E+3	5E-7	2E-9	-	-
41	Niobium-96	W, see ^{96}Nb	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{96}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-97 ²	W, see ^{97}Nb	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ^{97}Nb	-	7E+4	3E-5	1E-7	-	-
41	Niobium-98 ²	W, see ^{98}Nb	1E+4	5E+4	2E-5	8E-8	2E-4	2E-3
		Y, see ^{98}Nb	-	5E+4	2E-5	7E-8	-	-
42	Molybdenum-90	D, all compounds except those given for Y	4E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, oxides, hydroxides, and MoS	2E+3	5E+3	2E-6	6E-9	-	-
42	Molybdenum-93m	D, see ^{93}Mo	9E+3	2E+4	7E-6	2E-8	6E-5	6E-4
		Y, see ^{93}Mo	4E+3	1E+4	6E-6	2E-8	-	-
42	Molybdenum-93	D, see ^{93}Mo	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		Y, see ^{93}Mo	2E+4	2E+2	8E-8	2E-10	-	-
42	Molybdenum-99	D, see ^{99}Mo	2E+3 LLI wall (1E+3)	3E+3	1E-6	4E-9	-	-
		Y, see ^{99}Mo	1E+3	1E+3	6E-7	2E-9	2E-5	2E-4

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
42	Molybdenum-101 ²	D, see ⁹⁹ Mo	4E+4	1E+5	6E-5	2E-7	-	-
		Y, see ⁹⁹ Mo	St wall (5E+4)	-	-	-	7E-4	7E-3
			-	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	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
43	Technetium-98	D, see $^{99\text{m}}\text{Tc}$	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see $^{99\text{m}}\text{Tc}$	-	3E+2	1E-7	4E-10	-	-
43	Technetium-99m	D, see $^{99\text{m}}\text{Tc}$	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, see $^{99\text{m}}\text{Tc}$	-	2E+5	1E-4	3E-7	-	-
43	Technetium-99	D, see $^{99\text{m}}\text{Tc}$	4E+3	5E+3	2E-6	-	6E-5	6E-4
		W, see $^{99\text{m}}\text{Tc}$	-	St wall (6E+3) 7E+2	-	8E-9 9E-10	-	-
43	Technetium-101 ²	D, see $^{99\text{m}}\text{Tc}$	9E+4	3E+5	1E-4	5E-7	-	-
		W, see $^{99\text{m}}\text{Tc}$	St wall (1E+5)	-	-	-	2E-3	2E-2
43	Technetium-104 ²	D, see $^{99\text{m}}\text{Tc}$	2E+4	7E+4	3E-5	1E-7	-	-
		W, see $^{99\text{m}}\text{Tc}$	St wall (3E+4)	-	-	-	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	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
44	Ruthenium-106	D, see ^{106}Ru	2E+2 LLI wall (2E+2)	9E+1	4E-8	1E-10	-	-
		W, see ^{106}Ru	-	5E+1	2E-8	8E-11	-	3E-5
		Y, see ^{106}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 ^{99}Rh	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{99}Rh	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{99}Rh	-	2E+3	8E-7	3E-9	-	-
45	Rhodium-100	D, see ^{100}Rh	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{100}Rh	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{100}Rh	-	4E+3	2E-6	5E-9	-	-
45	Rhodium-101m	D, see ^{101}Rh	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{101}Rh	-	8E+3	4E-6	1E-8	-	-
		Y, see ^{101}Rh	-	8E+3	3E-6	1E-8	-	-
45	Rhodium-101	D, see ^{101}Rh	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{101}Rh	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{101}Rh	-	2E+2	6E-8	2E-10	-	-
45	Rhodium-102m	D, see ^{102}Rh	1E+3 LLI wall (1E+3)	5E+2	2E-7	7E-10	-	-
		W, see ^{102}Rh	-	4E+2	2E-7	5E-10	-	2E-4
		Y, see ^{102}Rh	-	1E+2	5E-8	2E-10	-	-
45	Rhodium-102	D, see ^{102}Rh	6E+2	9E+1	4E-8	1E-10	8E-6	8E-5
		W, see ^{102}Rh	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{102}Rh	-	6E+1	2E-8	8E-11	-	-
45	Rhodium-103m ²	D, see ^{103}Rh	4E+5	1E+6	5E-4	2E-6	6E-3	6E-2
		W, see ^{103}Rh	-	1E+6	5E-4	2E-6	-	-
		Y, see ^{103}Rh	-	1E+6	5E-4	2E-6	-	-

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
47	Silver-102 ^z	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	8E-5 - 9E-5 8E-5	2E-7 - 3E-7 3E-7	- 9E-4 - -	- 9E-3 - -
47	Silver-103 ^z	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 ^z	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 ^z	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 ^z	D, see ¹⁰² Ag W, see ¹⁰² Ag Y, see ¹⁰² Ag	6E+4 St. wall (6E+4) - -	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 - -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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 - -
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 ^{106}Cd W, see ^{106}Cd Y, see ^{106}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 - -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
48	Cadmium-113m	D, see ^{106}Cd	2E+1 Kidneys (4E+1)	2E+0 Kidneys (4E+0)	1E-9	-	-	-
		W, see ^{106}Cd	-	8E+0 Kidneys (1E+1)	-	5E-12	5E-7	5E-6
		Y, see ^{106}Cd	-	1E+1	4E-9	-	-	-
48	Cadmium-113	D, see ^{106}Cd	2E+1 Kidneys (3E+1)	2E+0 Kidneys (3E+0)	9E-10	-	-	-
		W, see ^{106}Cd	-	8E+0 Kidneys (1E+1)	-	5E-12	4E-7	4E-6
		Y, see ^{106}Cd	-	1E+1	6E-9	2E-11	-	-
48	Cadmium-115m	D, see ^{106}Cd	3E+2	5E+1 Kidneys (8E+1)	2E-8	-	4E-6	4E-5
		W, see ^{106}Cd	-	1E+2	5E-8	1E-10	-	-
		Y, see ^{106}Cd	-	1E+2	6E-8	2E-10	-	-
48	Cadmium-115	D, see ^{106}Cd	9E+2 LLI wall (1E+3)	1E+3	6E-7	2E-9	-	-
		W, see ^{106}Cd	-	1E+3	5E-7	-	1E-5	1E-4
		Y, see ^{106}Cd	-	1E+3	6E-7	2E-9	-	-
48	Cadmium-117m	D, see ^{106}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{106}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{106}Cd	-	1E+4	6E-6	2E-8	-	-
48	Cadmium-117	D, see ^{106}Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ^{106}Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ^{106}Cd	-	1E+4	6E-6	2E-8	-	-
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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	3E+2	6E+1	3E-8	9E-11	-	-
		LLI wall (4E+2)	-	-	-	-	5E-6	5E-5
		W, see ¹⁰⁹ In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115m	D, see ¹⁰⁹ In 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	4E+4	1E+5	5E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
		W, see ¹⁰⁹ In	-	1E+5	6E-5	2E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
50	Tin-110	D, all compounds except those given for W W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
			-	1E+4	5E-6	2E-8	-	-
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	2E+3	1E+3	5E-7	2E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		W, see ¹¹⁰ Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-117m	D, see ¹¹⁰ Sn	2E+3	1E+3	5E-7	-	-	-
		LLI wall (2E+3)	-	Bone surf (2E+3)	-	3E-9	3E-5	3E-4
		W, see ¹¹⁰ Sn	-	1E+3	6E-7	2E-9	-	-
50	Tin-119m	D, see ¹¹⁰ Sn	3E+3	2E+3	1E-6	3E-9	-	-
		LLI wall (4E+3)	-	-	-	-	6E-5	6E-4
		W, see ¹¹⁰ Sn	-	1E+3	4E-7	1E-9	-	-
50	Tin-121m	D, see ¹¹⁰ Sn	3E+3	9E+2	4E-7	1E-9	-	-
		LLI wall (4E+3)	-	-	-	-	5E-5	5E-4
		W, see ¹¹⁰ Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-121	D, see ¹¹⁰ Sn	6E+3	2E+4	6E-6	2E-8	-	-
		LLI wall (6E+3)	-	-	-	-	8E-5	8E-4
		W, see ¹¹⁰ Sn	-	1E+4	5E-6	2E-8	-	-
50	Tin-123m ²	D, see ¹¹⁰ Sn W, see ¹¹⁰ Sn	5E+4 -	1E+5 1E+5	5E-5 6E-5	2E-7 2E-7	7E-4 -	7E-3 -

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

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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-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 -
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 -	- 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 -	- 8E-5 -	- 8E-4 -

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
53	Iodine-123	D, all compounds	3E+3 Thyroid (1E+4)	6E+3 Thyroid (2E+4)	3E-6 -	- 2E-8	- 1E-4	- 1E-3
53	Iodine-124	D, all compounds	5E+1 Thyroid (2E+2)	8E+1 Thyroid (3E+2)	3E-8 -	- 4E-10	- 2E-6	- 2E-5
53	Iodine-125	D, all compounds	4E+1 Thyroid (1E+2)	6E+1 Thyroid (2E+2)	3E-8 -	- 3E-10	- 2E-6	- 2E-5
53	Iodine-126	D, all compounds	2E+1 Thyroid (7E+1)	4E+1 Thyroid (1E+2)	1E-8 -	- 2E-10	- 1E-6	- 1E-5
53	Iodine-128 ²	D, all compounds	4E+4 St wall (6E+4)	1E+5 -	5E-5 -	2E-7 -	- 8E-4	- 8E-3
53	Iodine-129	D, all compounds	5E+0 Thyroid (2E+1)	9E+0 Thyroid (3E+1)	4E-9 -	- 4E-11	- 2E-7	- 2E-6
53	Iodine-130	D, all compounds	4E+2 Thyroid (1E+3)	7E+2 Thyroid (2E+3)	3E-7 -	- 3E-9	- 2E-5	- 2E-4
53	Iodine-131	D, all compounds	3E+1 Thyroid (9E+1)	5E+1 Thyroid (2E+2)	2E-8 -	- 2E-10	- 1E-6	- 1E-5
53	Iodine-132 ^{m2}	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

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
56	Barium-131m ²	D, all compounds	4E+5 St wall (5E+5)	1E+6	6E-4	2E-6	-	-
56	Barium-131	D, all compounds	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
56	Barium-133m	D, all compounds	2E+3 LLI wall (3E+3)	9E+3	4E-6	1E-8	-	-
56	Barium-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5	2E-4
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56	Barium-139 ²	D, all compounds	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
56	Barium-140	D, all compounds	5E+2 LLI wall (6E+2)	1E+3	6E-7	2E-9	-	-
56	Barium-141 ²	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131 ²	D, all compounds except those given for W 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-10 -	2E-4 -	2E-3 -

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

Table I
Occupational Values

Table II
Effluent
Concentrations

Table III
Releases to
Sewers

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

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)		Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
61	Promethium-149	W, see ^{149}Pm	1E+3 LLI wall (1E+3)	2E+3	8E-7	3E-9	-	-	
		Y, see ^{149}Pm	-	2E+3	8E-7	2E-9	2E-5	2E-4	
61	Promethium-150	W, see ^{150}Pm	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4	
		Y, see ^{150}Pm	-	2E+4	7E-6	2E-8	-	-	
61	Promethium-151	W, see ^{151}Pm	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4	
		Y, see ^{151}Pm	-	3E+3	1E-6	4E-9	-	-	
62	Samarium-141m ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3	
62	Samarium-141 ²	W, all compounds	5E+4 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)	4E2 Bone surf (6E-2)	1E-11	-	-	-	
						9E-14	3E-7	3E-6	
62	Samarium-147	W, all compounds	2E+1 Bone surf (3E+1)	4E2 Bone surf (7E-2)	2E-11	-	-	-	
						1E-13	4E-7	4E-6	
62	Samarium-151	W, all compounds	1E+4 LLI wall (1E+4)	1E+2 Bone surf (2E+2)	4E-8	-	-	-	
						2E-10	2E-4	2E-3	
62	Samarium-153	W, all compounds	2E+3 LLI wall (2E+3)	3E+3	1E-6	4E-9	-	-	
						-	3E-5	3E-4	
62	Samarium-155 ²	W, all compounds	6E+4 St wall (8E+4)	2E+5	9E-5	3E-7	-	-	
						-	1E-3	1E-2	

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
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	-	5E-5	5E-4
			-		-	2E-10	-	-
63	Europium-156	W, all compounds	6E+2	5E+2	2E-7	6E-10	8E-6	8E-5
63	Europium-157	W, all compounds	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
63	Europium-158 ²	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
64	Gadolinium-145 ²	D, all compounds except those given for W	5E+4 St wall (5E+4)	2E+5	6E-5	2E-7	-	-
		W, oxides, hydroxides, and fluorides	-	2E+5	7E-5	-	6E-4	6E-3
			-			2E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
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 -
64	Gadolinium-147	D, see ^{146}Gd W, see ^{146}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 -	- 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 -	- 4E-7 -	- 4E-6 -
64	Gadolinium-153	D, see ^{145}Gd W, see ^{146}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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
66	Dysprosium-166	W, all compounds	6E+2 LLI wall (8E+2)	7E+2	3E-7	1E-9	-	-
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	-	-
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	-	-
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	-	-
67	Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
68	Erbium-161	W, all compounds	2E+4	6E+4	3E-5	9E-8	2E-4	2E-3
68	Erbium-165	W, all compounds	6E+4	2E+5	8E-5	3E-7	9E-4	9E-3
68	Erbium-169	W, all compounds	3E+3 LLI wall (4E+3)	3E+3	1E-6	4E-9	-	-
				-	-	-	5E-5	5E-4

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
71	Lutetium-174m	W, see ^{169}Lu	2E+3 LLI wall (3E+3)	2E+2 Bone surf (3E+2)	1E-7 -	- 5E-10	- 4E-5	- 4E-4
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2 Bone surf (2E+2)	5E-8 -	- 3E-10	7E-5 -	7E-4 -
		Y, see ^{169}Lu	-	2E+2	6E-8	2E-10	-	-
71	Lutetium-176m	W, see ^{169}Lu	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		Y, see ^{169}Lu	-	2E+4	9E-6	3E-8	-	-
71	Lutetium-176	W, see ^{169}Lu	7E+2	5E+0 Bone surf (1E+1)	2E-9 -	- 2E-11	1E-5 -	1E-4 -
		Y, see ^{169}Lu	-	8E+0	3E-9	1E-11	-	-
71	Lutetium-177m	W, see ^{169}Lu	7E+2	1E+2 Bone surf (1E+2)	5E-8 -	- 2E-10	1E-5 -	1E-4 -
		Y, see ^{169}Lu	-	8E+1	3E-8	1E-10	-	-
71	Lutetium-177	W, see ^{169}Lu	2E+3 LLI wall (3E+3)	2E+3	9E-7 -	3E-9 -	- 4E-5	- 4E-4
		Y, see ^{169}Lu	-	2E+3	9E-7	3E-9	-	-
71	Lutetium-178m ²	W, see ^{169}Lu	5E+4 St. wall (6E+4)	2E+5	8E-5 -	3E-7 -	- 8E-4	- 8E-3
		Y, see ^{169}Lu	-	2E+5	7E-5	2E-7	-	-
71	Lutetium-178 ²	W, see ^{169}Lu	4E+4 St wall (4E+4)	1E+5	5E-5 -	2E-7 -	- 6E-4	- 6E-3
		Y, see ^{169}Lu	-	1E+5	5E-5	2E-7	-	-
71	Lutetium-179	W, see ^{169}Lu	6E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{169}Lu	-	2E+4	6E-6	3E-8	-	-

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
72	Hafnium-181	D, see ^{170}Hf	1E+3	2E+2	7E-8	-	2E-5	2E-4
		W, see ^{170}Hf	-	Bone surf (4E+2) 4E+2	-	6E-10	-	-
72	Hafnium-182 ^m	D, see ^{170}Hf	4E+4	9E+4	4E-5	1E-7	5E-4	5E-3
		W, see ^{170}Hf	-	1E+5	6E-5	2E-7	-	-
72	Hafnium-182	D, see ^{170}Hf	2E+2	8E-1	3E-10	-	-	-
		W, see ^{170}Hf	Bone surf (4E+2)	Bone surf (2E+0) 3E+0	-	2E-12	5E-6	5E-5
		-	-	Bone surf (7E+0)	1E-9	-	-	-
72	Hafnium-183 ²	D, see ^{170}Hf	2E+4	5E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{170}Hf	-	6E+4	2E-5	8E-8	-	-
72	Hafnium-184	D, see ^{170}Hf	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{170}Hf	-	6E+3	3E-6	9E-9	-	-
73	Tantalum-172 ²	W, all compounds except those given for Y	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
		Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	-	1E+5	4E-5	1E-7	-	-
73	Tantalum-173	W, see ^{172}Ta	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ^{172}Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-174 ²	W, see ^{172}Ta	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
		Y, see ^{172}Ta	-	9E+4	4E-5	1E-7	-	-
73	Tantalum-175	W, see ^{172}Ta	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
		Y, see ^{172}Ta	-	1E+4	6E-6	2E-8	-	-
73	Tantalum-176	W, see ^{172}Ta	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		Y, see ^{172}Ta	-	1E+4	5E-6	2E-8	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
73	Tantalum-177	W, see ^{172}Ta Y, see ^{172}Ta	1E+4 -	2E+4 2E+4	8E-6 7E-6	3E-8 2E-8	2E-4 -	2E-3 -
73	Tantalum-178	W, see ^{172}Ta Y, see ^{172}Ta	2E+4 -	9E+4 7E+4	4E-5 3E-5	1E-7 1E-7	2E-4 -	2E-3 -
73	Tantalum-179	W, see ^{172}Ta Y, see ^{172}Ta	2E+4 -	5E+3 9E+2	2E-6 4E-7	8E-9 1E-9	3E-4 -	3E-3 -
73	Tantalum-180m	W, see ^{172}Ta Y, see ^{172}Ta	2E+4 -	7E+4 6E+4	3E-5 2E-5	9E-8 8E-8	3E-4 -	3E-3 -
73	Tantalum-180	W, see ^{172}Ta Y, see ^{172}Ta	1E+3 -	4E+2 2E+1	2E-7 1E-8	6E-10 3E-11	2E-5 -	2E-4 -
73	Tantalum-182m ²	W, see ^{172}Ta	2E+5 St wall (2E+5)	5E+5 -	2E-4 -	8E-7 -	- 3E-3	- 3E-2
		Y, see ^{172}Ta	-	4E+5	2E-4	6E-7	-	-
73	Tantalum-182	W, see ^{172}Ta Y, see ^{172}Ta	8E+2 -	3E+2 1E+2	1E-7 6E-8	5E-10 2E-10	1E-5 -	1E-4 -
73	Tantalum-183	W, see ^{172}Ta	9E+2 LLI wall (1E+3)	1E+3 -	5E-7 -	2E-9 -	- 2E-5	- 2E-4
		Y, see ^{172}Ta	-	1E+3	4E-7	1E-9	-	-
73	Tantalum-184	W, see ^{172}Ta Y, see ^{172}Ta	2E+3 -	5E+3 5E+3	2E-6 2E-6	8E-9 7E-9	3E-5 -	3E-4 -
73	Tantalum-185 ²	W, see ^{172}Ta Y, see ^{172}Ta	3E+4 -	7E+4 6E+4	3E-5 3E-5	1E-7 9E-8	4E-4 -	4E-3 -
73	Tantalum-186 ²	W, see ^{172}Ta	5E+4 St wall (7E+4)	2E+5 -	1E-4 -	3E-7 -	- 1E-3	- 1E-2
		Y, see ^{172}Ta	-	2E+5	9E-5	3E-7	-	-
74	Tungsten-176	D, all compounds	1E+4	5E+4	2E-5	7E-8	1E-4	1E-3

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
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	9E+4 St wall (1E+5)	3E+5	1E-4	4E-7	-	-
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	2E-3	2E-2
75	Rhenium-178 ²	D, see ¹⁷⁷ Re	7E+4 St wall (1E+5)	3E+5	1E-4	4E-7	-	-
		W, see ¹⁷⁷ Re	-	3E+5	1E-4	4E-7	1E-3	1E-2
75	Rhenium-181	D, see ¹⁷⁷ Re	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
		W, see ¹⁷⁷ Re	-	9E+3	4E-6	1E-8	-	-
75	Rhenium-182 (12.7 h)	D, see ¹⁷⁷ Re	7E+3	1E+4	5E-6	2E-8	9E-5	9E-4
		W, see ¹⁷⁷ Re	-	2E+4	6E-6	2E-8	-	-
75	Rhenium-182 (64.0 h)	D, see ¹⁷⁷ Re	1E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	2E+3	9E-7	3E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
75	Rhenium-184m	D, see ^{187}Re W, see ^{187}Re	2E+3 -	3E+3 4E+2	1E-6 2E-7	4E-9 6E-10	3E-5 -	3E-4 -
75	Rhenium-184	D, see ^{187}Re W, see ^{187}Re	2E+3 -	4E+3 1E+3	1E-6 6E-7	5E-9 2E-9	3E-5 -	3E-4 -
75	Rhenium-186m	D, see ^{187}Re W, see ^{187}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 ^{187}Re W, see ^{187}Re	2E+3 -	3E+3 2E+3	1E-6 7E-7	4E-9 2E-9	3E-5 -	3E-4 -
75	Rhenium-187	D, see ^{187}Re W, see ^{187}Re	6E+5 St wall -	8E+5 (9E+5) 1E+5	4E-4 - 4E-5	- 1E-6 1E-7	8E-3 - -	8E-2 - -
75	Rhenium-188m ²	D, see ^{187}Re W, see ^{187}Re	8E+4 -	1E+5 1E+5	6E-5 6E-5	2E-7 2E-7	1E-3 -	1E-2 -
75	Rhenium-188	D, see ^{187}Re W, see ^{187}Re	2E+3 -	3E+3 3E+3	1E-6 1E-6	4E-9 4E-9	2E-5 -	2E-4 -
75	Rhenium-189	D, see ^{187}Re W, see ^{187}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 - -

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
77	Iridium-184	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	8E+3 - -	2E+4 3E+4 3E+4	1E-5 1E-5 1E-5	3E-8 5E-8 4E-8	1E-4 -	1E-3 - -
77	Iridium-185	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	5E+3 - -	1E+4 1E+4 1E+4	5E-6 5E-6 4E-6	2E-8 2E-8 1E-8	7E-5 -	7E-4 - -
77	Iridium-186	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	2E+3 - -	8E+3 6E+3 6E+3	3E-6 3E-6 2E-6	1E-8 9E-9 8E-9	3E-5 -	3E-4 - -
77	Iridium-187	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	1E+4 - -	3E+4 3E+4 3E+4	1E-5 1E-5 1E-5	5E-8 4E-8 4E-8	1E-4 -	1E-3 - -
77	Iridium-188	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	2E+3 - -	5E+3 4E+3 3E+3	2E-6 1E-6 1E-6	6E-9 5E-9 5E-9	3E-5 -	3E-4 - -
77	Iridium-189	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	5E+3 LLI wall (5E+3) - -	5E+3 - 4E+3 4E+3	2E-6 - 2E-6 1E-6	7E-9 - 5E-9 5E-9	- 7E-5 -	- 7E-4 -
77	Iridium-190m ²	D, see ^{182}Ir W, see ^{182}Ir Y, see ^{182}Ir	2E+5 - -	2E+5 2E+5 2E+5	8E-5 9E-5 8E-5	3E-7 3E-7 3E-7	2E-3 -	2E-2 - -
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 - -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
77	Iridium-192	D, see ^{192}Ir W, see ^{192}Ir Y, see ^{192}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 ^{192}Ir W, see ^{192}Ir Y, see ^{192}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 ^{192}Ir W, see ^{192}Ir Y, see ^{192}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 ^{192}Ir W, see ^{192}Ir Y, see ^{192}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 ^{192}Ir W, see ^{192}Ir Y, see ^{192}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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
78	Platinum-197 ^{m2}	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
78	Platinum-199 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
78	Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
79	Gold-193	D, all compounds except those given for W and Y 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 - -

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
80	Mercury-197m	Vapor Organic D D, see $^{197\text{m}}\text{Hg}$ W, see $^{197\text{m}}\text{Hg}$	- 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 ^{197}Hg W, see ^{197}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 St wall (1E+5) D, see $^{199\text{m}}\text{Hg}$ W, see $^{199\text{m}}\text{Hg}$	- 6E+4 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	Mercury-203	Vapor Organic D D, see ^{203}Hg W, see ^{203}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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci}/\text{ml}$)	Col. 1 Air ($\mu\text{Ci}/\text{ml}$)	Col. 2 Water ($\mu\text{Ci}/\text{ml}$)	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
81	Thallium-200	D, all compounds	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
81	Thallium-201	D, all compounds	2E+4	2E+4	9E-6	3E-8	2E-4	2E-3
81	Thallium-202	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5	2E-4
82	Lead-195m ²	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4	8E-3
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
82	Lead-199 ²	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4	1E-3
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6	2E-5
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5	5E-4
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
82	Lead-210	D, all compounds	6E1 Bone surf (1E+0)	2E1 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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{m}^3$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}^3$)	Air ($\mu\text{Ci}/\text{m}^3$)	Water ($\mu\text{Ci}/\text{m}^3$)	
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	4E+1	5E+0	2E-9	-	-	-
		W, see ²⁰⁰ Bi	Kidneys (6E+1) -	Kidneys (6E+0) 7E-1	- 3E-10	9E-12 9E-13	8E-7 -	8E-6 -
83	Bismuth-210	D, see ²⁰⁰ Bi	8E+2	2E+2	1E-7	-	1E-5	1E-4
		W, see ²⁰⁰ Bi	-	Kidneys (4E+2) 3E+1	- 1E-8	5E-10 4E-11	- -	- -
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 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
83	Bismuth-214 ²	D, see ²⁰⁹ Bi W, see ²⁰⁹ 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 working level months)	7E-6 9E-9	2E-8 3E-11 (or 1.0 working level)	- -	- -
86	Radon-222	With daughters removed With daughters present	- -	1E+4 1E+2 (or 4 working level months)	4E-6 3E-8	1E-8 1E-10 (or 0.33 working level)	- -	- -
87	Francium-222 ²	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223 ²	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
88	Radium-223	W, all compounds	5E+0 Bone surf (9E+0)	7E-1	3E-10	9E-13	-	-
88	Radium-224	W, all compounds	8E+0 Bone surf (2E+1)	2E+0	7E-10	2E-12	-	1E-6
88	Radium-225	W, all compounds	8E+0 Bone surf (2E+1)	7E-1	3E-10	9E-13	-	-
88	Radium-226	W, all compounds	2E+0 Bone surf (5E+0)	6E-1	3E-10	9E-13	-	2E-6
88	Radium-227 ²	W, all compounds	2E+4 Bone surf (2E+4)	1E+4 Bone surf (2E+4)	6E-6	-	2E-7	3E-3
88	Radium-228	W, all compounds	2E+0 Bone surf (4E+0)	1E+0	5E-10	2E-12	-	-
89	Actinium-224	D, all compounds except those given for W and Y	2E+3 LLI wall (2E+3)	3E+1 Bone surf (4E+1)	1E-8	-	-	-
		W, halides and nitrates	-	5E+1	2E-8	5E-11	3E-5	3E-4
		Y, oxides and hydroxides	-	5E+1	2E-8	7E-11	-	-
89	Actinium-225	D, see ²²⁴ Ac	5E+1 LLI wall (5E+1)	3E-1 Bone surf (5E-1)	1E-10	-	-	-
		W, see ²²⁴ Ac	-	6E-1	3E-10	7E-13	7E-7	7E-6
		Y, see ²²⁴ Ac	-	6E-1	3E-10	9E-13	-	-

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	Air ($\mu\text{Ci}/\text{m}^3$)	Water ($\mu\text{Ci}/\text{m}^3$)	
90	Thorium-229	W, see ^{229}Th Y, see ^{229}Th	6E-1 Bone surf (1E+0) -	9E-4 Bone surf (2E-3) 2E-3 Bone surf (3E-3)	4E-13 - 1E-12 -	- 3E-15 -	- 2E-8 -	- 2E-7 -
90	Thorium-230	W, see ^{230}Th Y, see ^{230}Th	4E+0 Bone surf (9E+0) -	6E-3 Bone surf (2E-2) 2E-2 Bone surf (2E-2)	3E-12 - 6E-12 -	- 2E-14 -	- 1E-7 -	- 1E-6 -
90	Thorium-231	W, see ^{231}Th Y, see ^{231}Th	4E+3 -	6E+3 6E+3	3E-6 3E-6	9E-9 9E-9	5E-5 -	5E-4 -
90	Thorium-232	W, see ^{232}Th Y, see ^{232}Th	7E-1 Bone surf (2E+0) -	1E-3 Bone surf (3E-3) 3E-3 Bone surf (4E-3)	5E-13 - 1E-12 -	- 4E-15 -	- 3E-8 -	- 3E-7 -
90	Thorium-234	W, see ^{234}Th Y, see ^{234}Th	3E+2 LLI wall (4E+2) -	2E+2 -	8E-8 -	3E-10 -	- 5E-6 -	- 5E-5 -
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 ^{228}Pa Y, see ^{228}Pa	1E+3 -	1E+1 Bone surf (2E+1) 1E+1	5E-9 - 5E-9	- 3E-11 2E-11	2E-5 -	2E-4 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
91	Protactinium-230 W, see ^{230}Pa		6E+2 Bone surf (9E+2)	5E+0	2E-9	7E-12	-	-
		Y, see ^{230}Pa	-	4E+0	1E-9	5E-12	1E-5	1E-4
91	Protactinium-231 W, see ^{231}Pa		2E-1 Bone surf (5E-1)	2E-3 Bone surf (4E-3)	6E-13	-	-	-
		Y, see ^{231}Pa	-	4E-3 Bone surf (6E-3)	2E-12	-	6E-9	6E-8
			-			8E-15	-	-
91	Protactinium-232 W, see ^{232}Pa		1E+3	2E+1 Bone surf (6E+1)	9E-9	-	2E-5	2E-4
		Y, see ^{232}Pa	-	6E+1 Bone surf (7E+1)	2E-8	8E-11	-	-
			-			1E-10	-	-
91	Protactinium-233 W, see ^{233}Pa		1E+3 LLI wall (2E+3)	7E+2	3E-7	1E-9	-	-
		Y, see ^{233}Pa	-	6E+2	2E-7	8E-10	2E-5	2E-4
91	Protactinium-234 W, see ^{234}Pa		2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ^{234}Pa	-	7E+3	3E-6	9E-9	-	-
92	Uranium-230	D, UF_6 , UO_2F_2 , $\text{UO}_2(\text{NO}_3)_2$	4E+0 Bone surf (6E+0)	4E-1 Bone surf (6E-1)	2E-10	-	8E-13	8E-7
		W, UO_3 , UF_4 , UCl_4	-	4E-1	1E-10	8E-13	5E-13	-
		Y, UO_2 , U_3O_8	-	3E-1	1E-10	4E-13	-	-
92	Uranium-231	D, see ^{230}U	5E+3 LLI wall (4E+3)	8E+3	3E-6	1E-8	-	-
		W, see ^{230}U	-	6E+3	2E-6	8E-9	6E-5	6E-4
		Y, see ^{230}U	-	5E+3	2E-6	6E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi) DAC ($\mu\text{Ci/ml}$)		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
92	Uranium-232	D, see ^{230}U	2E+0 Bone surf (4E+0)	2E-1 Bone surf (4E-1)	9E-11 - 2E-10	- 6E-13 5E-13	- 6E-8 -	- 6E-7 -
		W, see ^{230}U	-	4E-1	2E-10	1E-14	-	-
		Y, see ^{230}U	-	8E-3	3E-12	-	-	-
92	Uranium-233	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 - 3E-10	- 3E-12 1E-12	- 3E-7 -	- 3E-6 -
		W, see ^{230}U	-	7E-1	3E-10	5E-14	-	-
		Y, see ^{230}U	-	4E-2	2E-11	-	-	-
92	Uranium-234 ³	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 - 3E-10	- 3E-12 1E-12	- 3E-7 -	- 3E-6 -
		W, see ^{230}U	-	7E-1	3E-10	5E-14	-	-
		Y, see ^{230}U	-	4E-2	2E-11	-	-	-
92	Uranium-235 ³	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	6E-10 - 3E-10	- 3E-12 1E-12	- 3E-7 -	- 3E-6 -
		W, see ^{230}U	-	8E-1	3E-10	6E-14	-	-
		Y, see ^{230}U	-	4E-2	2E-11	-	-	-
92	Uranium-236	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 - 3E-10	- 3E-12 1E-12	- 3E-7 -	- 3E-6 -
		W, see ^{230}U	-	8E-1	3E-10	6E-14	-	-
		Y, see ^{230}U	-	4E-2	2E-11	-	-	-
92	Uranium-237	D, see ^{230}U	2E+3 LLI wall (2E+3)	3E+3 -	1E-6 - 7E-7	4E-9 - 2E-9	- 3E-5 -	- 3E-4 -
		W, see ^{230}U	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{230}U	-	2E+3	6E-7	2E-9	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
92	Uranium-238 ¹	D, see ²³⁸ U W, see ²³⁸ U Y, see ²³⁸ U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	6E-10 - 3E-10	- 3E-12 1E-12	- 3E-7 -	- 3E-6 -
92	Uranium-239 ²	D, see ²³⁹ U W, see ²³⁹ U Y, see ²³⁹ 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 - -
92	Uranium-240	D, see ²⁴⁰ U W, see ²⁴⁰ U Y, see ²⁴⁰ 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 ¹	D, see ²³⁸ U W, see ²³⁸ U Y, see ²³⁸ U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 - 3E-10	- 3E-12 9E-13	- 3E-7 -	- 3E-6 -
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 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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 -
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-8 -	- 2E-7 -

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
95	Americium-238 ²	W, all compounds	4E+4	3E+3 Bone surf (6E+3)	1E-6	-	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	-	-	-
95	Americium-242m	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-
95	Americium-242	W, all compounds	4E+3	8E+1 Bone surf (9E+1)	4E-8	-	5E-5	5E-4
95	Americium-243	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-
95	Americium-244m ²	W, all compounds	6E+4 St wall (8E+4)	4E+3 Bone surf (7E+3)	2E-6	-	-	-
95	Americium-244	W, all compounds	3E+3	2E+2 Bone surf (3E+2)	8E-8	-	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	-	-
95	Americium-246 ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
96	Curium-249 ²	W, all compounds	5E+4	2E+4 Bone surf (3E+4)	7E-6	-	7E-4	7E-3
			-		-	4E-8	-	-
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
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-4	1E-3
			-		-	1E-9	-	-
98	Californium-244 ²	W, all compounds except those given for Y	3E+4 St wall (3E+4)	6E+2	2E-7	8E-10	-	-
		Y, oxides and hydroxides	-	6E+2	2E-7	8E-10	4E-4	4E-3
			-		-		-	-
98	Californium-246	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	4E+2	9E+0	4E-9	1E-11	5E-6	5E-5
			-	9E+0	4E-9	1E-11	-	-
98	Californium-248	W, see ²⁴⁴ Cf	8E+0 Bone surf (2E+1)	6E-2 Bone surf (1E-1)	3E-11	-	-	-
		Y, see ²⁴⁴ Cf	-	1E-1	4E-11	2E-13	2E-7	2E-6
						1E-13	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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-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-8 -	- 2E-7 -
98	Californium-252	W, see ^{244}Cf Y, see ^{244}Cf	2E+0 Bone surf (5E+0) -	2E-2 Bone surf (4E-2) 3E-2	8E-12 - 1E-11	- 5E-14 5E-14	- 7E-8 -	- 7E-7 -
98	Californium-253	W, see ^{244}Cf Y, see ^{244}Cf	2E+2 Bone surf (4E+2) -	2E+0 - 2E+0	8E-10 - 7E-10	3E-12 - 2E-12	- 5E-6 -	- 5E-5 -
98	Californium-254	W, see ^{244}Cf Y, see ^{244}Cf	2E+0 -	2E-2 2E-2	9E-12 7E-12	3E-14 2E-14	3E-8 -	3E-7 -
99	Einsteinium-250	W, all compounds	4E+4 -	5E+2 Bone surf (1E+3)	2E-7 -	- 2E-9	6E-4 -	6E-3 -
99	Einsteinium-251	W, all compounds	7E+3 -	9E+2 Bone surf (1E+3)	4E-7 -	- 2E-9	1E-4 -	1E-3 -

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 DAC ($\mu\text{Ci/ml}$)	Col. 1 Air ($\mu\text{Ci/ml}$)	Col. 2 Water ($\mu\text{Ci/ml}$)	Monthly Average Concentration ($\mu\text{Ci/ml}$)
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
-	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		-	2E+2	1E-7	1E-9	-	-
		Submersion ¹						

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{m}^3$)	Water ($\mu\text{Ci}/\text{m}^3$)	
		ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}^3$)					
-	Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours	-	2E-1	1E-10	1E-12	1E-8	1E-7
-	Any single radionuclide not listed above that decays by alpha emission or spontaneous fission, or any mixture for which either the identity or the concentration of any radionuclide in the mixture is not known	-	4E-4	2E-13	1E-15	2E-9	2E-8

FOOTNOTES:

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

²These radionuclides have radiological half-lives of less than two hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The derived air concentration 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 $\mu\text{Ci}/\text{m}^3$ for the listed derived air concentration 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 subsection 3 of section 33-10-04.1-06).

³For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see subdivision e of subsection 1 of section 33-10-04.1-06). If the percent by weight (enrichment) of U-235 is not greater than five, the concentration value for a forty-hour workweek is two tenths milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a forty-hour workweek shall not exceed 8E-3 (SA) $\mu\text{Ci}\text{-hr}/\text{m}^3$, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

$$\text{SA} = 3.6\text{E-7 curies/gram U} \quad \text{U-depleted}$$

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

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

NOTE:

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

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

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
	If it is known that Ac-227-D,W,Y, Th-229-W,Y, Th-232-W,Y, Pa-231-W,Y, Cm-248-W, and Cm-250-W are not present	-	-	-	1E-14	-	-	
	If, in addition, it is known that Sm-146-W, Gd-148-D,W, Gd-152-D, Th-228-W,Y, Th-230-W,Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, U-Nat-Y, Np-236-W, Np-237-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-W,Y, Pu-240-W,Y, Pu-242-W,Y, Pu-244-W,Y, Am-241-W, Am-242m-W, Am-243-W, Cm-243-W, Cm-244-W, Cm-245-W, Cm-246-W, Cm-247-W, Bk-247-W, Cf-249-W,Y, Cf-250-W,Y, Cf-251-W,Y, Cf-252-W,Y, and Cf-254-W,Y are not present	-	-	-	1E-13	-	-	
	If, in addition, it is known that Sm-147-W, Gd-152-W, Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, U-Nat-W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-W,Y, Es-254-W, Fm-257-W, and Md-258-W are not present	-	-	-	1E-12	-	-	
	If, in addition it is known that Fe-60, Sr-90, Cd-113m, Cd-113, In-115, I-129, Cs-134, Sm-145, Sm-147, Gd-148, Gd-152, Hg-194 (organic), Bi-210m, Ra-223, Ra-224, Ra-225, Ac-225, Th-228, Th-230, U-233, U-234, U-235, U-236, U-238, U-Nat, Cm-242, Cf-248, Es-254, Fm-257, and Md-258 are not present	-	-	-	-	1E-6	1E-5	

3. If a mixture of radionuclides consists of uranium and its daughters in ore dust ($10 \mu\text{m}$ activity median aerodynamic diameter particle distribution assumed) prior to chemical separation of the uranium from the ore, the following values may be used for the derived air concentration of the mixture: $6\text{E}-11 \mu\text{Ci}$ of gross alpha activity from uranium-238, uranium-234, thorium-230, and radium-226 per milliliter of air; $3\text{E}-11 \mu\text{Ci}$ of natural uranium per milliliter of air; or forty-five 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 appendix 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 "one" (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 derived air concentrations are DAC_A , DAC_B , and DAC_C , respectively, then the concentrations shall be limited so that the following relationship exists:

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

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Hydrogen-3	1,000	Chromium-48	1,000
Beryllium-7	1,000	Chromium-49	1,000
Beryllium-10	1	Chromium-51	1,000
Carbon-11	1,000	Manganese-51	1,000
Carbon-14	1,000	Manganese-52m	1,000
Fluorine-18	1,000	Manganese-52	100
Sodium-22	10	Manganese-53	1,000
Sodium-24	100	Manganese-54	100
Magnesium-28	100	Manganese-56	1,000
Aluminum-26	10	Iron-52	100
Silicon-31	1,000	Iron-55	100
Silicon-32	1	Iron-59	10
Phosphorus-32	10	Iron-60	1
Phosphorus-33	100	Cobalt-55	100
Sulfur-35	100	Cobalt-56	10
Chlorine-36	10	Cobalt-57	100
Chlorine-38	1,000	Cobalt-58m	1,000
Chlorine-39	1,000	Cobalt-58	100
Argon-39	1,000	Cobalt-60m	1,000
Argon-41	1,000	Cobalt-60	1
Potassium-40	100	Cobalt-61	1,000
Potassium-42	1,000	Cobalt-62m	1,000
Potassium-43	1,000	Nickel-56	100
Potassium-44	1,000	Nickel-57	100
Potassium-45	1,000	Nickel-59	100
Calcium-41	100	Nickel-63	100
Calcium-45	100	Nickel-65	1,000
Calcium-47	100	Nickel-66	10
Scandium-43	1,000	Copper-60	1,000
Scandium-44m	100	Copper-61	1,000
Scandium-44	100	Copper-64	1,000
Scandium-46	10	Copper-67	1,000
Scandium-47	100	Zinc-62	100
Scandium-48	100	Zinc-63	1,000
Scandium-49	1,000	Zinc-65	10
Titanium-44	1	Zinc-69m	100
Titanium-45	1,000	Zinc-69	1,000
Vanadium-47	1,000	Zinc-71m	1,000
Vanadium-48	100	Zinc-72	100
Vanadium-49	1,000	Gallium-65	1,000

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Gallium-66	100	Krypton-81	1,000
Gallium-67	1,000	Krypton-83m	1,000
Gallium-68	1,000	Krypton-85m	1,000
Gallium-70	1,000	Krypton-85	1,000
Gallium-72	100	Krypton-87	1,000
Gallium-73	1,000	Krypton-88	1,000
Germanium-66	1,000	Rubidium-79	1,000
Germanium-67	1,000	Rubidium-81m	1,000
Germanium-68	10	Rubidium-81	1,000
Germanium-69	1,000	Rubidium-82m	1,000
Germanium-71	1,000	Rubidium-83	100
Germanium-75	1,000	Rubidium-84	100
Germanium-77	1,000	Rubidium-86	100
Germanium-78	1,000	Rubidium-87	100
Arsenic-69	1,000	Rubidium-88	1,000
Arsenic-70	1,000	Rubidium-89	1,000
Arsenic-71	100	Strontium-80	100
Arsenic-72	100	Strontium-81	1,000
Arsenic-73	100	Strontium-83	100
Arsenic-74	100	Strontium-85m	1,000
Arsenic-76	100	Strontium-85	100
Arsenic-77	100	Strontium-87m	1,000
Arsenic-78	1,000	Strontium-89	10
Selenium-70	1,000	Strontium-90	0.1
Selenium-73m	1,000	Strontium-91	100
Selenium-73	100	Strontium-92	100
Selenium-75	100	Yttrium-86m	1,000
Selenium-79	100	Yttrium-86	100
Selenium-81m	1,000	Yttrium-87	100
Selenium-81	1,000	Yttrium-88	10
Selenium-83	1,000	Yttrium-90m	1,000
Bromine-74m	1,000	Yttrium-90	10
Bromine-74	1,000	Yttrium-91m	1,000
Bromine-75	1,000	Yttrium-91	10
Bromine-76	100	Yttrium-92	100
Bromine-77	1,000	Yttrium-93	100
Bromine-80m	1,000	Yttrium-94	1,000
Bromine-80	1,000	Yttrium-95	1,000
Bromine-82	100	Zirconium-86	100
Bromine-83	1,000	Zirconium-88	10
Bromine-84	1,000	Zirconium-89	100
Krypton-74	1,000	Zirconium-93	1
Krypton-76	1,000	Zirconium-95	10
Krypton-77	1,000	Zirconium-97	100
Krypton-79	1,000		

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Niobium-88	1,000	Palladium-101	1,000
Niobium-89m (66 min)	1,000	Palladium-103	100
Niobium-89 (122 min)	1,000	Palladium-107	10
Niobium-90	100	Palladium-109	100
Niobium-93m	10	Silver-102	1,000
Niobium-94	1	Silver-103	1,000
Niobium-95m	100	Silver-104m	1,000
Niobium-95	100	Silver-104	1,000
Niobium-96	100	Silver-105	100
Niobium-97	1,000	Silver-106m	100
Niobium-98	1,000	Silver-106	1,000
Molybdenum-90	100	Silver-108m	1
Molybdenum-93m	100	Silver-110m	10
Molybdenum-93	10	Silver-111	100
Molybdenum-99	100	Silver-112	100
Molybdenum-101	1,000	Silver-115	1,000
Technetium-93m	1,000	Cadmium-104	1,000
Technetium-93	1,000	Cadmium-107	1,000
Technetium-94m	1,000	Cadmium-109	1
Technetium-94	1,000	Cadmium-113m	0.1
Technetium-96m	1,000	Cadmium-113	100
Technetium-96	100	Cadmium-115m	10
Technetium-97m	100	Cadmium-115	100
Technetium-97	1,000	Cadmium-117m	1,000
Technetium-98	10	Cadmium-117	1,000
Technetium-99m	1,000	Indium-109	1,000
Technetium-99	100	Indium-110m (69.1m)	1,000
Technetium-101	1,000	Indium-110 (4.9h)	1,000
Technetium-104	1,000	Indium-111	100
Ruthenium-94	1,000	Indium-112	1,000
Ruthenium-97	1,000	Indium-113m	1,000
Ruthenium-103	100	Indium-114m	10
Ruthenium-105	1,000	Indium-115m	1,000
Ruthenium-106	1	Indium-115	100
Rhodium-99m	1,000	Indium-116m	1,000
Rhodium-99	100	Indium-117m	1,000
Rhodium-100	100	Indium-117	1,000
Rhodium-101m	1,000	Indium-119m	1,000
Rhodium-101	10	Tin-110	100
Rhodium-102m	10	Tin-111	1,000
Rhodium-102	10	Tin-113	100
Rhodium-103m	1,000	Tin-117m	100
Rhodium-105	100	Tin-119m	100
Rhodium-106m	1,000	Tin-121m	100
Rhodium-107	1,000	Tin-121	1,000
Palladium-100	100		

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Tin-123m	1,000	Tellurium-133	1,000
Tin-123	10	Tellurium-134	1,000
Tin-125	10	Iodine-120m	1,000
Tin-126	10	Iodine-120	100
Tin-127	1,000	Iodine-121	1,000
Tin-128	1,000	Iodine-123	100
Antimony-115	1,000	Iodine-124	10
Antimony-116m	1,000	Iodine-125	1
Antimony-116	1,000	Iodine-126	1
Antimony-117	1,000	Iodine-128	1,000
Antimony-118m	1,000	Iodine-129	1
Antimony-119	1,000	Iodine-130	10
Antimony-120 (16m)	1,000	Iodine-131	1
Antimony-120 (5.76d)	100	Iodine-132m	100
Antimony-122	100	Iodine-132	100
Antimony-124m	1,000	Iodine-133	10
Antimony-124	10	Iodine-134	1,000
Antimony-125	100	Iodine-135	100
Antimony-126m	1,000	Xenon-120	1,000
Antimony-126	100	Xenon-121	1,000
Antimony-127	100	Xenon-122	1,000
Antimony-128 (10.4m)	1,000	Xenon-123	1,000
Antimony-128 (9.01h)	100	Xenon-125	1,000
Antimony-129	100	Xenon-127	1,000
Antimony-130	1,000	Xenon-129m	1,000
Antimony-131	1,000	Xenon-131m	1,000
Tellurium-116	1,000	Xenon-133m	1,000
Tellurium-121m	10	Xenon-133	1,000
Tellurium-121	100	Xenon-135m	1,000
Tellurium-123m	10	Xenon-135	1,000
Tellurium-123	100	Xenon-138	1,000
Tellurium-125m	10	Cesium-125	1,000
Tellurium-127m	10	Cesium-127	1,000
Tellurium-127	1,000	Cesium-129	1,000
Tellurium-129m	10	Cesium-130	1,000
Tellurium-129	1,000	Cesium-131	1,000
Tellurium-131m	10	Cesium-132	100
Tellurium-131	100	Cesium-134m	1,000
Tellurium-132	10	Cesium-134	10
Tellurium-133m	100	Cesium-135m	1,000
		Cesium-135	100
		Cesium-136	10
		Cesium-137	10
		Cesium-138	1,000

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Barium-126	1,000	Promethium-141	1,000
Barium-128	100	Promethium-143	100
Barium-131m	1,000	Promethium-144	10
Barium-131	100	Promethium-145	10
Barium-133m	100	Promethium-146	1
Barium-133	100	Promethium-147	10
Barium-135m	100	Promethium-148m	10
Barium-139	1,000	Promethium-148	10
Barium-140	100	Promethium-149	100
Barium-141	1,000	Promethium-150	1,000
Barium-142	1,000	Promethium-151	100
Lanthanum-131	1,000	Samarium-141m	1,000
Lanthanum-132	100	Samarium-141	1,000
Lanthanum-135	1,000	Samarium-142	1,000
Lanthanum-137	10	Samarium-145	100
Lanthanum-138	100	Samarium-146	1
Lanthanum-140	100	Samarium-147	100
Lanthanum-141	100	Samarium-151	10
Lanthanum-142	1,000	Samarium-153	100
Lanthanum-143	1,000	Samarium-155	1,000
Cerium-134	100	Samarium-156	1,000
Cerium-135	100	Europium-145	100
Cerium-137m	100	Europium-146	100
Cerium-137	1,000	Europium-147	100
Cerium-139	100	Europium-148	10
Cerium-141	100	Europium-149	100
Cerium-143	100	Europium-150	
Cerium-144	1	(12.62h)	100
Praseodymium-136	1,000	Europium-150	
Praseodymium-137	1,000	(34.2y)	1
Praseodymium-138m	1,000	Europium-152m	100
Praseodymium-139	1,000	Europium-152	1
Praseodymium-142m	1,000	Europium-154	1
Praseodymium-142	100	Europium-155	10
Praseodymium-143	100	Europium-156	100
Praseodymium-144	1,000	Europium-157	100
Praseodymium-145	100	Europium-158	1,000
Praseodymium-147	1,000	Gadolinium-145	1,000
Neodymium-136	1,000	Gadolinium-146	10
Neodymium-138	100	Gadolinium-147	100
Neodymium-139m	1,000	Gadolinium-148	0.001
Neodymium-139	1,000	Gadolinium-149	100
Neodymium-141	1,000	Gadolinium-151	10
Neodymium-147	100	Gadolinium-152	100
Neodymium-149	1,000	Gadolinium-153	10
Neodymium-151	1,000	Gadolinium-159	100

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Terbium-147	1,000	Ytterbium-162	1,000
Terbium-149	100	Ytterbium-166	100
Terbium-150	1,000	Ytterbium-167	1,000
Terbium-151	100	Ytterbium-169	100
Terbium-153	1,000	Ytterbium-175	100
Terbium-154	100	Ytterbium-177	1,000
Terbium-155	1,000	Ytterbium-178	1,000
Terbium-156m (5.0h)	1,000	Lutetium-169	100
Terbium-156m (24.4h)	1,000	Lutetium-170	100
Terbium-156	100	Lutetium-171	100
Terbium-157	10	Lutetium-172	100
Terbium-158	1	Lutetium-173	10
Terbium-160	10	Lutetium-174m	10
Terbium-161	100	Lutetium-174	10
Dysprosium-155	1,000	Lutetium-176m	1,000
Dysprosium-157	1,000	Lutetium-176	100
Dysprosium-159	100	Lutetium-177m	10
Dysprosium-165	1,000	Lutetium-177	100
Dysprosium-166	100	Lutetium-178m	1,000
Holmium-155	1,000	Lutetium-178	1,000
Holmium-157	1,000	Lutetium-179	1,000
Holmium-159	1,000	Hafnium-170	100
Holmium-161	1,000	Hafnium-172	1
Holmium-162m	1,000	Hafnium-173	1,000
Holmium-162	1,000	Hafnium-175	100
Holmium-164m	1,000	Hafnium-177m	1,000
Holmium-164	1,000	Hafnium-178m	0.1
Holmium-166m	1	Hafnium-179m	10
Holmium-166	100	Hafnium-180m	1,000
Holmium-167	1,000	Hafnium-181	10
Erbium-161	1,000	Hafnium-182m	1,000
Erbium-165	1,000	Hafnium-182	0.1
Erbium-169	100	Hafnium-183	1,000
Erbium-171	100	Hafnium-184	100
Erbium-172	100	Tantalum-172	1,000
Thulium-162	1,000	Tantalum-173	1,000
Thulium-166	100	Tantalum-174	1,000
Thulium-167	100	Tantalum-175	1,000
Thulium-170	10	Tantalum-176	100
Thulium-171	10	Tantalum-177	1,000
Thulium-172	100	Tantalum-178	1,000
Thulium-173	100	Tantalum-179	100
Thulium-175	1,000	Tantalum-180m	1,000
		Tantalum-180	100
		Tantalum-182m	1,000

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Tantalum-182	10	Iridium-188	100
Tantalum-183	100	Iridium-189	100
Tantalum-184	100	Iridium-190m	1,000
Tantalum-185	1,000	Iridium-190	100
Tantalum-186	1,000	Iridium-192m	
Tungsten-176	1,000	(1.4m)	10
Tungsten-177	1,000	Iridium-192	
Tungsten-178	1,000	(73.8d)	1
Tungsten-179	1,000	Iridium-194m	10
Tungsten-181	1,000	Iridium-194	100
Tungsten-185	100	Iridium-195m	1,000
Tungsten-187	100	Iridium-195	1,000
Tungsten-188	10	Platinum-186	1,000
Rhenium-177	1,000	Platinum-188	100
Rhenium-178	1,000	Platinum-189	1,000
Rhenium-181	1,000	Platinum-191	100
Rhenium-182		Platinum-193m	100
(12.7h)	1,000	Platinum-193	1,000
Rhenium-182		Platinum-195m	100
(64.0h)	100	Platinum-197m	1,000
Rhenium-184m	10	Platinum-197	100
Rhenium-184	100	Platinum-199	1,000
Rhenium-186m	10	Platinum-200	100
Rhenium-186	100	Gold-193	1,000
Rhenium-187	1,000	Gold-194	100
Rhenium-188m	1,000	Gold-195	10
Rhenium-188	100	Gold-198m	100
Rhenium-189	100	Gold-198	100
Osmium-180	1,000	Gold-199	100
Osmium-181	1,000	Gold-200m	100
Osmium-182	100	Gold-200	1,000
Osmium-185	100	Gold-201	1,000
Osmium-189m	1,000	Mercury-193m	100
Osmium-191m	1,000	Mercury-193	1,000
Osmium-191	100	Mercury-194	1
Osmium-193	100	Mercury-195m	100
Osmium-194	1	Mercury-195	1,000
Iridium-182	1,000	Mercury-197m	100
Iridium-184	1,000	Mercury-197	1,000
Iridium-185	1,000	Mercury-199m	1,000
Iridium-186	100	Mercury-203	100
Iridium-187	1,000		

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Thallium-194m	1,000	Francium-223	100
Thallium-194	1,000	Radium-223	0.1
Thallium-195	1,000	Radium-224	0.1
Thallium-197	1,000	Radium-225	0.1
Thallium-198m	1,000	Radium-226	0.1
Thallium-198	1,000	Radium-227	1,000
Thallium-199	1,000	Radium-228	0.1
Thallium-201	1,000	Actinium-224	1
Thallium-200	1,000	Actinium-225	0.01
Thallium-202	100	Actinium-226	0.1
Thallium-204	100	Actinium-227	0.001
Lead-195m	1,000	Actinium-228	1
Lead-198	1,000	Thorium-226	10
Lead-199	1,000	Thorium-227	0.01
Lead-200	100	Thorium-228	0.001
Lead-201	1,000	Thorium-229	0.001
Lead-202m	1,000	Thorium-230	0.001
Lead-202	10	Thorium-231	100
Lead-203	1,000	Thorium-232	100
Lead-205	100	Thorium-234	10
Lead-209	1,000	Thorium-natural	100
Lead-210	0.01	Protactinium-227	10
Lead-211	100	Protactinium-228	1
Lead-212	1	Protactinium-230	0.1
Lead-214	100	Protactinium-231	0.001
Bismuth-200	1,000	Protactinium-232	1
Bismuth-201	1,000	Protactinium-233	100
Bismuth-202	1,000	Protactinium-234	100
Bismuth-203	100	Uranium-230	0.01
Bismuth-205	100	Uranium-231	100
Bismuth-206	100	Uranium-232	0.001
Bismuth-207	10	Uranium-233	0.001
Bismuth-210m	0.1	Uranium-234	0.001
Bismuth-210	1	Uranium-235	0.001
Bismuth-212	10	Uranium-236	0.001
Bismuth-213	10	Uranium-237	100
Bismuth-214	100	Uranium-238	100
Polonium-203	1,000	Uranium-239	1,000
Polonium-205	1,000	Uranium-240	100
Polonium-207	1,000	Uranium-natural	100
Polonium-210	0.1	Neptunium-232	100
Astatine-207	100	Neptunium-233	1,000
Astatine-211	10	Neptunium-234	100
Radon-220	1	Neptunium-235	100
Radon-222	1	Neptunium-236	
Francium-222	100	(1.15E+5)	0.001

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
Neptunium-236 (22.5h)	1	Curium-242	0.01
Neptunium-237	0.001	Curium-243	0.001
Neptunium-238	10	Curium-244	0.001
Neptunium-239	100	Curium-245	0.001
Neptunium-240	1,000	Curium-246	0.001
Plutonium-234	10	Curium-247	0.001
Plutonium-235	1,000	Curium-248	0.001
Plutonium-236	0.001	Curium-249	1,000
Plutonium-237	100	Berkelium-245	100
Plutonium-238	0.001	Berkelium-246	100
Plutonium-239	0.001	Berkelium-247	0.001
Plutonium-240	0.001	Berkelium-249	0.1
Plutonium-241	0.01	Berkelium-250	10
Plutonium-242	0.001	Californium-244	100
Plutonium-243	1,000	Californium-246	1
Plutonium-244	0.001	Californium-248	0.01
Plutonium-245	100	Californium-249	0.001
Americium-237	1,000	Californium-250	0.001
Americium-238	100	Californium-251	0.001
Americium-239	1,000	Californium-252	0.001
Americium-240	100	Californium-253	0.1
Americium-241	0.001	Californium-254	0.001
Americium-242m	0.001	Einsteinium-250	100
Americium-242	10	Einsteinium-251	100
Americium-243	0.001	Einsteinium-253	0.1
Americium-244m	100	Einsteinium-254m	1
Americium-244	10	Einsteinium-254	0.01
Americium-245	1,000	Fermium-252	1
Americium-246m	1,000	Fermium-253	1
Americium-246	1,000	Fermium-254	10
Curium-238	100	Fermium-255	1
Curium-240	0.1	Fermium-257	0.01
Curium-241	1	Mendelevium-257	10
		Mendelevium-258	0.01

* To convert μ Ci to kBq, multiply the μ Ci value by 37.

APPENDIX C

QUANTITIES¹ OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μ Ci)*	Radionuclide	Quantity (μ Ci)*
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

NOTE: For purposes of subdivision e of subsection 2 of section 33-10-04.1-13, subdivision a of subsection 5 of section 33-10-04.1-13, and subdivision a of subsection 1 of section 33-10-04.1-16 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.

¹The quantities listed above were derived by taking 1/10th of the most restrictive ALI listed in Table I, Columns 1 and 2, of Appendix B to Chapter 33-10-04.1, rounding to the nearest factor of 10, and constraining the values listed between 37 Bq and 37 MBq (0.001 and 1,000 μ Ci). Values of 3.7 MBq (100 μ Ci) have been assigned for radionuclides having a radioactive half-life in excess of E+9 years, except rhenium, 37 MBq (1,000 μ Ci), to take into account their low specific activity.

APPENDIX D
REQUIREMENTS FOR TRANSFER OF LOW-LEVEL RADIOACTIVE WASTE
FOR DISPOSAL AT LAND DISPOSAL FACILITIES AND MANIFESTS

1. Manifest.

The shipment manifest shall contain the name, address, and telephone number of the person generating the waste. The manifest shall also include the name, address, and telephone number or the name and United States environmental protection agency hazardous waste identification number of the person transporting the waste to the land disposal facility. The manifest shall also indicate: a physical description of the waste, the volume, radionuclide identity and quantity, the total radioactivity, and the principal chemical form. The solidification agent shall be specified. Waste containing more than one-tenth percent chelating agents by weight shall be identified and the weight percentage of the chelating agent estimated. Wastes classified as class A, class B, or class C in subsection 1 of appendix E shall be clearly identified as such in the manifest. The total quantity of the radionuclides hydrogen-3, carbon-14, technetium-99, and iodine-129 shall be shown. The manifest may be shipping papers used to meet the United States department of transportation or United States environmental protection agency rules or requirements of the receiver, provided all the required information is included. Copies of manifests may be legible carbon copies or legible photocopies.

2. Certification.

The waste generator shall include in the shipment manifest a certification that the transported materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable rules of the United States department of transportation and the department. An authorized representative of the waste generator shall sign and date the manifest.

3. Control and tracking.

a. Any radioactive waste generator who transfers radioactive waste to a land disposal facility or a licensed waste collector shall comply with the requirements in paragraphs 1 through 8. Any radioactive waste generator who transfers waste to a licensed waste processor who treats or repackages waste shall comply with the requirements of paragraphs 4 through 8. A licensee shall:

(1) Prepare all wastes so that the waste is classified according to subsection 1 of appendix E and meets the

waste characteristics requirements in subsection 2 of appendix E;

- (2) Label each package of waste to identify whether it is class A waste, class B waste, or class C waste, in accordance with subsection 1 of appendix E;
 - (3) Conduct a quality control program to ensure compliance with subsections 1 and 2 of appendix E; the program shall include management evaluation of audits;
 - (4) Prepare shipping manifests to meet the requirements of subsections 1 and 2;
 - (5) Forward a copy of the manifest to the intended recipient, at the time of shipment, or deliver to a collector at the time the waste is collected, obtaining acknowledgment of receipt in the form of a signed copy of the manifest or equivalent documentation from the collector;
 - (6) Include one copy of the manifest with the shipment;
 - (7) Retain a copy of the manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by subsection 12 of section 33-10-03-05; and
 - (8) For any shipments or any portion 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 subdivision e.
- b. Any waste collector licensee who handles only prepackaged waste shall:
- (1) Acknowledge receipt of the waste from the generator within one week of receipt by returning a signed copy of the manifest or equivalent documentation;
 - (2) Prepare a new manifest to reflect consolidated shipments; the new manifest shall serve as a listing or index for the detailed generator manifests. Copies of the generator manifests shall be a part of the new manifest. The waste collector may prepare a new manifest without attaching the generator manifests, provided the new manifest contains for each package the information specified in subsection 1. The collector licensee shall certify that nothing has been done to the waste that would invalidate the generator's certification;

- (3) Forward a copy of the new manifest to the land disposal facility operator at the time of shipment;
 - (4) Include the new manifest with the shipment to the disposal site;
 - (5) Retain a copy of the manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by subsection 12 of section 33-10-03-05, and retain information from generator manifest until disposition is authorized by the department; and
 - (6) For any shipments or any portion of a shipment for which acknowledgment of receipt is not received within the times set forth in this section, conduct an investigation in accordance with subdivision e.
- c. Any licensed waste processor who treats or repackages wastes shall:
- (1) Acknowledge receipt of the waste from the generator within one week of receipt by returning a signed copy of the manifest or equivalent documentation;
 - (2) Prepare a new manifest that meets the requirements of subsections 1 and 2. Preparation of the new manifest reflects that the processor is responsible for the waste;
 - (3) Prepare all wastes so that the waste is classified according to subsection 1 of appendix E and meets the waste characteristics requirements in subsection 2 of appendix E;
 - (4) Label each package of waste to identify whether it is class A waste, class B waste, or class C waste, in accordance with subsections 1 and 3 of appendix E;
 - (5) Conduct a quality control program to ensure compliance with subsections 1 and 2 of appendix E. The program shall include management evaluation of audits;
 - (6) Forward a copy of the new manifest to the disposal site operator or waste collector at the time of shipment, or deliver to a collector at the time the waste is collected, obtaining acknowledgment of receipt in the form of a signed copy of the manifest or equivalent documentation by the collector;
 - (7) Include the new manifest with the shipment;

- (8) Retain copies of original manifests and new manifests and documentation of acknowledgment of receipt as the record of transfer of licensed material required by subsection 12 of section 33-10-03-05; and
 - (9) For any shipment or portion of a shipment for which acknowledgment is not received within the times set forth in this section, conduct an investigation in accordance with subdivision e.
- d. The land disposal facility operator shall:
- (1) Acknowledge receipt of the waste within one week of receipt by returning a signed copy of the manifest or equivalent documentation to the shipper. The shipper to be notified is the licensee who last possessed the waste and transferred the waste to the operator. The returned copy of the manifest or equivalent documentation shall indicate any discrepancies between materials listed on the manifest and materials received;
 - (2) Maintain copies of all completed manifests or equivalent documentation until the department authorizes their disposition; and
 - (3) Notify the shipper, that is, the generator, the collector, or processor, and the department when any shipment or portion of a shipment has not arrived within sixty days after the advance manifest was received.
- e. Any shipment or portion of a shipment for which acknowledgment is not received within the times set forth in this section shall:
- (1) Be investigated by the shipper if the shipper has not received notification or receipt within twenty days after transfer; and
 - (2) Be traced and reported to whom. 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 two weeks of completion of the investigation.

APPENDIX E
CLASSIFICATION AND CHARACTERISTICS OF LOW-LEVEL
RADIOACTIVE WASTE

1. Classification of radioactive waste for land disposal.
 - a. Considerations. Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.
 - b. Classes of waste.
 - (1) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of class A waste must meet the minimum requirements set forth in subdivision a of subsection 2. If class A waste also meets the stability requirements set forth in subdivision b of subsection 2, it is not necessary to segregate the waste for disposal.
 - (2) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of class B waste must meet both the minimum and stability requirements set forth in subsection 2.
 - (3) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of class C waste must meet both the minimum and stability requirements set forth in subsection 2.
 - c. Classification determined by long-lived radionuclides. If the radioactive waste contains only radionuclides listed in table I, classification shall be determined as follows:
 - (1) If the concentration does not exceed one-tenth times the value in table I, the waste is class A.

- (2) If the concentration exceeds one tenth times the value in table I, but does not exceed the value in table I, the waste is class C.
- (3) If the concentration exceeds the value in table I, the waste is not generally acceptable for land disposal.
- (4) For wastes containing mixtures of radionuclides listed in table I, the total concentration shall be determined by the sum of fractions rule described in subdivision g.

TABLE I

Radionuclide	Concentration curie/cubic meter ^a	Concentration nanocurie/gram ^b
C-14	8	
C-14 in activated metal	80	
Ni-59 in activated metal	220	
Nb-94 in activated metal	0.2	
Tc-99	3	
I-129	0.08	
Alpha-emitting transuranic radionuclides with half-life greater than five years		100
Pu-241		3,500
Cm-242		20,000
Ra-226		100

^a To convert the curie per cubic meter values to gigabecquerel per cubic meter, multiply the curie per cubic meter value by thirty-seven.

^b To convert the nanocurie per gram values to becquerel per gram, multiply thenanocurie per gram value by thirty-seven.

d. Classification determined by short-lived radionuclides. If the waste does not contain any of the radionuclides listed in table I, classification shall be determined based on the concentrations shown in table II. However, as specified in subdivision f, if radioactive waste does not contain any nuclides listed in either table I or II, it is class A.

- (1) If the concentration does not exceed the value in column 1, the waste is class A.

- (2) If the concentration exceeds the value in column 1 but does not exceed the value in column 2, the waste is class B.
- (3) If the concentration exceeds the value in column 2 but does not exceed the value in column 3, the waste is class C.
- (4) If the concentration exceeds the value in column 3, the waste is not generally acceptable for near-surface disposal.
- (5) For wastes containing mixtures of the radionuclides listed in table II, the total concentration shall be determined by the sum of fractions rule described in subdivision g.

TABLE II

Radionuclide	Concentration, curie per cubic meter*		
	Column 1	Column 2	Column 3
Total of all radionuclides with less than 5-year half-life	700	*	*
H-3	40	*	*
Co-60	700	*	*
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600

*To convert the curie per cubic meter value to gigabecquerel per cubic meter, multiply the curie per cubic meter value by thirty-seven. There are no limits established for these radionuclides in class B or class C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be class B unless the concentrations of other radionuclides in table II determine the waste to be class C independent of these radionuclides.

- e. Classification determined by both long-lived and short-lived radionuclides. If the radioactive waste contains a mixture of radionuclides, some of which are listed in table I and some of which are listed in table II, classification shall be determined as follows:

- (1) If the concentration of a radionuclide listed in table I is less than one-tenth times the value listed in table I, the class shall be that determined by the concentration of radionuclides listed in table II.
 - (2) If the concentration of a radionuclide listed in table I exceeds one-tenth times the value listed in table I, but does not exceed the value in table I, the waste shall be class C, provided the concentration of radionuclides listed in table II does not exceed the value shown in column 3 of table II.
- f. Classification of wastes with radionuclides other than those listed in tables I and II. If the waste does not contain any radionuclides listed in either table I or II, it is class A.
- g. The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each radionuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than one if the waste class is to be determined by that column. Example: A waste contains strontium-90 in a concentration of one and eighty-five-hundredths terabecquerels per cubic meter (50 Ci/m^3) and cesium-137 in a concentration of eight hundred fourteen gigabecquerels per cubic meter (22 Ci/m^3). Since the concentrations both exceed the values in column 1, table II, they must be compared to column 2 values. For strontium-90 fraction, fifty divided by one hundred fifty is one-third, for cesium-137 fraction, twenty-two divided by forty-four is one-half; the sum of the fractions is eighty-three-hundredths. Since the sum is less than one, the waste is class B.
- h. Determination of concentrations in wastes. The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as becquerel (nanocurie) per gram.

2. Radioactive waste characteristics.

a. The following are minimum requirements for all classes of waste and are intended to facilitate handling and provide protection of health and safety of personnel at the disposal site.

- (1) Wastes shall be packaged in conformance with the conditions of the license issued to the site operator to which the waste will be shipped. Where the conditions of the site license are more restrictive than the provisions of chapter 33-10-04.1, the site license conditions shall govern.
- (2) Wastes shall not be packaged for disposal in cardboard or fiberboard boxes.
- (3) Liquid waste shall be packaged in sufficient absorbent material to absorb twice the volume of the liquid.
- (4) Solid waste containing liquid shall contain as little freestanding and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed one percent of the volume.
- (5) Waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.
- (6) Waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with paragraph 8.
- (7) Waste must not be pyrophoric. Pyrophoric materials contained in wastes shall be treated, prepared, and packaged to be nonflammable. (See section 33-10-01-04 for the definition of pyrophoric.)
- (8) Wastes in a gaseous form shall be packaged at an absolute pressure that does not exceed one and one-half atmospheres at twenty degrees Celsius. Total activity shall not exceed three and seven-tenths terabecquerels (100 Ci) per container.
- (9) Wastes containing hazardous, biological, pathogenic, or infectious material shall be treated to reduce to the maximum extent practicable the potential hazard from the nonradiological materials.

- b. The following requirements are intended to provide stability of the waste. Stability is intended to ensure that the waste does not degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.
- (1) Waste shall have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
 - (2) Notwithstanding the provisions in paragraphs 3 and 4 of subdivision a of subsection 2, liquid wastes, or wastes containing liquid, shall be converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed one percent of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5 percent of the volume of the waste for waste processed to a stable form.
 - (3) Void spaces within the waste and between the waste and its package shall be reduced to the extent practicable.

3. Labeling.

Each package of waste shall be clearly labeled to identify whether it is class A, class B, or class C waste, in accordance with subsection 1.

APPENDIX F

Standards for Unrestricted Areas

(a) Surface contamination limits

(1) Alpha emitters

(i) Removable:	$\frac{0.555 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{15 \text{ pCi}}{100 \text{ cm}^2}$	=	$\frac{33 \text{ dpm}}{100 \text{ cm}^2}$	average over any one surface
	$\frac{1.665 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{45 \text{ pCi}}{100 \text{ cm}^2}$	=	$\frac{100 \text{ dpm}}{100 \text{ cm}^2}$	maximum
(ii) Total (fixed):	$\frac{166.5 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{450 \text{ pCi}}{100 \text{ cm}^2}$	=	$\frac{1000 \text{ dpm}}{100 \text{ cm}^2}$	average over any one surface
	$\frac{832.5 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{2250 \text{ pCi}}{100 \text{ cm}^2}$	=	$\frac{5000 \text{ dpm}}{100 \text{ cm}^2}$	maximum or

$\frac{2.5 \text{ } \mu\text{Sv}}{\text{hr}}$ ($\frac{0.25 \text{ mrem}}{\text{hr}}$) maximum at 1 cm from surface

(2) Beta-Gamma emitters

(i) Removable: (all beta- gamma emitters except hydrogen-3)	$\frac{3.7 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{100 \text{ pCi}}{100 \text{ cm}^2}$	average over any one surface
	$\frac{18.5 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{500 \text{ pCi}}{100 \text{ cm}^2}$	maximum
Removable: (hydrogen-3)	$\frac{37 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{1000 \text{ pCi}}{100 \text{ cm}^2}$	average over any one surface
	$\frac{185 \text{ Bq}}{100 \text{ cm}^2}$	=	$\frac{5000 \text{ pCi}}{100 \text{ cm}^2}$	maximum

(ii) Total
(fixed): $\frac{2.5 \text{ } \mu\text{Sv}}{\text{hr}}$ ($\frac{0.25 \text{ mrem}}{\text{hr}}$) maximum at 1 cm from surface

(b) Concentration in air and water: appendix B, table II of chapter 33-10-04.1.

(c) Concentrations in soil and other materials except water:

- (1) Radioactive material except source material and radium: Schedule A, column II of chapter 33-10-03.
- (2) Source material and radium: Concentration of radionuclides above background concentrations for total radium, averaged over areas of 100 square meters, shall not exceed:
 - (i) 5 picocuries per gram of dry soil, averaged over the first 15 centimeters below the surface; and
 - (ii) 5 picocuries per gram of dry soil, averaged over layers of 15 centimeters thickness more than 15 centimeters below the surface.

(d) The level of gamma radiation measured at a distance of 100 centimeters from the surface shall not exceed background.

CHAPTER 33-10-05

33-10-05-03. Definitions. As used in this chapter, the following definitions apply:

1. "Cabinet radiography" means industrial radiography conducted in an enclosure or cabinet shielded so that radiation levels at every location on the exterior meets the conditions specified in subsection 5 1 of section ~~33-10-04-02~~ 33-10-04.1-07.
2. "Cabinet X-ray system" means an X-ray system with the X-ray tube installed in an enclosure independent of existing architectural structures except the floor on which it may be placed. The cabinet X-ray system is intended to contain at least that portion of a material being irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of ionizing 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 which may temporarily or occasionally incorporate portable shielding, is not considered a cabinet X-ray system.
3. "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.
4. "Collimator" means a device used to limit the size, shape, and direction of the primary radiation beam.
5. "Industrial radiography" means the examination of the macroscopic structure of materials by nondestructive methods using sources of ionizing radiation to produce radiographic images.
6. "Lixiscope" means a portable light-intensified imaging device using a sealed source.
7. "Permanent radiographic installation" means a shielded installation or structure designed or intended for radiography and in which radiography is regularly performed.
8. "Personal supervision" means guidance and instruction provided to a radiographer trainee by a radiographer instructor who is physically present at the site, in visual contact with the trainee while the trainee is using sources of radiation and associated equipment, and in such proximity that immediate assistance can be given if required.

9. "Radiographer" means any individual who performs or personally supervises industrial radiographic operations and who is responsible to the licensee or registrant for assuring compliance with the requirements of this article and all license (or certificate of registration) conditions.
10. "Radiographer instructor" means any radiographer who has been authorized by the department to provide on-the-job training to radiographer trainees in accordance with paragraph 2 of subdivision b of subsection 4 of section 33-10-05-05 in accordance with subdivision e of subsection 5 of section 33-10-05-06.
11. "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 their instruction.
12. "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.
13. "Radiographic personnel" means any radiographer, radiographer instructor, or radiographer trainee.
14. "Residential location" means any area where structures in which people lodge or live are located, and the grounds on which such structures are located including, but not limited to, houses, apartments, condominiums, and garages.
15. "Shielded position" means the location within the radiographic exposure device or storage container which, by manufacturer's design, is the proper location for storage of the sealed source.
16. "Shielded-room radiography" means industrial radiography conducted in a room so shielded that every location on the exterior meets the conditions specified in subsection 5 1 of section ~~33-10-04-02~~ 33-10-04.1-07.
17. "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.
18. "Storage area" means any location, facility, or vehicle which is used to store, transport, or 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.

19. "Storage container" means a shielded device in which sealed sources are secured and stored.
20. "Temporary jobsite" means any location where industrial radiography is performed other than the locations listed in a specific license or certificate of registration.
21. "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 United States department of transportation.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-05-03.1. Exemptions.

1. Except for the requirements of subdivisions b and c of subsection 6 of section 33-10-05-06, certified cabinet X-ray systems designed to exclude individuals from the interior of the cabinet are exempt from the requirements of this chapter.
2. Industrial users of lixiscopes are exempt from the requirements of this chapter.

History: Effective March 1, 1994.

General Authority: NDCC 23-20.1-04

Law Implemented: NDCC 23-20.1-04

33-10-05-04. Equipment control.

1. 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 in NBS handbook 136, issued January 1981).
 - b. In addition to the requirements specified in subdivision a, the following requirements apply to radiographic exposure devices and associated equipment.
 - (1) Each radiographic exposure device 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 source; 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.

(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 subdivisions a and b, 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, lockbox, 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 have passed the crushing tests for the control tube as specified in American national standard N432 and a kinking resistance test that closely approximates the kinking forces 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 American national standard N432.
- (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 newly manufactured radiographic exposure devices and associated equipment acquired by licensees after January 10, 1992, must comply with the requirements of this section.

e. All radiographic exposure devices and associated equipment in use after January 10, 1996, must comply with the requirements of this section.

2. Limits on levels of radiation for radiographic exposure devices and storage containers.

- a. Radiographic exposure devices measuring less than four inches [10 centimeters] from the sealed source storage position to any exterior surface of the device shall have no radiation level in excess of fifty milliroentgens [1.29×10^{-5} coulombs per kilogram] per hour at six inches [15 centimeters] from any exterior surface of the device. Radiographic exposure devices measuring a minimum of four inches [10 centimeters] from the sealed source storage position to any exterior surface of the device, and all storage containers for sealed sources or outer containers for radiographic exposure devices, shall have no radiation level in excess of two hundred milliroentgens [5.16×10^{-5} coulombs per kilogram] per hour at any exterior surface, and ten milliroentgens [2.58×10^{-6} coulombs per kilogram]

per hour at thirty-nine and four-tenths inches [1 meter] from any exterior surface. The radiation levels specified are with the sealed source in the shielded (i.e., "off") position.

- b. Subdivision a of this subsection applies to all equipment manufactured prior to January 10, 1992. After January 10, 1996, radiographic equipment other than storage containers and source changers must meet the requirements of subsection 1, and subsection 2 applies only to storage containers and source changers.

~~2~~ 3. Locking of sources of radiation.

- a. Each source of radiation shall be provided with a lock or lockable outer container designed to prevent unauthorized or accidental production of radiation or removal or exposure of a sealed source and shall be kept locked at all times except when under the direct surveillance of a radiographer or radiographer trainee, or as may be otherwise authorized pursuant to subsection 1 of section 33-10-05-06. Each storage container and source changer likewise shall be provided with a lock and must be kept locked when containing sealed sources except when the container is under the direct surveillance of a radiographer or radiographer trainee.
- b. Radiographic exposure devices, source changers, and storage containers, prior to being moved from one location to another and also prior to being secured to a given location, shall be locked and surveyed to assure that the sealed source is in the shielded position.
- c. The sealed source must be secured in its shielded position by locking the exposure device or securing the remote control each time the sealed source is returned to its shielded position. Then a survey must be performed to determine that the sealed source is in the shielded position pursuant to subdivision b of subsection 3 of section 33-10-05-06.

~~3~~ 4. Storage precautions.

- a. Locked radiographic exposure devices, source changers, storage containers, and radiation machines shall be physically secured to prevent tampering or removal by unauthorized personnel.
- b. Radiographic exposure devices, source changers, or transport containers that contain radioactive material may not be stored in residential locations. This requirement does not apply to storage of radioactive material in a vehicle in transit for use at temporary jobsites, if the

licensee complies with subdivision c and if the vehicle does not constitute a permanent storage location as described in subdivision d.

- c. If a vehicle is to be used for storage of radioactive material, a vehicle survey must be performed after securing radioactive material in the vehicle and before transport to ensure that radiation levels do not exceed the limits specified in ~~subdivision a of~~ subsection 5.3 of section ~~33-10-04-05~~ 33-10-04.1-16 at the exterior surface of the vehicle.
- d. A storage or use location is permanent if radioactive material is stored at the location for more than ninety days and any one or more of the following applies to the location:
 - (1) Telephone service is established by the licensee.
 - (2) Industrial radiographic services are advertised for or from the location.
 - (3) Industrial radiographic operations are conducted at other sites due to arrangements made from the location.

~~4.~~ 5. Radiation survey instruments.

- a. The licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments to make physical radiation surveys as required by this chapter and chapter ~~33-10-04~~ 33-10-04.1. Instrumentation required by this subsection must have a range such that two milliroentgens [5.16×10^{-7} coulombs per kilogram] per hour through one roentgen [2.58×10^{-4} coulombs per kilogram] per hour can be measured.
- b. Each radiation survey instrument shall be calibrated:
 - (1) At energies appropriate for use and at intervals not to exceed three months and after each instrument servicing.
 - (2) Such that accuracy within plus or minus twenty percent can be demonstrated.
 - (3) At two points located approximately one-third and two-thirds of full-scale on each scale for linear scale instruments; at midrange 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 must be maintained for two years after the calibration date for inspection by the department.
- d. Each radiation survey instrument must be checked with a radiation source at the beginning of each day of use and at the beginning of each workshift to ensure it is operating properly.

~~5.~~ 6. 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, the United States nuclear regulatory commission, or any agreement state.
- 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 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 five-thousandths microcurie [185 becquerels] 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 subdivision e paragraph 5 of subdivision a of subsection 3 of section 33-10-03-05. Records of leak test results shall be kept in units of microcuries [becquerels] and maintained for inspection by the department for two years after the required leak test is performed.
- d. Any test conducted pursuant to subdivisions b and c which reveals the presence of five-thousandths microcurie [185 becquerels] 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 this article. 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. Each radiographic exposure device must have permanently attached to it a durable tag which has, as a minimum, the instruction: "Danger - Radioactive Material - Do Not Handle - Notify Civil Authorities if Found".
- ~~6-~~ 7. **Quarterly inventory.** Each licensee shall conduct a quarterly physical inventory to account for all sealed sources and radiography exposure devices received or possessed by the licensee. The records of the inventories shall be maintained for two years from the date of the inventory for inspection by the department and shall include the quantities and kinds of radioactive material, the location of sealed sources, the date of the inventory, the name of the individual conducting the inventory, the manufacturer, the model number, and the serial number.
- ~~7-~~ 8. **Utilization logs.** Each licensee or registrant shall maintain current logs, which shall be kept available for inspection by the department for two years from the date of the recorded event, showing for each source of radiation the following information:
- a. A unique identification, such as serial number, of each radiation machine, each radiographic exposure device in which a sealed source is located, and each sealed source.
 - b. The identity of the radiographer to whom assigned.
 - c. Locations where used and dates of use.
 - d. The dates each source of radiation is removed from storage and returned to storage.
- ~~8-~~ 9. **Inspection and maintenance.**
- a. Each licensee or registrant shall ensure that checks for obvious defects in radiation machines, radiographic exposure devices, storage containers, and source changers are performed prior to each day or shift the equipment is used.
 - b. Each licensee or registrant shall conduct a program of at least quarterly inspection and maintenance of radiation machines, radiographic exposure devices, storage containers, and source changers to assure proper functioning of components important to safety. All appropriate parts shall be maintained in accordance with the manufacturer's specifications. Records of inspection and maintenance shall be maintained for inspection by the department for two years from the date the inspection and maintenance is performed.

- c. If any inspection conducted pursuant to subdivision a or b reveals damage to components critical to radiation safety, the device shall be removed from service and labeled as defective until repairs have been made.

9- 10. Permanent radiographic installations. Permanent radiographic installations having high radiation area entrance controls of the type described in subparagraphs b and c of paragraph 2 of subdivision c of subsection 3 of section 33-10-04-03 subsection 1 of section 33-10-04.1-10 shall also meet the following requirements:

- a. Each entrance that is used for personnel access to the high radiation area shall have both visible and audible warning signals to warn of the presence of radiation. The visible signal shall be activated by radiation whenever the source is exposed. The audible signal shall be activated when an attempt is made to enter the installation while the source is exposed.
- b. The control device or alarm system shall be tested for proper operation at the beginning of each day of equipment use. If a control device or alarm system is operating improperly, it must be immediately labeled as defective and repaired before industrial radiographic operations are resumed. Records of these tests shall be maintained for inspection by the department for two years from the date the tests were conducted.

11. Reporting requirements.

a. In addition to the reporting requirements specified in subsection 5 of section 33-10-04.1-16 and under other sections of this chapter, each licensee shall provide a written report to the department, within thirty 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.
- (3) Failure of any component (critical to safe operation of the device) to properly perform its intended function.

b. The licensee shall include the following information in each report submitted under subdivision a:

- (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.
- (7) Qualifications of personnel involved in the incident.

c. Reports of overexposure submitted under subsection 3 of section 33-10-04.1-16 which involve failure of safety components of radiography equipment must also include the information specified in subdivision b.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-05-04.1. Exemptions.

- ~~1. Except for the requirements of subdivisions b and c of subsection 6 of section 33-10-05-06, certified cabinet X-ray systems designed to exclude individuals from the interior of the cabinet are exempt from the requirements of this chapter.~~
- ~~2. Industrial users of lixiscopes are exempt from the requirements of this chapter. Repealed effective March 1, 1994.~~

History: ~~Effective June 1, 1992.~~

General Authority: ~~NBCC 28-32-02~~

Law Implemented: ~~NBCC 28-32-02~~

33-10-05-05. Personal radiation safety requirements for radiographic personnel.

1. Training and testing.

- a. The licensee or registrant shall not permit any individual to act as a radiographer trainee until such individual has received copies of, instructions in, and has demonstrated an understanding of:

- (1) The subjects outlined in appendix A of this chapter;

- (2) The rules contained in this chapter and in the applicable sections of chapters ~~33-10-04~~ 33-10-04.1, 33-10-10, and 33-10-13;
 - (3) The appropriate department license or certificate of registration; and
 - (4) The licensee's or registrant's operating and emergency procedures.
- b. The licensee or registrant shall not permit any individual to act as a radiographer, as defined in this chapter, until such individual:
- (1) Has met the requirements of subdivision a of subsection 1;
 - (2) Has provided the department with documentation showing completion of at least thirty days of on-the-job training by a radiographer instructor as a radiographer trainee following completion of the requirements of subdivision a of subsection 1;
- Note: This requirement does not apply to individuals designated as radiographers prior to March 1, 1992.
- (3) Has demonstrated competence in the use of sources of radiation, radiographic exposure devices, related handling tools, and radiation survey instruments which may be employed in industrial radiographic assignments;
 - (4) Has demonstrated an understanding of the instructions in subdivision a of subsection 1 by successful completion of a written test and a field examination on the subjects covered; and
 - (5) Has successfully completed an examination administered by the department or a third party designated by the department after March 1, 1993.
- c. Records of the above training, including copies of written tests and dates of oral tests and field examinations, shall be maintained by the licensee or registrant for inspection by the department for three years following termination of employment.
- d. Each licensee or registrant shall conduct an internal audit program to ensure that the department's radioactive material license conditions and the licensee's or registrant's operating and emergency procedures are followed by each radiographer. These internal audits shall be performed at least quarterly, and each

radiographer shall be audited at least quarterly. Records of internal audits shall be maintained for inspection by the department for two years from the date of the audit.

2. Operating and emergency procedures. The licensee's or registrant's operating and emergency procedures shall include instructions in at least the following:

- a. The handling and use of sources of radiation to be employed such that no individual is likely to be exposed to radiation doses in excess of the limits established in chapter ~~33-10-04~~ 33-10-04.1.
- b. Methods and occasions for conducting radiation surveys.
- c. Methods for controlling access to radiographic areas.
- d. Methods and occasions for locking and securing sources of radiation.
- e. Personnel monitoring and the use of personnel monitoring equipment, including steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale.
- f. Transportation to field locations, including packing of sources of radiation in the vehicles, posting of vehicles, and control of sources of radiation during transportation.
- g. Minimizing exposure of individuals in the event of an accident.
- h. The procedure for notifying proper personnel in the event of an accident.
- i. Maintenance of records.
- j. The inspection and maintenance of radiographic exposure devices, source changers, storage containers, and radiation machines.

3. Personnel monitoring control.

- a. The licensee or registrant shall not permit any individual to act as a radiographer or as a radiographer trainee unless, at all times during radiographic operations, each such individual wears a direct-reading pocket dosimeter, an alarm ratemeter, and either a film badge or a thermoluminescent dosimeter except that for permanent radiography facilities where other appropriate alarming or warning devices are in routine use, the wearing of an alarming ratemeter is not required. Pocket dosimeters shall have a range from zero to at least two hundred

milliroentgens [5.6×10^{-5} coulombs per kilogram] and shall be recharged daily or at the start of each shift. Each badge or thermoluminescent dosimeter shall be assigned to and worn by only one individual.

- b. Pocket dosimeters shall be read and exposures recorded at least once daily.
- c. Pocket dosimeters shall be checked for correct response to radiation at periods not to exceed one year. Acceptable dosimeters shall read within plus or minus thirty percent of the true radiation exposure. Records of this check must be maintained for inspection by the department for two years from the date of the annual check for correct response.
- d. If an individual's pocket dosimeter is discharged beyond its range, industrial radiographic operations by that individual shall cease and the individual's film badge or thermoluminescent dosimeter must be processed immediately. The individual may not return to work with sources of radiation until a determination of the radiation exposure has been made.
- e. Reports received from the film badge or thermoluminescent dosimeter processor and records of daily pocket dosimeter readings shall be kept for inspection by the department until the department authorizes disposition.
- f. If a film badge or thermoluminescent dosimeter is lost or damaged, the worker shall cease work immediately until a replacement film badge or thermoluminescent dosimeter is provided and the exposure is calculated for the time period from issuance to loss or damage of the film badge or thermoluminescent dosimeter.
- g. Each alarm ratemeter must:
 - (1) Be checked to ensure that the alarm functions properly (sounds) prior to use at the start of each shift;
 - (2) Be set to give an alarm signal at a preset dose rate of five hundred milliroentgens per hour;
 - (3) Require special means to change the preset alarm function; and
 - (4) Be calibrated at periods not to exceed one year for correct response to radiation: Acceptable ratemeters must alarm within plus or minus twenty percent of the true radiation dose rate.

4. Supervision of radiographer trainee. Whenever a radiographer trainee uses radiographic exposure devices, sealed sources or related source handling tools, or conducts radiation surveys required by subdivisions b and c of subsection 3 of section 33-10-05-06 to determine that the sealed source has returned to the shielded position after an exposure, the radiographer trainee shall be under the personal supervision of a radiographer instructor.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-05-06. Precautionary procedures in radiographic operations.

1. Security. During each radiographic operation, the radiographer or radiographer trainee shall maintain a direct surveillance of the operation to protect against unauthorized entry into a high radiation area, as defined in chapter 33-10-01, except:
 - a. Where the high radiation area is equipped with a control device or alarm system as described in paragraph 2 of subdivision c of subsection 3 1 of section 33-10-04-03 33-10-04.1-10.
 - b. Where the high radiation area is locked to protect against unauthorized or accidental entry.
2. Posting. Notwithstanding any provisions in subdivision c of subsection ~~4 3~~ of section ~~33-10-04-03 33-10-04.1-13~~, areas in which radiography is being performed shall be conspicuously posted as required by paragraph 1 of subdivision c of subsection 3 of section 33-10-04-03 and subdivision b of subsection 3 2 of section 33-10-04-03 33-10-04.1-13.
3. Radiation surveys and survey records.
 - a. No radiographic operation shall be conducted unless calibrated and operable radiation survey instrumentation, as described in subsection ~~4 5~~ of section 33-10-05-04 is available and used at each site where radiographic exposures are made.
 - b. A survey with a radiation survey instrument shall be made after each radiographic exposure to determine that the sealed source has been returned to its shielded position. The entire circumference of the radiographic exposure device shall be surveyed. If the radiographic exposure device has a source guide tube, the survey shall include the entire length of the guide tube.

- c. A survey must be made of the storage area as defined in section 33-10-05-03 whenever a radiographic exposure device is being placed in storage.
 - d. A physical radiation survey, as specified in subsection 2 3 of section 33-10-05-04, shall be made to determine that each sealed source is in its shielded position prior to securing the radiographic exposure device, storage container, or source changer in a storage area as defined in section 33-10-05-03.
 - e. A physical radiation survey shall be made after each radiographic exposure using radiation machines to determine that the machine is "off".
 - f. Records shall be kept of the surveys required by subdivisions c and d of subsection 3. Such records shall be maintained for inspection by the department for two years after completion of the survey. If the survey was used to determine an individual's exposure, however, the records of the survey must be maintained until the department authorizes their disposition.
4. Documents and records required at temporary jobsites. Each licensee or registrant conducting industrial radiography at a temporary jobsite shall have the following records available at that site for inspection by the department:
- a. Appropriate license or certificate of registration or equivalent document.
 - b. Operating and emergency procedures.
 - c. Applicable rules.
 - d. Survey records required pursuant to subsection 3 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 record for specific devices in use at the site. Acceptable records include tags or labels which are affixed to the device or survey meter.
5. Specific requirements for radiographic personnel performing industrial radiography.
- a. At a jobsite, the following must be supplied by the licensee or registrant:
 - (1) At least one operable, calibrated survey instrument;

- (2) A current whole body personnel monitor (thermoluminescent dosimeter or film badge) for each individual;
 - (3) An operable, calibrated pocket dosimeter with a range of zero to two hundred milliroentgens [5.16×10^{-5} coulombs per kilogram] for each worker; ~~and~~
 - (4) An alarm ratemeter set to give an alarm signal at a preset dose rate of five hundred milliroentgens per hour; and
 - (5) The appropriate barrier ropes and signs.
- b. Industrial radiographic operations may not be performed if any of the items specified in subdivision a of subsection 5 are not available at the jobsite or are inoperable.
 - c. Each licensee or registrant shall provide as a minimum two radiographic personnel when sources of radiation are used at temporary jobsites. If one of the personnel is a radiographer trainee, the other must be a radiographer instructor.
 - d. No individual other than a radiographer or a radiographer trainee who is under the personal supervision of a radiographer instructor may manipulate controls or operate equipment used in industrial radiographic operations.
 - e. No individual may act as a radiographer instructor unless such individual:
 - (1) Has met the requirements of subdivision b of subsection 1 of section 33-10-05-05;
 - (2) Has one year of documented experience as a radiographer; and
 - (3) Has been named as a radiographer instructor on the license or registration certificate issued by the department.
 - f. During an inspection by the department, the department inspector may terminate an operation if any of the items required in subdivision a of subsection 5 are not available and operable or if the required number of radiographic personnel are not present. Operations may not be resumed until such conditions are met.
6. 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 chapter and subsection 5 1 of section ~~33-10-04-02~~ 33-10-04.1-07. If such a system is a certified cabinet X-ray system, it shall comply with all applicable requirements of this chapter and 21 CFR 1020.40.
 - (2) Be evaluated at intervals not to exceed one year to assure compliance with the applicable requirements as specified in paragraph 1. Records of these evaluations shall be maintained for inspection by the department for a period of two 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 chapter except that:
- (1) Operating personnel must be provided with either a film badge or a thermoluminescent dosimeter and reports of the results must 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 paragraph 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 and recorded in accordance with subsection ~~9~~ 10 of section 33-10-05-04.
 - (4) The registrant shall perform an evaluation at intervals not to exceed one year, to determine conformance with subsection 5 1 of section ~~33-10-04-02~~ 33-10-04.1-07. 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 two years after the evaluation.
- c. Certified cabinet X-ray systems shall be maintained in compliance with 21 CFR 1020.40 unless prior approval has

been granted by the department pursuant to subsection 1 of section 33-10-01-05.

7. Prohibitions. Industrial radiography performed with a sealed source which is not fastened to or contained in radiographic exposure devices, known as fishpole radiography, is prohibited unless specifically authorized by the department.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

CHAPTER 33-10-06

33-10-06-03. General requirements.

1. Administrative controls.

- a. Registrant. The registrant shall be responsible for directing the operation of the X-ray systems which have been registered with the department. The registrant or the registrant's agent shall assure that the following requirements are met in the operation of the X-ray system.
 - (1) An X-ray system which does not meet the requirements of this article shall not be operated for diagnostic or therapeutic purposes, if so directed by the department.
 - (2) Individuals who will be operating the X-ray systems shall be adequately instructed in the safe operating procedures and be competent in the safe use of the equipment. As a minimum, such instruction should consist of subjects outlined in appendix F of this chapter.
 - (3) A chart shall be provided in the vicinity of the diagnostic X-ray system's control panel, which specifies for all examinations performed with that system the following information:
 - (a) Patient's anatomical size versus technique factors to be utilized.
 - (b) Type and size of the film or film-screen combination to be used.
 - (c) Type and focal distance of the grid to be used, if any.
 - (d) Source-image receptor distance to be used.
 - (e) Type and location of placement of gonad shielding to be used.
 - (4) Written safety procedures and rules shall be provided to each individual operating X-ray equipment, including any restrictions of the operating technique required for the safe operation of the particular X-ray system. The operator shall be able to demonstrate familiarity with this article.

- (5) Except for patients who cannot be moved out of the room, only the staff and ancillary personnel required for the medical procedure or training shall be in the room during the radiographic exposure. Other than the patient being examined:
- (a) All individuals shall be positioned such that no part of the body will be struck by the useful beam unless protected by five-tenths millimeter lead equivalent.
 - (b) Staff and ancillary personnel shall be protected from the direct scatter radiation by protective aprons or whole body protective barriers of not less than ~~twenty-five hundredths millimeter~~ one-hundredths millimeter lead equivalent.
 - (c) Patients who cannot be removed from the room shall be protected from the direct scatter radiation by whole body protective barriers of ~~twenty-five hundredths millimeter~~ one-hundredths millimeter lead equivalent or shall be so positioned that the nearest portion of the body is at least two meters from both the tube head and the nearest edge of the image receptor.
- (6) Gonad shielding of not less than ~~twenty-five hundredths millimeter~~ one-hundredths millimeter lead equivalent ~~shall~~ must be used for patients who have not passed the reproductive age during radiographic procedures in which the gonads are in the useful beam, except for cases in which this would interfere with the diagnostic procedure.
- (7) Individuals ~~shall~~ may not be exposed to the useful beam except for healing arts purposes and when such exposure has been authorized by a licensed practitioner of the healing arts. This provision specifically prohibits deliberate exposure for the following purposes:
- (a) Exposure of an individual for training, demonstration or other non-healing-arts purposes.
 - (b) Exposure of an individual for the purpose of healing arts screening except as authorized by paragraph 11.
- (8) When a patient or film must be provided with auxiliary support during a radiation exposure:

- (a) Mechanical holding devices shall be used when the technique permits. The safety rules, required by this section shall list individual projections where holding devices cannot be utilized.
 - (b) Written safety procedures, as required by paragraph 4, shall indicate the requirements for selecting a holder and the procedure the holder shall follow.
 - (c) The human holder shall be protected as required by paragraph 5.
 - (d) No individual shall be used routinely to hold film or patients.
 - (e) In those cases where the patient must hold the film, except during intraoral examinations, any portion of the body other than the area of clinical interest struck by the useful beam shall be protected by not less than five-tenths millimeter lead equivalent material.
 - (f) A record shall be made of the examination and shall include the name of the human holder, date of the examination, number of exposures, and technique factors utilized for the exposure.
- (9) Procedures and auxiliary equipment designed to minimize patient and personnel exposure commensurate with the needed diagnostic information shall be utilized. This is interpreted to include but not limited to:
- (a) The speed of film or screen and film combinations shall be the fastest speed consistent with the diagnostic objective of the examinations.
 - (b) The radiation exposure to the patient shall be the minimum exposure required to produce images of good diagnostic quality.
 - (c) Proper film processing procedures:
 - [1] Time temperature film processing must be as recommended by the film manufacturer or as noted in appendix D for manual processing.
 - [2] Automatic processors temperature and "replenishment rates" must be maintained as

specified by the processor manufacturer or as noted in subsection 3 of appendix D.

[3] The darkroom integrity must be maintained as noted in subsection 4 of appendix D.

- (d) Portable or mobile equipment shall be used only for examinations where it is impractical to transfer the patients to a stationary X-ray installation.
 - (e) X-ray systems subject to section 33-10-06-06 shall not be utilized in procedures where the source to patient distance is less than thirty centimeters.
- (10) All individuals who are associated with the operation of an X-ray system are subject to the requirements of ~~subsections 1 and 2 of section 33-10-04-02~~ 33-10-04.1-06. In addition:
- (a) When protective clothing or devices are worn on portions of the body and a monitoring device is required, at least one such monitoring device shall be utilized as follows:
 - [1] When an apron is worn, the monitoring device shall be worn at the collar outside of the apron.
 - [2] The dose to the whole body based on the maximum dose attributed to the most critical organ shall be recorded in the reports required by subsection ~~1 and 7 of section 33-10-04-05~~ 33-10-04.1-15. If more than one device is used and a record is made of the data, each dose shall be identified with the area where the device was worn on the body.
 - (b) Exposure of a personnel monitoring device to deceptively indicate a dose delivered to an individual is prohibited.
- (11) Healing arts screening. Any person proposing to conduct a healing arts screening program shall not initiate such a program without prior approval of the department. When requesting such approval, that person shall submit the information outlined in appendix E of this chapter. If any information submitted to the department becomes invalid or outdated, the department shall be immediately notified.

b. Information and maintenance record and associated information. The registrant shall maintain the following information for each X-ray system for inspection by the department:

- (1) Maximum rating of technique factors.
- (2) Model and serial numbers of all certifiable components.
- (3) Aluminum equivalent filtration of the useful beam, including any routine variation.
- (4) Tube rating charts and cooling curves.
- (5) Records of surveys, calibrations, maintenance, and modifications performed on the X-ray system after the effective date of section 33-10-06-03 with the names of persons who performed such services.
- (6) A scale drawing of the room in which a stationary X-ray system is located with such drawing indicating the use of areas adjacent to the room and an estimation of the extent of occupancy by an individual in such areas. In addition, the drawing shall include:
 - (a) The results of a survey for radiation levels present at the operator's position and at pertinent points outside the room at specified test conditions; or
 - (b) The type and thickness of materials, or lead equivalency, or each protective barrier.
- (7) A copy of all correspondence with this department regarding that X-ray system.

c. X-ray log. Each facility shall maintain an X-ray log containing the patient's name, the type of examinations, and the dates those examinations were performed. When the patient or film must be provided with human auxiliary support, the name of the human holder shall be recorded.

2. Plan review.

a. Prior to construction, the floor plans and equipment arrangement or all new installations, or modifications of existing installations, utilizing X-rays for diagnostic or therapeutic purposes shall be submitted to the department for review and approval. The required information is denoted in appendices A, B, and C of this chapter.

- b. The department may require the applicant to utilize the services of a qualified expert to determine the shielding requirements prior to the plan review and approval.
- c. The approval of such plans shall not preclude the requirement of additional modifications should a subsequent analysis of operating conditions indicate the possibility of an individual receiving a dose in excess of the limits prescribed in subsections 1, 4, and 5 of section ~~33-10-04-02~~ sections 33-10-04.1-06 and 33-10-04.1-07.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-06-04. General requirements for all diagnostic X-ray systems. In addition to other requirements of this chapter, all diagnostic X-ray systems shall meet the following requirements:

1. **Warning label.** The control panel containing the main power switch shall bear the warning statement, legible and accessible to view: "WARNING: This X-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed."
2. **Battery charge indicator.** On battery-powered X-ray generators, visual means shall be provided on the control panel to indicate whether the battery is in a state of charge adequate for proper operation.
3. **Leakage radiation from the diagnostic source assembly.** The leakage radiation from the diagnostic source assembly measured at a distance of one meter in any direction from the source shall not exceed one hundred milliroentgens in one hour when the X-ray tube is operated at its leakage technique factors. Compliance shall be determined by measurements averaged over an area of one hundred square centimeters with no linear dimension greater than twenty centimeters.
4. **Radiation from components other than the diagnostic source assembly.** The radiation emitted by a component other than the diagnostic source assembly shall not exceed two milliroentgens in one hour at five centimeters from any accessible surface of the component when it is operated in an assembled X-ray system under any conditions for which it was designed. Compliance shall be determined by measurements averaged over an area of one hundred square centimeters with no linear dimension greater than twenty centimeters.
5. **Beam quality.**

a. Half-value layer.

- (1) The half-value layer (HVL) of the useful beam for a given X-ray tube potential shall not be less than the values shown in table I. If it is necessary to determine such half-value layer at an X-ray tube potential which is not listed in table I, linear interpolation or extrapolation may be made.

TABLE I

Design Operating Range (Kilovolts Peak)	Measured Potential (Kilovolts peak)	Half-value Layer (Millimeters of aluminum)
Below 50	30	0.3
	40	0.4
	49	0.5
50 to 70	50	1.2
	60	1.3
	70	1.5
Above 70	71	2.1
	80	2.3
	90	2.5
	100	2.7
	110	3.0
	120	3.2
	130	3.5
	140	3.8
	150	4.1

- (2) The above half-value layer (HVL) criteria will be considered to have been met if it can be demonstrated that the aluminum equivalent of the total filtration in the primary beam is not less than that shown in table II.

TABLE II

Filtration Required vs. Operating Voltage

Operating Voltage (kVp)	Total Filtration (inherent plus added) (millimeters aluminum equivalent)
Below 50	0.5 millimeters
50 - 70	1.5 millimeters
Above 70	2.5 millimeters

- (3) In addition to the requirements of paragraph 1, all intraoral dental radiographic systems manufactured on and after December 1, 1980, shall have a minimum half-value layer not less than one and one-half millimeters aluminum equivalent filtration permanently installed in the useful beam.
- (4) ~~Beryllium window tubes shall have a minimum of five-tenths millimeter aluminum equivalent filtration permanently installed in the useful beam.~~
- ~~(5)~~ For capacitor energy storage equipment, compliance with the requirements of this subsection shall be determined with the maximum quantity of charge per exposure.
- ~~(6)~~ (5) The required minimal aluminum equivalent filtration shall include the filtration contributed by all materials which are always present between the source and the patient.
- b. Filtration controls. For X-ray systems which have variable kilovolts peak and variable filtration for the useful beam, a device shall link the kilovolts peak selector with the filters and shall prevent an exposure unless the minimum amount of filtration required by paragraphs 1 or 2 of subdivision a is in the useful beam for the given kilovolts peak which has been selected.
6. Multiple tubes. Where two or more radiographic tubes are controlled by one exposure switch, the tube or tubes which have been selected shall be clearly indicated prior to initiation of the exposure. This indication shall be both on the X-ray control panel and at or near the tube housing assembly which has been selected.

7. Mechanical support of tube head. The tube housing assembly supports shall be adjusted such that the tube housing assembly will remain stable during an exposure unless tube housing movement is a designed function of the X-ray system.
8. Technique indicators.
 - a. The technique factors to be used during an exposure shall be indicated before the exposure begins, except when automatic exposure controls are used, in which case the technique factors which are set prior to the exposure shall be indicated.
 - b. The requirements of subdivision a may be met by permanent markings on equipment having fixed technique factors. Indication of technique factors shall be visible from the operators position except in the case of spot films made by the fluoroscopist.
9. Structural shielding requirements (see appendix C).

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-06-05. Fluoroscopic X-ray systems except for computed tomography X-ray systems. All fluoroscopic X-ray systems shall meet the following requirements:

1. Limitation of useful beam.
 - a. Primary barrier.
 - (1) The fluoroscopic imaging assembly shall be provided with a primary protective barrier which intercepts the entire cross section of the useful beam at any source-image receptor distance (SID).
 - (2) The X-ray tube used for fluoroscopy shall not produce X-rays unless the barrier is in position to intercept the entire useful beam.
 - b. X-ray field.
 - (1) The X-ray field produced by non-image-intensified fluoroscopic equipment shall not extend beyond the entire visible area of the image receptor. This requirement applies to field size for both fluoroscopic procedures and spot filming procedures. In addition:

- (a) Means shall be provided for stepless adjustment of the field size.
 - (b) The minimum field size at the greatest source-image receptor distance shall be equal to or less than five centimeters by five centimeters.
 - (c) For equipment manufactured after February 25, 1978, when the angle between the image receptor and the beam axis of the X-ray beam is variable, means shall be provided to indicate when the axis of the X-ray beam is perpendicular to the plane of the image receptor.
 - (d) Compliance with this paragraph shall be determined with the beam axis indicated to be perpendicular to the plane of the image receptor.
- (2) For image-intensified fluoroscopic equipment, neither the length nor the width of the X-ray field in the plane of the image receptor shall exceed that of the visible area of the image receptor by more than three percent of the source-image receptor distance. The sum of the excess length and the excess width shall be no greater than four percent of the source-image receptor distance. In addition:
- (a) Means shall be provided to permit further limitation of the field. Beam-limiting devices manufactured after May 22, 1979, and incorporated in equipment with a variable source-image receptor distance and/or a visible area of greater than three hundred square centimeters shall be provided with means for stepless adjustment of the X-ray field.
 - (b) All equipment with a fixed source-image receptor distance and a visible area of three hundred square centimeters or less shall be provided with either stepless adjustment of the X-ray field or with means to further limit the X-ray field size at the plane of the image receptor to one hundred twenty-five square centimeters or less. Stepless adjustment shall, at the greatest source-image receptor distance, provide continuous field sizes from the maximum obtainable to a field size of five by five centimeters or less.
 - (c) For equipment manufactured after February 25, 1978, when the angle between the image receptor

and beam axis is variable, means shall be provided to indicate when the axis of the X-ray beam is perpendicular to the plane of the image receptor.

- (d) Compliance shall be determined with the beam axis indicated to be perpendicular to the plane of the image receptor. For rectangular X-ray fields used with circular image reception, the error in alignment shall be determined along the length and width dimensions of the X-ray field which pass through the center of the visible area of the image receptor.
- (3) Spot-film devices which are certified components shall meet the following additional requirements:
- (a) Means shall be provided between the source and the patient for adjustment of the X-ray field size in the plane of the film to the size of that portion of the film which has been selected on the spot-film selector. Such adjustment shall be automatically accomplished except when the X-ray field size in the plane of the film is smaller than that of the selected portion of the film. For spot-film devices manufactured after June 21, 1979, if the X-ray field size is less than the size of the selected portion of the film, the means for adjustment of the field size shall be only at the operator's option.
 - (b) It shall be possible to adjust the X-ray field size in the plane of the film to a size smaller than the selected portion of the film. The minimum field size at the greatest source-image receptor distance shall be equal to, or less than, five centimeters by five centimeters.
 - (c) The center of the X-ray field in the plane of the film shall be aligned with the center of the selected portion of the film to within two percent of the source-image receptor distance.
 - (d) On spot-film devices manufactured after February 25, 1978, if the angle between the plane of the image receptor and beam axis is variable, means shall be provided to indicate when the axis of the X-ray beam is perpendicular to the plane of the image receptor, and compliance shall be determined with the beam axis indicated to be perpendicular to the plane of the image receptor.

(4) If a means exists to override any of the automatic X-ray field size adjustments required in subdivision b of subsection 1 that means:

(a) Must be designed for use only in the event of system failure.

(b) Must incorporate a signal visible at the fluoroscopist's position which will indicate whenever the automatic field size adjustment is overridden.

(c) Must be clearly and durably labeled as follows:

FOR X-RAY FIELD
LIMITATION SYSTEM FAILURE

2. Activation of the fluoroscopic tube. X-ray production in the fluoroscopic mode shall be controlled by a device which requires continuous pressure by the fluoroscopist for the entire time of any exposure. When recording serial fluoroscopic images, the fluoroscopist shall be able to terminate the X-ray exposure or exposures at any time, but means may be provided to permit completion of any single exposure of the series in process.

3. Exposure rate limits.

a. Entrance exposure rate allowable limits.

(1) The exposure measured at the point where the center of the useful beam enters the patient shall not exceed ten roentgens [2.58 millicoulomb per kilogram] per minute, except during recording of fluoroscopic images or when provided with optional high level control.

(2) When provided with optional high level control, the equipment shall not be operable at any combination of tube potential and current which will result in an exposure rate in excess of five roentgens [1.29 millicoulomb per kilogram] per minute at the point where the center of the useful beam enters the patient unless the high level control is activated.

(a) Special means of activation of high level controls shall be required. The high level control shall only be operable when continuous manual activation is provided by the operator.

(b) A continuous signal audible to the fluoroscopist shall indicate that the high level control is being employed.

- (3) In addition to the other requirements of this section, certified equipment which does not incorporate an automatic exposure control shall not be operable at any combination of tube potential and current which will result in any exposure rate in excess of five roentgens [1.29 millicoulomb per kilogram] per minute at the point where the center of beam enters the patient except during recording of fluoroscopic images or when provided with an optional high level control.
- (4) Compliance with the requirements of subsection 3 of this section shall be determined as follows:
 - (a) Movable grids and compression devices shall be removed from the useful beam during the measurement.
 - (b) If the source is below the table, the exposure rate shall be measured one centimeter above the tabletop or cradle.
 - (c) If the source is above the table, the exposure rate shall be measured at thirty centimeters above the tabletop with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement.
 - (d) All C-arm fluoroscopes, both stationary and mobile, shall meet the entrance exposure rate limits specified in paragraphs 1, 2, and 3 of subdivision a of subsection 3, shall be measured thirty centimeters from the input surface of the fluoroscopic imaging assembly with the source positioned at any available source-image receptor distance provided that the end of the spacer assembly or beam-limiting device is not closer than thirty centimeters from the input surface of the fluoroscopic imaging assembly.
- (5) Periodic measurement of entrance exposure rate shall be performed as follows:
 - (a) Such measurements shall be made annually or after any maintenance of the system which might affect the exposure rate.
 - (b) Results of these measurements shall be posted where any fluoroscopist may have ready access to such results while using the fluoroscope and in the record required in paragraph 5 of subdivision b of subsection 1 of section 33-10-06-03. Results of the measurements shall

include the roentgen per minute, as well as the technique factors used to determine such results. The name of the person performing the measurements and the date the measurements were performed shall be included in the results.

(c) Personnel monitoring devices may be used to perform the measurements required by subparagraph a provided the measurements are made as described in subparagraph d.

(d) Conditions of periodic measurements of entrance exposure rate are as follows:

[1] The measurement shall be made under the conditions that satisfy the requirements of paragraph 4.

[2] The kilovolts peak shall be the kilovolts typical of clinical use of the X-ray system.

[3] The X-ray systems that incorporates automatic exposure control shall have sufficient material placed in the useful beam to produce a milliamperage typical of the use of the X-ray system.

[4] X-ray systems that do not incorporate an automatic exposure control shall utilize a milliamperage typical of clinical use of the X-ray system. Materials should be placed in the useful beam when conducting these periodic measurements to protect the imaging system.

4. Barrier transmitted radiation rate limits.

a. The exposure rate due to transmission through the primary protective barrier with the attenuation block in the useful beam, combined with radiation from the image intensifier, if provided, shall not exceed two milliroentgens [0.516 microcoulomb kilogram] per hour at ten centimeters from any accessible surface of the fluoroscopic imaging assembly beyond the plane of the image receptor for each roentgen per minute of entrance exposure rate.

b. Measuring compliance of barrier transmission.

(1) The exposure rate due to transmission through the primary protective barrier combined with radiation from the image intensifier shall be determined by

measurements averaged over an area of one hundred square centimeters with no linear dimension greater than twenty centimeters.

- (2) If the source is below the tabletop, the measurement shall be made with the input surface of the fluoroscopic imaging assembly positioned thirty centimeters above the tabletop.
 - (3) If the source is above the tabletop and the source-image receptor distance is variable, the measurement shall be made with the end of the beam-limiting device or spacer as close to the tabletop as it can be placed, provided that it shall not be closer than thirty centimeters.
 - (4) Movable grids and compression devices shall be removed from the useful beam during the measurement.
 - (5) The attenuation block shall be positioned in the useful beam ten centimeters from the point of measurement of entrance exposure rate and between this point and the input surface of the fluoroscopic imaging assembly.
5. Indication of potential and current. During fluoroscopy and cinefluorography, the kilovolt and the milliamperere shall be continuously indicated.
6. Source-skin distance. The source to skin distance shall not be less than:
- a. Thirty-eight centimeters on stationary fluoroscopes installed after September 1, 1968.
 - b. Thirty-five centimeters on stationary fluoroscopes which were in operation prior to ~~October 1, 1962~~ September 1, 1968.
 - c. Thirty centimeters on all mobile fluoroscopes.
 - d. Twenty centimeters for image intensified fluoroscopes used for specific surgical application. The written safety procedures must provide precautionary measures to be adhered to during the use of this device.
7. Fluoroscopic timer.
- a. Means shall be provided to preset the cumulative on-time of the fluoroscopic tube. The maximum cumulative time of the timing device shall not exceed five minutes without resetting.

- b. A signal audible to the fluoroscopist shall indicate the completion of any preset cumulative on-time. Such signal shall continue to sound while X-rays are produced until the timing device is reset.
8. Mobile fluoroscopes. In addition to the other requirements of this section, mobile fluoroscopes shall provide intensified imaging.
9. Control of scattered radiation.
 - a. Fluoroscopic table designs when combined with procedures utilized shall be such that no unprotected part of any staff or ancillary individual's body shall be exposed to unattenuated scattered radiation which originates from under the table. The attenuation required shall be not less than twenty-five ~~hundredths millimeter~~ one-hundredths millimeter lead equivalent.
 - b. Equipment configuration when combined with procedures shall be such that no portion of any staff or ancillary individual's body, except the extremities, shall be exposed to the unattenuated scattered radiation emanating from above the tabletop unless that individual:
 - (1) Is at least one hundred twenty centimeters from the center of the useful beam; or
 - (2) The radiation has passed through not less than twenty-five ~~hundredths millimeter~~ one-hundredths millimeter lead equivalent material, e.g., drapes, bucky-slot cover-sliding or folding panel, or self-supporting curtains, in addition to any lead equivalency provided by the protective apron referred to in paragraph 5 of subdivision a of subsection 1 of section 33-10-06-03.
 - c. The department may grant exceptions to subdivision b of this subsection in some special procedures where a sterile field will not permit the use of the normal protective barriers. Where the use of prefitted sterilized covers for the barriers is practical, the department shall not permit such exception.
10. Radiation therapy simulation system. Radiation therapy simulation systems shall be exempt from all the requirements of subsections 1, 3, 4, and 7 of section 33-10-06-05 provided that:
 - a. Such systems are designed and used in such a manner that no individual other than the patient is in the X-ray room during periods of time when the system is producing X-rays; and

- b. Such systems as do not meet the requirements of subsection 7 of section 33-10-06-05 are provided with a means of indicating the cumulative time that an individual patient has been exposed to X-rays. Procedures shall require in such cases that the timer be reset between examinations.

11. Structural shielding requirements (see appendix E).

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-06-06. Radiographic systems other than fluoroscopic, dental intraoral, veterinarian, or computed tomography X-ray systems.

- 1. Beam limitations. The useful beam shall be limited to the area of clinical interest.
 - a. General purpose stationary and mobile X-ray systems.
 - (1) There shall be provided a means for stepless adjustment of the size of the X-ray field.
 - (2) Means shall be provided for visually defining the perimeter of the X-ray field. The total misalignment of the edges of the visually defined field with the respective edges of the X-ray field along either the length or width of the visually defined field shall not exceed two percent of the distance from the source to the center of the visually defined field when the surface upon which it appears is perpendicular to the axis of the X-ray beam.
 - (3) The department may grant an exemption to paragraphs 1 and 2 of this subdivision on noncertified X-ray systems, provided the registrant makes a written application for such exemption and demonstrates in the application:
 - (a) That it is impractical to comply with paragraphs 1 and 2 of this subdivision; and
 - (b) The purpose of paragraphs 1 and 2 of this subdivision will be met by other means.
 - b. Additional requirements for stationary general purpose X-ray systems. In addition to the requirements of subdivision a of this subsection, all stationary X-ray systems shall meet the following requirements:

- (1) Means shall be provided to indicate when the axis of the X-ray beam is perpendicular to the plane of the image receptor, to align the center of the X-ray field with respect to the center of the image receptor to within two percent of the source-image receptor distance, and to indicate the source-image receptor distance to within two percent.
 - (2) The beam-limiting device shall numerically indicate the field size in the plane of the image receptor to which it is adjusted.
 - (3) Indication of field size dimensions and source-image receptor distance's shall be specified in inches or centimeters, and shall be such that aperture adjustments result in X-ray field dimensions in the plane of the image receptor which correspond to those indicated by the beam-limiting device to within two percent of the source-image receptor distance when the beam axis is indicated to be perpendicular to the plane of the image receptor.
- c. X-ray systems designed for one image receptor size. Radiographic equipment designed for only one image receptor size at the fixed source-image receptor distance shall be provided with means to limit the field at the plane of the image receptor to dimensions no greater than those of the image receptor, and to align the center of the X-ray field with the center of the image receptor to within two percent of the source-image receptor distance, or shall be provided with means to both size and align the X-ray field such that the X-ray field at the plane of the image receptor does not extend beyond any edge of the image receptor.
- d. Systems designed for or provided with special attachments for mammography. Radiographic systems designed only for mammography and general purpose radiographic systems, when special attachments for mammography are in service, shall be provided with means to limit the useful beam such that the X-ray field at the plane of the image receptor does not extend beyond any edge of the image receptor at any designated source-image receptor distance except the edge of the image receptor designed to be adjacent to the chest wall where the X-ray field may not extend beyond this edge by more than two percent of the source-image receptor distance. This requirement can be met with a system which performs as prescribed in paragraph 3 of subdivision e of this subsection. When the beam-limiting device and image receptor support device are designed to be used to immobilize the breast during a mammographic procedure and the source-image receptor distance may vary, the source-image receptor distance indication specified in

subparagraphs a and b of paragraph 3 of subdivision e of this subsection shall be the maximum source-image receptor distance for which beam-limiting device or aperture is designed. In addition, each image receptor support intended for installation on a system designed only for mammography shall have clear and permanent markings to indicate the maximum image receptor size for which it is designed.

e. Special purpose X-ray systems.

- (1) Means shall be provided to limit the X-ray field in the plane of the image receptor so that such field does not exceed each dimension of the image receptor by more than two percent of the source-image receptor distance when the axis of the X-ray beam is perpendicular to the plane of the image receptor.
- (2) Means shall be provided to align the center of the X-ray field with the center of the image receptor to within two percent of the source-image receptor distance, or means shall be provided to both size and align the X-ray field such that the X-ray field at the plane of the image receptor does not extend beyond any edge of the image receptor.
- (3) Paragraphs 1 and 2 of this subdivision may be met with a system that meets the requirements for a general purpose X-ray system as specified in subsection 1 of this section, or, when alignment means are also provided, may be met with either:
 - (a) An assortment of removable, fixed-aperture, beam-limiting devices sufficient to meet the requirement for each combination of image receptor size and source-image receptor distance for which the unit is designed with each such device having clear and permanent markings to indicate the image receptor size and source-image receptor distance for which it is designed; or
 - (b) A beam-limiting device having multiple fixed apertures sufficient to meet the requirement for each combination of image receptor size and source-image receptor distance for which the unit is designed. Permanent, clearly legible markings shall indicate the image receptor size and source-image receptor distance for which each aperture is designed and shall indicate which aperture is in position for use.

2. Radiation exposure control devices.

- a. Timers. Means shall be provided to terminate the exposure at the preset time interval, preset product of current and time, a preset number of pulses, or a preset radiation exposure to the image receptor. In addition, it shall not be possible to make an exposure when the timer is set to a "zero" or "off" position if either position is provided.
- b. X-ray control (exposure switch).
 - (1) A control which shall be the equivalent of a dead-man switch shall be incorporated into each X-ray system such that an exposure can be terminated at any time except for:
 - (a) Exposure of one-half second or less; or
 - (b) During serial radiography when means shall be provided to permit completion of any single exposure of the series in process.
 - (2) Each X-ray control shall be located in such a way as to meet the following requirements:
 - (a) Stationary X-ray systems shall be required to have the X-ray control permanently mounted in a protected area so that the operator is required to remain in that protected area during the entire exposure (See appendix B).
 - (b) Mobile and portable X-ray systems which are:
 - [1] Used for greater than one week in one location (one room or suite) shall meet the requirements of subparagraph a of this paragraph.
 - [2] Used for greater than one hour and less than one week at one location, (one room or suite) shall meet the requirement of item 1 of this subparagraph or be provided with a six and one-half feet [1.98 meters] high protective barrier which is placed at least six feet [1.83 meters] from the tube housing assembly and at least six feet [1.83 meters] from the patient.
 - [3] Used to make an exposure of only one patient at the use location shall meet the requirement of item 1 or 2 of this subparagraph or be provided with a method of X-ray control which will permit the operator to be at least twelve feet [3.66

meters] from the tube housing assembly during an exposure.

(c) The X-ray control shall provide visual indication observable at or from the operator's protected position whenever X-rays are produced. In addition, a signal audible to the operator shall indicate that the exposure has terminated.

c. Automatic exposure controls. When an automatic exposure control is provided:

(1) Indication shall be made on the control panel when this mode of operation is selected;

(2) If the X-ray tube potential is equal to or greater than fifty kilovolts peak, the minimum exposure time for field emission equipment rated for pulsed operation shall be equal to or less than a time interval equivalent to two pulses;

(3) The minimum exposure time for all equipment other than that specified in paragraph 2 shall be equal to or less than one-sixtieth second or a time interval required to deliver five milliamperere seconds, whichever is greater;

(4) Either the product of the peak X-ray tube potential, current, and exposure time shall be limited to not more than sixty kilowatt seconds per exposure or the product of X-ray tube current and exposure time shall be limited to not more than six hundred milliamperere seconds per exposure except when the X-ray tube potential is less than fifty kilovolts peak in which case the product of X-ray tube current and exposure time shall be limited to not more than two ~~hundred~~ thousand milliamperere seconds per exposure; and

(5) A visible signal shall indicate when an exposure has been terminated at the limits required by paragraph 4 of this subdivision, and manual resetting shall be required before further automatically timed exposures can be made.

d. Reproducibility. With a timer setting of five-tenths seconds or less, the average exposure period (\bar{T}) shall be greater than or equal to five times the maximum exposure period (T_{\max}) minus the minimum exposure period (T_{\min}) when four tests are performed.

$$\bar{T} \geq 5(T_{\max} - T_{\min})$$

3. Source-to-skin distance. All mobile or portable radiographic systems shall be provided with means to limit the source-to-skin distance to not less than thirty centimeters.
4. Exposure reproducibility. The coefficient of variation of exposure shall not exceed ten-hundredths when all technique factors are held constant. This requirement shall be deemed to have been met if, when four exposures are made at identical technique factors, that the value of the average exposure (\bar{E}) is greater than or equal to five times the maximum exposure (E_{\max}) minus the minimum exposure (E_{\min}),

$$\bar{E} \geq 5(E_{\max} - E_{\min})$$

5. Radiation from capacitor energy storage equipment in standby status. Radiation emitted from the X-ray tube when the exposure switch or timer is not activated shall not exceed a rate of two milliroentgens per hour at five centimeters from any accessible surface of the diagnostic source assembly, with the beam-limiting device fully open.
6. Additional requirements applicable to certified systems only. Diagnostic X-ray systems incorporating one or more certified components shall be required to comply with the following additional requirements which relate to that certified components.
 - a. Reproducibility. When the equipment is operated on an adequate power supply as specified by the manufacturer in accordance with the requirements of applicable federal standards, the estimated coefficient of variation of radiation exposures shall be no greater than five-hundredths for any specific combination of selected technique factors.
 - b. Linearity. When the equipment allows a choice of X-ray tube current settings and is operated on power supply as specified by the manufacturer in accordance with the requirements of applicable federal standards, for any fixed X-ray tube potential within the range of forty percent to one hundred percent of the maximum rating, the average ratios of exposure to the indicated milliamperere-seconds product, (milliroentgen per milliamperere second) obtained at any two consecutive tube current settings shall not differ by more than ten-hundredths times their sum,

$$| \bar{X}_1 - \bar{X}_2 | \leq 0.10 (\bar{X}_1 + \bar{X}_2)$$

where \bar{X}_1 and \bar{X}_2 are the average milliroentgen per milliampere second values obtained at each of two consecutive tube current settings.

- c. Accuracy. Deviation of technique factors from indicated values shall not exceed the limits specified for that system by its manufacturer.
- d. Beam limitation for stationary and mobile general purpose X-ray systems.
 - (1) There shall be provided a means of stepless adjustment of the size of the X-ray field. The minimum field size at a source-image receptor distance of one hundred centimeters shall be equal to or less than five centimeters by five centimeters.
 - (2) When a light localizer is used to define the X-ray field, it shall provide an average illumination of not less than one hundred sixty lux or fifteen foot-candles at one hundred centimeters or at the maximum source-image receptor distance, whichever is less. The average illumination shall be based upon measurements made in the approximate center of each quadrant of the light field.
 - (3) The edge of the light field at one hundred centimeters or at the maximum source-image receptor distance, whichever is less, shall have a contrast ratio, corrected for ambient lighting, of not less than four in the case of beam-limiting devices designed for use on stationary equipment, and a contrast ratio of not less than three in the case of beam-limiting devices designed for use on mobile equipment. The contrast ratio is defined as I_1/I_2 where I_1 is the illumination three millimeters from the edge of the light field toward the center of the field; and I_2 is the illumination three millimeters from the edge of the light field away from the center of the field. Compliance shall be determined with a measuring instrument aperture of one millimeter in diameter.
- e. Beam limitation for portable X-ray systems. Beam limitation for portable X-ray systems shall meet the beam

limitation requirements of subdivision a of subsection 1 and subdivision d of subsection 6 of section 33-10-06-06.

- f. Field limitation and alignment on stationary general purpose X-ray systems. For stationary, general purpose X-ray systems which contain a tube housing assembly, an X-ray control, and, for those systems so equipped, a table, all certified in accordance with 21 CFR 1020.30(c).
- (1) Positive beam limitation (PBL) shall be provided whenever all the following conditions are met:
 - (a) The image receptor is inserted into a permanently mounted cassette holder.
 - (b) The image receptor length and width are each less than fifty centimeters.
 - (c) The X-ray beam axis is within plus or minus three degrees of vertical and the source-image receptor distance is ninety centimeters to one hundred thirty centimeters inclusive; or the X-ray beam axis is within plus or minus three degrees of horizontal and the source-image receptor distance is ninety centimeters to two hundred five centimeters inclusive.
 - (d) The X-ray beam axis is perpendicular to the plane of the image receptor to within plus or minus three degrees.
 - (e) Neither tomographic nor stereoscopic radiography is being performed.
 - (f) The positive beam limitation system has not been intentionally overridden. The override provision is subject to paragraph 3.
 - (2) Positive beam limitation (PBL) shall prevent the production of X-rays when:
 - (a) Either the length or width of the X-ray field in the plane of the image receptor differs, except as permitted by paragraph 5, from the corresponding image receptor dimensions by more than three percent of the source-image receptor distance.
 - (b) The sum of the length and width differences as stated in subparagraph a, without regard to sign, exceeds four percent of the source-image receptor distance.

- (3) If a means of overriding the positive beam limitation (PBL) system exists, that means:
 - (a) Must be designed for use only in the event of positive beam limitation system failure or if the system is being serviced.
 - (b) If in a position that the operator would consider it part of the operational controls or if it is referenced in the operator's manual or in other materials intended for the operator.
 - [1] Must require that a key be utilized to defeat the positive beam limitation;
 - [2] Must require that the key remain in place during the entire time the positive beam limitation system is overridden; and
 - [3] Must require that the key or key switch be clearly and durably labeled as follows:

FOR X-RAY FIELD LIMITATION
SYSTEM FAILURE

- (4) Compliance with paragraph 2 must be determined when the equipment indicates that the beam axis is perpendicular to the plane of the image receptor and the requirements of paragraph 1 are met. Compliance must be determined no sooner than five seconds after insertion of the image receptor.
 - (5) The positive beam limitation system must be capable of operation, at the discretion of the operator, such that the size of the field may be made smaller than the size of the image receptor through stepless adjustment of the field size. The minimum field size at the source-image receptor distance of one hundred centimeters must be equal to or less than five centimeters by five centimeters.
 - (6) The positive beam limitation system must be designed such that if a change in image receptor does not cause an automatic return to positive beam limitation function as described in paragraph 2, then any change of image receptor size or source-image receptor distance must cause the automatic return.
- g. Timers. Except for dental panoramic systems, termination of exposure shall cause automatic resetting of the timer to its initial setting or to "zero".

- h. Transmission limit for image receptor supporting devices used for mammography. For X-ray systems manufactured after September 5, 1978, which are designed only for mammography, the transmission of the primary beams through the image receptor support provided with the system will be limited such that the exposure five centimeters from any accessible surface beyond the plane of the image receptor supporting device does not exceed one-tenth milliroentgen [25.8 microcoulomb per kilogram] for each activation of the tube. Exposure shall be measured with the system operated at the minimum source-image receptor distance for which it is designed. Compliance shall be determined at the maximum rated peak tube potential for the system and at the maximum rated product of tube current and exposure time (milliamperere second) for that peak tube potential. Compliance shall be determined by measurements averaged over an area of one hundred square centimeters with no linear dimension greater than twenty centimeters.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20-04, 23-20.1-03, 23-20.1-04

33-10-06-07. Intraoral dental radiographic systems. In addition to the requirements of sections 33-10-06-03 and 33-10-06-04, the requirements of this section apply to X-ray equipment and associated facilities used for dental radiography. Criteria for extraoral dental radiographic systems are covered in section 33-10-06-06.

1. Source-to-skin distance. X-ray systems designed for use with an intraoral image receptor shall be provided with means to limit source-to-skin distance to not less than:
 - a. Eighteen centimeters if operable above fifty kilovolts peak.
 - b. Ten centimeters if not operable above fifty kilovolts peak.
2. Field limitation. Radiographic systems designed for use with an intraoral image receptor shall be provided with means to limit source-to-skin distance, to not less than:
 - a. If the minimum source-to-skin distance (SSD) is eighteen centimeters or more, the X-ray field, at the minimum source-to-skin distance, shall be containable in a circle having a diameter of no more than seven centimeters.
 - b. If the minimum source-to-skin distance is less than eighteen centimeters, the X-ray field, at the minimum

source-to-skin distance, shall be containable in a circle having a diameter of no more than six centimeters.

- c. An open-ended shielded position indicating device shall be used. The shielding shall be equivalent to the requirements of subsection 4 of section 33-10-06-04.
3. Timers. Means shall be provided to terminate the exposure at a preset time interval, preset product of current and time, a preset number of pulses, or a preset radiation exposure to the image receptor. In addition:
- a. It shall not be possible to make an exposure when the timer is set to a zero or off position if either position is provided.
 - b. Reproducibility. With a timer setting of five-tenths seconds or less, the average exposure period (\bar{T}) must be greater than or equal to five times the maximum exposure period (T_{\max}) minus the minimum exposure period (T_{\min}) when four timer tests are performed:

$$\bar{T} > 5(T_{\max} - T_{\min})$$

4. X-ray control (exposure switch).

- a. An X-ray control shall be incorporated into each X-ray system such that an exposure can be terminated by the operator at any time, except for exposures of one-half second or less.
- b. Each X-ray control shall be located in such a way as to meet the following criteria:
 - (1) Stationary X-ray systems shall be required to have the X-ray control permanently mounted in a protected area, so that the operator is required to remain in that protected area during the entire exposure.
 - (2) Mobile and portable X-ray systems which are:
 - (a) Used for greater than one week in one location (one room or suite) shall meet the requirements of paragraph 1 of this subdivision.
 - (b) Used for greater than one hour and less than one week at one location (one room or suite) shall meet the requirements of subparagraph a of this paragraph or be provided with a six and

one-half-foot [1.98-meter] high protective barrier which is placed at least six feet [1.83 meters] from the tube housing assembly and at least six feet [1.83 meters] from the patient.

(c) Used to make exposures of a patient at the use location shall meet the requirements of subparagraph a or b of this paragraph or be provided with a method of X-ray control which will permit the operator to be at least twelve feet [3.66 meters] from the tube head assembly during an exposure.

c. The X-ray control shall provide visual indication observable at or from the operator's protected position whenever X-rays are produced. In addition, a signal audible to the operator shall indicate that the exposure has terminated.

5. Exposure reproducibility. The coefficient of variation shall not exceed ten-hundredths when all technique factors are held constant. This requirement shall be deemed to have been met if, when four exposures are made at identical technique factors, the value of the average exposure (\bar{E}) is greater than or equal to five times the maximum exposure (E_{\max}) minus the minimum exposure (E_{\min}),

$$\bar{E} \geq 5(E_{\max} - E_{\min})$$

6. Administrative controls.

a. Patient and film holding devices shall be used when the techniques permit.

b. The tube housing and the position indicating device shall not be handheld during an exposure.

c. The X-ray system shall be operated in such a manner that the useful beam at the patient's skin does not exceed the requirements of subdivision a of subsection 2 of this section.

d. Dental fluoroscopy without image intensification shall not be used.

7. Additional requirements applicable to certified systems only. Only diagnostic X-ray systems incorporating one or more certified components shall be required to comply with the following additional requirements which relate to that certified component.

- a. Reproducibility. When the equipment is operated on an adequate power supply as specified by the manufacturer, the estimated coefficient of variation of radiation exposures shall be no greater than five-hundredths for any specific combination of selected technique factors.
- b. Linearity. When the equipment allows a choice of X-ray tube current settings and is operated on a power supply as specified by the manufacturer in accordance with the requirements of applicable federal standards, for any fixed X-ray tube potential within the range of forty percent to one hundred percent of the maximum rating, the average ratios of exposure to the indicated milliamperere-seconds product (milliroentgen per milliamperere second), obtained at any two consecutive tube current settings shall not differ by more than ten-hundredths times their sum,

$$|\bar{X}_1 - \bar{X}_2| \leq 0.10 (\bar{X}_1 + \bar{X}_2),$$

where \bar{X}_1 and \bar{X}_2 are the average millirem per milliamperere seconds values obtained at each of two consecutive tube current settings.

- c. Accuracy. Deviation of technique factors from indicated values shall not exceed the limits specified for that system by its manufacturer.
- d. Timers. Termination of exposure shall cause automatic resetting of the timer to its initial setting or to "zero".
- e. Beam quality. All certified dental X-ray systems manufactured on and after December 1, 1980, shall have a minimum half-value layer not less than one and one-half millimeters aluminum equivalent. Systems operating above seventy kilovolts peak are subject to the filtration requirements of subdivision a of subsection 5 of section 33-10-06-04.

8. Structural shielding requirements (see appendix E C).

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-06-08. Therapeutic X-ray systems of less than one megaelectronvolt (MeV).

1. Equipment requirements.

a. Leakage radiation. When the tube is operated at its leakage technique factors, the leakage radiation shall not exceed the value specified at the distance specified for the classification of that X-ray system.

(1) Contact therapy systems. Leakage radiation shall not exceed one hundred milliroentgens [25.8 microcoulomb per kilogram] per hour at five centimeters from the surface of the tube housing assembly.

(2) Zero - one hundred fifty kilovolts peak systems. Systems which are manufactured or installed prior to October 1, 1982, shall have a leakage radiation which does not exceed one roentgen [0.258 millicoulomb per kilogram] in one hour at one meter from the source.

(3) Zero - one hundred fifty kilovolts peak systems. Systems which are manufactured on or after October 1, 1982, shall have a leakage radiation which does not exceed one hundred milliroentgens [25.8 microcoulomb per kilogram] in one hour at one meter from the source.

(4) One hundred fifty-one - nine hundred ninety-nine kilovolts peak systems. The leakage radiation shall not exceed one roentgen [0.258 millicoulomb per kilogram] in one hour at one meter from source except systems that operate in excess of five hundred kilovolts peak may have a leakage radiation at one meter from the source not to exceed one-tenth percent of the useful beam one meter from the source.

b. Permanent beam-limiting devices. Permanent fixed diaphragms or cones used for limiting the useful beam shall provide the same or higher degree of protection as required by the tube housing assembly.

c. Removable and adjustable beam-limiting devices.

(1) Removable beam-limiting devices shall, for the portion of the useful beam to be blocked by the useful devices, transmit not more than one percent of the beam at the maximum kilovoltage and maximum treatment filter. This requirement does not apply to auxiliary blocks or materials placed in the useful beam to shape the useful beam to the individual patient.

- (2) Adjustable beam-limiting devices installed after October 1, 1982, shall meet the requirements of paragraph 1 of this subdivision.
 - (3) Adjustable beam-limiting devices installed before October 1, 1982, shall, for the portion of the X-ray beam to be blocked by these devices, transmit not more than five percent of the original X-ray beam at the maximum kilovoltage and maximum treatment filter.
- d. Filter system. The filter system shall be so designed that:
- (1) The filters cannot be accidentally displaced at any possible tube orientation;
 - (2) The radiation at five centimeters from the filter insertion slot opening does not exceed thirty roentgens [7.74 millicoulomb per kilogram] per hour under any operating conditions; and
 - (3) Each filter is marked as to its material of construction and its thickness. For wedge filters, the wedge angle must appear on the wedge or wedge tray.
- e. Tube immobilization. The tube housing assembly shall be capable of being immobilized during stationary treatments.
- f. Focal spot marking. The tube housing assembly shall be so marked that it is possible to determine the location of the focal spot to within five millimeters, and such marking shall be readily accessible for use during calibration procedures.
- g. Beam block. Contact therapy tube housing assemblies shall have a removable shield of at least five-tenths millimeter lead equivalency at one hundred kilovolts peak that can be positioned over the entire useful beam exit port during periods when the beam is not in use.
- h. Beam monitor system. Systems of greater than one hundred fifty kilovolts peak manufactured after October 1, 1982, shall be provided with a beam monitor system which:
- (1) Shall have the detector of the monitor system interlocked to prevent incorrect positioning in the useful beam;
 - (2) Shall not allow irradiation until a preselected value of exposure of roentgens has been made at the treatment control panel;

- (3) Shall independently terminate irradiation when the preselection number of roentgens has been reached;
- (4) Shall be so designed that, in the event of a system malfunction or electrical power failure, the dose administered to a patient prior to the system malfunction or power failure can be accurately determined;
- (5) Shall have a display at the control panel from which the dose at a reference point in the treatment volume can be calculated;
- (6) Shall have a control panel display which maintains the reading until intentionally reset to zero; and
- (7) Shall have a control panel display which does not have scale multiplying factors and utilizes a design such that increasing dose is displayed by increasing numbers.

i. Timer.

- (1) A timer shall be provided which has a display at the treatment control panel. The timer shall be graduated in minutes and fractions of minutes. The timer shall have a preset time selector and an elapsed time indicator.
- (2) The timer shall be a cumulative timer which activates with the production of radiation and retains its reading after irradiation is interrupted or terminated. After irradiation is terminated and before irradiation can be reinitiated, it shall be necessary to reset the elapsed time indicator to zero.
- (3) The timer shall terminate irradiation when a preselected time has elapsed if any dose monitoring system present has not previously terminated irradiation.
- (4) The timer shall permit accurate presetting and determination of exposure times as short as one second.
- (5) The timer shall not permit an exposure if set at zero.
- (6) The timer shall not activate until the shutter is opened when patient irradiation is controlled by a shutter mechanism.

- j. Control panel functions. The control panel, in addition to the displays required in other requirements of this section shall have:
 - (1) An indication of whether electrical power is available at the control panel and if activation of the X-ray tube is possible;
 - (2) An indication of whether X-rays are being produced;
 - (3) Means for indicating kilovolts and X-ray tube current;
 - (4) The means for terminating an exposure at any time;
 - (5) A locking device which will prevent unauthorized use of the X-ray system; and
 - (6) For X-ray equipment manufactured after October 1, 1982, a positive display of specific filters in the beam.
- k. Multiple tubes. When a control panel may energize more than one X-ray tube:
 - (1) It shall be possible to activate only one X-ray tube any time;
 - (2) There shall be an indication at the control panel identifying which X-ray tube is energized; and
 - (3) There shall be an indication at the tube housing assembly when that tube is energized.
- l. Source-to-skin distance. There shall be means of determining the source-to-skin distance to within one centimeter.
- m. Shutters. Unless it is possible to bring the X-ray output to the prescribed exposure parameters within five seconds, the beam shall be automatically attenuated by a shutter having a lead equivalency not less than that of the tube housing assembly. In addition,
 - (1) After the unit is at operating parameters, the shutter shall be controlled electrically by the operator from the control panel; and
 - (2) An indication of shutter position shall appear at the control panel.
- n. Low filtration X-ray tubes. Each X-ray system equipped with a beryllium or other low-filtration window shall be

clearly labeled as such upon the tube housing assembly and at the control panel.

2. Facility design requirements for systems capable of operating above fifty kilovolts peak.

a. Aural communication. Provision shall be made for two-way aural communication between the patient and the operator at the control panel. However, where excessive noise levels or treatment requirements make aural communication impractical, other methods of communication shall be used.

b. Viewing systems.

(1) Windows, mirrors, closed-circuit television, or an equivalent system shall be provided to permit continuous observation of the patient during irradiation and shall be so located that the operator can observe the patient from the control panel.

(2) When the primary viewing system is by electronic means, television, an alternate viewing system, which may be electronic, shall be available for use in the event of failure of the primary viewing system.

c. Additional requirements for X-ray systems capable of operation above one hundred fifty kilovolts peak.

(1) All protective barriers must be fixed except for entrance doors or beam interceptors.

(2) The control panel shall be outside the treatment room.

(3) Entrance interlocks shall be provided such that all entrance doors must be closed before treatment can be initiated or continued. If the radiation beam is interrupted by any door opening, it shall not be possible to restore the machine to operation without closing the door and reinitiating irradiation by manual action at the control panel.

(4) When any door referred to in paragraph 3 of this subdivision is opened while the X-ray tube is activated, the exposure at a distance of one meter from the source must be reduced to less than one hundred milliroentgens [25.8 microcoulomb per kilogram] per hour.

3. Surveys, calibrations, spot checks, and operating procedures.

a. Surveys.

- (1) All new facilities, and existing facilities not previously surveyed, shall have a survey made by, or under the direction of, a qualified expert. In addition, such surveys shall be done after any change in the facility or equipment which might cause a significant increase in radiation hazard.
- (2) The registrant shall obtain a written report of the survey from the qualified expert, and a copy of the report shall be transmitted by the registrant to the department within thirty days of receipt of the report.
- (3) The survey and report shall indicate all instances where the installation, in the opinion of the qualified expert, is in violation of this article.

b. Calibration.

- (1) The calibration of an X-ray system shall be performed at intervals not to exceed one year and after any change or replacement of components which could cause a change in the radiation output.
- (2) The calibration of the radiation output of the X-ray system shall be performed by or under the direction of a qualified expert who is physically present at the facility during such calibration.
- (3) Calibration of the radiation output of an X-ray system shall be performed with a calibrated dosimetry system. The calibration of such system shall be traceable to a national standard. The instrument shall have been calibrated within the preceding two years.
- (4) The calibrations must be such that the dose at a reference point in soft tissue can be calculated to within an uncertainty of five percent.
- (5) The calibration of the X-ray system shall include, but not be limited to, the following determinations:
 - (a) Verification that the X-ray system is operating in compliance with the design specifications.
 - (b) The exposure rates for each combination of field size, technique factors, filter, and treatment distance used.
 - (c) The degree of congruence between the radiation field and the field indicated by the localizing device if such device is present.

- (d) An evaluation of the uniformity of the largest radiation field used.
 - (6) Records of calibration shall be maintained by the registrant for five years after completion of the calibration.
 - (7) A copy of the most recent X-ray system calibration shall be available at or in the area of the control panel.
- c. Spot checks. Spot checks shall be performed on X-ray systems capable of operation at greater than one hundred fifty kilovolts peak. Such spot checks shall meet the following requirements:
- (1) The spot check procedures shall be in writing and shall have been developed by a qualified expert. A copy of the procedures shall be submitted to the department prior to its implementation.
 - (2) If a qualified expert does not perform the spot check measurement, the results of the spot check measurements shall be reviewed by a qualified expert within fifteen days.
 - (3) The spot check procedures shall specify the frequency at which tests or measurements are to be performed. The spot check procedures shall specify that the spot check shall be performed during the calibration specified in subdivision b of subsection 3 of section 33-10-06-08. The acceptable tolerance for each parameter measured in the spot check when compared to the value for that parameter determined in the calibration specified in subdivision b of subsection 3 of section 33-10-06-08 shall be stated.
 - (4) The cause for a parameter exceeding a tolerance set by the qualified expert shall be investigated and corrected before the system is used for patient irradiation.
 - (5) Whenever a spot check indicates a significant change in the operating characteristics of a system, as specified in the qualified expert's spot check procedures, the system shall be recalibrated as required in subdivision b of subsection 3 of section 33-10-06-08.
 - (6) Records of spot check measurements shall be maintained by the registrant for two years after completion of the spot check measurements and any necessary corrective actions.

- (7) Where a spot check involves a radiation measurement, such measurement shall be obtained using a system satisfying the requirements of subdivision b of subsection 3 of section 33-10-06-08 or which has been intercompared with a system meeting those requirements within the previous year.

d. Operating procedures.

- (1) X-ray systems shall not be left unattended unless the system is secured against unauthorized use.
- (2) When a patient must be held in position for radiation therapy, mechanical supporting or restraining devices shall be used.
- (3) The tube housing assembly shall not be held by hand during operation unless the system is designed to require such holding and the peak tube potential of the system does not exceed fifty kilovolts peak. In such cases, the holder shall wear protective gloves and apron of not less than five-tenths millimeter lead equivalency at one hundred kilovolts peak.
- (4) No individual other than the patient shall be in the treatment room unless such individual is protected by a barrier sufficient to meet the requirements of ~~subsection 4 of section 33-10-04-02~~ 33-10-04.1-06. No individual other than the patient shall be in the treatment room during exposures when the kilovolts peak exceeds one hundred fifty.
- (5) The X-ray system shall not be used in the administration of radiation therapy unless the requirements of subdivision b of this subsection and paragraph 4 of subdivision c have been met.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-06-09. X-ray and electron therapy systems with energies of one megaelectronvolt (MeV) and above. Chapter 33-10-09 except subdivisions c and d of subsection 7 of section 33-10-09-03 shall apply to medical facilities using therapy systems with energies one megaelectronvolt and above.

1. Definitions. In addition to the definitions provided in section 33-10-06-02, the following definitions are applicable to this section.

- a. "Applicator" means a structure which determines the extent of the treatment field at a given distance from the virtual source and which may or may not incorporate the beam-limiting device.
- b. "Beam scattering filter" means a filter used in order to scatter a beam of electrons.
- c. "Central axis of the beam" means a line passing through the virtual source and the center of the plane figure formed by the edge of the first beam-limiting device.
- d. "Dose monitoring system" means a system of devices for the detection, measurement, and display of quantities of radiation.
- e. "Dose monitor unit" means a unit response from the dose monitoring system from which the absorbed dose can be calculated.
- f. "Existing equipment" means therapy systems subject to this section which were manufactured on or before January 1, 1985.
- g. "Field flattening filter" means a filter used to provide dose uniformity over the area of a useful beam of X-rays at a specified depth.
- h. "Field size" means the dimensions along the major axes of an area in a plane perpendicular to the specified direction of the beam of incident radiation at the normal treatment distance and defined by the intersection of the major axes and the fifty percent isodose line. Material shall be placed in the beam such that dose maximum is produced at the normal treatment distance when field size is being determined.
- i. "Gantry" means that part of the system supporting and allowing possible movements of the radiation head.
- j. "Interruption of irradiation" means the stopping of irradiation with the possibility of continuing irradiation without resetting of operating conditions at the control panel.
- k. "Isocenter" means a fixed point in space located at the center of the smallest sphere through which the central axis of the beams passes in all conditions.
- l. "Moving beam therapy" means radiation therapy with relative displacement of the useful beam and the patient during irradiation. It includes arc therapy, skip therapy, and rotational therapy.

- m. "New equipment" means systems subject to this section which were manufactured after January 1, 1985.
- n. "Normal treatment distance" means:
 - (1) For electron irradiation, the virtual source to surface distance along the central axis of the useful beam as specified by the manufacturer for the applicator.
 - (2) For X-ray irradiation, the virtual source to isocenter distance along the central axis of the useful beam. For nonisocentric equipment, this distance shall be that specified by the manufacturer.
- o. "Radiation head" means the structure from which the useful beam emerges.
- p. "Shadow tray" means a device attached to the radiation head to support auxiliary beam-limiting material.
- q. "Stationary beam therapy" means radiation therapy without relative displacement of the useful beam and patient during radiation.
- r. "Target" means that part of a radiation source which intercepts a beam of accelerated particles with subsequent emission of other radiation.
- s. "Virtual source" means a point from which radiation appears to originate.

2. Requirements for equipment.

- a. Leakage radiation to the patient area.
 - (1) New equipment shall meet the following requirements:
 - (a) For all operating conditions producing maximum leakage, the absorbed dose in rads [grays] due to leakage radiation, including X-rays, electrons, and neutrons, at any point in a circular plane of two meters radius centered on and perpendicular to the central axis of the beam at the isocenter or the normal treatment distance and outside the maximum useful beam, shall not exceed one-tenth percent of the maximum absorbed dose in rads [grays] of the unattenuated useful beam measured at the point of intersection of the central axis of the beam and the plane surface. Measurements excluding those for neutrons shall be averaged over an area up to but not exceeding two hundred square

centimeters at the positions specified. Measurements of the portion of the leakage radiation dose contributed by neutrons shall be averaged over an area up to but not exceeding two hundred square centimeters.

(b) For each system the registrant shall determine, or obtain from the manufacturer, the leakage radiation existing at the positions specified in subparagraph a for specified operation conditions. Records on leakage radiation shall be maintained at the installation for inspection by the department.

(2) Existing equipment shall meet the following requirements:

(a) For operating conditions producing maximum leakage radiation, the absorbed dose in rads [grays] due to leakage radiation excluding neutrons at any point in a circular plane of two meters radius centered on a perpendicular to the central axis of the beam one meter from the virtual source, and outside the maximum size useful beam, may not exceed one-tenth percent of the maximum absorbed dose in rads [grays] of the unattenuated useful beam measured at the point of intersection of the central axis of the beam and the surface of the circular plane. Measurements shall be averaged over an area up to but not exceeding one hundred square centimeters at the positions specified.

(b) For each system, the registrant shall determine, or obtain from the manufacturer, the leakage radiation existing at the positions specified in subparagraph a of this paragraph for specified operating conditions. Records on radiation leakage shall be maintained at the installation for inspection by the department.

b. Leakage radiation outside the patient area for new equipment.

(1) The absorbed dose in rads [grays] due to leakage radiation, except in the area specified in subparagraph a of paragraph 1 of subdivision a, when measured at any point one meter from the path of charged particle, before the charged particle strikes the target or window, may not exceed one-tenth percent for X-ray leakage nor five-hundredths percent for neutron leakage of the maximum absorbed dose in rads [grays] of the unattenuated useful beam measured

at the point of intersection of the central axis of the beam and the circular plane specified in subparagraph a of paragraph 1 of subdivision a of this subsection.

- (2) The registrant shall determine, or obtain from the manufacturer, the actual leakage radiation existing at the positions specified in paragraph 1 of this subdivision for specified operating conditions. Radiation measurements excluding neutrons shall be averaged over an area up to but not exceeding one hundred square centimeters at the positions specified. Neutron measurements shall be averaged over an area up to but not exceeding two hundred square centimeters.

c. Beam-limiting devices. Adjustable or interchangeable beam-limiting devices shall be provided and such devices shall transmit no more than two percent of the useful beam at the normal treatment distance for the portion of the useful beam which is to be attenuated by the beam-limiting device. The neutron component of the useful beam shall not be included in this requirement.

d. Filters.

- (1) Each filter which is removable from the system shall be clearly marked with an identification number. Documentation available at the control panel shall contain a description of the filter. For wedge filters, the wedge angle shall appear on the wedge or wedge tray.
- (2) If the absorbed dose rate data required by subdivision p of subsection 2 of section 33-10-06-04 relates exclusively to operation with a field flattening or beam scattering filter in place, such filter shall be removable only by the use of tools.
- (3) For new equipment which utilizes a system of wedge filters, interchangeable field flattening filters, or interchangeable beam scattering filters:
 - (a) Irradiation shall not be possible until a selection of a filter has been made at the treatment control panel;
 - (b) An interlock system shall be provided to prevent irradiation if the filter selected is not in the correct position;
 - (c) A display shall be provided at the treatment control panel showing the filters in use; and

- (d) An interlock shall be provided to prevent irradiation if any filter selection operation carried out in the treatment room does not agree with the filter selection operation carried out at the treatment control panel.
- e. Beam quality. The registrant shall determine, or obtain from the manufacturer, data sufficient to assure that the following beam quality requirements are met:

- (1) The absorbed dose resulting from X-rays in a useful electron beam at a point on the central axis of the beam ten centimeters greater than the practical range of the electrons shall not exceed the value stated in table III. Linear interpolation shall be used for values not stated.

TABLE III

Maximum Energy of Electron Beam in MeV	X-ray Absorbed Dose as a Fraction of Maximum Absorbed Dose
1	0.03
15	0.05
35	0.10
50	0.20

- (2) Compliance with paragraph 1 of this subdivision shall be determined using:
- (a) A measurement within a phantom with the incident surface of the phantom at the normal treatment distance and normal to the central axis of the beam;
- (b) The largest field size available which does not exceed fifteen centimeters by fifteen centimeters; and
- (c) A phantom whose cross-sectional dimensions exceed the measurement radiation field by at least five centimeters and whose depth is sufficient to perform the required measurement.
- (3) The absorbed dose at a surface located at the normal treatment distance, at the point of intersection of that surface with the central axis of the useful beam during X-ray irradiation, shall not exceed the limits stated in table IV. Linear interpolation shall be used for values not stated.

Table IV	
Maximum Photon Energy in MeV	Absorbed Dose at the Surface as a Fraction of the Maximum Absorbed Dose
1	0.80
2	0.70
5	0.60
15	0.50
35	0.40
50	0.20

- (4) Compliance with paragraph 3 of this subdivision shall be determined by measurements made:
- (a) Within a phantom using an instrument which will allow extrapolation to the surface absorbed dose;
 - (b) Using a phantom whose size and placement meet the requirements of paragraph 2 of this subdivision;
 - (c) After removal of all beam modifying devices which can be removed without the use of tools, except for beam scattering or beam flattening filters; and
 - (d) The largest field size available which does not exceed fifteen centimeters by fifteen centimeters.
- (5) The registrant shall determine, or obtain from the manufacturer, the maximum percentage absorbed dose in the useful beam due to stray neutrons, excluding stray neutron radiation, for specified operating conditions.
- f. Beam monitors. All therapy systems shall be provided with radiation detectors in the radiation head.
- (1) New equipment shall be provided with at least two radiation detectors. The detectors shall be incorporated into two separate dose monitoring systems.
 - (2) Existing equipment shall be provided with at least one radiation detector. This detector shall be incorporated into a primary dose monitoring system.

(3) The detectors and system into which the detector is incorporated shall meet the following requirements:

(a) Each detector shall be removable only with tools and shall be interlocked to prevent incorrect positioning.

(b) Each detector shall form part of a dose monitoring system from whose readings in dose monitor units the absorbed dose at a reference point in the treatment volume can be calculated.

(c) Each dose monitoring system shall be capable of independently monitoring, interrupting, and terminating irradiation.

(d) For new equipment, the design of the dose monitoring systems shall assure that:

[1] The malfunctioning of one system does not affect the correct functioning of the second system; and

[2] The failure of any element common to both systems which could affect the correct function of both systems shall terminate irradiation.

(e) Each dose monitoring system shall have a legible display at the treatment control panel. For new equipment, each display shall:

[1] Maintain a reading until intentionally reset to zero;

[2] Have only one scale and no scale multiplying factors;

[3] Utilize a design such that increasing dose is displayed by increasing numbers and shall be so designed that, in the event of an overdosage of radiation, the absorbed dose may be accurately determined; and

[4] In the event of power failure, the dose monitoring information required in this subparagraph displayed at the control panel at the time of failure shall be retrievable in at least one system for a twenty-minute period of time.

g. Beam symmetry. In new equipment inherently capable of producing useful beams with asymmetry exceeding five

percent, the asymmetry of the radiation beam in two orthogonal directions must be monitored before the beam passes through the beam-limiting device. Facilities must be provided so that, if the difference in dose rate between one region and another region symmetrically displaced from the central axis of the beam exceeds five percent of the central axis dose rate, indication of this condition is made at the control panel; and if this difference exceeds ten percent, the irradiation is terminated.

h. Selection and display of dose monitor units.

- (1) Irradiation shall not be possible until a selection of a number of dose monitor units has been made at the treatment control panel.
- (2) After useful beam termination, it shall be necessary to reset the dosimeter display to zero before treatment can be reinitiated.
- (3) The preselected number of dose monitor units shall be displayed at the treatment control panel until reset manually for the next irradiation.
- (4) For new equipment after termination of irradiation, it shall be necessary to manually reset the preselected dose monitor units before irradiation can be initiated.

i. Termination of irradiation by the dose monitoring system or systems during stationary beam therapy.

- (1) Each primary system shall terminate irradiation when the preselected number of dose monitor units has been detected by the system.
- (2) If original design of the equipment included a second dose monitoring system, that system must be capable of terminating irradiation when not more than fifteen percent or forty dose monitor units above the preselected number of dose monitor units set at the control panel has been detected by the second dose monitoring.
- (3) For new equipment, a second dose monitoring system must be present. That system must be capable of terminating irradiation when not more than ten percent or twenty-five dose monitoring units above the preselected number of dose monitor units set at the control panel has been detected by the second dose monitoring system.

- (4) For new equipment, an indicator on the control panel must show which dose monitoring system has terminated irradiation.
- j. Interruption switches. It shall be possible to interrupt irradiation and equipment movements at any time from the operator's position at the treatment control panel. Following an interruption, it shall be possible to restart irradiation by operator action without any reselection of operating conditions. If any change is made of a preselected value during an interruption, irradiation and equipment movements shall be automatically terminated.
 - k. Termination switches. It shall be possible to terminate irradiation and equipment movements, or go from an interruption condition to termination conditions, at any time from the operator's position at the treatment control panel.
 - l. Timer.
 - (1) A timer shall be provided which has a display at the treatment control panel. The timer shall be graduated in minutes and decimals of minutes. The timer shall have a preset time selector and an elapsed time indicator.
 - (2) The timer shall be a cumulative timer which activates with the production of radiation and retains its reading after irradiation is interrupted or terminated. After irradiation is terminated and before irradiation can be reinitiated, it shall be necessary to reset the elapsed time indicator to zero.
 - (3) For new equipment after termination of irradiation and before irradiation can be reinitiated, it shall be necessary to manually reset the preset time selector.
 - (4) The timer shall terminate irradiation when a preselected time has elapsed if the dose monitor systems have not previously terminated irradiation.
 - m. Selection of radiation type. Equipment capable of both X-ray therapy and electron therapy shall meet the following requirements:
 - (1) Irradiation shall not be possible until a selection of radiation type has been made at the treatment control panel.

- (2) An interlock system shall be provided to ensure that the equipment can emit only the radiation type which has been selected.
 - (3) An interlock system shall be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations carried out at the treatment control panel.
 - (4) An interlock system shall be provided to prevent irradiation with X-rays except to obtain a port film when electron applicators are fitted.
 - (5) An interlock system shall be provided to prevent irradiation with electrons when accessories specific for X-ray therapy are fitted.
 - (6) The radiation type selected shall be displayed at the treatment control panel before and during irradiation.
- n. Selection of energy. Equipment capable of generating radiation beams of different energies shall meet the following requirements:
- (1) Irradiation shall not be possible until a selection of energy has been made at the treatment control panel.
 - (2) An interlock system shall be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations carried out at the treatment control panel.
 - (3) The nominal energy value selected shall be displayed at the treatment control panel before and during irradiation.
 - (4) For new equipment, an interlock system shall be provided to terminate irradiation if the energy of the electrons striking the X-ray target or electron window deviates by more than twenty percent or three megaelectron volts, whichever is smaller, from the selected nominal energy.
- o. Selection of stationary beam therapy or moving beam therapy. Equipment capable of both stationary beam therapy and moving beam therapy shall meet the following requirements:

- (1) Irradiation shall not be possible until a selection of stationary beam therapy or moving beam therapy has been made at the treatment control panel.
 - (2) An interlock system shall be provided to ensure that the equipment can operate only in the mode which has been selected.
 - (3) An interlock system shall be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations carried out at the treatment control panel.
 - (4) The mode of operation shall be displayed at the treatment control panel.
 - (5) For new equipment, an interlock system shall be provided to terminate irradiation if:
 - (a) Movement of the gantry occurs during stationary beam therapy; or
 - (b) Movement of the gantry stops during moving beam therapy unless such stoppage is a preplanned function.
 - (6) Moving beam therapy shall be controlled to obtain the selected relationships between incremental dose monitor units and incremental angle of movement.
 - (a) For new equipment, an interlock system shall be provided to terminate irradiation if the number of dose monitor units delivered in any ten degrees of arc differs by more than twenty percent from the selected value.
 - (b) For new equipment, where gantry angle terminates the irradiation in arc therapy, the dose monitor units shall differ by less than five percent from the value calculated from the absorbed dose per unit angle relationship.
 - (7) Where the dose monitor system terminates the irradiation in arc therapy, the termination of irradiation shall be as required by subsection 1 of this section.
- p. Absorbed dose rate. For new equipment, a system shall be provided from whose readings the absorbed dose rate at a reference point in the treatment volume can be calculated (the radiation detectors specified in subdivision f of

subsection 2 of section 33-10-06-09 may form part of this system). In addition:

- (1) The dose monitor unit rate shall be displayed at the treatment control panel.
 - (2) If the equipment can deliver under any conditions an absorbed dose rate at the normal treatment distance more than twice the maximum value specified by the manufacturer's anticipated dose rate for any machine parameters utilized, a device shall be provided which terminates irradiation when the absorbed dose rate exceeds a value twice the specified maximum. The value at which the irradiation will be terminated shall be a record maintained by the registrant.
- q. Location of virtual source and beam orientation. The registrant shall determine, or obtain from the manufacturer, the location with reference to an accessible point on the radiation head of:
- (1) The X-ray target or the virtual source of X-rays.
 - (2) The electron window or the virtual source of electrons if the system has electron beam capabilities.
- r. System checking facilities. Capabilities shall be provided so that all radiation safety interlocks can be checked for correct operation. When preselection of any of the operating conditions requires action in the treatment room and at the treatment control panel, selection at one location shall not give a display at the other location until the requisite selected operations in both locations have been completed.
3. Facility and shielding requirements. In addition to chapter ~~33-10-04~~ 33-10-04.1, the following design requirements shall apply:
- a. Protective barriers. All protective barriers must be fixed except for entrance doors or beam interceptors.
 - b. Control panel. The control panel must be located outside the treatment room.
 - c. Viewing systems.
 - (1) Windows, mirrors, closed-circuit television, or an equivalent system shall be provided to permit continuous observation of the patient during irradiation and shall be so located that the operator

may observe the patient from the treatment control panel.

(2) When the viewing system is by electronic means an alternate viewing system, which may be electronic, shall be available for use in the event of failure of the primary system.

d. Aural communications. Provision shall be made for two-way aural communication between the patient and the operator at the control panel. However, where excessive noise levels or treatment requirements make aural communication impractical, other methods of communication shall be used.

e. Room entrances. Treatment room entrances shall be provided with warning lights in readily observable positions near the outside of all access doors to indicate when the useful beam is "on".

f. Entrance interlocks. Interlocks shall be provided such that all entrance doors must be closed before treatment can be initiated or continued. If the radiation beam is interrupted by any door opening, it shall not be possible to restore the machine to operation without closing the door and reinitiating exposure by manual action at the control panel.

4. Surveys, calibrations, spot checks, and operating procedures.

a. Surveys.

(1) All new facilities, and existing facilities not previously surveyed, shall have a survey made by, or under the direction of, a qualified expert. In addition, such surveys shall also be done after any change in the facility or equipment which might cause a significant increase in radiation hazard.

(2) The registrant shall obtain a written report of the survey from the qualified expert and a copy of the report shall be transmitted by the registrant to the department within thirty days of receipt of the report.

(3) The survey and report shall indicate all instances where the installation, in the opinion of the qualified expert, is in violation of this article.

b. Calibrations.

(1) The calibration of systems subject to section 33-10-06-09 shall be performed in accordance with an established calibration protocol acceptable to the

department (the calibration protocol published by the American association of physicists in medicine is accepted as an established protocol. For other protocols, the user shall submit that protocol to the department for concurrence that the protocol is acceptable) before the system is first used for irradiation of patient and thereafter at time intervals which do not exceed twelve months and after any change which might significantly alter the calibration, spatial distribution, or other characteristics of the therapy beam.

- (2) The calibration shall be performed under the direct supervision of a radiological physicist who is physically present at the facility during the calibration.
- (3) Calibration radiation measurements required by paragraph 1 must be performed using a dosimetry system:
 - (a) Having a calibration factor for cobalt-60 gamma rays traceable to a national standard.
 - (b) Which has been calibrated within the previous two years and after any servicing that may have affected its calibration.
 - (c) Which has been calibrated in such a fashion that an uncertainty can be stated for the radiation quantities monitored by the system.
 - (d) Which has had constancy checks performed on the system as specified by a radiological physicist.
- (4) Calibrations must be in sufficient detail that the dose at a reference point in soft tissue may be calculated to within an uncertainty of five percent.
- (5) The calibration of the therapy beam shall include but be not limited to the following determinations:
 - (a) Verification that the equipment is operating in compliance with the design specifications concerning the light localizer, the sidelight and back-pointer alignment with the isocenter, when applicable, variation in the axis of rotation for the table, gantry and jaw system, and beam flatness and symmetry at specified depths.
 - (b) The absorbed dose rate at various depths of water for the range of field sizes used, for

each effective energy, that will verify the accuracy of the dosimetry of all therapy procedures utilized with that therapy beam.

- (c) The uniformity of the radiation field and any dependency upon the direction of the useful beam.
 - (d) Verification that existing depth-dose data and isodose charts applicable to the specific machine continue to be valid or are updated to existing machine conditions.
 - (e) Verification of transmission and electron buildup factors for all accessories such as wedges, shadow trays, and compensators.
- (6) Records of the calibration performed pursuant to paragraph 1 of this subdivision shall be maintained by the registrant for five years after completion of the full calibration.
- (7) A copy of the latest calibration performed pursuant to paragraph 1 of this subdivision shall be available in the area of the control panel.
- c. Spot checks. Spot checks shall be performed on systems subject to this section during calibrations and thereafter at intervals not to exceed one month. Such spot checks shall meet the following requirements:
- (1) The spot check procedures shall be in writing and shall have been developed by a radiological physicist. A copy of the procedure shall be submitted to the department prior to its implementation.
 - (2) If a radiological physicist does not perform the spot check measurements, the results of the spot check measurements shall be reviewed by a radiological physicist within fifteen days.
 - (3) The spot check procedures shall specify the frequency at which tests or measurements are to be performed and the acceptable tolerance for each parameter measured in the spot check when compared to the value for that parameter determined in the calibration.
 - (4) At intervals not to exceed one week, spot checks shall be made of absorbed dose measurements at a minimum of two depths in a phantom.

- (5) Where a system has built-in devices which provide a measurement of any parameter during irradiation, such measurement may not be utilized as a spot check measurement.
- (6) The cause for a parameter exceeding a tolerance set by the radiological physicist shall be investigated and corrected before the system is used for patient irradiation.
- (7) Whenever a spot check indicates a significant change in operating characteristics of a system, as specified in the radiological physicist's spot check procedures, the system shall be recalibrated as required in subdivision b of subsection 4 of this section.
- (8) Records of spot check measurements shall be maintained by the registrant for a period of two years after completion of the spot check measurements and any necessary corrective actions.
- (9) Where a spot check involves a radiation measurement, such measurement shall be obtained using a system satisfying the requirements of subdivision b of subsection 4 of this section or which has been intercompared with a system meeting those requirements within the previous year.

d. Operating procedures.

- (1) No individual other than the patient shall be in the treatment room during treatment of a patient.
- (2) If a patient must be held in position during treatment, mechanical supporting or restraining devices shall be used.
- (3) The system shall not be used in the administration of radiation therapy unless the requirements of subdivisions a, b, and c of this subsection have been met.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~20-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~20-32-02~~ 23-20.1-03, 23-20.1-04

33-10-06-10. Veterinary medicine radiographic installations. In addition to the requirements of sections 33-10-06-03 and 33-10-06-04, the following regulations shall apply to all veterinary medicine radiographic installations:

1. Equipment.

- a. The protective tube housing shall be equivalent to the requirements of subsection 3 of section 33-10-06-04.
- b. Diaphragms or cones shall be provided for collimating the useful beam to the area of clinical interest and shall provide the same degree of protection as is required of the housing.
- c. The total filtration permanently in the useful beam shall not be less than five-tenths millimeters aluminum equivalent for machines operating up to fifty kilovolts peak, one and one-half millimeters aluminum equivalent for machines operating between fifty and seventy kilovolts peak, and two and one-half millimeters aluminum equivalent for machines operating above seventy kilovolts peak.
- d. A device shall be provided to terminate the exposure after a preset time or exposure.
- e. A dead-man type of exposure switch shall be provided, together with an electrical cord of sufficient length, so that the operator can stand out of the useful beam and at least six feet [1.83 meters] from the animal during all X-ray exposures.

2. Structural shielding. All wall, ceiling, and floor areas shall be equivalent to or provided with applicable protective barriers as required in appendix E of this chapter to assure compliance with ~~sections 33-10-04-02, 33-10-04-04, and 33-10-04-05~~ chapter 33-10-04.1.

3. Operating procedures.

- a. The operator shall stand well away from the useful beam and the animal during radiographic exposures.
- b. No individual other than the operator shall be in the X-ray room while exposures are being made unless such individual's assistance is required.
- c. When an animal must be held in position during radiography, mechanical supporting or restraining devices should be used. If the animal must be held by an individual, that individual shall be protected with appropriate shielding devices, such as protective gloves and apron, and the individual shall be so positioned that no part of the individual's body will be struck by the useful beam. The exposure of any individual used for this purpose shall be monitored.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04
Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

APPENDIX B
MINIMUM DESIGN REQUIREMENTS FOR AN X-RAY MACHINE
OPERATOR'S BOOTH

1. Space requirements.
 - a. The operator shall be allotted not less than seven and five-tenths square feet [0.697 square meters] of unobstructed floor space in the booth.
 - b. The operator's booth may be any geometric configuration with no dimension of less than two feet [0.61 meters].
 - c. The space shall be allotted excluding any encumbrance by the console, such as overhang, cables, or other similar encroachments.
 - d. The booth must be located or constructed such that unattenuated direct scatter radiation originating on the examination table or at the wall cassette not reach the operator's station in the booth.
2. Structural requirements.
 - a. The booth walls shall be permanently fixed barriers of at least seven feet [2.13 meters] high.
 - b. When a door or movable panel is used as an integral part of the booth structure, it must have an interlock which will prevent an exposure when the door or panel is not closed.
 - c. Shielding must be provided to meet the requirements of chapter ~~33-10-04~~ 33-10-04.1 of these rules.
3. X-ray control placement.
 - a. The X-ray control for the system shall be fixed within the booth and:
 - (1) Shall be at least forty inches [1.02 meters] from any open edge of the booth wall which is nearest to the examining table.
 - (2) Shall allow the operator to use the majority of the available viewing windows.
4. Viewing system requirements.
 - a. Each booth shall have at least one viewing device which will:

- (1) Be so placed that the operator can view the patient during any exposure, and
 - (2) The device shall be so placed that the operator can have full view of any occupant of the room and should be so placed that the operator can view any entry into the room. If any door, which allows access to the room, cannot be seen from the booth, then that door must have an interlock controlling the exposure which will prevent the exposure if the door is not closed.
- b. When the viewing system is a window, the following requirements also apply:
- (1) The viewing area must be at least one square foot [0.0929 square meters].
 - (2) The design of the booth must be such that the operator's expected position when viewing the patient and operating the X-ray system is at least eighteen inches [0.457 meters] from the edge of the booth.
 - (3) The material constituting the window must have the same lead equivalence as that required in the booth's wall in which it is mounted.
- c. When the viewing system is by mirrors, the mirrors must be so located as to accomplish the general requirements subdivision a of subsection 4 of appendix B.
- d. When the viewing system is by electronic means:
- (1) The camera shall be so located as to accomplish the general requirements in subdivision a of appendix B, and
 - (2) There shall be an alternate viewing system as a backup for the primary system.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

APPENDIX C
STRUCTURAL SHIELDING REQUIREMENTS

1. General requirements.

- a. Each installation ~~shall~~ must be provided with such primary or secondary barriers as are necessary to assure compliance with ~~subsections 7, 4, and 5 of section 33-10-04-02~~ sections 33-10-04.1-06 and 33-10-04.1-07. This requirement ~~shall~~ must be deemed to be met if the thicknesses of such barriers are equivalent to those as computed in accordance with Appendices B, C, and D of the National Council on Radiation Protection and Measurements Report No. 49, "Medical X-Ray and Gamma-Ray Protection For Energies Up to 10 MeV."
- b. Lead barriers ~~shall~~ must be mounted in such manner that they will not sag or cold-flow because of their own weight and shall be protected against mechanical damage.
- c. Joints between different kinds of protective materials ~~shall~~ must be ~~so~~ designed so that the overall protection of the barrier is not impaired.
- d. Joints at the floor and ceiling ~~shall~~ must be ~~so~~ designed so that the overall protection is not impaired.
- e. Windows, window frames, doors, and door frames ~~shall~~ must have the same lead equivalent as that required of the adjacent wall.
- f. Holes in protective barriers ~~shall~~ must be covered so that overall attenuation is not impaired.

2. Fluoroscopic X-ray systems. Ordinarily, only secondary barriers are necessary except combined fluoroscopic-radiographic installations.

3. Radiographic systems other than fluoroscopic, dental intraoral, or veterinarian systems:

- a. All wall, floor, and ceiling areas exposed to the useful beam ~~shall~~ must have primary barriers. Primary barriers in walls ~~shall~~ must extend to a minimum height of eighty-four inches [2.13 meters] above the floor.
- b. Secondary barriers ~~shall~~ must be provided in all wall, floor, and ceiling areas not having primary barriers or where the primary barrier requirements are lower than the secondary requirements.
- c. The operator's station at the control shall be behind a protective barrier, either in a separate room, in a

protected booth, or behind a shield which will intercept the useful beam and any radiation which has been scattered only once.

- d. A window of lead equivalent glass equal to that required by the adjacent barrier or a mirror system shall be provided large enough and so placed that the operator can see the patient without having to leave the protected area during exposure.
 - e. For mobile and portable X-ray systems which are used for greater than one week in one location (one room or suite), the requirements of this appendix shall apply.
4. Intraoral dental radiographic systems.
- a. Dental rooms containing X-ray machines shall be provided with primary barriers at all areas struck by the useful beam. Consideration shall be given to the attenuation provided by the patient.
 - b. When dental X-ray units are installed in adjacent rooms or areas, protective barriers shall be provided between the rooms or areas.
- Note: In many cases, structural materials of ordinary walls suffice as a protective barrier without addition of special shielding material.
5. Therapeutic X-ray installations. The structural shielding requirements shall be deemed to be met if the barriers have been designed and constructed in accordance with the National Council on Radiation Protection and Measurements Report No. 49, "Medical X-Ray and Gamma-Ray Protection for Energies Up to 10 MeV" or its replacement.
6. Veterinary medicine radiographic installations.
- a. All wall, floor, and ceiling areas exposed to the useful beam shall have primary barriers. Primary barriers in walls shall extend to a minimum height of eighty-four inches [2.13 meters] above the floor.
 - b. Secondary barriers shall be provided in all wall, floor, and ceiling areas not having primary barriers or where the primary barrier requirements are lower than the secondary requirements.

CHAPTER 33-10-07

33-10-07-01. Purpose and scope. This chapter establishes requirements and provisions for the use of radionuclides in the healing arts and for issuance of licenses authorizing the medical use of this material. These requirements and provisions provide for the protection of the public health and safety. The requirements and provisions of this chapter are in addition to, and not in substitution for, ~~others~~ other requirements in this article. The requirements and provisions of this article apply to applicants and licensees subject to this chapter unless specifically exempted.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-01.1. Definitions. As used in this chapter, the following definitions apply:

1. "Area of use" means a portion of a physical structure that has been set aside for the purpose of receiving, using, or storing radioactive material.
2. "As low as reasonably achievable" (ALARA) means making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical:
 - a. Consistent with the purpose for which the licensed activity is undertaken;
 - b. Taking into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations; and
 - c. In relation to utilization of nuclear energy in the public interest.
3. "Authorized user" means a practitioner of the healing arts who is identified as an authorized user on a department [agreement state, licensing state or United States nuclear regulatory commission] license that authorizes the medical use of radioactive material.
4. "Brachytherapy" means a method of radiation therapy in which sealed sources are utilized to deliver a radiation dose at a distance of up to a few centimeters, by surface, intracavitary, or interstitial application.

5. "Dedicated check source" means a radioactive source that is used to assure the constant operation of a radiation detection or measurement device over several months or years. This source may also be used for other purposes.
6. "Diagnostic clinical procedures manual" means a collection of written procedures that describes each method (and other instructions and precautions) by which the licensee performs diagnostic clinical procedures; where each diagnostic clinical procedure has been approved by the authorized user and includes the radiopharmaceutical, dosage, and route of administration.
7. "Management" means the chief executive officer or that individual's designee.
- ~~7-~~ 8. "Medical institution" means an organization in which several medical disciplines are practiced.
- ~~8-~~ 9. "Medical use" means the intentional internal or external administration of radioactive material, or the radiation therefrom, to humans in the practice of the healing arts.
- 9- 10. "Misadministration" means the administration of:
- ~~a. A radiopharmaceutical or radiation from a sealed source other than the one intended;~~
 - ~~b. A radiopharmaceutical or radiation to the wrong patient;~~
 - ~~c. A radiopharmaceutical or radiation by a route of administration other than that intended by the prescribing physician;~~
 - ~~d. A diagnostic dosage of a radiopharmaceutical differing from the prescribed dosage by more than fifty percent;~~
 - ~~e. A therapeutic dosage of a radiopharmaceutical differing from the prescribed dosage by more than ten percent; or~~
 - ~~f. A therapeutic radiation dose from a sealed source such that errors in the source calibration; time of exposure; and treatment geometry result in a calculated total treatment dose differing from the final prescribed total treatment dose by more than ten percent.~~
- a. A radiopharmaceutical dosage greater than thirty microcuries [1110 kilobecquerels] of either sodium iodide I-125 or I-131:
- (1) Involving the wrong patient or wrong radiopharmaceutical; or

- (2) When both the administered dosage differs from the prescribed dosage by more than twenty percent of the prescribed dosage and the difference between the administered dosage and prescribed dosage exceeds thirty microcuries [1110 kilobecquerels].
- b. A therapeutic radiopharmaceutical dosage, other than sodium iodide I-125 or I-131:
- (1) Involving the wrong patient, wrong radiopharmaceutical, or wrong route of administration; or
- (2) When the administered dosage differs from the prescribed dosage by more than twenty percent of the prescribed dosage.
- c. A gama stereotactic radiosurgery radiation dose:
- (1) Involving the wrong patient or wrong treatment site; or
- (2) When the calculated total administered dose differs from the total prescribed dose by more than ten percent of the total prescribed dose.
- d. A teletherapy radiation dose:
- (1) Involving the wrong patient, wrong mode of treatment, or wrong treatment site;
- (2) When the treatment consists of three or fewer fractions and the calculated total administered dose differs from the total prescribed dose by more than ten percent of the total prescribed dose;
- (3) When the calculated weekly administered dose is thirty percent greater than the weekly prescribed dose; or
- (4) When the calculated total administered dose differs from the total prescribed dose by more than twenty percent of the total prescribed dose.
- e. A brachytherapy radiation dose:
- (1) Involving the wrong patient, wrong radioisotope, or wrong treatment site (excluding, for permanent implants, seeds that were implanted in the correct site but migrated outside the treatment site);
- (2) Involving a sealed source that is leaking;

- (3) When, for a temporary implant, one or more sealed sources are not removed upon completion of the procedure; or
- (4) When the calculated administered dose differs from the prescribed dose by more than twenty percent of the prescribed dose.
- f. A diagnostic radiopharmaceutical dosage, other than quantities greater than thirty microcuries [1110 kilobecquerels] of either sodium iodide I-125 or I-131, both:
- (1) Involving the wrong patient, wrong radiopharmaceutical, wrong route of administration, or when the administered dosage differs from the prescribed dosage; and
- (2) When the dose to the patient exceeds five rems [50 millisieverts] effective dose equivalent or fifty rems [500 millisieverts] dose equivalent to any individual organ.
- ~~10.~~ 11. "Mobile nuclear medicine service" means the transportation and medical use of radioactive material.
- ~~11.~~ 12. "Output" means the exposure rate, dose rate, or a quantity related in a known manner to these rates from a teletherapy unit for a specified set of exposure conditions.
13. "Prescribed dosage" means the quantity of radiopharmaceutical activity as documented:
- a. In a written directive; or
- b. Either in the diagnostic clinical procedures manual or in any appropriate record in accordance with the directions of the authorized user for diagnostic procedures.
14. "Prescribed dose" means:
- a. For gamma stereotactic radiosurgery, the total dose as documented in the written directive;
- b. For teletherapy, the total dose and dose per fraction as documented in the written directive; or
- c. For brachytherapy, either the total source strength and exposure time or the total dose, as documented in the written directive.
15. "Recordable event" means the administration of:

- a. A radiopharmaceutical or radiation without a written directive where a written directive is required;
- b. A radiopharmaceutical or radiation where a written directive is required without daily recording of each administered radiopharmaceutical dosage or radiation dose in the appropriate record;
- c. A radiopharmaceutical dosage greater than thirty microcuries [1110 kilobecquerels] of either sodium iodide I-125 or I-131 when both:
 - (1) The administered dosage differs from the prescribed dosage by more than ten percent of the prescribed dosage; and
 - (2) The difference between the administered dosage and prescribed dosage exceeds fifteen microcuries [555 kilobecquerels];
- d. A therapeutic radiopharmaceutical dosage, other than sodium iodide I-125 or I-131, when the administered dosage differs from the prescribed dosage by more than ten percent of the prescribed dosage;
- e. A teletherapy radiation dose when the calculated weekly administered dose is fifteen percent greater than the weekly prescribed dose; or
- f. A brachytherapy radiation dose when the calculated administered dose differs from the prescribed dose by more than ten percent of the prescribed dose.

~~12.~~ "Teletherapy physicist" means an individual identified as the qualified teletherapy physicist on a department license.

~~13.~~ 16. "Teletherapy" means therapeutic irradiation in which the source of radiation is at a distance from the body.

17. "Teletherapy physicist" means an individual identified as the qualified teletherapy physicist on a department license.

~~14.~~ 18. "Visiting authorized user" means an authorized user who is not identified on the license of the licensee being visited.

19. "Written directive" means an order in writing for a specific patient, dated and signed by an authorized user prior to the administration of a radiopharmaceutical or radiation, except as specified in subdivision f, containing the following information:

- a. For any administration of quantities greater than thirty microcuries [1110 kilobecquerels] of either sodium iodide I-125 or I-131: the dosage;
- b. For a therapeutic administration of a radiopharmaceutical other than sodium iodide I-125 or I-131: the radiopharmaceutical, dosage, and route of administration;
- c. For gamma stereotactic radiosurgery: target coordinates, collimator size, plug pattern, and total dose;
- d. For teletherapy: the total dose, dose per fraction, treatment site, and overall treatment period;
- e. For high-dose-rate remote afterloading brachytherapy: the radioisotope, treatment site, and total dose; or
- f. For all other brachytherapy:
 - (1) Prior to implantation: the radioisotope, number of sources, and source strengths; and
 - (2) After implantation but prior to completion of the procedure: the radioisotope, treatment site, and total source strength and exposure time (or, equivalently, the total dose).

History: Effective June 1, 1986; amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-04. Additional requirements.

1. As low as reasonably achievable program.

- a. Each licensee shall develop and implement a written program to maintain radiation doses and releases of radioactive material in effluents to unrestricted areas as low as reasonably achievable in accordance with subsection 2 of section ~~33-10-04-01~~ 33-10-04.1-05.
- b. To satisfy the requirement of subdivision a:
 - (1) The management, radiation safety officer, and all authorized users shall participate in the establishment, implementation, and operation of the program as required by this article or the radiation safety committee; or
 - (2) For licensees that are not medical institutions, management and all authorized users shall participate

in the program as required by the radiation safety officer.

- c. The as low as reasonably achievable program must include an annual review by the radiation safety committee for licensees that are medical institutions, or management and the radiation safety officer for licensees that are not medical institutions, of summaries of the types and amounts of radioactive material used, occupational dose reports, and continuing education and training for all personnel who work with or in the vicinity of radioactive material. The purpose of the review is to ensure that individuals make every reasonable effort to maintain occupational doses, doses to the general public, and releases of radioactive material as low as reasonably achievable, taking into account the state of technology, and the cost of improvements in relation to benefits.
- d. The licensee shall retain a current written description of the as low as reasonably achievable program for the duration of the license. The written description must include:
 - (1) A commitment by management to keep occupational doses as low as reasonably achievable;
 - (2) A requirement that the radiation safety officer brief management once each year on the radiation safety program;
 - (3) Personnel exposure investigational levels as established in accordance with the requirements of paragraph 8 of subdivision b of subsection 3 that, when exceeded, will initiate an investigation by the radiation safety officer of the cause of the exposure; and
 - (4) Personnel exposure investigational levels as established in accordance with the requirements of paragraph 8 of subdivision b of subsection 3 that, when exceeded, will initiate a prompt investigation by the radiation safety officer of the cause of the exposure and consideration of actions that might be taken to reduce the probability of recurrence.

2. Radiation safety officer.

- a. A licensee shall appoint a radiation safety officer responsible for implementing the radiation safety program. The licensee, through the radiation safety officer, shall ensure that radiation safety activities are being performed in accordance with approved procedures and

regulatory requirements in the daily operation of the licensee's radioactive material program.

b. The radiation safety officer shall:

- (1) Investigate overexposures, accidents, spills, losses, thefts, unauthorized receipts, uses, transfers, and disposals, and other deviations from approved radiation safety practice and implement corrective actions as necessary;
- (2) Implement written policy and procedures for:
 - (a) Authorizing the purchase of radioactive material;
 - (b) Receiving and opening packages of radioactive material;
 - (c) Storing radioactive material;
 - (d) Keeping an inventory record of radioactive material;
 - (e) Using radioactive material safely;
 - (f) Taking emergency action if control of radioactive material is lost;
 - (g) Performing periodic radiation surveys;
 - (h) Performing checks and calibrations of survey instruments and other safety equipment;
 - (i) Disposing of radioactive material;
 - (j) Training personnel who work in or frequent areas where radioactive material is used or stored; and
 - (k) Keeping a copy of all records and reports required by this article, a copy of this article, a copy of each licensing request and license and amendments, and the written policy and procedures required by this article; and
- (3) For medical use not sited at a medical institution, approve or disapprove radiation safety program changes with the advice and consent of management prior to submittal to the department for licensing action; or

- (4) For medical use sited at a medical institution, assist the radiation safety committee in the performance of its duties.
3. Radiation safety committee. Each medical institution licensee shall establish a radiation safety committee to oversee the use of radioactive material.
- a. The committee shall meet the following administrative requirements:
 - (1) Membership must consist of at least three individuals and must include an authorized user of each type of use permitted by the license, the radiation safety officer, a representative of the nursing service, and a representative of management who is neither an authorized user nor a radiation safety officer. Other members may be included as the licensee deems appropriate.
 - (2) The committee shall meet at least once each calendar quarter.
 - (3) To establish a quorum and to conduct business, one-half of the committee's membership must be present, including the radiation safety officer and the management's representative.
 - (4) The minutes of each radiation safety committee meeting must include:
 - (a) The date of the meeting;
 - (b) Members present;
 - (c) Members absent;
 - (d) Summary of deliberations and discussions;
 - (e) Recommended actions and the numerical results of all ballots; and
 - (f) Document any reviews required in subdivision c of subsection 1 and subdivision b of this subsection.
 - (5) The committee shall provide each member with a copy of the meeting minutes, and retain one copy until the department authorizes its disposition.
 - b. To oversee the use of licensed material, the committee shall:

- (1) Be responsible for monitoring the institutional program to maintain occupational doses as low as reasonably achievable;
- (2) Review, on the basis of safety and with regard to the training and experience standards of this part, and approve or disapprove any individual who is to be listed as an authorized user, the radiation safety officer, or teletherapy physicist before submitting a license application or request for amendment or renewal;
- (3) Review on the basis of safety and approve or disapprove each proposed method of use of radioactive material;
- (4) Review on the basis of safety, and approve with the advice and consent of the radiation safety officer and the management representative, or disapprove procedures and radiation safety program changes prior to submittal to the department for licensing action;
- (5) Review quarterly, with the assistance of the radiation safety officer, occupational radiation exposure records of all personnel working with radioactive material;
- (6) Review quarterly, with the assistance of the radiation safety officer, all incidents involving radioactive material with respect to cause and subsequent actions taken;
- (7) Review annually, with the assistance of the radiation safety officer, the radioactive material program; and
- (8) Establish a table of investigational levels for occupational dose that, when exceeded, will initiate investigations and considerations of action by the radiation safety officer.

4. Statement of authorities and responsibilities.

- a. A licensee shall provide sufficient authority and organizational freedom to the radiation safety officer and the radiation safety committee to:
 - (1) Identify radiation safety problems;
 - (2) Initiate, recommend, or provide solutions; and
 - (3) Verify implementation of corrective actions.

- b. A licensee shall establish, in writing, the authorities, duties, responsibilities, and radiation safety activities of the radiation safety officer and the radiation safety committee.

5. Supervision.

- a. A licensee who permits the receipt, possession, use, or transfer of radioactive material by an individual under the supervision of an authorized user as allowed by section 33-10-07-03.1 shall:

- (1) Instruct the supervised individual in the principles of radiation safety appropriate to that individual's use of radioactive material and in the licensee's written quality management program;
- (2) Review the supervised individual's use of radioactive material, provide reinstruction as needed and review records kept to reflect this use;
- (3) Require the authorized user to be immediately available to communicate with the supervised individual;
- (4) Require the authorized user to be able to be physically present and available to the supervised individual on one hour's notice (the supervising authorized user need not be present for each use of radioactive material); and
- (5) Require that only those individuals specifically trained, and designated by the authorized user, shall be permitted to administer radionuclides or radiation to patients.

- b. A licensee shall require the supervised individual receiving, possessing, using, or transferring radioactive material under section 33-10-07-03.1 to:

- (1) Follow the instructions of the supervising authorized user;
- (2) Follow the written radiation safety and quality management procedures established by the ~~radiation safety officer~~ licensee; and
- (3) Comply with this article and the license conditions with respect to the use of radioactive material.

6. Visiting authorized user.

- a. A licensee may permit any visiting authorized user to use licensed material for medical use under the terms of the licensee's license for sixty days each year if:
 - (1) The visiting authorized user has the prior written permission of the licensee's management and, if the use occurs on behalf of an institution, the institution's radiation safety committee;
 - (2) The licensee has a copy of an agreement state, licensing state, or United States nuclear regulatory commission license that identifies the visiting authorized user by name as an authorized user for medical use; and
 - (3) Only those procedures for which the visiting authorized user is specifically authorized by an agreement state, licensing state, or United States nuclear regulatory commission license are performed by that individual.
- b. A licensee need not apply for a license amendment in order to permit a visiting authorized user to use licensed material as described in subdivision a.
- c. A licensee shall retain copies of the records specified in subdivision a for five years from the date of the last visit.

7. Mobile nuclear medicine service administrative requirements.

- a. The department will only license mobile nuclear medicine services in accordance with this chapter and other applicable requirements of this article to serve clients who do not have a department license.
- b. Mobile nuclear medicine service licensees shall retain for the duration of service a letter signed by the management of each location where services are rendered that authorizes use of radioactive material.
- c. A mobile nuclear medicine service may not have radioactive material delivered directly from the manufacturer or the distributor to the client's address of use.

~~8. Records and reports of misadministrations.~~

- ~~a. When a misadministration involves any therapy procedure, the licensee shall notify the department. The licensee shall also notify the referring physician of the affected patient and the patient or a responsible relative or guardian, unless the referring physician agrees to inform the patient or believes, based on medical judgment, that~~

telling the patient or the patient's responsible relative or guardian would be harmful to one or the other, respectively. These notifications must be made within twenty-four hours after the licensee discovers the misadministration. If the referring physician, patient, or the patient's responsible relative or guardian cannot be reached within twenty-four hours, the licensee shall notify them as soon as practicable. The licensee is not required to notify the patient or the patient's responsible relative or guardian without first consulting the referring physician; however, the licensee may not delay medical care for the patient because of this.

b. Within fifteen days after an initial therapy misadministration report to the department, the licensee shall report, in writing, to the department and to the referring physician, and furnish a copy of the report to the patient or the patient's responsible relative or guardian if either was previously notified by the licensee as required by subdivision a. The written report must include the licensee's name; the referring physician's name; a brief description of the event; the effect on the patient; the action taken to prevent recurrence; whether the licensee informed the patient or the patient's responsible relative or guardian; and if not, why not. The report may not include the patient's name or other information that could lead to identification of the patient.

c. When a misadministration involves a diagnostic procedure, the radiation safety officer shall promptly investigate its cause, make a record for department review, and retain the record as directed in subdivision d. The licensee shall also notify the referring physician and the department in writing on NRC form 473 "Diagnostic Misadministration Report" within fifteen days if the misadministration involved the use of radioactive material not intended for medical use; administration of dosage five-fold different from the intended dosage; or administration of radioactive material such that the patient is likely to receive an organ dose greater than two rems (0.02 sieverts) or a whole body dose greater than five hundred millirems (5 millisieverts). Licensees may use dosimetry tables in package inserts, corrected only for amount of radioactivity administered, to determine whether a report is required.

d. Each licensee shall retain a record of each misadministration for ten years. The record must contain the names of all individuals involved in the event, including the physician, allied health personnel, the patient, and the patient's referring physician, the patient's social security number or identification number

if one has been assigned, a brief description of the event, the effect on the patient, and the action taken, if any, to prevent recurrence.

- e. Aside from the notification requirement, nothing in subdivisions a through d shall affect any rights or duties or licensees, and physicians in relation to each other, patients, or responsible relative or guardians.

8. Quality management program.

- a. Each applicant or licensee under this part, as applicable, shall establish and maintain a written quality management program to provide high confidence that radioactive material or radiation from radioactive material will be administered as directed by the authorized user. The quality management program must include written policies and procedures to meet the following specific objectives:

(1) That, prior to administration, a written directive is prepared for:

(a) Any teletherapy radiation dose;

(b) Any gamma stereotactic radiosurgery radiation dose;

(c) Any brachytherapy radiation dose;

(d) Any administration of quantities greater than thirty microcuries [1110 kilobecquerels] of either sodium iodide I-125 or I-131; or

(e) Any therapeutic administration of a radiopharmaceutical, other than sodium iodide I-125 or I-131.

(If, because of the patient's condition, a delay in order to provide a written revision to an existing written directive would jeopardize the patient's health, an oral revision to an existing written directive will be acceptable, provided that the oral revision is documented immediately in the patient's record and a revised written directive is signed by the authorized user within forty-eight hours of the oral revision.

Also, a written revision to an existing written directive may be made for any diagnostic or therapeutic procedure provided that the revision is dated and signed by an authorized user prior to the administration of the radiopharmaceutical dosage, the brachytherapy dose, the gamma stereotactic

radiosurgery dose, the teletherapy dose, or the next teletherapy fractional dose.

If, because of the emergent nature of the patient's condition, a delay in order to provide a written directive would jeopardize the patient's health, an oral directive will be acceptable, provided that the information contained in the oral directive is documented immediately in the patient's record and a written directive is prepared within twenty-four hours of the oral directive.)

- (2) That, prior to each administration, the patient's identity is verified by more than one method as the individual named in the written directive;
- (3) That final plans of treatment and related calculations for brachytherapy, teletherapy, and gamma stereotactic radiosurgery are in accordance with the respective written directives;
- (4) That each administration is in accordance with the written directive; and
- (5) That any unintended deviation from the written directive is identified and evaluated, and appropriate action is taken.

b. The licensee shall:

- (1) Develop procedures for and conduct a review of the quality management program including, since the last review, and evaluation of:
 - (a) A representative sample of patient administrations;
 - (b) All recordable events; and
 - (c) All misadministrations;to verify compliance with all aspects of the quality management program (these reviews must be conducted at intervals no greater than twelve months);
- (2) Evaluate each of these reviews to determine the effectiveness of the quality management program and, if required, make modifications to meet the objectives of subdivision a of this section; and
- (3) Retain records of each review, including the evaluations and findings of the review, in an auditable form for three years.

c. The licensee shall evaluate and respond, within thirty days after discovery of the recordable event, to each recordable event by:

- (1) Assembling the relevant facts including the cause;
- (2) Identifying what, if any, corrective action is required to prevent recurrence; and
- (3) Retaining a record, in an auditable form, for three years, of the relevant facts and what corrective action, if any, was taken.

d. The licensee shall retain:

- (1) Each written directive; and
- (2) A record of each administered radiation dose or radiopharmaceutical dosage where a written directive is required in paragraph 1 of subdivision a, in an auditable form, for three years after the date of administration.

e. The licensee may make modifications to the quality management program to increase the program's efficiency provided the program's effectiveness is not decreased. The licensee shall furnish the modification to the department within thirty days after the modification has been made.

f. (1) Each applicant for a new license, as applicable, shall submit to the department a quality management program as part of the application for a license and implement the program upon issuance of the license by the department.

(2) Each existing licensee, as applicable, shall submit to the department by January 1, 1995, a written certification that the quality management program has been implemented along with a copy of the program.

9. Notifications, reports, and records of misadministrations.

a. For a misadministration:

(1) The licensee shall notify the department by telephone no later than the next working day after discovery of the misadministration.

(2) The licensee shall submit a written report to the department within fifteen days after discovery of the misadministration. The written report must include the licensee's name; the prescribing physician's

name; a brief description of the event; why the event occurred; the effect on the patient; what improvements are needed to prevent recurrence; actions taken to prevent recurrence; whether the licensee notified the patient, or the patient's responsible relative or guardian (this person will be subsequently referred to as "the patient" in this subsection), and if not, why not, and if the patient was notified, what information was provided to the patient. The report must not include the patient's name or other information that could lead to identification of the patient.

(3) The licensee shall notify the referring physician and also notify the patient of the misadministration no later than twenty-four hours after its discovery, unless the referring physician personally informs the licensee either that the referring physician will inform the patient or that, based on medical judgment, telling the patient would be harmful. The licensee is not required to notify the patient without first consulting the referring physician. If the referring physician or patient cannot be reached within twenty-four hours, the licensee shall notify the patient as soon as possible thereafter. The licensee may not delay any appropriate medical care for the patient, including any necessary remedial care as a result of the misadministration, because of any delay in notification.

(4) If the patient was notified, the licensee shall also furnish, within fifteen days after discovery of the misadministration, a written report to the patient by sending either:

(a) A copy of the report that was submitted to the department; or

(b) A brief description of both the event and the consequences as they may affect the patient, provided a statement is included that the report submitted to the department can be obtained from the licensee.

b. Each licensee shall retain a record of each misadministration for five years. The record must contain the names of all individuals involved (including the prescribing physician, allied health personnel, the patient, and the patient's referring physician), the patient's social security number or identification number if one has been assigned, a brief description of the misadministration, why it occurred, the effect on the

patient, what improvements are needed to prevent recurrence, and the actions taken to prevent recurrence.

c. Aside from the notification requirement, nothing in this section affects any rights or duties of licensees and physicians in relation to each other, patients, or the patient's responsible relatives or guardians.

9- 10. Suppliers. A licensee shall use for medical use only:

- a. Radioactive material manufactured, labeled, packaged, and distributed in accordance with a license issued pursuant to these rules or the equivalent rules of another agreement state, a licensing state, or the United States nuclear regulatory commission; and
- b. Reagent kits that have been manufactured, labeled, packaged, and distributed in accordance with an approval issued by the United States food and drug administration.
- c. Teletherapy sources manufactured and distributed in accordance with a license issued pursuant to this article, or the equivalent rules of another agreement state, a licensing state, or the United States nuclear regulatory commission.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-05. Specific requirements.

1. Quality control of imaging equipment. Each licensee shall establish written quality control procedures for all equipment used to obtain images from radionuclide studies. As a minimum, the procedures must include quality control procedures recommended by equipment manufacturers or procedures which have been approved by the department. The licensee shall conduct quality control procedures in accordance with written procedures.
2. Possession, use, calibration, and check of dose calibrators.
 - a. A medical use licensee authorized to administer radiopharmaceuticals shall possess a dose calibrator and use it to measure the amount of activity administered to each patient.
 - b. A licensee shall:
 - (1) Check each dose calibrator for constancy with a dedicated check source at the beginning of each day

of use. To satisfy the requirement of this section, the check shall be done on a frequently used setting with a sealed source of not less than ten microcuries [370 kilobecquerels] of radium-226 or fifty microcuries [1.85 megabecquerels] of any other photon-emitting radionuclide with a half-life greater than ninety days;

- (2) Test each dose calibrator for accuracy upon installation and at intervals not to exceed twelve months thereafter by assaying at least two sealed sources containing different radionuclides, the activity of which the manufacturer has determined within five percent of the stated activity, with minimum activity of ten microcuries [370 kilobecquerels] for radium 226 and fifty microcuries [1.85 megabecquerels] for any other photon-emitting radionuclide, and at least one of which has a principal photon energy between one hundred thousand electron volts and five hundred thousand electron volts;
 - (3) Test each dose calibrator for linearity upon installation and at intervals not to exceed three months thereafter over the range of use between ten microcuries [370 kilobecquerels] and the highest dosage that will be administered; and
 - (4) Test each dose calibrator for geometry dependence upon installation over the range of volumes and volume configurations for which it will be used. The licensee shall keep a record of this test for the duration of the use of the dose calibrator.
- c. A licensee shall mathematically correct dosage readings for any geometry or linearity error that exceeds ten percent if the dosage is greater than ten microcuries [370 kilobecquerels] and shall repair or replace the dose calibrator if the accuracy or constancy error exceeds ten percent.
 - d. A licensee shall also perform checks and tests required by subdivision b following adjustment or repair of the dose calibrator.
 - e. A licensee shall retain a record of each check and test required by this section for two years. The records required by subdivision b must include:
 - (1) For paragraph 1 of subdivision b, the model and serial number of the dose calibrator, the identity and calibrated activity of the radionuclide contained in the check source, the date of the check, the

activity measured, the instrument settings, and the initials of the individual who performed the check;

- (2) For paragraph 2 of subdivision b, the model and serial number of the dose calibrator, the model and serial number of each source used and the identity of the radionuclide contained in the source and its activity, the date of the test, the results of the test, the instrument settings, and the signature of the radiation safety officer;
- (3) For paragraph 3 of subdivision b, the model and serial number of the dose calibrator, the calculated activities, the measured activities, the date of the test, and the signature of the radiation safety officer; and
- (4) For paragraph 4 of subdivision b, the model and serial number of the dose calibrator, the configuration and calibrated activity of the source measured, the activity of the source, the activity measured and the instrument setting for each volume measured, the date of the test, and the signature of the radiation safety officer.

3. Calibration and check of survey instruments.

- a. A licensee shall ensure that the survey instruments used to show compliance with this section have been calibrated before first use, annually, and following repair.
- b. To satisfy the requirements of subdivision a the licensee shall:
 - (1) Calibrate all required scale readings up to one thousand millirems [10 millisieverts] per hour with a radiation source;
 - (2) For each scale that must be calibrated, calibrate two readings separated by at least fifty percent of scale rating; and
 - (3) Conspicuously note on the instrument the apparent dose rate from a dedicated check source as determined at the time of calibration, and the date of calibration.
- c. To satisfy the requirements of subdivision b, the licensee shall consider a point as calibrated if the indicated exposure rate differs from the calculated exposure rate by not more than twenty percent, and shall conspicuously attach a correction chart or graph to the instrument.

- d. A licensee shall check each survey instrument for proper operation with the dedicated check source before each use. The licensee is not required to keep records of these checks.
 - e. The licensee shall retain a record of each calibration required in subdivision a for two years. The record must include:
 - (1) A description of the calibration procedure; and
 - (2) A description of the source used and the certified dose rates from the source, and the rates indicated by the instrument being calibrated, the correction factors deduced from the calibration data, the signature of the individual who performed the calibration, and the date of calibration.
 - f. To meet the requirements of subdivisions a, b, and c the licensee may obtain the services of individuals licensed by the department, the United States nuclear regulatory commission, and agreement state, or a licensing state to perform calibrations of survey instruments. Records of calibrations which contain information required by subdivision e must be maintained by the licensee.
4. Assay of radiopharmaceutical dosages. A licensee shall:
- a. Assay, within thirty minutes before medical use, the activity of each radiopharmaceutical dosage that contains more than ten microcuries [370 kilobecquerels] of a photon-emitting radionuclides;
 - b. Assay, before medical use, the activity of each radiopharmaceutical dosage with a desired activity of ten microcuries [370 kilobecquerels] or less of a photon-emitting radionuclide to verify that the dosage does not exceed ten microcuries [370 kilobecquerels]; and
 - c. Retain a record of the assays required by subdivisions a and b for two years. To satisfy this requirement, the record must contain the:
 - (1) Generic name, trade name, or abbreviation of the radiopharmaceutical, its lot number, and expiration dates and the radionuclide;
 - (2) Patient's name, and identification number if one has been assigned;
 - (3) Prescribed dosage and activity of the dosage at the time of assay, or a notation that the total activity is less than ten microcuries [370 kilobecquerels];

- (4) Date and time of the assay and administration; and
 - (5) Initials of the individual who performed the assay.
5. Authorization for calibration and reference sources. Any person authorized by subsection 1 of section 33-10-07-03.1 for medical use of radioactive material may receive, possess, and use the following radioactive material for check, calibration, and reference use:
- a. Sealed sources manufactured and distributed by persons specifically licensed pursuant to chapter ~~33-10-03.1~~ 33-10-03 or equivalent provisions of the United States nuclear regulatory commission, agreement state, or licensing state and that do not exceed fifteen millicuries [555 megabecquerels] each;
 - b. Any radioactive material listed in sections 33-10-07-06 and 33-10-07-07 with a half-life of one hundred days or less in individual amounts not to exceed fifteen millicuries [555 megabecquerels];
 - c. Any radioactive material listed in sections 33-10-07-06 and 33-10-07-07 with a half-life greater than one hundred days in individual amounts not to exceed two hundred microcuries [7.4 megabecquerels] each; and
 - d. Technetium-99m in individual amounts not to exceed fifty millicuries [1.85 gigabecquerels].
6. Requirements for possession of sealed sources and brachytherapy sources.
- a. A licensee in possession of any sealed source or brachytherapy source shall follow the radiation safety and handling instructions supplied by the manufacturer or equivalent instructions approved by the department and shall maintain the instructions for the duration of source use in a legible form convenient to users.
 - b. A licensee in possession of a sealed source shall assure that:
 - (1) The source is tested for leakage before its first use unless the licensee has a certificate from the supplier indicating that the source was tested within six months before transfer to the licensee; and
 - (2) The source is tested for leakage at intervals not to exceed six months or at intervals approved by the department, another agreement state, a licensing state, or the United States nuclear regulatory commission.

- c. To satisfy the leak test requirements of subdivision b, the licensee shall assure that:
 - (1) Leak tests are capable of detecting the presence of five thousandths microcurie [185 becquerels] of radioactive material on the test sample, or in the case of radium, the escape of radon at the rate of one thousandth microcurie [37 becquerels] per twenty-four hours;
 - (2) Test samples are taken from the source or from the surfaces of the device in which the source is mounted or stored on which radioactive contamination might be expected to accumulate; and
 - (3) Test samples are taken when the source is in the "off" position.
- d. A licensee shall retain leak test records for five years. The records must contain the model number, and serial number, if assigned, of each source tested, the identity of each source radionuclide and its estimated activity, the measured activity of each test sample expressed in microcuries [becquerels], a description of the method used to measure each test sample, the date of the test, and the signature of the radiation safety officer.
- e. If the leak test reveals the presence of five thousandths microcurie [185 becquerels] or more of removable contamination, the licensee shall:
 - (1) Immediately withdraw the sealed source from use and store it in accordance with the requirements of these regulations; and
 - (2) File a report with the department within five days of receiving the leak test results describing the equipment involved, the test results, and the action taken.
- f. A licensee need not perform a leak test on the following sources:
 - (1) Sources containing only radioactive material with a half-life of less than thirty days;
 - (2) Sources containing only radioactive material as a gas;
 - (3) Sources containing one hundred microcuries [3.7 megabecquerels] or less of beta or photon-emitting material or ten microcuries [370 kilobecquerels] or less of alpha-emitting material;

- (4) Seeds of iridium-192 encased in nylon ribbon; and
 - (5) Sources stored and not being used. The licensee shall, however, test each such source for leakage before any use or transfer unless it has been tested for leakage within six months before the date of use or transfer.
- g. A licensee in possession of a sealed source or brachytherapy source shall conduct a physical inventory of all such sources at intervals not to exceed three months. The licensee shall retain each inventory record for five years. The inventory records must contain the model number of each source, and serial number if one has been assigned, the identity of each source radionuclide and its estimated activity, the location of each source, date of the inventory, and the signature of the radiation safety officer.
 - h. A licensee in possession of a sealed source or brachytherapy source shall survey with a radiation survey instrument at intervals not to exceed three months all areas where such sources are stored. This does not apply to teletherapy sources in teletherapy units or sealed sources in diagnostic devices.
 - i. A licensee shall retain a record of each survey required in subdivision h for two years. The record must include the date of the survey, a sketch of each area that was surveyed, the measured dose rate at several points in each area expressed in millirems [microsieverts] per hour, the model number and serial number of the survey instrument used to make the survey, and the signature of the radiation safety officer.
7. Syringe shields.
- a. A licensee shall keep syringes that contain radioactive material to be administered in a radiation shield.
 - b. A licensee shall require each individual who prepares or administers radiopharmaceuticals to use a syringe radiation shield unless the use of the shield is contraindicated for that patient.
8. Syringe labels. Unless utilized immediately, a licensee shall conspicuously label each syringe, or syringe radiation shield that contains a syringe with a radiopharmaceutical, with the radiopharmaceutical name or its abbreviation, the type of diagnostic study or therapy procedure to be performed, or the patient's name.

9. Vial shields. A licensee shall require each individual preparing or handling a vial that contains a radiopharmaceutical to keep the vial in a vial radiation shield.
10. Vial shield labels. A licensee shall conspicuously label each vial radiation shield that contains a vial of a radiopharmaceutical with the radiopharmaceutical name or its abbreviation.
11. Surveys for contamination and ambient radiation dose rate.
 - a. A licensee shall survey with a radiation detection survey instrument at the end of each day of use all areas where radiopharmaceuticals are routinely prepared for use or administered.
 - b. A licensee shall survey with a radiation detection survey instrument at least once each week all areas where radiopharmaceuticals or radioactive wastes are stored.
 - c. A licensee shall conduct the surveys required by subdivisions a and b so as to be able to measure dose rates as low as one-tenth millirem [1 microsievert] per hour.
 - d. A licensee shall establish dose rate action levels for the surveys required by subdivisions a and b and shall require that the individual performing the survey immediately notify the radiation safety officer if a dose rate exceeds an action level.
 - e. A licensee shall survey for removable contamination each day of use all areas where radiopharmaceuticals are routinely prepared for use or administered and each week where radioactive materials are stored.
 - f. A licensee shall conduct the surveys required by subdivision e so as to be able to detect contamination on each wipe sample of two thousand disintegrations per minute [33.3 becquerels].
 - g. A licensee shall establish removable contamination action levels for the surveys required by subdivision e and shall require that the individual performing the survey immediately notify the radiation safety officer if contamination exceeds action levels.
 - h. A licensee shall retain a record of each survey required by subdivisions a, b, and e for two years. The record must include the date of the survey, a sketch of each area surveyed, action levels established for each area, the measured dose rate at several points in each area

expressed in millirems [microsieverts] per hour or the removable contamination in each area expressed in disintegrations per minute [becquerels] per one hundred square centimeters, the serial number and the model number of the instrument used to make the survey or analyze the samples, and the initials of the individual who performed the survey.

12. Release of patients containing radiopharmaceuticals or permanent implants.
 - a. A licensee may not authorize release from confinement for medical care any patient administered a radiopharmaceutical until either:
 - (1) The dose rate from the patient is less than five millirems [50 microsieverts] per hour at a distance of one meter; or
 - (2) The activity in the patient is less than thirty millicuries [1.11 gigabecquerels].
 - b. A licensee shall not authorize release from confinement for medical care any patient administered a permanent implant until the dose rate from the patient is less than five millirems [50 microsieverts] per hour at a distance of one meter.
13. Mobile nuclear medicine service technical requirements. A licensee providing mobile nuclear medicine service shall:
 - a. Transport to each address of use only syringes or vials containing prepared radiopharmaceuticals or radiopharmaceuticals that are intended for reconstitution of radiopharmaceutical kits;
 - b. Bring into each location of use all radioactive material to be used and, before leaving, remove all unused radioactive material and associated radioactive waste;
 - c. Secure or keep under constant surveillance and immediate control all radioactive material when in transit or at a location of use;
 - d. Check survey instruments and dose calibrators as required in paragraph 1 of subdivision b of subsection 2, subdivisions d and e of subsection 2, subdivision d of subsection 3, and check all other transported equipment for proper function before medical use at each location of use;
 - e. Carry a calibrated survey meter in each vehicle that is being used to transport radioactive material, and, before

leaving a client location of use, survey all areas of radiopharmaceutical use with a radiation detection survey instrument to ensure that all radiopharmaceuticals and all associated radioactive waste have been removed.

- f. Retain a record of each survey required by subdivision e for two years. The record must include the date of the survey, a plan of each area that was surveyed, the measured dose rate at several points in each area of use expressed in millirems [microsieverts] per hour, the model and serial number of the instrument used to make the survey, and the initials of the individual who performed the survey.

14. Storage of volatiles and gases.

- a. A licensee shall store volatile radiopharmaceuticals and radioactive gases in the shippers' radiation shield and container.
- b. A licensee shall store and use a multidose container in a properly functioning fume hood.

15. Decay-in-storage.

- a. A licensee ~~shall~~ may hold radioactive material for decay-in-storage before disposal in ordinary trash ~~and is exempt from the requirements of section 33-10-04-04~~ if the licensee:
 - (1) Holds radioactive material for decay a minimum of ten half-lives;
 - (2) Monitors radioactive material at the container surface before disposal as ordinary trash and determines that its radioactivity cannot be distinguished from the background radiation level with a radiation detection survey instrument set on its most sensitive scale and with no interposed shielding;
 - (3) Removes or obliterates all radiation labels; and
 - (4) Separates and monitors each generator column individually with all radiation shielding removed to ensure that its contents have decayed to background radiation level before disposal.
- b. For radioactive material disposed in accordance with subdivision a, the licensee shall retain a record of each disposal for two years. The record must include the date of the disposal, the date on which the radioactive material was placed in storage, the radionuclides

disposed, the model and serial number of the survey instrument used, the background dose rate, the radiation dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-07. Specific requirements for the use of radiopharmaceuticals, generators, and reagent kits for imaging and localization studies.

1. Use of radiopharmaceuticals, generators, and reagent kits for imaging and localization studies.

a. A licensee may use the following radiopharmaceuticals, generators, and reagent kits for imaging and localization studies:

(1) Molybdenum-99/technetium-99m generators for the elution or extraction of technetium-99m as pertechnetate.

(2) Technetium-99m as pertechnetate.

(3) Prepared radiopharmaceuticals and reagent kits for the preparation of the following technetium-99m labeled radiopharmaceuticals:

(a) Sulfur colloid;

(b) Pentetate sodium;

(c) Human serum albumin microspheres;

(d) Polyphosphate;

(e) Macroaggregated human serum albumin;

(f) Etidronate sodium;

(g) Stannous pyrophosphate;

(h) Human serum albumin;

(i) Medronate sodium;

(j) Gluceptate sodium;

(k) Oxidronate sodium;

- (l) Disofenin; and
 - (m) Succimer.
- (4) Iodine-131 as sodium iodide, iodinated human serum albumin, macroaggregated iodinated human serum albumin, colloidal (macroaggregated) iodinated human serum albumin, rose bengal, or sodium iodohippurate.
 - (5) Iodine-125 as sodium iodide or fibrinogen.
 - (6) Chromium-51 as human serum albumin.
 - (7) Gold-198 in colloidal form.
 - (8) Mercury-197 as chlormerodrin.
 - (9) Selenium-75 as selenomethionine.
 - (10) Strontium-85 as nitrate.
 - (11) Ytterbium-169 as pentetate sodium.
 - (12) Gallium-67 as citrate.
 - (13) Indium-111 as chloride or DTPA.
 - (14) Tin-113/indium-113m generators for the elution of indium-113m as chloride.
 - (15) Yttrium-87/strontium-87m generators for the elution of strontium-87m.
 - (16) Thallium-201 as chloride.
 - (17) Iodine-123 as sodium iodide or iodohippurate.
 - (18) Any radioactive material in a diagnostic radiopharmaceutical, except aerosol or gaseous form, or any generator or reagent kit for preparation and diagnostic use of a radiopharmaceutical containing radioactive material for which the food and drug administration has accepted a "notice of claimed investigational exemption for a new drug" (IND), approved a "product licensing agreement" (PLA), or approved a "new drug application" (NDA).
- b. A licensee using radiopharmaceuticals specified in subdivision a for clinical procedures shall comply with the product label or package insert regarding physical form, route of administration, and dosage range.

- c. A licensee shall elute generators in compliance with subsection 2 and prepare radiopharmaceuticals from kits in accordance with the manufacturer's instructions.
 - d. Technetium-99m pentetate as an aerosol for lung function studies is not subject to the restrictions in subdivision b.
 - e. Provided the conditions of subsection 3 are met, a licensee shall use radioactive aerosols or gases only if specific application is made to and approved by the department.
2. Permissible molybdenum-99 concentration.
- a. A licensee may not administer a radiopharmaceutical containing more than fifteen hundredths microcurie of molybdenum-99 per millicurie of technetium-99m [0.15 kilobecquerel of molybdenum-99 per megabecquerel of technetium-99m].
 - b. A licensee preparing technetium-99m radiopharmaceuticals from molybdenum-99/technetium-99m generators shall measure the molybdenum-99 concentration in each eluate or extract.
 - c. A licensee who must measure molybdenum concentration shall retain a record of each measurement for two years. The record must include, for each elution or extraction of technetium-99m, the measured activity of the technetium expressed in millicuries [megabecquerels], the measured activity of molybdenum expressed in microcuries [kilobecquerels], the ratio of the measures expressed as microcuries of molybdenum per millicurie of technetium [kilobecquerels of molybdenum per megabecquerel of technetium], the date of the test, and the initials of the individual who performed the test.
 - d. A licensee shall report immediately to the department each occurrence of molybdenum-99 concentration exceeding the limits specified in subdivision a.
3. Control of aerosols and gases.
- a. A licensee who administers radioactive aerosols or gases shall do so with a system that will keep airborne concentrations within the limits prescribed by subsections 3 and 6 of section 33-10-04-02 sections 33-10-04.1-06 and 33-10-04.1-07.
 - b. The system must either be directly vented to the atmosphere through an air exhaust or provide for collection and decay or disposal of the aerosol or gas in a shielded container.

- c. A licensee shall only administer radioactive gases in rooms that are at negative pressure compared to surrounding rooms.
 - d. Before receiving, using, or storing a radioactive gas, the licensee shall calculate the amount of time needed after a release to reduce the concentration in the area of use to the occupational limit listed in appendix ~~A~~ B of chapter ~~33-10-04~~ 33-10-04.1. The calculation must be based on the highest activity of gas handled in a single container and the measured available air exhaust rate.
 - e. A licensee shall post the time calculated in subdivision d at the area of use and require that, in case of a gas spill, individuals evacuate the room until the posted time has elapsed.
 - f. A licensee shall check the operation of collection systems monthly and measure the ventilation rates in areas of use at intervals not to exceed six months. Records of these checks and measurements must be maintained for two years.
 - g. A copy of the calculations required in subdivision d must be recorded and retained for the duration of the license.
4. Possession of survey instruments. A licensee authorized to use radioactive material for imaging and localization studies shall possess a portable radiation detection survey instrument capable of detecting dose rates over the range of one-tenth millirem [1 microsievert] per hour to fifty millirems [500 microsieverts] per hour, and a portable radiation measurement survey instrument capable of measuring dose rates over the range one millirem [10 microsieverts] per hour to one thousand millirems [10 millisieverts] per hour. The instruments must be operable and calibrated in accordance with subsection 3 of section 33-10-07-05.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-08. Specific requirements for the use of radiopharmaceuticals for therapy.

- 1. Use of radiopharmaceuticals for therapy. A licensee may use the following prepared radiopharmaceuticals:
 - a. Iodine-131 as iodide for treatment of hyperthyroidism, cardiac dysfunction, and thyroid carcinoma.
 - b. Phosphorus-32 as soluble phosphate for treatment of polycythemia vera, leukemia, and bone metastases.

- c. Phosphorus-32 as colloidal chromic phosphate for intracavitary treatment of malignant effusions.
- d. Gold-198 as colloid for intracavitary treatment of malignant effusions.
- e. Any radioactive material in a radiopharmaceutical and for a therapeutic use for which the food and drug administration has accepted a "notice of claimed investigational exemption for a new drug" (IND), or approved a "new drug application" (NDA). The licensee shall comply with the package insert instructions regarding indications and method of administration.

2. Safety instruction.

- a. A licensee shall provide oral and written radiation safety instruction for all personnel caring for patients undergoing radiopharmaceutical therapy. Refresher training must be provided at intervals not to exceed one year.
- b. To satisfy subdivision a, the instruction must describe the licensee's procedures for:
 - (1) Patient control;
 - (2) Visitor control;
 - (3) Contamination control;
 - (4) Waste control;
 - (5) Notification of the radiation safety officer or authorized user in case of the patient's death or medical emergency; and
 - (6) Chapter 33-10-10 training requirements.
- c. A licensee shall keep a record of individuals receiving instruction required by subdivision a, a description of the instruction, the date of instruction, and the name of the individual who gave the instruction. Such record must be maintained for inspection by the department for two years.

3. Safety precautions.

- a. For each patient receiving radiopharmaceutical therapy and hospitalized for compliance with subsection 12 of section 33-10-07-05, a licensee shall:

- (1) Provide a private room with a private sanitary facility;
- (2) Post the patient's door with a "Caution: Radioactive Material" sign and note on the door or on the patient's chart where and how long visitors may stay in the patient's room;
- (3) Authorize visits by individuals under eighteen years of age only on a case-by-case basis with the approval of the authorized user after consultation with the radiation safety officer;
- (4) Promptly after administration of the dosage, measure the dose rates in contiguous restricted and unrestricted areas with a radiation measurement survey instrument to demonstrate compliance with the requirements of ~~subsection 5 of section 33-10-04-02~~ chapter 33-10-04.1 and retain for two years a record of each survey that includes the time and date of the survey, a plan of the area or list of points surveyed, the measured dose rate at several points expressed in millirems per hour, the instrument used to make the survey, and the initials of the individual who made the survey;
- (5) Either monitor material and items removed from the patient's room to determine that any contamination cannot be distinguished from the natural background radiation level with a radiation detection survey instrument set on its most sensitive scale and with no interposed shielding, or handle these materials and items as radioactive waste;
- (6) Provide the patient with radiation safety guidance that will help to keep radiation ~~does~~ dose to household members and the public as low as reasonably achievable before authorizing release of the patient;
- (7) Survey the patient's room and private sanitary facility for removable contamination with a radiation detection survey instrument before assigning another patient to the room. The room must not be reassigned until removable contamination is less than two hundred disintegrations per minute [3.33 becquerels] per one hundred square centimeters; and
- (8) Measure the thyroid burden of each individual who helped prepare or administer a dosage of iodine-131 within three days after administering the dosage, and retain for the period required by subdivision ~~e a~~ of ~~subsection 7 of section 33-10-04-05~~ subsection 7 of section 33-10-04.1-15 a record of each thyroid burden measurement, date of

measurement, the name of the individual whose thyroid burden was measured, and the initials of the individual who made the measurements.

- b. A licensee shall notify the radiation safety officer or the authorized user immediately if the patient dies or has a medical emergency.
4. Possession of survey instruments. A licensee authorized to use radioactive material for radiopharmaceutical therapy shall possess a portable radiation detection survey instrument capable of detecting dose rates over the range one-tenth millirem [1 microsievert] per hour to fifty millirems [500 microsieverts] per hour, and a portable radiation measurement survey instrument capable of measuring dose rates over the range one millirem [10 microsieverts] per hour to one thousand millirems [10 millisieverts] per hour. The instrument must be operable and calibrated in accordance with subsection 3 of section 33-10-07-05.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-10. Specific requirements for the use of sources for brachytherapy.

1. Use of sources for brachytherapy. A licensee shall use the following sources in accordance with the manufacturer's radiation safety and handling instructions:
 - a. Cesium-137 as a sealed source in needles and applicator cells for topical, interstitial, and intracavitary treatment of cancer;
 - b. Cobalt-60 as a sealed source in needles and applicator cells for topical, interstitial, and intracavitary treatment of cancer;
 - c. Gold-198 as a sealed source in seeds for interstitial treatment of cancer;
 - d. Iodine-125 as a sealed source in seeds for interstitial treatment of cancer;
 - e. Iridium-192 as seeds encased in nylon ribbon for interstitial treatment of cancer;
 - f. Radium-226 as a sealed source in needles or applicator cells for topical, interstitial, and intracavitary treatment of cancer;

- g. Radon-222 as seeds for interstitial treatment of cancer;
- h. Strontium-90 as a sealed source in an applicator for treatment of superficial eye conditions; and
- i. Palladium-103 as a sealed source in seeds for the interstitial treatment of cancer.

2. Safety instruction.

- a. The licensee shall provide oral and written radiation safety instruction to all personnel caring for a patient receiving implant therapy. Refresher training must be provided at intervals not to exceed one year.
- b. To satisfy subdivision a, the instruction must describe:
 - (1) Size and appearance of the brachytherapy sources;
 - (2) Safe handling and shielding instructions in case of a dislodged source;
 - (3) Procedures for patient control;
 - (4) Procedures for visitor control;
 - (5) Procedures for notification of the radiation safety officer or authorized user if the patient dies or has a medical emergency; and
 - (6) Chapter 33-10-10 training requirements.
- c. A licensee shall maintain a record of individuals receiving instruction required by subdivision a, a description of the instruction, the date of instruction, and the name of the individual who gave the instruction for two years.

3. Safety precautions.

- a. For each patient receiving implant therapy a licensee shall:
 - (1) Not place the patient in the same room with a patient who is not receiving radiation therapy unless the licensee can demonstrate compliance with the requirement of ~~subsection 5 of section 33-10-04-02~~ subdivision a of subsection 1 of section 33-10-04.1-07 at a distance of one meter from the implant;
 - (2) Post the patient's door with a "Caution: Radioactive Materials" sign and note on the door or the patient's

chart where and how long visitors may stay in the patient's room;

- (3) Authorize visits by individuals under eighteen years of age only on a case-by-case basis with the approval of the authorized user after consultation with the radiation safety officer;
- (4) Promptly after implanting the sources, survey the dose rates in contiguous restricted and unrestricted areas with a radiation measurement survey instrument to demonstrate compliance with ~~subsection 5 of section 33-10-04-02~~ chapter 33-10-04.1 and retain for two years a record of each survey that includes the time and date of the survey, a sketch of the area or list of points surveyed, the measured dose rate at several points expressed in millirems [microsieverts] per hour, the instrument used to make the survey, and the initials of the individual who made the survey; and
- (5) Provide the patient with radiation safety guidance that will help keep the radiation dose to household members and the public as low as reasonably achievable before releasing the patient if the patient was administered a permanent implant.

- b. A licensee shall notify the radiation safety officer or authorized user immediately if the patient dies or has a medical emergency.

4. Brachytherapy sources inventory.

- a. Each time brachytherapy sources are returned to an area of storage from an area of use, the licensee shall immediately count or otherwise verify the number returned to ensure that all sources taken from the storage area have been returned.
- b. A licensee shall make a record of brachytherapy source utilization which includes:
 - (1) The names of the individuals permitted to handle the sources;
 - (2) The number and activity of sources removed from storage, the room number of use and patient's name, the time and date they were removed from storage, the number and activity of sources in storage after the removal, and the initials of the individual who removed the sources from storage; and

- (3) The number and activity of sources returned to storage, the room number of use and patient's name, the time and date they were returned to storage, the number and activity of sources in storage after the return, and the initials of the individual who returned the sources to storage.
 - c. Immediately after implanting sources in a patient and immediately after removal of sources from a patient, the licensee shall make a radiation survey of the patient and the area of use to confirm that no sources have been misplaced. The licensee shall make a record of each survey.
 - d. A licensee shall maintain the records required in subdivisions b and c for two years.
5. Release of patients treated with temporary implants.
 - a. Immediately after removing the last temporary implant source from a patient, the licensee shall perform a radiation survey of the patient with a radiation detection survey instrument to confirm that all sources have been removed. The licensee may not release from confinement for medical care a patient treated by temporary implant until all sources have been removed.
 - b. A licensee shall maintain a record of patient surveys which demonstrate compliance with subdivision a for two years. Each record must include the date of the survey, the name of the patient, the dose rate from the patient expressed as millirems [microsieverts] per hour and measured within one meter from the patient, and the initials of the individual who made the survey.
6. Possession of survey instruments. A licensee authorized to use radioactive material for implant therapy shall possess a portable radiation detection survey instrument capable of detecting dose rates over the range one-tenth millirem [1 microsievert] per hour to fifty millirems [500 microsieverts] per hour, and a portable radiation measurement survey instrument capable of measuring dose rates over the range one millirem [10 microsieverts] per hour to one thousand millirems [10 millisieverts] per hour. The instruments must be operable and calibrated in accordance with subsection 3 of section 33-10-07-05.

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Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-11. Specific requirements for the use of a sealed source in teletherapy.

1. Use of a sealed source in a teletherapy unit. A licensee shall use cobalt-60 or cesium-137 as a sealed source in a teletherapy unit for medical use in accordance with the manufacturer's radiation safety and operating instructions.
2. Maintenance and repair restrictions. Only a person specifically licensed by the department, the United States nuclear regulatory commission, or an agreement state to perform teletherapy unit maintenance and repair shall install, relocate, or remove a teletherapy sealed source or a teletherapy unit that contains a sealed source or maintain, adjust, or repair the source drawer, the shutter or other mechanism of a teletherapy unit that could expose the source, reduce the shielding around the source, or result in increased radiation levels.
3. Amendments. In addition to the requirements specified in section ~~33-10-07-03~~ 33-10-07-03.1, a licensee shall apply for and receive a license amendment before:
 - a. Making any change in the treatment room shielding;
 - b. Making any change in the location of the teletherapy unit within the treatment room;
 - c. Using the teletherapy unit in a manner that could result in increased radiation levels in areas outside the teletherapy treatment room;
 - d. Relocating the teletherapy unit; or
 - e. Allowing an individual not listed on the licensee's license to perform the duties of the teletherapy physicist.
4. Safety instruction.
 - a. A licensee shall conspicuously post written instructions at the teletherapy unit console. These instructions must inform the operator of:
 - (1) The procedure to be followed to ensure that only the patient is in the treatment room before turning the primary beam of radiation "on" to begin a treatment or after a door interlock interruption;
 - (2) The procedure to be followed if the operator is unable to turn the primary beam of radiation "off" with controls outside the treatment room or any other abnormal operation occurs; and

- (3) The names and telephone numbers of the authorized users and radiation safety officer to be immediately contacted if the teletherapy unit or console operates abnormally.
 - b. A licensee shall provide instruction in the topics identified in subdivision a to all individuals who operate a teletherapy unit and shall provide appropriate refresher training to individuals at intervals not to exceed one year.
 - c. A licensee shall maintain a record of individuals receiving instruction required by subdivision b, a description of the instruction, the date of instruction, and the name of the individual who gave the instruction for two years.
5. Doors, interlocks, and warning systems.
 - a. A licensee shall control access to the teletherapy room by a door at each entrance.
 - b. A licensee shall equip each entrance to the teletherapy room with an electrical interlock system that shall:
 - (1) Prevent the operator from turning the primary beam of radiation "on" unless each treatment room entrance door is closed;
 - (2) Turn the beam of radiation "off" immediately when an entrance door is opened; and
 - (3) Prevent the primary beam of radiation from being turned "on" following an interlock interruption until all treatment room entrance doors are closed and the beam on-off control is reset at the console.
 - c. A licensee shall equip each entrance to the teletherapy room with a conspicuously visible beam condition indicator light.
6. Possession of survey instrument. A licensee authorized to use radioactive material in a teletherapy unit shall possess either a portable radiation detection survey instrument capable of detecting dose rates over the range one-tenth millirem [1 microsievert] per hour to fifty millirems [500 microsieverts] per hour or a portable radiation measurement survey instrument capable of measuring dose rates over the range one millirem [10 microsieverts] per hour to one thousand millirems [10 millisieverts] per hour. The instruments must be operable and calibrated in accordance with subsection 3 of section 33-10-07-05.

7. Radiation monitoring device.

- a. A licensee shall have in each teletherapy room a permanent radiation monitor capable of continuously monitoring beam status.
- b. Each radiation monitor must be capable of providing visible notice of a teletherapy unit malfunction that results in an exposed or partially exposed source. The visible indicator of high radiation levels must be observable by an individual entering the teletherapy room.
- c. Each radiation monitor must be equipped with a backup power supply separate from the power supply to the teletherapy unit. This backup power supply may be a battery system.
- d. A radiation monitor must be checked with a dedicated check source for proper operation each day before the teletherapy unit is used for treatment of patients.
- e. A licensee shall maintain a record of the check required by subdivision d for two years. The record must include the date of the check, notation that the monitor indicates when the source is exposed, and the initials of the individual who performed the check.
- f. If a radiation monitor is inoperable, the licensee shall require any individual entering the teletherapy room to use a survey instrument or audible alarm personal dosimeter to monitor for any malfunction of the source exposure mechanism. The instrument or dosimeter must be checked with a dedicated check source for proper operation at the beginning of each day of use. The licensee shall keep a record as described in subdivision e.
- g. A licensee shall promptly repair or replace the radiation monitor if it is inoperable.

8. Viewing system. A licensee shall construct or equip each teletherapy room to permit continuous observation of the patient from the teletherapy unit console during irradiation.

9. Dosimetry equipment.

- a. A licensee shall have a calibrated dosimetry system available for use. To satisfy this requirement, one of the following two conditions must be met:
 - (1) The system must have been calibrated by the national institute of standards and technology or by a calibration laboratory accredited by the American association of physicists in medicine. The

calibration must have been performed within the previous two years and after any servicing that may have affected system calibration; or

(2) The system must have been calibrated within the previous four years; eighteen to thirty months after that calibration, the system must have been intercompared at an intercomparison meeting with another dosimetry system that was calibrated within the past twenty-four months by the national institute of standards and technology or by a calibration laboratory accredited by the American association of physicists in medicine. The intercomparison meeting must be sanctioned by a calibration laboratory or radiologic physics center accredited by the American association of physicists in medicine. The results of the intercomparison meeting must have indicated that the calibration factor of the licensee's system had not changed by more than two percent. The licensee may not use the intercomparison result to change the calibration factor. When intercomparing dosimetry systems to be used for calibrating cobalt-60 teletherapy units, the licensee shall use a teletherapy unit with a cobalt-60 source. When intercomparing dosimetry systems to be used for calibrating cesium-137 teletherapy units, the licensee shall use a teletherapy unit with a cesium-137 source.

b. The licensee shall have available for use a dosimetry system for spot-check measurements. To meet this requirement, the system may be compared with a system that has been calibrated in accordance with subdivision a. This comparison must have been performed within the previous year and after each servicing that may have affected system calibration. The spot-check system must be the same system used to meet the requirement in subdivision a.

c. The licensee shall maintain a record of each calibration, intercomparison, and comparison for the duration of the license. For each calibration, intercomparison, or comparison, the record must include the date, the model numbers and serial numbers of the instruments that were calibrated, intercompared, or compared as required by subdivisions a and b the correction factors that were determined, the names of the individuals who performed the calibration, intercomparison, or comparison, and evidence that the intercomparison meeting was sanctioned by a calibration laboratory or radiologic physics center accredited by the American association of physicists in medicine.

10. Full calibration measurements.

- a. A licensee authorized to use a teletherapy unit for medical use shall perform full calibration measurements on each teletherapy unit:
 - (1) Before the first medical use of the unit;
 - (2) Before medical use under the following conditions:
 - (a) Whenever spot-check measurements indicate that the output differs by more than five percent from the output obtained at the last full calibration corrected mathematically for radioactive decay;
 - (b) Following replacement of the source or following reinstallation of the teletherapy unit in a new location; and
 - (c) Following any repair of the teletherapy unit that includes removal of the source or major repair of the components associated with the source exposure assembly; and
 - (3) At intervals not exceeding one year.
- b. To satisfy the requirement of subdivision a, full calibration measurements must include determination of:
 - (1) The output within three percent for the range of field sizes and for the distance or range of distances used for medical use;
 - (2) The coincidence of the radiation field and the field indicated by the light beam localizing device;
 - (3) The uniformity of the radiation field and its dependence on the orientation of the useful beam;
 - (4) Timer accuracy, constancy, and linearity;
 - (5) "On-off" error; and
 - (6) The accuracy of all distance measuring and localization devices in medical use.
- c. A licensee shall use the dosimetry system described in subsection 9 to measure the output for one set of exposure conditions. The remaining radiation measurements required in paragraph 1 of subdivision b may then be made using a dosimetry system that indicates relative dose rates.

- d. A licensee shall make full calibration measurements required by subsection 1 in accordance with either the procedures recommended by the scientific committee on radiation dosimetry of the American association of physicists in medicine that are described in Physics in Medicine and Biology vol. 16, no. 3, 1971, pp. 379-396, or by task group 21 of the radiation therapy committee of the American association of physicists in medicine that are described in Medical Physics vol. 10, no. 6, 1983, pp. 741-771, and vol. 11, no. 2, 1984, p. 213.
- e. A licensee shall correct mathematically the outputs determined in paragraph 1 of subdivision b for physical decay for intervals not exceeding one month for cobalt-60 and intervals not exceeding six months for cesium-137.
- f. Full calibration measurements required by subdivision a and physical decay corrections required by subdivision e must be performed by a teletherapy physicist named on the licensee's license or authorized by a license issued by the United States nuclear regulatory commission or an agreement state to perform such services.
- g. A licensee shall maintain a record of each calibration for the duration of the license. The record must include the date of the calibration, the manufacturer's name, model number, and serial number for both the teletherapy unit and the source, the model numbers and serial numbers of the instruments used to calibrate the teletherapy unit, tables that describe the output of the unit over the range of field sizes and for the range of distances used in radiation therapy, a determination of the coincidence of the radiation field and the field indicated by the light beam localizing device, the measured timer accuracy for a typical treatment time, the calculated "on-off" error, the estimated accuracy of each distance measuring or localization device, and the signature of the teletherapy physicist.

11. Periodic spot checks.

- a. A licensee authorized to use teletherapy units for medical use shall perform output spot checks on each teletherapy unit at intervals not to exceed one month.
- b. To satisfy the requirement of subdivision a, spot checks must include determination of:
 - (1) Timer constancy and timer linearity over the range of use;
 - (2) "On-off" error;

- (3) The coincidence of the radiation field and the field indicated by the light beam localizing device;
 - (4) The accuracy of all distance measuring and localization devices used for medical use;
 - (5) The output for one typical set of operating conditions; and
 - (6) The difference between the measurement made in paragraph 5 and the anticipated output, expressed as a percentage of the anticipated output (i.e., the value obtained at last full calibration corrected mathematically for physical decay).
- c. A licensee shall use the dosimetry system described in subsection 9 to make the spot check required in paragraph 5 of subdivision a b.
- d. A licensee shall perform spot checks required by subdivision a in accordance with procedures established by the teletherapy physicist. The teletherapy physicist does not need to actually perform the output spot-check measurements.
- e. A licensee shall have the teletherapy physicist review the results of each output spot check within fifteen days. The teletherapy physicist shall promptly notify the licensee in writing of the results of each output spot check. The licensee shall keep a copy of each written notification for two years.
- f. A licensee authorized to use a teletherapy unit for medical use shall perform safety spot checks of each teletherapy facility at intervals not to exceed one month.
- g. To satisfy the requirement of subdivision f, safety spot checks shall assure proper operation of:
- (1) Electrical interlocks at each teletherapy room entrance;
 - (2) Electrical or mechanical stops installed for the purpose of limiting use of the primary beam of radiation restriction of source housing angulation or elevation, carriage or stand travel, and operation of the beam "on-off" mechanism;
 - (3) Beam condition indicator lights on the teletherapy unit, on the control console, and in the facility;
 - (4) Viewing systems;

- (5) Treatment room doors from inside and outside the treatment room; and
 - (6) Electrically assisted treatment room doors with the teletherapy unit electrical power turned "off".
- h. A licensee shall lock the control console in the "off" position if any door interlock malfunctions. No licensee may use the unit until the interlock system is repaired unless specifically authorized by the department.
 - i. A licensee shall promptly repair any system identified in subdivision g that is not operating properly. The teletherapy unit may not be used until all repairs are completed.
 - j. A licensee shall maintain a record of each spot check required by subdivisions a and f for two years. The record must include the date of the spot check, the manufacturer's name, model number, and serial number for both the teletherapy unit, and source, the manufacturer's name, model number and serial number of the instrument used to measure the output of the teletherapy unit, the timer constancy and linearity, the calculated "on-off" error, a determination of the coincidence of the radiation field and the field indicated by the light beam localizing device, the timer constancy and linearity for a typical treatment time, the calculated "on-off" error, the estimated accuracy of each distance measuring or localization device, the difference between the anticipated output and the measured output, notations indicating the operability of each entrance door electrical interlock, each electrical or mechanical stop, each beam condition indicator light, the viewing system and doors, and the signature of the individual who performed the periodic spot check.

12. Radiation surveys for teletherapy facilities.

- a. Before medical use, after each installation of a teletherapy source, and after making any change for which an amendment is required by subsection 3, the licensee shall perform radiation surveys with an operable radiation measurement survey instrument calibrated in accordance with subsection 3 of section 33-10-07-05 to verify that:
 - (1) The maximum and average radiation levels at one meter from the teletherapy source with the source in the "off" position and the collimators set for a normal treatment field do not exceed ten millirems [100 microsieverts] per hour and two millirems [20 microsieverts] per hour, respectively; and

- (2) With the teletherapy source in the "on" position with the largest clinically available treatment field and with a scattering phantom in the primary beam of radiation, that:
 - (a) Radiation levels in restricted areas are not likely to cause personnel exposures in excess of the limits specified in subsection 1 of section ~~33-10-04-02~~ 33-10-04.1-06; and
 - (b) Radiation levels in unrestricted areas do not exceed the limits specified in ~~subdivision a of subsection 5 of section 33-10-04-02~~ subsection 1 of section 33-10-04.1-07.
 - b. If the results of the surveys required in subdivision a indicate any radiation levels in excess of the respective limit specified in that paragraph, the licensee shall lock the control in the "off" position and not use the unit:
 - (1) Except as may be necessary to repair, replace, or test the teletherapy unit, the teletherapy unit shielding, or the treatment room shielding; or
 - (2) Until the licensee has received a specific exemption from the department.
 - c. A licensee shall maintain a record of the radiation measurements made following installation of a source for the duration of the license. The record must include the date of the measurements, the reason the survey is required, the manufacturer's name, model number and serial number of the teletherapy unit, the source, and the instrument used to measure radiation levels, each dose rate measured around the teletherapy source while in the "off" position and the average of all measurements, a plan of the areas surrounding the treatment room that were surveyed, the measured dose rate at several points in each area expressed in millirems [microsieverts] per hour, the calculated maximum level of radiation over a period of one week for each restricted and unrestricted area, and the signature of the radiation safety officer.
13. Safety spot checks for teletherapy facilities.
- a. A licensee shall promptly check all systems listed in subdivision g of subsection 11 for proper function after each installation of a teletherapy source and after making any change for which an amendment is required by subsection 3.
 - b. If the results of the safety spot checks required in subdivision a indicate the malfunction of any system

specified in subsection 11, the licensee shall lock the control console in the "off" position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

- c. A licensee shall maintain a record of the safety spot checks following installation of a source for two years. The record must include notations indicating the operability of each entrance door interlock, each electrical or mechanical stop, each beam condition indicator light, the viewing system, doors, and the signature of the radiation safety officer.
14. Modification of teletherapy unit or room before beginning a treatment program. If the survey required by subsection 12 indicates that an individual in an unrestricted area may be exposed to levels of radiation greater than those permitted by ~~subdivision a of subsection 5 of section 33-10-04-02~~ subsection 1 of section 33-10-04.1-07, before beginning the treatment program the licensee shall:
- a. Either equip the unit with stops or add additional radiation shielding to ensure compliance with ~~subdivision a of subsection 5~~ 1 of section 33-10-04.1-07;
 - b. Perform the survey required by subsection 12 again; and
 - c. Include in the report required by subsection 15 the results of the initial survey, a description of the modification made to comply with subdivision a, and the results of the second survey; or
 - d. Request and receive a license amendment under ~~subdivision b of subsection 5 of section 33-10-04-02~~ subdivision c of subsection 1 of section 33-10-04.1-07 that authorizes radiation levels in unrestricted areas greater than those permitted by subdivision a of subsection 5 of section ~~33-10-04-02~~ 1 of section 33-10-04.1-07.
15. Reports of teletherapy surveys, checks, tests, and measurements. A licensee shall furnish a copy of the records required in subsections 12, 13, and 14 and the output from the teletherapy source expressed as rems [sieverts] per hour at one meter from the source as determined during the full calibration required in subsection 10 to the department within thirty days following completion of the action that initiated the record requirement.
16. Five-year inspection.

- a. A licensee shall have each teletherapy unit fully inspected and serviced during teletherapy source replacement or at intervals not to exceed five years, whichever comes first, to assure proper functioning of the source exposure mechanism.
- b. This inspection and servicing may only be performed by persons specifically licensed to do so by the department, an agreement state, or the United States nuclear regulatory commission.
- c. A licensee shall maintain a record of the inspection and servicing for the duration of the license. The record must contain the inspector's name, the inspector's license number, the date of inspection, the manufacturer's name and model number and serial number for both the teletherapy unit and source, a list of components inspected, a list of components serviced and the type of service, a list of components replaced, and the signature of the inspector.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-07-12. Specific requirements for training.

1. Radiation safety officer. Except as provided in subsection 2 an individual fulfilling the responsibilities of the radiation safety officer as provided in subsection 2 of section 33-10-07-04 shall:
 - a. Be certified by the:
 - (1) American board of health physics in comprehensive health physics;
 - (2) American board of radiology in radiological physics, therapeutic radiological physics, or medical nuclear physics;
 - (3) American board of nuclear medicine;
 - (4) American board of science in nuclear medicine; or
 - (5) Board of pharmaceutical specialities in nuclear pharmacy or science; or
 - b. Have had two hundred hours of classroom and laboratory training as follows:
 - (1) Radiation physics and instrumentation;

- (2) Radiation protection;
 - (3) Mathematics pertaining to the use and measurement of radioactivity;
 - (4) Radiation biology;
 - (5) Radiopharmaceutical chemistry; and
 - (6) One year of full-time experience in radiation safety at a medical institution under the supervision of the individual identified as the radiation safety officer by the department, an agreement state, licensing state, or United States nuclear regulatory commission license that authorizes the medical use of radioactive material;
- c. Be an authorized user for those radioactive material uses that come within the radiation safety officer's responsibilities.
2. Training for experienced radiation safety officer. An individual identified as a radiation safety officer by the department, agreement state, licensing state, or United States nuclear regulatory commission license on October 1, 1986, who oversees only the use of radioactive material for which the licensee was authorized on that date need not comply with the training requirements of subsection 1.
3. Training for uptake, dilution, or excretion studies. Except as provided in subsections 11 and 12, the licensee shall require the authorized user of a radiopharmaceutical listed in section 33-10-07-06 to be a physician who:
- a. Is certified in:
 - (1) Nuclear medicine by the American board of nuclear medicine;
 - (2) Diagnostic radiology by the American board of radiology;
 - (3) Diagnostic radiology or radiology within the previous five years by the American osteopathic board of radiology; or
 - (4) Nuclear medicine by the American osteopathic board of nuclear medicine; or
 - b. Has completed forty hours of instruction in basic radionuclide handling techniques applicable to the use of prepared radiopharmaceuticals, and twenty hours of supervised clinical experience.

- (1) To satisfy the basic instruction requirement, forty hours of classroom and laboratory instruction must include:
 - (a) Radiation physics and instrumentation;
 - (b) Radiation protection;
 - (c) Mathematics pertaining to the use and measurement of radioactivity;
 - (d) Radiation biology; and
 - (e) Radiopharmaceutical chemistry.
 - (2) To satisfy the requirement for twenty hours of supervised clinical experience, training must be under the supervision of an authorized user at a medical institution and must include:
 - (a) Examining patients and reviewing the patients' case histories to determine the patients' suitability for radionuclide diagnosis, limitations, or contraindications;
 - (b) Selecting the suitable radiopharmaceuticals and calculating and measuring the dosages;
 - (c) Administering dosages to patients and using syringe radiation shields;
 - (d) Collaborating with the authorized user in the interpretation of radionuclide test results; and
 - (e) Patient followup; or
 - c. Has successfully completed a six-month training program in nuclear medicine as part of a training program that has been approved by the accreditation council for graduate medical education and that included classroom and laboratory training, work experience, and supervised clinical experience in all the topics identified in subdivision b.
4. Training for imaging and localization studies. Except as provided in subsections 11 and 12, the licensee shall require the authorized user of a radiopharmaceutical, generator, or reagent kit specified in section 33-10-07-07 to be a physician who:
- a. Is certified in:

- (1) Nuclear medicine by the American board of nuclear medicine;
 - (2) Diagnostic radiology by the American board of radiology;
 - (3) Diagnostic radiology or radiology within the previous five years by the American osteopathic board of radiology; or
 - (4) Nuclear medicine by the American osteopathic board of nuclear medicine;
- b. Has completed two hundred hours of instruction in basic radionuclide handling techniques applicable to the use of prepared radiopharmaceuticals, generators, and reagent kits, five hundred hours of supervised work experience, and five hundred hours of supervised clinical experience:
- (1) To satisfy the basic instruction requirement, two hundred hours of classroom and laboratory training must include:
 - (a) Radiation physics and instrumentation;
 - (b) Radiation protection;
 - (c) Mathematics pertaining to the use and measurement of radioactivity;
 - (d) Radiopharmaceutical chemistry; and
 - (e) Radiation biology.
 - (2) To satisfy the requirement for five hundred hours of supervised work experience, training shall be under the supervision of an authorized user at a medical institution and must include:
 - (a) Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
 - (b) Calibrating dose calibrators and diagnostic instruments and performing checks for proper operation of survey meters;
 - (c) Calculating and safely preparing patient dosages;
 - (d) Using administrative controls to prevent the misadministration of radioactive material;

- (e) Using emergency procedures to contain spilled radioactive material safely and using proper decontamination procedures; and
 - (f) Eluting technetium-99m from generator systems, assaying and testing the eluate for molybdenum-99 and alumina contamination, and processing the eluate with reagent kits to prepare technetium-99m labeled radiopharmaceuticals.
- (3) To satisfy the requirement for five hundred hours of supervised clinical experience, training shall be under the supervision of an authorized user at a medical institution and must include:
- (a) Examining patients and reviewing the patients' case histories to determine the patients' suitability for radionuclide diagnosis, limitations, or contraindications;
 - (b) Selecting the suitable radiopharmaceuticals and calculating and measuring the dosages;
 - (c) Administering dosages to patients and using syringe radiation shields;
 - (d) Collaborating with the authorized user in the interpretation of radionuclide test results; and
 - (e) Patient follow-up; or
- c. Has successfully completed a six-month training program in nuclear medicine that has been approved by the accreditation council for graduate medical education and that included classroom and laboratory training, work experience, and supervised clinical experience in all the topics identified in subdivision b.
5. Training for therapeutic use of radiopharmaceuticals. Except as provided in subsection 11, the licensee shall require the authorized user of a radiopharmaceutical listed in section 33-10-07-08 for therapy to be a physician who:
- a. Is certified by:
 - (1) The American board of nuclear medicine; or
 - (2) The American board of radiology in radiology, therapeutic radiology, or radiation oncology; or
 - b. Has completed eighty hours of instruction in basic radionuclide handling techniques applicable to the use of

therapeutic radiopharmaceuticals, and has had supervised clinical experience.

(1) To satisfy the requirement for instruction, eighty hours of classroom and laboratory training must include:

- (a) Radiation physics and instrumentation;
- (b) Radiation protection;
- (c) Mathematics pertaining to the use and measurement of radioactivity; and
- (d) Radiation biology;

(2) To satisfy the requirement for supervised clinical experience, training must be under the supervision of an authorized user at a medical institution and must include:

- (a) Use of iodine-131 for diagnosis of thyroid function and the treatment of hyperthyroidism or cardiac dysfunction in ten individuals;
- (b) Use of soluble phosphorus-32 for the treatment of ascites, polycythemia vera, leukemia, or bone metastases in three individuals;
- (c) Use of iodine-131 for treatment of thyroid carcinoma in three individuals; and
- (d) Use of colloidal chromic phosphorus-32 or of colloidal gold-198 for intracavitary treatment of malignant effusions in three individuals.

6. Training for therapeutic use of brachytherapy sources. Except as provided in subsection 11, the licensee shall require the authorized user using a brachytherapy source specified in section 33-10-07-10 for therapy to be a physician who:

a. Is certified in:

- (1) Radiology, therapeutic radiology, or radiation oncology by the American board of radiology;
- (2) Radiation oncology by the American osteopathic board of radiology;
- (3) Radiology, with a specialization in radiotherapy, as a British "fellow of the faculty of radiology" or "fellow of the royal college of radiology"; or

- (4) Therapeutic radiology by the Canadian royal college of physicians and surgeons; or
- b. Is in the active practice of therapeutic radiology, has completed two hundred hours of instruction in basic radionuclide handling techniques applicable to the therapeutic use of brachytherapy sources and five hundred hours of supervised work experience and a minimum of three years of supervised clinical experience.
- (1) To satisfy the requirement for instruction, two hundred hours of classroom and laboratory training must include:
 - (a) Radiation physics and instrumentation;
 - (b) Radiation protection;
 - (c) Mathematics pertaining to the use and measurement of radioactivity; and
 - (d) Radiation biology.
 - (2) To satisfy the requirement for five hundred hours of supervised work experience, training must be under the supervision of an authorized user at a medical institution and must include:
 - (a) Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
 - (b) Checking survey meters for proper operation;
 - (c) Preparing, implanting, and removing sealed sources;
 - (d) Using administrative controls to prevent the misadministration of radioactive material; and
 - (e) Using emergency procedures to control radioactive material.
 - (3) To satisfy the requirement for a period of supervised clinical experience, training must include one year in a formal training program approved by the residency review committee for radiology of the accreditation council for graduate medical education or the committee on postdoctoral training of the American osteopathic association, and an additional two years of clinical experience in therapeutic radiology under the supervision of an authorized user

at a medical institution. The supervised clinical experience must include:

- (a) Examining individuals and reviewing their case histories to determine their suitability for brachytherapy treatment, and any limitations or contraindications;
- (b) Selecting the proper brachytherapy sources, dose, and method of administration;
- (c) Calculating the dose; and
- (d) Postadministration followup and review of case histories in collaboration with the authorized user.

7. Training for ophthalmic use of strontium-90. Except as provided in subsection 11, the licensee shall require the authorized user using only strontium-90 for ophthalmic radiotherapy to be a physician who:

- a. Is certified in radiology, therapeutic radiology, or radiation oncology by the American board of radiology; or
- b. Is in the active practice of therapeutic radiology or ophthalmology, and has completed twenty-four hours of instruction in basic radionuclide handling techniques applicable to the use of strontium-90 for ophthalmic radiotherapy, and a period of supervised clinical training in ophthalmic radiotherapy.

(1) To satisfy the requirement for instruction, the classroom and laboratory training must include:

- (a) Radiation physics and instrumentation;
- (b) Radiation protection;
- (c) Mathematics pertaining to the use and measurement of radioactivity; and
- (d) Radiation biology.

(2) To satisfy the requirement for a period of supervised clinical training in ophthalmic radiotherapy, training must be under the supervision of an authorized user at a medical institution and must include the use of strontium-90 for the ophthalmic treatment of five individuals that includes:

- (a) Examination of each individual to be treated;

- (b) Calculation of the dose to be administered;
 - (c) Administration of the dose; and
 - (d) Followup and review of each individual's case history.
8. Training for use of sealed sources for diagnosis. Except as provided in subsection 11, the licensee shall require the authorized user using a sealed source in a device specified in section 33-10-07-09 to be a physician, dentist, or podiatrist who:
- a. Is certified in:
 - (1) Radiology, diagnostic radiology with special competence in nuclear radiology, therapeutic radiology, or radiation oncology by the American board of radiology;
 - (2) Nuclear medicine by the American board of nuclear medicine; or
 - (3) Diagnostic radiology or radiology by the American osteopathic board of radiology; or
 - b. Has completed eight hours of classroom and laboratory instruction in basic radionuclide handling techniques specifically applicable to the use of the device. To satisfy the requirement for instruction, the training must include:
 - (1) Radiation physics, mathematics pertaining to the use and measurement of radioactivity, and instrumentation;
 - (2) Radiation biology; and
 - (3) Radiation protection and training in the use of the device for the purposes authorized by the license.
9. Training for teletherapy. Except as provided in subsection 11, the licensee shall require the authorized user of a sealed source specified in section 33-10-07-11 to be a physician who:
- a. Is certified in:
 - (1) Radiology, therapeutic radiology, or radiation oncology by the American board of radiology;
 - (2) Radiation oncology by the American osteopathic board of radiology;

- (3) Radiology, with specialization in radiotherapy, as a British "fellow of the faculty of radiology" or "fellow of the royal college of radiology"; or
 - (4) Therapeutic radiology by the Canadian royal college of physicians and surgeons; or
- b. Is in the active practice of therapeutic radiology, and has completed two hundred hours of instruction in basic radionuclide techniques applicable to the use of a sealed source in a teletherapy unit, five hundred hours of supervised work experience, and a minimum of three years of supervised clinical experience.
- (1) To satisfy the requirement for instruction, the classroom and laboratory training must include:
 - (a) Radiation physics and instrumentation;
 - (b) Radiation protection;
 - (c) Mathematics pertaining to the use and measurement of radioactivity; and
 - (d) Radiation biology.
 - (2) To satisfy the requirement for supervised work experience, training must be under the supervision of an authorized user at an institution and shall include:
 - (a) Review of the full calibration measurements and periodic spot checks;
 - (b) Preparing treatment plans and calculating treatment times;
 - (c) Using administrative controls to prevent misadministrations;
 - (d) Implementing emergency procedures to be followed in the event of the abnormal operation of a teletherapy unit or console; and
 - (e) Checking and using survey meters.
 - (3) To satisfy the requirement for a period of supervised clinical experience, training must include one year in a formal training program approved by the residency review committee for radiology of the accreditation council for graduate medical education or the committee on postdoctoral training of the American osteopathic association and an additional

two years of clinical experience in therapeutic radiology under the supervision of an authorized user at a medical institution. The supervised clinical experience must include:

- (a) Examining individuals and reviewing the individuals' case histories to determine the individuals' suitability for teletherapy treatment, and any limitations or contraindications;
- (b) Selecting the proper dose and how it is to be administered;
- (c) Calculating the teletherapy doses and collaborating with the authorized user in the review of patients' progress and consideration of the need to modify originally prescribed doses as warranted by patients' reaction to radiation; and
- (d) Postadministration followup and review of case histories.

10. Training for teletherapy physicist. The licensee shall require the teletherapy physicist to:

a. Be certified by the American board of radiology in:

- (1) Therapeutic radiological physics;
- (2) Roentgen-ray and gamma-ray physics;
- (3) X-ray and radium physics; or
- (4) Radiological physics; or

b. Hold a master's or doctor's degree in physics, biophysics, radiological physics, or health physics, and have completed one year of full-time training in therapeutic radiological physics and also one year of full-time work experience under the supervision of a teletherapy physicist at a medical institution. To meet this requirement, the individual shall have performed the tasks listed in subsection 6 of section 33-10-07-05 and subsections 10, 11, and 12 of section 33-10-07-11 under the supervision of a teletherapy physicist during the year of work experience.

11. Training for experienced authorized users. Practitioners of the healing arts identified as authorized users for the human use of radioactive material on a department, United States nuclear regulatory commission, agreement state, or licensing

state license on April 1, 1987, who perform only those methods of use for which the practitioners were authorized on that date need not comply with the training requirements of this section.

12. Physician training in a three-month program. A physician who, before July 1, 1984, began a three-month nuclear medicine training program approved by the accreditation council for graduate medical education and has successfully completed the program, is exempted from the requirements of subsections 3 and 4.
13. Recentness of training. The training and experience specified in this section shall have been obtained within the five years preceding the date of application or the individual shall have had continuing applicable experience since the required training and experience was completed.
14. Training for treatment of hyperthyroidism. Except as provided in subsection 11, the licensee shall require the authorized user of only iodine-131 for the treatment of hyperthyroidism to be a physician with special experience in thyroid disease who has had classroom and laboratory training in basic radioisotope handling techniques applicable to the use of iodine-131 for treating hyperthyroidism, and supervised clinical experience as follows:
 - a. Eighty hours of classroom and laboratory training that includes:
 - (1) Radiation physics and instrumentation;
 - (2) Radiation protection;
 - (3) Mathematics pertaining to the use and measurement of radioactivity; and
 - (4) Radiation biology; and
 - b. Supervised clinical experience under the supervision of an authorized user that includes the use of iodine-131 for diagnosis of thyroid function, and the treatment of hyperthyroidism in ten individuals.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

CHAPTER 33-10-08

33-10-08-03. Equipment requirements.

1. **Safety device.** A device which prevents the entry of any portion of an individual's body into the primary X-ray beam path or which causes the beam to be shut off upon entry into its path shall be provided on all open-beam configurations. A registrant may apply to the department for an exemption from the requirement of a safety device. Such application shall include:
 - a. A description of the various safety devices that have been evaluated.
 - b. The reason each of these devices cannot be used.
 - c. A description of the alternative methods that will be employed to minimize the possibility of an accidental exposure, including procedures to assure that operators and others in the area will be informed of the absence of safety devices.
2. **Warning devices.**
 - a. Open-beam configurations shall be provided with a readily discernible indication of:
 - (1) X-ray tube (ON-OFF) status located near the radiation source housing, if the primary beam is controlled in this manner.
 - (2) Shutter status (OPEN-CLOSED) located near each port on the radiation source housing, if the primary beam is controlled in this manner.
 - b. An easily visible warning light labeled with the words "X-RAY ON", or words having a similar intent, must be located:
 - (1) Near any switch that energizes an X-ray tube and shall be illuminated only when the tube is energized.
 - (2) In the case of a radioactive source, near any switch that opens a housing shutter and must be illuminated only when the shutter is open.
 - c. Warning devices shall be labeled so that their purpose is easily identified. On equipment installed after August 1, 1979, warning devices shall have fail-safe characteristics.

3. Ports. Unused ports on radiation source housings shall be secured in the closed position in a manner which will prevent casual opening.
4. Labeling. All analytical X-ray equipment shall be labeled with a readily discernible sign or signs bearing the radiation symbol and the words:
 - a. "CAUTION - HIGH INTENSITY X-RAY BEAM", or words having a similar intent, on the X-ray source housing; and
 - b. "CAUTION RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED", or words having a similar intent, near any switch that energizes an X-ray tube if the radiation source is an X-ray tube; or
 - c. "CAUTION - RADIOACTIVE MATERIAL", or words having a similar intent, on the source housing in accordance with ~~section 33-10-04-03~~ subsection 4 of section 33-10-04.1-13 if the radiation source is a radionuclide.
5. Shutters. On open-beam configurations installed after August 1, 1979, each port on the radiation source housing shall be equipped with a shutter that cannot be opened unless a collimator or a coupling has been connected to the port.
6. Warning lights.
 - a. An easily visible warning light labeled with the words "X-RAY ON", or words having a similar intent, shall be located:
 - (1) Near any switch that energizes an X-ray tube and shall be illuminated only when the tube is energized; or
 - (2) In the case of a radioactive source, near any switch that opens a housing shutter, and shall be illuminated only when the shutter is open.
 - b. On equipment installed after August 1, 1979, warning lights shall have fail-safe characteristics.
7. Radiation source housing. Each radiation source housing is subject to the following requirements:
 - a. Each X-ray tube housing shall be equipped with an interlock that shuts off the tube if it is removed from the radiation source housing or if the housing is disassembled.
 - b. Each radioactive source housing or port cover or each X-ray tube housing shall be so constructed that, with all

shutters closed, the radiation measured at a distance of five centimeters from its surface is not capable of producing a dose in excess of two and one-half millirems [0.25 millisieverts] in one hour. For systems utilizing X-ray tubes, this limit shall be met at any specified tube rating.

8. **Generator cabinet.** Each X-ray generator shall be supplied with a protective cabinet which limits leakage radiation measured at a distance of five centimeters from its surface such that it is not capable of producing a dose in excess of one-quarter millirem [2.5 microsieverts] in one hour.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03

33-10-08-04. Area requirements.

1. **Radiation levels.** The local components of an analytical X-ray system shall be located and arranged and shall include sufficient shielding or access control such that no radiation levels exist in any area surrounding the local component group which could result in a dose to an individual present therein in excess of the dose limits given in subsection 5 1 of section ~~33-10-04-02~~ 33-10-04.1-07. For systems utilizing X-ray tubes, these levels shall be met at any specified tube rating.

2. **Surveys.**

- a. Radiation surveys, as required by subsection 4 2 of section ~~33-10-04-03~~ 33-10-04.1-07, of all analytical X-ray systems sufficient to show compliance with subsection 1 of this section shall be performed:

- (1) Upon installation of the equipment, and at least once every twelve months thereafter.
- (2) Following any change in the initial arrangement, number, or type of local components in the system.
- (3) Following any maintenance requiring the disassembly or removal of a local component in the system.
- (4) During the performance of maintenance and alignment procedures if the procedures require the presence of a primary X-ray beam when any local component in the system is disassembled or removed.
- (5) Any time a visual inspection of the local components in the system reveals an abnormal condition.

(6) Whenever personnel monitoring devices show a significant increase over the previous monitoring period or the readings are approaching the limits specified in section ~~33-10-04-02~~ 33-10-04.1-06.

b. Radiation survey measurements shall not be required if a registrant can demonstrate compliance with subsection 1 to the satisfaction of the department.

3. Posting. Each area or room containing analytical X-ray equipment shall be conspicuously posted with a sign or signs bearing the radiation symbol and the words "CAUTION - X-RAY EQUIPMENT", or words having a similar intent in accordance with section ~~33-10-04-03~~ 33-10-04.1-13.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03

33-10-08-06. Personnel requirements.

1. Instruction. No individual shall be permitted to operate or maintain analytical X-ray equipment unless such individual has received instruction in and demonstrated competence as to all of the following:

a. Identification of radiation hazards associated with the use of the equipment.

b. Significance of the various radiation warning, safety devices, and interlocks incorporated into the equipment, or the reasons they have not been installed on certain pieces of equipment and the extra precautions required in such cases.

c. Proper operating procedures for the equipment.

d. Recognition of symptoms of an acute localized exposure.

e. Proper procedures for reporting an actual or suspected exposure.

2. Personnel monitoring.

a. Finger or wrist dosimetric devices shall be provided to and shall be used by:

(1) Analytical X-ray equipment workers using systems having an open-beam configuration and not equipped with a safety device.

(2) Personnel maintaining analytical X-ray equipment if the maintenance procedures require the presence of a primary X-ray beam when any local component in the analytical X-ray system is disassembled or removed.

b. Reported dose values shall not be used for the purpose of determining compliance with subsection 1 of section ~~33-10-04-02~~ 33-10-04.1-06 unless evaluated by a qualified expert.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03

CHAPTER 33-10-09

33-10-09-01. Purpose and scope.

1. This chapter establishes procedures for the registration and the use of particle accelerators.
2. In addition to the requirements of this chapter, all registrants are subject to the requirements of chapters 33-10-01, 33-10-02, ~~33-10-04~~ 33-10-04.1, and 33-10-10. Registrants engaged in industrial radiographic operations are subject to the requirements of chapter 33-10-05 and registrants engaged in the healing arts are subject to the requirements of chapter 33-10-06 or 33-10-07, or both. Registrants whose operations result in the production of radioactive material are subject to the requirements of chapter 33-10-03.

History: Amended effective June 1, 1986; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-09-02. Registration procedure.

1. Registration requirements. No person shall receive, possess, use, transfer, own, or acquire a particle accelerator except as authorized in a registration issued pursuant to chapter 33-10-02.
2. General requirements for the issuance of a registration for particle accelerators. (Refer to chapter 33-10-02.) In addition to the requirements of chapter 33-10-02, a registration application for use of a particle accelerator will be approved only if the department determines all of the following:
 - a. The applicant is qualified by reason of training and experience to use the accelerator in question for the purpose requested in accordance with this chapter and chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10 in such a manner as to minimize danger to public health and safety or property.
 - b. The applicant's proposed or existing equipment, facilities, operating and emergency procedures are adequate to protect health and minimize danger to public health and safety or property.
 - c. The issuance of the registration will not be inimical to the health and safety of the public, and the applicant

satisfies any applicable special requirement in subsection 3.

- d. The applicant has appointed a radiation safety officer.
 - e. The applicant or the applicant's staff has substantial experience in the use of particle accelerators and training sufficient for application to its intended uses.
 - f. The applicant has established a radiation safety committee to approve, in advance, proposals for uses of particle accelerators, whenever deemed necessary by the department.
 - g. The applicant has an adequate training program for particle accelerator operators.
3. Human use of particle accelerators. In addition to the requirements set forth in chapter 33-10-02, a registration for use of a particle accelerator in the healing arts will be issued only if all of the following are met:
- a. Whenever deemed necessary by the department, the applicant has appointed a medical committee of at least three members to evaluate all proposals for research, diagnostic, and therapeutic use of a particle accelerator. Membership of the committee should include physicians expert in internal medicine, hematology, therapeutic radiology, and a person experienced in depth dose calculations and protection against radiation.
 - b. The individuals designated on the application as the users have substantial training and experience in deep therapy techniques or in the use of particle accelerators to treat humans.
 - c. The individual designated on the application as the user must be a physician.

History: Amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-09-03. Radiation safety requirements for the use of particle accelerators.

- 1. General requirements.
 - a. This section establishes radiation safety requirements for the use of particle accelerators. The requirements of this section are in addition to, and not in substitution for, other applicable requirements of the chapter.

- b. The registrant shall be responsible for assuring that all requirements of this chapter are met.

2. Limitations.

- a. No registrant shall permit any individual to act as an operator of a particle accelerator until such individual has:
 - (1) Been instructed in radiation safety and shall have demonstrated an understanding thereof.
 - (2) Received copies of and instruction in this chapter and the applicable requirements of chapters ~~33-10-04~~ 33-10-04.1 and 33-10-10, pertinent registration conditions and the registrant's operating and emergency procedures, and shall have demonstrated understanding thereof.
 - (3) Demonstrated competence to use the particle accelerator, related equipment, and survey instruments which will be employed.
- b. The radiation safety committee or the radiation safety officer shall have the authority to terminate the operations at a particle accelerator facility if such action is deemed necessary to protect health and minimize danger to public health and safety or property.

3. Shielding and safety design requirements.

- a. A qualified expert, specifically approved by the department, shall be consulted in the design of a particle accelerator installation and called upon to perform a radiation survey when the accelerator is first capable of producing radiation.
- b. Each particle accelerator installation shall be provided with such primary or secondary barriers as are necessary to assure compliance with ~~subsections 4 and 5 of section 33-10-04-02~~ subsection 1 of section 33-10-04.1-06 and subsection 1 of section 33-10-04.1-07.

4. Particle accelerator controls and interlock systems.

- a. Instrumentation, readouts, and controls on the particle accelerator control console shall be clearly identified and easily discernible.
- b. Each entrance into a target room or other high radiation area shall be provided with a safety interlock that shuts down the machine under conditions of barrier penetration.

- c. Each safety interlock shall be on a circuit which shall allow its operation independently of all other safety interlocks.
- d. All safety interlocks shall be designed so that any defect or component failure in the interlock system prevents operation of the accelerator.
- e. When a safety interlock system has been tripped, it shall only be possible to resume operation of the accelerator by manually resetting controls at the position where the interlock has been tripped, and lastly at the main control console.
- f. A scram button or other emergency power cutoff switch shall be located and easily identifiable in all high radiation areas. Such a cutoff switch shall include a manual reset so that the accelerator cannot be restarted from the accelerator control console without resetting the cutoff switch.

5. Warning devices.

- a. All locations designated as high radiation areas, and entrances to such locations, shall be equipped with easily observable warning lights that operate when, and only when, radiation is being produced.
- b. Except in facilities designed for human exposure, each high radiation area shall have an audible warning device which shall be activated for fifteen seconds prior to the possible creation of such high radiation area. Such warning device shall be clearly discernible in all high radiation areas and all areas immediately adjacent to the high radiation areas.
- c. Barriers, temporary or otherwise, and pathways leading to high radiation areas shall be posted in accordance with subsection ~~3 1~~ of section ~~33-10-04-03~~ 33-10-04.1-13.

6. Operating procedures.

- a. Particle accelerators, when not in operation, shall be secured to prevent unauthorized use.
- b. The safety interlock system shall not be used to turn off the accelerator beam except in an emergency.
- c. All safety and warning devices, including interlocks, shall be checked for proper operability at intervals not to exceed three months. Results of such tests shall be maintained at the accelerator facility for inspection by the department.

- d. Electrical circuit diagrams of the accelerator and the associated interlock systems shall be kept current and maintained for inspection by the department and shall be available to the operator at each accelerator facility.
 - e. If, for any reason, it is necessary to intentionally bypass a safety interlock or interlocks, such action shall be:
 - (1) Authorized by the radiation safety committee or radiation safety officer.
 - (2) Recorded in a permanent log and a notice posted at the accelerator control console.
 - (3) Terminated as soon as possible.
 - f. A copy of the current operating and the emergency procedures shall be maintained at the accelerator control panel.
7. Radiation monitoring requirements.
- a. There shall be available at each particle accelerator facility, appropriate portable monitoring equipment which is operable and has been appropriately calibrated for the radiations being produced at the facility. Such equipment shall be tested for proper operation daily and calibrated at intervals not to exceed one year, and after each servicing and repair.
 - b. A radiation protection survey shall be performed and documented by a qualified expert, specifically approved by the department, when changes have been made in shielding, operation, equipment, or occupancy of adjacent areas.
 - c. Radiation levels in all high radiation areas shall be continuously monitored. The monitoring devices shall be electrically independent of the accelerator control and safety interlock systems and capable of providing a readout at the control panel.
 - d. All area monitors shall be calibrated at intervals not to exceed one year and after each servicing and repair.
 - e. Whenever applicable, periodic surveys shall be made to determine the amount of airborne particulate radioactivity present.
 - f. Whenever applicable, periodic wipe test surveys shall be made to determine the degree of contamination.

- g. All surveys shall be made in accordance with the written procedures established by a qualified expert, specifically approved by the department, or the radiation safety officer of the particle accelerator facility.
 - h. Records of all radiation protection surveys, calibration results, instrumentation tests and wipe test results must be maintained at the accelerator facility for inspection by the department.
8. Ventilation systems.
- a. Means shall be provided to ensure that personnel entering any area where airborne radioactivity may be produced will not be exposed to airborne radioactive material in excess of those limits specified in chapter ~~33-10-04~~ 33-10-04.1, appendix ~~A, table I~~ B.
 - b. A registrant, as required by subsection ~~6 2~~ of section ~~33-10-04-02~~ 33-10-04.1-07, shall not vent, release, or otherwise discharge airborne radioactive material to an unrestricted area which exceeds the limits specified in chapter ~~33-10-04~~ 33-10-04.1, appendix ~~A~~ B, table II, except as authorized pursuant to subsection ~~2~~ of section ~~33-10-04-04~~ 33-10-0.14-14 or subdivision b of subsection ~~6 2~~ of section ~~33-10-04-02~~ 33-10-04.1-07. For purposes of this subdivision, concentrations may be averaged over a period not greater than one year. Every reasonable effort should be made to maintain releases of radioactive material to unrestricted areas, as far below these limits as is reasonably achievable.

History: Amended effective October 1, 1982; June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

CHAPTER 33-10-10

33-10-10-02. General regulatory provisions and specific requirements.

1. Posting of notices to workers.

- a. Each licensee or registrant shall post current copies of the following documents:
 - (1) This chapter and chapter ~~33-10-04~~ 33-10-04.1.
 - (2) The license, certificate of registration, conditions, or documents incorporated into the license by reference and amendments thereto.
 - (3) The operating procedures applicable to activities under the license or registration.
 - (4) Any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or order issued pursuant to chapter 33-10-01, and any response from the licensee or registrant.
- b. If posting of a document specified in paragraph 1, 2, or 3 of subdivision a is not practicable, the licensee or registrant may post a notice which describes the document and states where it may be examined.
- c. ~~Department Form RAD 681 "Notice to Employees"~~ The department's "Notice to Employees" Form (SFN 8414) must be posted by each licensee or registrant as required by this article.
- d. Documents, notices, or forms posted pursuant to this subsection must appear in a sufficient number of places to permit individuals engaged in work under the license or registration to observe them on the way to or from any particular work location to which the document applies, must be conspicuous, and must be replaced if defaced or altered.
- e. Department documents posted pursuant to paragraph 4 of subdivision a must be posted within five working days after receipt of the documents from the department. The licensee's or registrant's response, if any, must be posted within five working days after dispatch from the licensee or registrant. Such documents must remain posted for a minimum of five working days or until action

correcting the violation has been completed, whichever is later.

2. Instructions to workers.

a. All individuals working in or frequenting any portion of a restricted area who in the course of employment are engaged in licensed activities which involve exposure to radiation or to radioactive material, or both:

(1) Must be kept informed of the storage, transfer, or use of radioactive material or of sources of radiation in such portions of the restricted area the licensee's facility.

(2) Must be instructed in the health protection problems associated with exposure to such radiation or radioactive material to the individual and potential offspring, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed.

(3) Must be instructed in, and instructed to observe, to the extent within the worker's control, the applicable provisions of this article and licenses for the protection of personnel from exposures to radiation or radioactive material occurring in such areas.

(4) Must be instructed of their responsibility to report promptly to the licensee or registrant any condition which may constitute, lead to, or cause a violation of North Dakota Century Code chapter 23-20.1, this article, and licenses or unnecessary exposure to radiation or radioactive material.

(5) Must be instructed in the appropriate response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation or radioactive material.

(6) Must be advised as to the radiation exposure reports which workers must be furnished pursuant to subsection 3.

b. The extent of these instructions must be commensurate with potential radiological health protection problems in the restricted area present in the workplace.

3. Notifications and reports to individuals.

a. Radiation exposure data for an individual and the results of any measurements, analyses, and calculations of

radioactive material deposited or retained in the body of an individual must be reported to the individual as specified in this subsection. The information reported must include data and results obtained pursuant to this article, orders, or license conditions, as shown in records maintained by the licensee or registrant pursuant to ~~subdivisions a and c of subsection 1 of section 33-10-04-05~~ subsection 7 of section 33-10-04.1-15. Each notification and report must:

- (1) Be in writing.
- (2) Include appropriate identifying data such as the name of the licensee or registrant, the name of the individual, and the individual's identification number, preferably social security number.
- (3) Include the individual's exposure information.
- (4) Contain the following statement:

This report is furnished to you under the provisions of North Dakota State Radiological Health Rules (North Dakota Administrative Code chapter 33-10-10). You should preserve this report for further reference.

- b. Each licensee or registrant shall advise each worker annually, in writing, of the worker's exposure to radiation or radioactive material dose as shown in records maintained by the licensee or registrant pursuant to ~~subdivisions a and c of subsection 1 of section 33-10-04-05~~ subsection 7 of section 33-10-04.1-15.
- c. Each licensee or registrant shall furnish to each worker a report of the worker's exposure to sources of radiation or radioactive material upon termination of employment at the request of a worker formerly engaged in activities controlled by the licensee or registrant. The report shall include the dose record for each year the worker was required to be monitored pursuant to subsection 2 of section 33-10-04.1-09. Such report must be furnished within thirty days from the time of termination of employment date of the request, or within thirty days after the exposure dose of the individual has been determined by the licensee or registrant, whichever is later. The report must cover each calendar quarter in which the period of time that the worker's activities involved exposure to radiation from radioactive material licensed by, or radiation machines registered with the department; and must include the dates and locations of work under the license or registration in which the worker participated during this period.

- d. When a licensee or registrant is required pursuant to subsection 5 of section 33-10-04-05 subsection 3 of section 33-10-04.1-16 to report to the department any exposure of an individual to sources of radiation or radioactive material, the licensee or the registrant shall also provide the individual a report on the individual's exposure data included therein. Such reports must be transmitted at a time not later than the transmittal to the department.
- e. At the request of a worker who is terminating employment in a given calendar quarter with the licensee or registrant in work involving exposure to radiation dose, or of a worker who, while employed by another person, is terminating assignment to work involving radiation dose in the licensee's facility in that calendar quarter or radioactive material, during the current year, each licensee or registrant shall provide at termination to each such worker, or to the worker's designee, at termination a written report regarding the radiation dose received by that worker from operations of the licensee or registrant during that specifically identified calendar quarter the current year or fraction thereof, or provide a written estimate of that dose if the finally determined personnel monitoring results are not available at that time. Estimated doses must be clearly indicated as such. If the most recent individual monitoring results are not available at that time, a written estimate of the dose shall be provided together with a clear indication that this is an estimate.
4. Presence of representatives of licensees or registrants and workers during inspection.
- a. Each licensee or registrant shall afford to the department at all reasonable times opportunity to inspect materials, machines, activities, facilities, premises, and records pursuant to this article.
- b. During an inspection, department inspectors may consult privately with workers as specified in subsection 5. The licensee or registrant may accompany department inspectors during other phases of an inspection.
- c. If, at the time of inspection, an individual has been authorized by the workers to represent them during department inspections, the licensee or registrant shall notify the inspectors of such authorization and shall give the workers' representative an opportunity to accompany the inspectors during the inspection of physical working conditions.

- d. Each workers' representative must be routinely engaged in work under control of the licensee or registrant and must have received instructions as specified in subsection 2.
- e. Different representatives of licensees or registrants and workers may accompany the inspectors during different phases of an inspection if there is no resulting interference with the conduct of the inspection. However, only one workers' representative at a time may accompany the inspectors.
- f. With the approval of the licensee or registrant and the workers' representative, an individual who is not routinely engaged in work under control of the licensee or registrant, for example, a consultant to the licensee or registrant or to the workers' representative, must be afforded the opportunity to accompany department inspectors during the inspection of physical working conditions.
- g. Notwithstanding the other provisions of this subsection, department inspectors are authorized to refuse to permit accompaniment by any individual who deliberately interferes with a fair and orderly inspection. With regard to any area containing proprietary information, the workers' representative for that area must be an individual previously authorized by the licensee or registrant to enter that area. With regard to areas containing information classified by an agency of the United States government in the interest of national security, an individual who accompanies an inspector may have access to such information only if authorized to do so.

5. Consultation with workers during inspections.

- a. Department inspectors may consult privately with workers concerning matters of occupational radiation protection and other matters related to applicable provisions of department rules and licenses to the extent the inspectors deem necessary for the conduct of an effective and thorough inspection.
- b. During the course of an inspection any worker may bring privately to the attention of the inspectors, either orally or in writing, any past or present condition which the worker has reason to believe may have contributed to or caused any violation of North Dakota Century Code chapter 23-20.1, this article, or license condition, or any unnecessary exposure of an individual to radiation from licensed radioactive material or a registered radiation machine under the licensee's or registrant's

control. Any such notice, in writing, must comply with the requirements of subdivision a of subsection 6.

- c. The provisions of subdivision b may not be interpreted as authorization to disregard instructions pursuant to subsection 2.

6. Requests by workers for inspections.

- a. Any worker or representative of workers believing that violations of North Dakota Century Code chapter 23-20.1, this article, or license conditions exist or have occurred in work under a license or registration with regard to radiological working conditions in which the worker is engaged, may request an inspection by giving notice of the alleged violation to the department. Any such notice must be in writing, must set forth the specific grounds for the notice, and must be signed by the worker or representative of the workers. A copy must be provided to the licensee or registrant by the department no later than at the time of inspection except that, upon the request of the worker giving such notice, the worker's name and the name of individuals referred to therein may not appear in such copy or on any record published, released, or made available by the department, except for good cause shown.
- b. If, upon receipt of such notice, the department determines that the complaint meets the requirements set forth in subdivision a and that there are reasonable grounds to believe that the alleged violation exists or has occurred, an inspection must be made as soon as practicable, to determine if such alleged violation exists or has occurred. Inspections pursuant to this subsection need not be limited to matters referred to in the complaint.
- c. No license, registrant, or contractor or subcontractor of a licensee or registrant may discharge or in any manner discriminate against any worker because such worker has filed any complaint or instituted or caused to be instituted any proceeding under this article or has testified or is about to testify in any such proceeding or because of the exercise by such worker on behalf of the worker or others of any option afforded by this chapter.

7. Inspections not warranted - informal review.

- a. (1) If the department determines, with respect to a complaint under subsection 6, that an inspection is not warranted because there are no reasonable grounds to believe that a violation exists or has occurred, the department shall notify the complainant in writing of such determination. The complainant may obtain review of such determination by submitting a

written statement of position with the department which will provide the licensee or registrant with a copy of such statement by certified mail, excluding, at the request of the complainant, the name of the complainant. The licensee or registrant may submit an opposing written statement of position with the department which will provide the complainant with a copy of such statement by certified mail.

- (2) Upon the request of the complainant, the department may hold an informal conference in which the complainant and the licensee or registrant may orally present their views. An informal conference may also be held at the request of the licensee or registrant but disclosure of the identity of the complainant will be made only following receipt of written authorization from the complainant. The department shall render an informal opinion after the close of the conference. The complainant shall have the right of petition for a formal administrative hearing as provided for by North Dakota Century Code chapter 28-32 and North Dakota Administrative Code article 33-22, following the decision of such formal conference.

- b. If the department determines that an inspection is not warranted because the requirements of subdivision a of subsection 6 have not been met, the department shall notify the complainant in writing of such determination. Such determination must be without prejudice to the filing of a new complaint meeting the requirements of subdivision a of subsection 6.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC 28-32-02

CHAPTER 33-10-11

33-10-11-03. Exemptions. No application fees, license fees, amendment fees, renewal fees, or special project fees, shall be required for:

1. A license authorizing the use of source material as shielding only in devices and containers; provided, however, that all other licensed byproduct material, naturally occurring or accelerator-produced radioactive material, source material, or special nuclear material in the device or container will be subject to the fees prescribed in appendix A of this chapter.
2. Nonprofit educational institutions are exempt from the fees prescribed in appendices A and B of this chapter. This exemption does not apply to those radioactive material licenses or machine registration certificates which authorize any of the following:
 - a. Human use.
 - b. Remunerated services to other persons.
 - c. Distribution of byproduct material, naturally occurring or accelerator-produced radioactive material, source material, or special nuclear material, or products containing byproduct material, ~~source~~ naturally occurring or accelerator-produced radioactive material, source material, or special nuclear material.
 - d. Activities performed under a government contract.
3. The department may, upon application by an interested person, or upon its own initiative, grant such exemptions from the requirements of this chapter as it determines are authorized by law and are otherwise in the public interest.

History: Effective October 1, 1982; amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC ~~20-32-02~~ 23-20.1-04

Law Implemented: NDCC 23-20.1-03, 23-20.1-04, 23-20.1-04.5

33-10-11-04. Payment of fees. The following fees are nonrefundable:

1. License and registration fees. The appropriate licensing or registration fee shall accompany the application for licensure or registration when filed with the department.

2. **Amendment fees.** The appropriate amendment fee shall accompany the application for amendment when filed with the department.
3. **Renewal fees.** The appropriate renewal fee shall accompany the renewal application when filed with the department.
4. **Reciprocity fee.** The appropriate reciprocity fee shall accompany the written notification as required in sections 33-10-03-06 and 33-10-02-12.
5. **Special project fees.** Fees for special projects are payable upon notification by the department when the review of the project is completed. Special projects mean those projects submitted to the department for review and for which specific fees are not prescribed in this chapter. Special project fees will be based upon the current professional staff hourly rate (thirty-three percent of the current nuclear regulatory commission rate listed in 10 CFR 170.20).
6. **Annual fees.** Annual fees are required to be paid by all radioactive material licensees no later than the anniversary date of the license expiration date (e.g., a license that expires April 30, 1996, will have the annual fee due not later than April thirtieth of each calendar year). The initial application or renewal fee constitutes the first year annual fee and annual fees for North Dakota licensees will be only required for the second through fifth years of the license.
7. **Inspection and survey fees.** Fees for regulatory inspections and surveys of North Dakota licensees are included in the registration or application and renewal fees for each registration or license type. Special inspections will require the nonroutine inspection fee to be paid upon notification by the department when the inspection has been completed. Reciprocity licensees which are inspected will be billed for the routine or nonroutine inspection for the license type, as appropriate.
8. **Method of payment.** Fee payments shall be by check, draft, or money order made payable to the North Dakota state department of health and consolidated laboratories.
9. **Return Submittal of application and fee payment.** The application for licensure or registration shall be accompanied by the fee payment and shall be submitted to:

North Dakota State Department of Health
and Consolidated Laboratories
Division of Environmental Engineering
1200 Missouri Avenue, Room 304
Box 5520
Bismarck, ND 58502-5520

History: Effective October 1, 1982; amended effective June 1, 1986;
June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC 23-20.1-04, 23-20.1-04.5

APPENDIX A
SCHEDULE OF FEES FOR RADIOACTIVE MATERIAL LICENSES

Applicants for radioactive material licenses and other regulatory services and holders of radioactive material licenses shall pay the following fees:

Category of Materials Licenses and Types of Fees	Fee (\$)
<p>1. Special nuclear material:</p> <p>A. Licenses for possession and use of 200 grams or more of plutonium in unsealed form or 350 grams or more of contained U-235 in unsealed form or 200 grams or more of U-233 in unsealed form. This includes applications to terminate licenses as well as licenses authorizing possession only:</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>Full Cost Full Cost Full Cost Full Cost Full Cost 35,725</p>
<p>B. Licenses for receipt and storage of spent fuel at an independent spent fuel storage installation (ISFSI): (Regulated by NRC)</p>	N/A
<p>C. Licenses for possession and use of special nuclear material in sealed sources contained in devices used in industrial measuring systems, including X-ray fluorescence analyzers:</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>320 250 125 155 435 375</p>
<p>D. All other special nuclear material licenses, except licenses authorizing special nuclear material in unsealed form in combination that would constitute a critical quantity.</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>460 345 75 230 265 625</p>

<p>2. Source material:</p> <p>A. Licenses for possession and use of source material in recovery operations such as milling, in-situ leaching, heap-leaching, refining uranium mill concentrates to uranium hexafluoride, or buying stations, ion exchange facilities and in processing of ores containing source material for extraction of metals other than uranium or thorium, including licenses authorizing the possession of byproduct waste material (tailings) from source material recovery operations, as well as licenses authorizing the possession and maintenance of a facility in a standby mode:</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>Full Cost Full Cost Full Cost Full Cost Full Cost 189,565</p>
<p>B. Licenses for possession and use of source material for shielding:</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>110 55 40 95 115 105</p>
<p>C. All other source material licenses:</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>530 250 150 265 500 765</p>
<p>3. <u>Byproduct material and naturally occurring or accelerator-produced radioactive material:</u></p> <p>A. Licenses of broad scope for possession and use of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> issued pursuant to chapter 33-10-03 for processing or manufacturing of items containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> for commercial distribution:</p> <p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>1465 1165 75 700 1050 2200</p>

<p>B. Other licenses for possession and use of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> issued pursuant to chapter 33-10-03 for processing or manufacturing of items containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> for commercial distribution:</p> <p>Application-New License 765 Renewal 435 Amendment 185 Inspection (routine) 335 Inspection (nonroutine) 665 Annual Fee 1100</p>	
<p>C. Licenses issued pursuant to chapter 33-10-03 authorizing the processing or manufacturing and distribution or redistribution of radiopharmaceuticals, generators, reagent kits and/or sources and devices containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u>:</p> <p>Application-New License 1135 Renewal 465 Amendment 150 Inspection (routine) 465 Inspection (nonroutine) 635 Annual Fee 2500</p>	
<p>D. License and approvals issued pursuant to chapter 33-10-03 authorizing distribution or redistribution of radiopharmaceuticals, generators, reagent kits and/or sources or devices not involving processing of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u>:</p> <p>Application-New License 365 Renewal 165 Amendment 105 Inspection (routine) 265 Inspection (nonroutine) 400 Annual Fee 875</p>	
<p>E. Licenses for possession and use of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> in sealed sources for irradiation of materials in which the source is not removed from its shield (self-shielded units):</p> <p>Application-New License 165 Renewal 160 Amendment 115 Inspection (routine) 155 Inspection (nonroutine) 230 Annual Fee 405</p>	

<p>F. License for possession and use of less than 10,000 curies of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> in sealed sources for irradiation of materials in which the source is exposed for irradiation purposes:</p>	
<p>G. Licenses for possession and use of 10,000 curies or more of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> in sealed sources for irradiation of materials in which the source is exposed for irradiation purposes:</p>	
<p>H. Licenses issued pursuant to chapter 33-10-03 to distribute items containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> that require device review to persons exempt from the licensing requirements of chapter 33-10-03, except specific licenses authorizing redistribution of items that have been authorized for distribution to persons exempt from the licenses of chapter 33-10-03:</p>	
<p>I. Licenses issued pursuant to chapter 33-10-03 to distribute items containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u>, or quantities of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> that do not require device evaluation to persons exempt from the licensing requirements of chapter 33-10-03, except for specific licenses authorizing redistribution of items that have been authorized for distribution to persons exempt from the licensing requirements of chapter 33-10-03:</p>	

<p>J. Licenses issued pursuant to chapter 33-10-03 to distribute items containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> that require sealed source and/or device review to persons generally licensed under chapter 33-10-03, except specific licenses authorizing redistribution of items that have been authorized for distribution to persons generally licensed under this chapter:</p>	
<p>K. Licenses issued pursuant to chapter 33-10-03 to distribute items containing byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u>, or quantities <u>of byproduct material or naturally occurring or accelerator-produced radioactive material</u> that do not require sealed source and/or device review to persons generally licensed under this chapter, except specific licenses authorizing for redistribution of items that have been authorized for distribution to persons generally licensed under this chapter:</p>	
<p>L. Licenses of broad scope for possessions and use of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> issued pursuant to chapter 33-10-03 for research and development that do not authorize commercial distribution:</p>	
<p>M. Other licenses for possession and use of byproduct material <u>or naturally occurring or accelerator-produced radioactive material</u> issued pursuant to chapter 33-10-03 for research and development that do not authorize commercial distribution:</p>	

Application-New License	835
Renewal	195
Amendment	130
Inspection (routine)	230
Inspection (nonroutine)	345
Annual Fee	1705

Application-New License	635
Renewal	315
Amendment	95
Inspection (routine)	230
Inspection (nonroutine)	345
Annual Fee	1340

Application-New License	765
Renewal	665
Amendment	165
Inspection (routine)	310
Inspection (nonroutine)	400
Annual Fee	600

Application-New License	365
Renewal	365
Amendment	210
Inspection (routine)	265
Inspection (nonroutine)	310
Annual Fee	935

N.	Licenses that authorize services for other licenses, except (1) licenses that authorize calibration and/or leak testing services only are subject to the fees specified in fee Category 3P, and (2) licenses that authorize waste disposal services are subject to the fees specified in fee Categories 4A, 4B, and 4C: Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee	465 265 135 230 345 1065
O.	License for possession and use of byproduct material or naturally occurring or accelerator-produced radioactive material issued pursuant to chapter 33-10-05 for industrial radiography operations: Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee	1000 600 165 400 835 600
P.	All other specific byproduct material or naturally occurring or accelerator-produced radioactive material licenses, except those in Categories 4A through 9D: Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee	250 165 125 400 600 475
4. A.	Waste disposal and processing: Licenses specifically authorizing the receipt of waste byproduct material, naturally occurring or accelerator-produced radioactive material, source material, or special nuclear material from other persons for the purpose of contingency storage or commercial land disposal by the licensee; or licenses authorizing contingency storage of low level radioactive waste at the site of nuclear power reactors; or licenses for receipt of waste from other persons for incineration or other treatment, packaging of resulting waste and residues, and transfer of packages to another person authorized to receive or dispose of waste material: Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee	Full Cost Full Cost Full Cost Full Cost Full Cost 21,295

<p>B. Licenses specifically authorizing the receipt of waste byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or <u>special nuclear material</u> from other persons for the purpose of packaging or repackaging the material. The license will dispose of the material by transfer to another person authorized to receive or dispose of the material:</p> <p>Application-New License 935 Renewal 635 Amendment 65 Inspection (routine) 535 Inspection (nonroutine) 700 Annual Fee 3165</p>	
<p>C. Licenses specifically authorizing the receipt of prepackaged waste byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material from other persons. The licensee will dispose of the material by transfer to another person authorized to receive or dispose of the material:</p> <p>Application-New License 635 Renewal 310 Amendment 75 Inspection (routine) 535 Inspection (nonroutine) 700 Annual Fee 1800</p>	
<p>5. Well logging:</p> <p>A. Licenses for possession and use of byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, and/or special nuclear material for well logging, well surveys, and tracer studies other than field flooding tracer studies:</p> <p>Application-New License 1135 Renewal 665 Amendment 180 Inspection (routine) 265 Inspection (nonroutine) 400 Annual Fee 2305</p>	
<p>B. Licenses for possession and use of byproduct material or <u>naturally occurring or accelerator-produced radioactive material</u>, for field flooding tracer studies:</p> <p>Application-New License Full Cost Renewal Full Cost Amendment Full Cost Inspection (routine) 230 Inspection (nonroutine) 335 Annual Fee 3435</p>	

<p>6. Nuclear laundries: A. Licenses for commercial collection and laundry of items contaminated with byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material:</p>	<p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>700 465 115 400 635 1200</p>
<p>7. Human use of byproduct, <u>naturally occurring or accelerator-produced</u>, source, or special nuclear material: A. Licenses issued pursuant to chapter 33-10-03 for human use of byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material in sealed sources contained in teletherapy devices:</p>	<p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>1135 265 145 400 635 3205</p>
<p>B. Licenses of broad scope issued to medical institutions or two or more physicians pursuant to chapter 33-10-03 authorizing research and development, including human use of byproduct material, except licenses for byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material in sealed sources contained in teletherapy devices:</p>	<p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>765 665 120 535 600 2900</p>
<p>C. Other licenses issued pursuant to chapter 33-10-03 for human use of byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, and/or special nuclear material, except licenses for byproduct material, source material, <u>naturally occurring or accelerator-produced radioactive material</u>, or special nuclear material in sealed sources contained in teletherapy devices:</p>	<p>Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>235 335 145 335 500 1140</p>

<p>8. A.</p>	<p>Civil defense: Licenses for possession and use of byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material for civil defense activities: Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>195 135 105 230 230 440</p>
<p>9. A.</p>	<p>Device, product or sealed source safety evaluation: Safety evaluation of devices or products containing byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material, except reactor fuel devices, for commercial distribution: Application-each device Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>1100 1100 400 Full Cost Full Cost 2040</p>
<p>B.</p>	<p>Safety evaluation of devices or products containing byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material manufactured in accordance with the unique specifications of, and for use by a single applicant, except reactor fuel devices: Application-each device Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>800 535 195 Full Cost Full Cost 1040</p>
<p>C.</p>	<p>Safety evaluation of sealed sources containing byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material, except reactor fuel, for commercial distribution: Application-each device Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee</p>	<p>345 230 75 Full Cost Full Cost 440</p>

<p>D. Safety evaluation of sealed sources containing byproduct material, <u>naturally occurring or accelerator-produced radioactive material</u>, source material, or special nuclear material, manufactured in accordance with the unique specifications of, and for use by a single applicant, except reactor fuel:</p> <p>Application-each source 175 Renewal 115 Amendment 40 Inspection (routine) Full Cost Inspection (nonroutine) Full Cost Annual Fee 225</p>	
<p>10. Transportation of radioactive material: (Regulated by NRC)</p>	N/A
<p>11. Review of standardized spent fuel facilities: (Regulated by NRC)</p>	N/A
<p>12. Special projects:</p>	Full Cost
<p>13. A. Spent fuel storage cask Certificate of Compliance: (Regulated by NRC)</p>	N/A
<p>B. Inspections related to spent fuel storage cask Certificate of Compliance: (Regulated by NRC)</p>	N/A
<p>C. Inspections related to storage of spent fuel under of this chapter: (Regulated by NRC)</p>	N/A
<p>14. Byproduct, <u>naturally occurring or accelerator-produced</u>, source, or special nuclear material licenses and other approvals authorizing decommissioning, decontamination, reclamation or site restoration activities pursuant to 10 CFR parts 30, 40, 70 and 72:</p> <p>Application-New License Full Cost Renewal Full Cost Amendment Full Cost Inspection (routine) Full Cost Inspection (nonroutine) Full Cost Annual Fee Full Cost</p>	
<p>15. Import and Export licenses: (Regulated by NRC)</p>	N/A
<p>16. Reciprocity: Other agreement state and NRC licensees who conduct activities in North Dakota under the reciprocity provisions of chapters 33-10-02 and 33-10-03. Application fee (due 3 days prior to entry into State)</p> <p>Inspections (routine and nonroutine)</p>	<p>Fees as specified in annual fees for license type</p> <p>Fees as specified under inspection fees for license type</p>

17. Demonstration and sales of devices containing radioactive materials.	100 per year
18. Radiation training courses.	100 per year
19. Decontamination services.	500 per year
20. Installation, removal, repair and servicing of devices containing radioactive materials.	475 per year
21. Multiple offices: Add the following fees per additional office location: Application-New License Renewal Amendment Inspection (routine) Inspection (nonroutine) Annual Fee	25% of base fee 25% of base fee same as base fee same as base fee same as base fee 25% of base fee
22. Administrative amendment (limited to the following amendment requests: - Corporate name change - Minor O&E manual changes (industrial sources) - Filing of training certificates (gauge users)	\$55
23. Inspection of radioactive materials package shipments to low-level radioactive waste disposal facility.	Full Cost
24. Certificate - in vitro testing with radioactive material under general license. Application - 3 year certificate.	\$75

History: Effective October 1, 1982; amended effective June 1, 1986; June 1, 1992; March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC 23-20.1-04, 23-20.1-04.5

APPENDIX B
SCHEDULE OF FEES FOR REGISTRATION CERTIFICATION AND INSPECTIONS

Applications for registration of radiation machines and other regulatory services shall pay the following fees for each machine that they possess and use at their facilities. The fees cover a three-year registration period and the renewal fee is the amount listed.

Registration Category	Fee/Machine (in dollars)
Dentistry	60
Medical:	
A. Radiographic Machine (including computed tomography)	100
B. Fluoroscopic Machine	150
C. Combined Radiographic-Fluoroscopic	200
D. (1) Therapeutic: Linear Accelerator (10 MEV)	150
(2) Therapeutic: Linear Accelerator (10 MEV)	250
E. Superficial X-ray	75
Chiropractic	90
Podiatry	75
Veterinary Medicine	60
Industrial Radiography	250
Accelerators (Industrial and Research)	150
Education and Research	150
Other Registration Fees and Services	Annual Service Fees (in dollars)
X-Ray Service and Installers	150
Radiation Training Courses	100
X-ray Sales and Demonstrations	150
Combined Sales and Service (Assembler)	200
Dosimeterists and Physicists	100

Shielding Evaluations (Routine)	150 per evaluation
Shielding Evaluations (Nonroutine)	Full cost
Reciprocity (X-ray producing machines)	150 per year <u>per machine</u>

History: Effective October 1, 1982; amended effective June 1, 1986;
June 1, 1992; March 1, 1994.

General Authority: NDCC 28-32-02

Law Implemented: NDCC 23-20.1-04, 23-20.1-04.5

CHAPTER 33-10-12

33-10-12-01. Purpose. This chapter establishes radiation safety requirements for persons using sources of radiation for wireline service operations including mineral logging, radioactive markers, and subsurface tracer studies. The requirements of this chapter are in addition to, and not in substitution for, the requirements of chapters 33-10-01, 33-10-02, 33-10-03, ~~33-10-04~~ 33-10-04.1, and 33-10-10.

History: Effective June 1, 1986; amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-12-05. Equipment control.

1. Limits on levels of radiation. Sources of radiation shall be used, stored, and transported in such a manner that the transportation requirements of chapter 33-10-13 and the dose limitation requirements of chapter ~~33-10-04~~ 33-10-04.1 are met.
2. Storage precautions.
 - a. Each source of radiation, except accelerators, must be provided with a storage or transport container. The container shall be provided with a lock, or tamper seal for calibration sources, to prevent unauthorized removal of, or exposure to, the source of radiation.
 - b. Sources of radiation shall be stored in a manner which will minimize danger from explosion or fire.
3. Transport precautions. Transport containers shall be physically secured to the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal.
4. Radiation survey instruments.
 - a. The licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments at each field station to make physical radiation surveys as required by this chapter and by ~~subsection 4 of section 33-10-04-03~~ section 33-10-04.1-09. Instrumentation shall be capable of measuring one-tenth milliroentgen [25.8 nanocoulombs per kilogram] per hour through at least fifty milliroentgens [12.9 microcoulombs per kilogram] per hour. Survey instruments acquired before March 1, 1992, and capable of measuring one-tenth milliroentgen [25.8 nanocoulombs per kilogram] per hour through at least

twenty milliroentgens [5.16 microcoulombs per kilogram] per hour also satisfy this requirement until March 1, 1997.

- b. Each radiation survey instrument shall be 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-thirds of full-scale on each scale; for logarithmic scale instruments, at midrange of each decade, and at two points of at least one decade; and for digital instruments, at appropriate points; and
 - (3) So that accuracy within plus or minus twenty percent of the true radiation level can be demonstrated on each scale.
- c. Calibration records shall be maintained for a period of three years for inspection by the department.

5. Leak testing of sealed sources.

- a. Requirements. Each licensee using sealed sources of radioactive material shall have the sources tested for leakage. Records of leak test results shall be kept in units of microcuries [becquerels] and maintained for inspection by the department for three years from the date the leak test is performed.
- b. Method of testing. Tests for leakage shall be performed only by persons specifically authorized to perform such tests by the department, the United States nuclear regulatory commission, an agreement state, or a licensing state. The test sample shall be taken from the surface of the source, source holder, or from the surface of the device in which the source is stored or mounted and on which one might expect contamination to accumulate. The test sample shall be analyzed for radioactive contamination, and the analysis shall be capable of detecting the presence of five-thousandths microcurie [185 becquerels] of radioactive material on the test sample.
- c. Interval of testing. Each sealed source of radioactive material shall be tested at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made prior to the transfer, the sealed source may not be put into use until tested. If, for any reason, it is suspected that a sealed source may be leaking, it shall be removed from service immediately and tested for leakage as soon as practical.

- d. Leaking or contaminated sources. If the test reveals the presence of five-thousandths microcurie [185 becquerels] or more of leakage or contamination, the licensee shall immediately withdraw the source from use and shall cause it to be decontaminated, repaired, or disposed of in accordance with this article. A report describing the equipment involved, the test results, and the corrective action taken shall be filed with the department within five days of receiving the test results.
- e. Exemptions. The following sources are exempt from the periodic leak test requirements of subdivisions a, b, c, and d of this subsection:
 - (1) Hydrogen-3 sources.
 - (2) Sources of radioactive material with a half-life of thirty days or less.
 - (3) Sealed sources of radioactive material in gaseous form.
 - (4) Sources of beta and/or gamma emitting radioactive material with an activity of one hundred microcuries [3.7 megabecquerels] or less.
 - (5) Sources of alpha emitting radioactive material with an activity of ten microcuries [370 kilobecquerels] or less.
- 6. **Quarterly inventory.** Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation. Records or inventories shall be maintained for three years from the date of the inventory for inspection by the department and shall include the quantities and kinds of sources of radiation, the location where sources of radiation are assigned, the date of the inventory, and the name of the individual conducting the inventory.
- 7. **Utilization records.** Each licensee or registrant shall maintain current records, which shall be maintained for inspection by the department for three years from the date of the recorded event, showing the following information for each source of radiation:
 - a. Make, model number, and a serial number or a description of each source of radiation used.
 - b. The identity of the well-logging supervisor or field unit to whom assigned.
 - c. Locations where used and dates of use.

- d. In the case of tracer materials and radioactive markers, the utilization record shall indicate the radionuclide and activity used in a particular well.
8. Design, performance, and certification criteria for sealed sources used in downhole operations.
- a. Each sealed source, except those containing radioactive material in gaseous form, used in downhole operations and manufactured after June 1, 1986, shall be certified by the manufacturer, or other testing organization acceptable to the department, to meet the following minimum criteria:
 - (1) Be of doubly encapsulated construction.
 - (2) Contain radioactive material whose chemical and physical forms are as insoluble and nondispersible as practical.
 - (3) Has been individually pressure tested to at least twenty-four thousand, six hundred fifty-six pounds per square inch absolute without failure.
 - b. For sealed sources, except those containing radioactive material in gaseous form, acquired after June 1, 1986, in the absence of a certificate from a transferor certifying that an individually sealed source meets the requirements of subdivision a, the sealed source shall not be put into use until such determinations and testing have been performed.
 - c. Each sealed source, except those containing radioactive material in gaseous form, used in downhole operations after June 1, 1986, shall be certified by the manufacturer, or other testing organization acceptable to the department, as meeting the sealed source performance requirements for oil well logging as contained in the American national standard N43.6, "Classification of Sealed Radioactive Sources," (formerly N542, ANSI/NBS 126) in effect on June 1, 1986.
 - d. Certification documents shall be maintained for inspection by the department for a period of three years after source disposal. If the source is abandoned downhole, the certification documents shall be maintained until the department authorizes disposition.
9. Labeling.
- a. Each source, source holder, or logging tool containing radioactive material shall bear a durable, legible, and clearly visible marking or label, which has, as a minimum,

the standard radiation caution symbol, without the conventional color requirement, and the following wording:

DANGER*
RADIOACTIVE

This labeling shall be on the smallest component transported as a separate piece of equipment.

- b. Each transport container shall have permanently attached to it a durable, legible, and clearly visible label which has, as a minimum, the standard radiation caution symbol and the following wording:

DANGER*
RADIOACTIVE
NOTIFY CIVIL AUTHORITIES (OR NAME OF COMPANY)

* or CAUTION

10. Inspection and maintenance.

- a. Each licensee or registrant shall conduct, at intervals not to exceed six months, a program of inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools to assure proper labeling and physical condition. Records of inspection and maintenance shall be maintained for a period of three years for inspection by the department.
- b. If any inspection conducted pursuant to subdivision a of this subsection reveals damage to labeling or components critical to radiation safety, the device shall be removed from service until repairs have been made.
- c. 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 United States nuclear regulatory commission, an agreement state, or a licensing state to perform this operation.
- d. The repair, opening, or modification of any sealed source shall be performed only by persons specifically authorized to do so by the department, the United States nuclear regulatory commission, an agreement state, or a licensing state.

History: Effective June 1, 1986; amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-12-06. Requirement for personnel safety.

1. Training requirements.

a. No licensee or registrant may permit any individual to act as a logging supervisor as defined in this chapter until such individual has:

(1) Received, in a course recognized by the department, the United States nuclear regulatory commission, an agreement state, or a licensing state, instruction in the subjects outlined in appendix A of this chapter and demonstrated an understanding thereof.

(2) Read and received instruction in the rules contained in this chapter and the applicable sections of chapters 33-10-01, ~~33-10-04~~ 33-10-04.1, and 33-10-10 or their equivalent, conditions of appropriate license or certificate of registration, and the licensee's or registrant's operating and emergency procedures, and demonstrated an understanding thereof.

(3) Demonstrated competence to use sources of radiation, related handling tools, and radiation survey instruments which will be used on the job.

b. No licensee or registrant may permit any individual to assist in the handling of sources of radiation until such individual has:

(1) Read or received instruction in the licensee's or registrant's operating and emergency procedures and demonstrated an understanding thereof.

(2) Demonstrated competence to use, under the personal supervision of the logging supervisor, the sources of radiation, related handling tools, and radiation survey instruments which will be used on the job.

c. The licensee or registrant shall maintain employee training records for inspection by the department for three years following termination of employment.

2. Operating and emergency procedures. The licensee's or registrant's operating and emergency procedures shall include instructions in at least the following:

a. Handling and use of sources of radiation to be employed so that no individual is likely to be exposed to radiation doses in excess of the standards established in chapter ~~33-10-04~~ 33-10-04.1.

- b. Methods and occasions for conducting radiation surveys.
- c. Methods and occasions for locking and securing sources of radiation.
- d. Personnel monitoring and the use of personnel monitoring equipment.
- e. Transportation to temporary jobsites and field stations, including the packaging and placing of sources of radiation in vehicles, placarding the vehicles, and securing sources of radiation during transportation.
- f. Minimizing exposure of individuals in the event of an accident.
- g. Procedure for notifying proper personnel in the event of an accident.
- h. Maintenance of records.
- i. Inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools.
- j. Procedures to be followed in the event a sealed source is lodged downhole.
- k. Procedures to be used for picking up, receiving, and opening packages containing radioactive material.
- l. For the use of tracers, decontamination of the environment, equipment, and personnel.
- m. Maintenance of records generated by logging personnel at temporary jobsites.
- 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 radioactive material and actions to obtain suitable radiation survey instruments as required by subsection 4 of section 33-10-12-05.

3. Personnel monitoring.

- a. No licensee or registrant may permit any individual to act as a logging supervisor or to assist in the handling of sources of radiation unless each such individual wears either a film badge or a thermoluminescent dosimeter (TLD). Each film badge or thermoluminescent dosimeter shall be assigned to and worn by only one individual. Film badges must be replaced at least monthly and

thermoluminescent dosimeters replaced at least quarterly. After replacement, each film badge or thermoluminescent dosimeter must be promptly processed.

- b. Personnel monitoring records shall be maintained for inspection until the department authorizes disposition.

History: Effective June 1, 1986; amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-12-07. Precautionary procedures in logging and subsurface tracer operations.

1. Security. During each logging or tracer application, the logging supervisor or other designated employee shall maintain direct surveillance of the operation to protect against unauthorized or unnecessary entry into a restricted area, as defined in chapter 33-10-01.
2. Handling tools. The licensee shall provide and require the use of tools that will assure remote handling of sealed sources other than low activity calibration sources.
3. Subsurface tracer studies.
 - a. Protective gloves and other appropriate protective clothing and equipment shall be used by all personnel handling radioactive tracer material. Precautions shall be taken to avoid ingestion or inhalation of radioactive material.
 - b. No licensee may cause the injection of radioactive material into potable aquifers without prior written authorization from the department.
4. Particle accelerators. No licensee or registrant may permit aboveground testing of particle accelerators, designed for use in well logging, which results in the production of radiation, except in areas or facilities controlled or shielded so that the requirements of ~~subsections 4 and 5 of section 33-10-04-02~~ subsections 1, 7, and 8 of section 33-10-04.1-06 and section 33-10-04.1-07, as applicable, are met.

History: Effective June 1, 1986; amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

33-10-12-09. Notification of incidents, abandonment, and lost sources.

1. Notification of incidents and sources lost in other than downhole logging operations shall be made in accordance with appropriate provisions of chapter ~~33-10-04~~ 33-10-04.1.
2. Whenever a sealed source or device containing radioactive material is lodged downhole, the licensee shall:
 - a. Monitor at the surface for the presence of radioactive contamination with a radiation survey instrument or logging tool during logging tool recovery operations.
 - b. Notify the department immediately by telephone and subsequently within thirty days, by confirmatory letter if the licensee knows or has reason to believe that a sealed source has been ruptured. This letter must identify the well or other location, describe the magnitude and extent of the escape of radioactive material, assess the consequences of the rupture, and explain efforts planned or being taken to mitigate these consequences.
3. When it becomes apparent that efforts to recover the radioactive source will not be successful, the licensee shall:
 - a. Advise the well operator of an appropriate method of abandonment, which shall include:
 - (1) The immobilization and sealing in place of the radioactive source with a cement plug.
 - (2) The setting of a whipstock or other deflection device.
 - (3) The mounting of a permanent identification plaque, at the surface of the well, containing the appropriate information required by subsection 4.
 - b. Notify the department by telephone, facsimile, or overnight express mail giving the circumstances of the loss, and request approval of the proposed abandonment procedures.
 - c. File a written report with the department within thirty days of the abandonment. The licensee shall send a copy of the report to:

North Dakota Industrial Commission
Oil and Gas Division
600 East Boulevard
Bismarck, North Dakota 58505

The report must contain the following information:

- (1) Date of occurrence.
 - (2) A description of the well logging source involved, including the radionuclide and its quantity, chemical, and physical form.
 - (3) Surface location and identification of well.
 - (4) Results of efforts to immobilize and set the source in place.
 - (5) A brief description of the attempted recovery effort.
 - (6) Depth of the radioactive source.
 - (7) Depth of the top of the cement plug.
 - (8) Depth of the well.
 - (9) Any other information, such as a warning statement, contained on the permanent identification plaque.
 - (10) The names of the state agencies receiving a copy of this report.
4. Whenever a sealed source containing radioactive material is abandoned downhole, the licensee shall provide a permanent plaque for posting the well or well bore. An example of a suggested plaque is shown in appendix B of this chapter. This plaque shall:
- a. Be constructed of long-lasting material, such as stainless steel or monel.
 - b. Contain the following information engraved on its face:
 - (1) The word "CAUTION".
 - (2) The radiation symbol without the conventional color requirement.
 - (3) The date of abandonment.
 - (4) The name of the well operator or well owner.
 - (5) The well name and well identification numbers or other designation.
 - (6) The sealed sources by radionuclide and activity.

- (7) The source depth and the depth to the top of the plug.
 - (8) An appropriate warning, depending on the specific circumstances of each abandonment. Appropriate warnings may include: (a) "Do not drill below plug back depth"; (b) "Do not enlarge casing"; or (c) "Do not reenter the hole", followed by the words, "before contacting the North Dakota state department of health and consolidated laboratories".
5. The licensee shall immediately notify the department by telephone and subsequently by confirming letter if the licensee knows or has reason to believe that radioactive material has been lost in or in proximity to an underground potable aquifer. Such notice shall designate the well location and shall describe the magnitude and extent of loss of radioactive material, assess the consequences of such loss, and explain efforts planned or being taken to mitigate these consequences.

History: Effective June 1, 1986; amended effective June 1, 1992; March 1, 1994.

General Authority: NDCC ~~28-32-02~~ 23-20.1-04

Law Implemented: NDCC ~~28-32-02~~ 23-20.1-03, 23-20.1-04

CHAPTER 33-15-01

33-15-01-04. Definitions. As used in this article, except as otherwise specifically provided or where the context indicates otherwise, the following words shall have the meanings ascribed to them in this section:

1. "Act" means North Dakota Century Code chapter 23-25.
2. "Air contaminant" means any solid, liquid, gas, or odorous substance or any combination thereof.
3. "Air pollution" means the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as is or may be injurious to human health, welfare, or property, animal or plant life, or which unreasonably interferes with the enjoyment of life or property.
4. "Ambient air" means the surrounding outside air.
5. "ASME" means the American society of mechanical engineers.
6. "Control equipment" means any device or contrivance which prevents or reduces emissions.
7. "Department" means the North Dakota state department of health and consolidated laboratories.
8. "Emission" means a release of air contaminants into the ambient air.
9. "Existing" means equipment, machines, devices, articles, contrivances, or installations which are in being on or before July 1, 1970, unless specifically designated within this article; except that any existing equipment, machine, device, contrivance, or installation which is altered, repaired, or rebuilt after July 1, 1970, must be reclassified as "new" if such alternation, rebuilding, or repair results in the emission of an additional or greater amount of air contaminants.
10. "Federally enforceable" means all limitations and conditions which are enforceable by the administrator of the United States environmental protection agency including those requirements developed pursuant to 40 CFR parts 60 and 61, requirements within any applicable state implementation plan, any permit requirements established pursuant to 40 CFR 52.21 or under regulations approved pursuant to 40 CFR part 51, subpart I, including operating permits issued under a United States environmental protection agency-approved program that is incorporated into the state implementation plan and

expressly requires adherence to any permit issued under such program.

11. "Fuel burning equipment" means any furnace, boiler apparatus, stack, or appurtenances thereto used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer.
- ~~+1-~~ 12. "Fugitive emissions" means solid airborne particulate matter, fumes, gases, mist, smoke, odorous matter, vapors, or any combination thereof generated incidental to an operation process procedure or emitted from any source other than through a well-defined stack or chimney.
- ~~+2-~~ 13. "Garbage" means putrescible animal and vegetable wastes resulting from the handling, preparation, cooking, and consumption of food, including wastes from markets, storage facilities, handling, and sale of produce and other food products.
- ~~+3-~~ 14. "Heat input" means the aggregate heat content of all fuels whose products of combustion pass through a stack or stacks. The heat input value to be used shall be the equipment manufacturer's or designer's guaranteed maximum input, whichever is greater.
- ~~+4-~~ 15. "Incinerator" means any article, machine, equipment, device, contrivance, structure, or part of a structure used for the destruction of garbage, rubbish, or other wastes by burning or to process salvageable material by burning.
- ~~+5-~~ 16. "Inhalable particulate matter" means particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers. Also known as PM₁₀.
- ~~+6-~~ 17. "Installation" means any property, real or personal, including, but not limited to, processing equipment, manufacturing equipment, fuel burning equipment, incinerators, or any other equipment, or construction, capable of creating or causing emissions.
- ~~+7-~~ 18. "Multiple chamber incinerator" means any article, machine, equipment, contrivance, structure, or part of a structure used to dispose of combustible refuse by burning, consisting of three or more refractory lined combustion furnaces in series physically separated by refractory walls, interconnected by gas passage ports or ducts and employing adequate parameters necessary for maximum combustion of the material to be burned.
- ~~+8-~~ 19. "New" means equipment, machines, devices, articles, contrivances, or installations built or installed on or after July 1, 1970, unless specifically designated within this article, and installations existing at said stated time which

are later altered, repaired, or rebuilt and result in the emission of an additional or greater amount of air contaminants.

- ~~19~~ 20. "Opacity" means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background.
- ~~20~~ 21. "Open burning" means the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the ambient air without passing through an adequate stack, duct, or chimney.
- ~~21~~ 22. "Particulate matter" means any airborne finely divided solid or liquid material with an aerodynamic diameter smaller than one hundred micrometers.
- ~~22~~ 23. "Particulate matter emissions" means all finely divided solid or liquid material, other than uncombined water, emitted to the ambient air.
- ~~23~~ 24. "Person" means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this state, any other state or political subdivision or agency thereof and any legal successor, representative agent, or agency of the foregoing.
- ~~24~~ 25. "Pesticide" includes (a) any agent, substance, or mixture of substances intended to prevent, destroy, control, or mitigate any insect, rodent, nematode, predatory animal, snail, slug, bacterium, weed, and any other form of plant or animal life, fungus, or virus, that may infect or be detrimental to persons, vegetation, crops, animals, structures, or households or be present in any environment or which the department may declare to be a pest, except those bacteria, fungi, protozoa, or viruses on or in living man or other animals; (b) any agent, substance, or mixture of substances intended to be used as a plant regulator, defoliant, or desiccant; and (c) any other similar substance so designated by the department, including herbicides, insecticides, fungicides, nematocides, molluscicides, rodenticides, lampreycides, plant regulators, gametocides, post-harvest decay preventatives, and antioxidants.
- ~~25~~ 26. "PM₁₀" means particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers.
- ~~26~~ 27. "PM₁₀ emissions" means finely divided solid or liquid material with an aerodynamic diameter less than or equal to a nominal ten micrometers emitted to the ambient air.
- ~~27~~ 28. "Premises" means any property, piece of land or real estate, or building.

- ~~28.~~ 29. "Process weight" means the total weight of all materials introduced into any specific process which may cause emissions. Solid fuels charged will be considered as part of the process weight, but liquid and gaseous fuels and combustion air will not.
- ~~29.~~ 30. "Process weight rate" means the rate established as follows:
- a. For continuous or longrun steady state operations, the total process weight for the entire period of continuous operation or for a typical portion thereof, divided by the number of hours of such period or portion thereof.
 - b. For cyclical or batch operations, the total process weight for a period that covers a complete operation or an integral number of cycles, divided by the hours of actual process operation during such a period. Where the nature of any process or operation or the design of any equipment is such as to permit more than one interpretation of this definition, the interpretation that results in the minimum value for allowable emission shall apply.
- ~~30.~~ 31. "Public nuisance" means any condition of the ambient air beyond the property line of the offending person which is offensive to the senses, or which causes or constitutes an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.
- ~~31.~~ 32. "Refuse" means any combustible waste material, trade waste, rubbish, or garbage containing carbon in a free or combined state.
- ~~32.~~ 33. "Rubbish" means nonputrescible solid wastes consisting of both combustible and noncombustible wastes. Combustible rubbish includes paper, rags, cartons, wood, furniture, rubber, plastics, yard trimmings, leaves, and similar materials. Noncombustible rubbish includes glass, crockery, cans, dust, metal furniture and like materials which will not burn at ordinary incinerator temperatures (one thousand six hundred to one thousand eight hundred degrees Fahrenheit [1144 degrees Kelvin to 1255 degrees Kelvin]).
- ~~33.~~ 34. "Salvage operation" means any operation conducted in whole or in part for the salvaging or reclaiming of any product or material.
- ~~34.~~ 35. "Smoke" means small gasborne particles resulting from incomplete combustion, consisting predominantly, but not exclusively, of carbon, ash, and other combustible material, that form a visible plume in the air.
- ~~35.~~ 36. "Source" means any property, real or personal, or person contributing to air pollution.

- 36- 37. "Source operation" means the last operation preceding emission which operation (a) results in the separation of the air contaminant from the process materials or in the conversion of the process materials into air contaminants, as in the case of combustion fuel; and (b) is not an air pollution abatement operation.
- 37- 38. "Stack or chimney" means any flue, conduit, or duct arranged to conduct emissions.
- 38- 39. "Submerged fill pipe" means any fill pipe the discharge opening of which is entirely submerged when the liquid level is six inches [15.24 centimeters] above the bottom of the tank; or when applied to a tank which is loaded from the side, means any fill pipe the discharge opening of which is entirely submerged when the liquid level is one and one-half times the fill pipe diameter in inches [centimeters] above the bottom of the tank.
- 39- 40. "Standard conditions" means a dry gas temperature of sixty-eight degrees Fahrenheit [293 degrees Kelvin] and a gas pressure of fourteen and seven-tenths pounds per square inch absolute [101.3 kilopascals].
- 40- 41. "Trade waste" means solid, liquid, or gaseous waste material resulting from construction or the conduct of any business, trade, or industry, or any demolition operation, including, but not limited to, wood, wood containing preservatives, plastics, cartons, grease, oil, chemicals, and cinders.
41. "Volatile organic compounds" means any compound containing carbon and hydrogen or containing carbon and hydrogen in combination with any other element which has a modified Reid vapor pressure of one and one-half pounds per square inch absolute [10.3 kilopascals] or greater under actual storage conditions. The following compounds are excluded unless each is subject to an emissions standard under sections 111 or 112 of the Federal Clean Air Act: methane; ethane; methylene chloride; ~~1,1,1~~ trichloroethane (methyl chloroform); trichlorotrifluoroethane (CFC-113) (Freon 113); trichlorofluoromethane (CFC-11); dichlorodifluoromethane (CFC-12); chlorodifluoromethane (CFC-22); trifluoromethane (FC-23); dichlorotetrafluoroethane (CFC-114); chloropentafluoroethane (CFC-115); dichlorotrifluoroethane (HCFC-123); tetrafluoroethane (HCFC-134a); dichlorofluoroethane (HCFC-141b); and chlorodifluoroethane (HCFC-142b).
42. "Volatile organic compounds" means any compounds of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. This includes any such organic compound other than the following,

which have been determined to have negligible photochemical reactivity: methane; ethane; methylene chloride (dichloromethane); 1, 1, 1-trichloroethane (methyl chloroform); 1,1,1-trichloro-2,2,2-trifluoroethane (CFC-113); trichlorofluoromethane (CFC-11); dichlorodifluoromethane (CFC-12); chlorodifluoromethane (CFC-22); trifluoromethane (FC-23); 1,2-dichloro 1,1,2,2-tetrafluoroethane (CFC-114); chloropentafluoroethane (CFC-115); 1,1,1-trifluoro-2,2-dichloroethane (HCFC-123); 1,1,1,2-tetrafluoroethane (HFC-134a); 1,1-dichloro 1-fluoroethane (HCFC-141b); 1-chloro 1,1-difluoroethane (HCFC-142b); 2-chloro - 1,1,1,2-tetrafluoroethane (HCFC-124); pentafluoroethane (HFC-125); 1,1,2,2-tetrafluoroethane (HFC-134); 1,1,1-trifluoroethane (HFC-143a); 1,1-difluoroethane (HFC-152a); and perfluorocarbon compounds which fall into these classes:

- a. Cyclic, branched, or linear, completely fluorinated alkanes;
- b. Cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;
- c. Cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and
- d. Sulfur containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine.

For purposes of determining compliance with emission limits, volatile organic compounds will be measured by the test methods in 40 CFR part 60, appendix A, as applicable. Where such a method also measures compounds with negligible photochemical reactivity, these negligibly reactive compounds may be excluded as volatile organic compounds if the amount of such compounds is accurately quantified, and such exclusion is approved by the department.

As a precondition to excluding these compounds as volatile organic compounds or at any time thereafter, the department may require an owner or operator to provide monitoring or testing methods and results demonstrating, to the satisfaction of the enforcement authority, the amount of negligibly reactive compounds in the source's emissions.

~~42-~~ 43. "Waste classification" means the seven classifications of waste as defined by the incinerator institute of America and American society of mechanical engineers.

History: Amended effective October 1, 1987; January 1, 1989; June 1, 1990; June 1, 1992; March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-03

CHAPTER 33-15-12

33-15-12-02. Standards of performance.

Subpart A - General provisions.

*60.2. The definition of administrator is deleted and replaced with the following:

Administrator means the department except for those duties that cannot be delegated by the United States environmental protection agency. For those duties that cannot be delegated, administrator means the department and the administrator of the United States environmental protection agency.

Subpart C - Emission guidelines and compliance times.

Subpart Ca - Emissions guidelines and compliance times for municipal waste combustors.

Subpart D - Standards of performance for fossil-fuel fired steam generators for which construction is commenced after August 17, 1971.

Subpart Da - Standards of performance for electric utility steam generating units for which construction is commenced after September 18, 1978.

Subpart Db - Standards of performance for industrial-commercial-institutional steam generating units.

Subpart Dc - Standards of performance for small industrial-commercial-institutional steam generating units.

Subpart E - Standards of performance for incinerators.

Subpart Ea - Standards of performance for municipal waste combustors.

Subpart F - Standards of performance for portland cement plants.

Subpart G - Standards of performance for nitric acid plants.

Subpart H - Standards of performance for sulfuric acid plants.

Subpart I - Standards of performance for asphalt concrete plants.

Subpart J - Standards of performance for petroleum refineries.

Subpart K - Standards of performance for storage vessels for petroleum liquids for which construction, reconstruction, or

modification commenced after July 1, 1970, and prior to May 19, 1978.

*60.110(c) is deleted in its entirety and replaced with the following:

(c) Any facility under 60.110(a) that commenced construction, reconstruction, or modification after July 1, 1970, and prior to May 19, 1978, is subject to the requirements of this subpart.

Subpart Ka - Standards of performance for storage vessels for petroleum liquids for which construction, reconstruction, or modification commenced after May 18, 1978, and prior to July 23, 1984.

Subpart Kb - Standards of performance for volatile organic liquid storage vessels (including petroleum liquid storage vessels) for which construction, reconstruction, or modification commenced after July 23, 1984.

Subpart L - Standards of performance for secondary lead smelters.

Subpart M - Standards of performance for secondary brass and bronze ingot production plants.

Subpart N - Standards of performance for primary emissions from basic oxygen process furnaces for which construction is commenced after June 11, 1973.

Subpart Na - Standards of performance for secondary emissions from basic oxygen process steelmaking facilities for which construction is commenced after January 20, 1983.

Subpart O - Standards of performance for sewage treatment plants.

Subpart P - Standards of performance for primary copper smelters.

Subpart Q - Standards of performance for primary zinc smelters.

Subpart R - Standards of performance for primary lead smelters.

Subpart S - Standards of performance for primary aluminum reduction plants.

Subpart T - Standards of performance for the phosphate fertilizer industry: wet-process phosphoric acid plants.

Subpart U - Standards of performance for the phosphate fertilizer industry: superphosphoric acid plants.

Subpart V - Standards of performance for the phosphate fertilizer industry: diammonium phosphate plants.

Subpart W - Standards of performance for the phosphate fertilizer industry: triple superphosphate plants.

Subpart X - Standards of performance for the phosphate fertilizer industry: granular triple superphosphate storage facilities.

Subpart Y - Standards of performance for coal preparation plants.

Subpart Z - Standards of performance for ferroalloy production facilities.

Subpart AA - Standards of performance for steel plants: Electric arc furnaces.

Subpart AAa - Standards of performance for steel plants: electric arc furnaces and argon-oxygen decarburization vessels constructed after August 17, 1983.

Subpart BB - Standards of performance for kraft pulp mills.

Subpart CC - Standards of performance for glass manufacturing plants.

Subpart DD - Standards of performance for grain elevators.

Subpart EE - Standards of performance for surface coatings of metal furniture.

Subpart FF - [Reserved]

Subpart GG - Standards of performance for stationary gas turbines.

Subpart HH - Standards of performance for lime manufacturing plants.

Subpart KK - Standards of performance for lead-acid battery manufacturing plants.

Subpart LL - Standards of performance for metallic mineral processing plants.

Subpart MM - Standards of performance for automobile and light-duty truck surface coating operations.

Subpart NN - Standards of performance for phosphate rock plants.

Subpart PP - Standards of performance for ammonium sulfate manufacture.

Subpart QQ - Standards of performance for the graphic arts industry: publication rotogravure printing.

Subpart RR - Standards of performance for pressure-sensitive tape and label surface coating operations.

Subpart SS - Standards of performance for industrial surface coating: large appliances.

Subpart TT - Standards of performance for metal coil surface coating.

Subpart UU - Standards of performance for asphalt processing and asphalt roofing manufacture.

Subpart VV - Standards of performance for equipment leaks of VOC in the synthetic organic chemicals manufacturing industry.

Subpart WW - Standards of performance for the beverage can surface coating industry.

Subpart XX - Standards of performance for bulk gasoline terminals.

Subpart AAA - Standards of performance for new residential wood heaters.

Subpart BBB - Standards of performance for the rubber tire manufacturing industry.

Subpart CCC - [Reserved]

Subpart DDD - Standards of performance for the polymer manufacturing industry.

Subpart EEE - [Reserved]

Subpart FFF - Standards of performance for flexible vinyl and urethane coating and printing.

Subpart GGG - Standards of performance for equipment leaks of VOC in petroleum refineries.

Subpart HHH - Standards of performance for synthetic fiber production facilities.

Subpart III - Standards of performance for volatile organic compound (VOC) emissions from the synthetic organic chemical manufacturing industry (SOCMI) air oxidation unit processes.

Subpart JJJ - Standards of performance for petroleum dry cleaners.

Subpart KKK - Standards of performance for equipment leaks of VOC from onshore natural gas processing plants.

Subpart LLL - Standards of performance for onshore natural gas processing; SO₂ emissions.

Subpart NNN - Standards of performance for volatile organic compound (VOC) emissions from synthetic organic chemical manufacturing industry (SOCMI) distillation operations.

Subpart OOO - Standards of performance for nonmetallic mineral processing plants.

Subpart PPP - Standards of performance for wool fiberglass insulation manufacturing plants.

Subpart QQQ - Standards of performance for VOC emissions from petroleum refinery wastewater systems.

Subpart SSS - Standards of performance for magnetic tape coating facilities.

Subpart TTT - Standards of performance for industrial surface coating: surface coating of plastic parts for business machines.

Subpart UUU - Standards of performance for calciners and dryers in mineral industries.

Subpart VVV - Standards of performance for polymeric coating of supporting substrates facilities.

Appendix A - Test methods.

Appendix B - Performance specifications.

Appendix C - Determination of emission rate changes.

Appendix D - Required emission inventory information.

Appendix E - [Reserved]

Appendix F - Quality assurance procedures.

Appendix I - Removable label and owner's manual.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-03

CHAPTER 33-15-13

33-15-13-01.1. Scope. The subparts and appendices of 40 Code of Federal Regulations, part 61 [40 CFR 61] as they exist on May 1, ~~1991~~ 1993, which are listed in section 33-15-13-01.2 are incorporated into this chapter by reference. Any changes to the emission standard are listed below the title of the standard.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-03

33-15-13-01.2. Emission standards.

Subpart A - General provisions.

*61.02 - The definition of administrator is deleted and replaced with the following:

Administrator means the department except for those duties that cannot be delegated by the United States environmental protection agency. For those duties that cannot be delegated, administrator means the department and the administrator of the United States environmental protection agency.

The following definition is added:

"Waiver of compliance" means a permit to operate with a compliance schedule.

*Sections 61.07 and 61.08 are deleted in their entirety and replaced with the following:

Application for permit to construct. The owner or operator of any new source to which a standard prescribed under these subparts is applicable, prior to the date on which construction or modification is planned to commence, shall apply for and receive a permit to construct as provided in section 33-15-14-02. For those sources on which construction or modification has commenced and initial startup has not occurred prior to the effective date of a standard of this chapter, the owner or operator shall apply for a permit to construct within thirty days after the effective date of the standard.

Neither the submission of an application for a permit to construct nor the administrator's approval of construction or modification shall:

- (1) Relieve an owner or operator of legal responsibility for compliance with any applicable provisions of this chapter or of any other applicable federal, state, or local requirement; or
- (2) Prevent the administrator from implementing or enforcing this chapter or taking any other action under this article.

*61.09(b) is deleted in its entirety.

*61.11(f) is deleted in its entirety and replaced with the following:

- (f) The granting of a permit under this section does not abrogate the department's authority under section 33-15-01-06 and subsection 9 of section 33-15-14-02, and subsection 6 of section 33-15-14-03.

*61.16 is deleted in its entirety and replaced with the following:

Availability of information.

- a. Emission data provided to, or otherwise obtained by, the department in accordance with the provisions of this chapter must be available to the public.
- b. Any records, reports, or information, other than emission data, provided to, or otherwise obtained by, the department in accordance with the provisions of this chapter must be available to the public, except that upon a showing satisfactory to the department by any person that such records, reports, or information, or particular part thereof (other than emission data), if made public, would divulge methods or processes entitled to protection as trade secrets of such person, the department will consider such records, reports, or information, or particular part thereof, confidential in accordance with the purposes of section 1905 of title 18 of the United States Code, except that such records, reports, or information, or particular part thereof, may be disclosed to other officers, employees, or authorized representatives of the state and federal government concerned with carrying out the provisions of North Dakota Century Code chapter 23-25 or when relevant in any proceeding under North Dakota Century Code chapter 23-25.

*61.17 is deleted in its entirety.

Subpart C - National emission standard for beryllium.

Subpart D - National emission standard for beryllium rocket motor firing.

Subpart E - National emission standard for mercury.

Subpart F - National emission standard for vinyl chloride.

Subpart G - [Reserved]

Subpart J - National emission standard for equipment leaks (fugitive emission sources) of benzene.

Subpart L - National emission standard for benzene emissions from coke byproduct recovery plants.

Subpart N - National emission standard for inorganic arsenic emissions from glass manufacturing plants.

Subpart O - National emission standard for inorganic arsenic emissions from primary copper smelters.

Subpart P - National emission standard for inorganic arsenic emissions from arsenic trioxide and metallic arsenic production facilities.

Subpart S - [Reserved]

Subpart U - [Reserved]

Subpart V - National emission standard for equipment leaks (fugitive emission sources).

Subpart Y - National emission standard for benzene emissions from benzene storage vessels.

Subpart BB - National emission standard for benzene emissions from benzene transfer operations.

Subpart FF - National emission standard for benzene waste operations.

Appendix A - National emission standards for hazardous air pollutants, compliance status information.

Appendix B - Test methods.

Appendix C - Quality assurance procedures.

History: Effective June 1, 1992; amended effective March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-03

33-15-13-02. Emission standard for asbestos.

1. **Applicability.** The provisions of this section are applicable to those sources specified in subsections 3 through 17.
2. **Definitions.** All terms that are used in this section and are not defined below are given the same meaning as in North Dakota Century Code chapter 23-25 and in section ~~33-15-13-01~~ 33-15-13-01.2.
 - a. "Active waste disposal site" means any disposal site other than an inactive site.
 - b. "Adequately wet" means to sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material, then that material has not been adequately wetted; however, the absence of visible emissions is not sufficient evidence of being adequately wet.
 - c. "Asbestos" means the asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), anthophyllite, and actinolite-tremolite.
 - d. "Asbestos abatement" means any demolition, renovation, salvage, repair, or construction activity which involves the repair, enclosure, encapsulation, removal, handling, or disposal of more than three square feet [0.28 square meters] or three linear feet [0.91 meters] of friable asbestos material. Asbestos abatement also means any inspections, preparation of management plans, and abatement project design for both friable and nonfriable asbestos material.
 - e. "Asbestos abatement project designer" means any person who develops the plans, specifications, and designs for an asbestos abatement project.
 - f. "Asbestos abatement project monitor" means any person, employed to monitor an asbestos removal project to ensure any of the following:
 - (1) The removal is conducted in accordance with state and federal regulations.
 - (2) State-of-the-art work practices are employed.
 - (3) The abatement is conducted as designed.
 - (4) Personal and ambient air samples are collected properly.

Persons acting as the project designer who do not ensure personal and ambient air samples are collected properly and employees of the asbestos removal contractor are excluded from this definition.

- g. "Asbestos abatement supervisor" means any person employed by the asbestos contractor who supervises workers engaged in asbestos removal, encapsulation, enclosure, and repair. Supervisors may include those individuals with the position title of foreman, working foreman, or leadman pursuant to collective bargaining agreements.
- h. "Asbestos-containing waste material" means asbestos mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this section. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.
- i. "Asbestos contractor" means any partnership, firm, association, operation, or sole proprietorship that contracts to perform asbestos abatement for another.
- j. "Asbestos inspector" means any person who inspects facilities for asbestos-containing materials.
- k. "Asbestos management planner" means any person who develops facility plans for the management of asbestos-containing materials.
- l. "Asbestos mill" means any facility engaged in converting, or in any intermediate step in converting, asbestos ore into commercial asbestos. Outside storage of asbestos materials is not considered a part of the asbestos mill.
- m. "Asbestos tailings" means any solid waste that contains asbestos and is a product of asbestos mining or milling operations.
- n. "Asbestos waste from control devices" means any waste material that contains asbestos and is collected by a pollution control device.
- o. "Asbestos worker" means an employee or agent of an asbestos contractor, or a public employee engaged in the abatement of more than three square feet [0.28 square meters] or three linear feet [0.91 meters] of friable

asbestos material, except for individuals engaged in abatement at their private residence.

- p. "Category I nonfriable asbestos-containing material" means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than one percent asbestos as determined using the methods specified in appendix A, subpart F, 40 CFR part 763, section 1, polarized light microscopy.
- q. "Category II nonfriable asbestos-containing material" means any material, excluding category I nonfriable asbestos-containing material, containing more than one percent asbestos as determined using the methods specified in appendix A, subpart F, 40 CFR part 763, section 1, polarized light microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure or by mechanical forces expected to act on the material.
- r. "Commercial asbestos" means any material containing asbestos that is extracted from ore and has value because of its asbestos content.
- s. "Cutting" means to penetrate with a sharp-edged instrument and includes sawing, but does not include shearing, slicing, or punching.
- t. "Demolition" means the wrecking or taking out of any load-supporting structural member of a facility, together with any related handling operations or the intentional burning of any facility.
- u. "Emergency renovation operation" means a renovation operation that was not planned but results from a sudden, unexpected event that, if not immediately attended to, presents a safety or public health hazard, is necessary to protect equipment from damage, or is necessary to avoid imposing an unreasonable financial burden. This term includes operations necessitated by nonroutine failures of equipment.
- v. "Encapsulation" means a method of asbestos abatement that includes the treatment of asbestos-containing materials with a sealant material that completely surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers. A bridging encapsulant creates a membrane over the surface while a penetrating encapsulant penetrates the material and binds the material's components together.
- w. "Enclosure" means a method of asbestos abatement that includes the construction of a permanent, airtight,

impermeable barrier around asbestos-containing material to prevent the release of asbestos fibers into the air.

- x. "Fabricating" means any processing (e.g., cutting, sawing, drilling) of a manufactured product that contains commercial asbestos, with the exception of processing at temporary sites (field fabricating) for the construction or restoration of facilities. In the case of friction products, fabricating includes bonding, debonding, grinding, sawing, drilling, or other similar operations performed as part of fabricating.
- y. "Facility" means any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of this definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation, or building that was previously subject to this section is not excluded, regardless of its current use or function.
- z. "Facility component" means any part of a facility including equipment.
- aa. "Friable asbestos material" means any material containing more than one percent asbestos that hand pressure or mechanical forces expected to act on the material can crumble, pulverize, or reduce to powder when dry. The percentage of asbestos is determined using the method specified in appendix A, subpart F, 40 CFR part 763, section 1, polarized light microscopy. If the asbestos content is greater than zero percent, assume the material contains greater than one percent asbestos or verify the asbestos content by point counting using polarized light microscopy. If a result obtained by point count is different from a result obtained by visual estimation, the point count result will be used.
- bb. "Fugitive source" means any source of emissions not controlled by an air pollution control device.
- cc. "Glove-bag" means a sealed compartment with attached inner gloves used for the handling of asbestos-containing materials. Properly installed and used, glove-bags provide a small work area enclosure typically used for small-scale asbestos stripping operations. Information on glove-bag installation, equipment and supplies, and work

practices is contained in the occupational safety and health administration's (OSHA's) final rule on occupational exposure to asbestos, appendix G, 29 CFR 1926.58.

- dd. "Grinding" means to reduce to powder or small fragments and includes mechanical chipping or drilling.
- ee. "In poor condition" means the binding of the material is losing its integrity as indicated by peeling, cracking, or crumbling of the material.
- ff. "Inactive waste disposal site" means any disposal site or portion of it where additional asbestos-containing waste material has not been deposited within the past year.
- gg. "Installation" means any building or structure or any group of buildings or structures at a single demolition or renovation site that are under the control of the same owner or operator (or owner or operator under common control).
- hh. "Leaktight" means that solids or liquids cannot escape or spill out. It also means dusttight.
- ii. "Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of asbestos are increased. Failures of equipment shall not be considered malfunctions if they are caused in any way by poor maintenance, careless operations, or any other preventable upset conditions, equipment breakdown, or process failure.
- jj. "Manufacturing" means the combining of commercial asbestos, or in the case of woven friction products, the combining of textiles containing commercial asbestos, with any other materials, including commercial asbestos, and the processing of this combination into a product. Chlorine production is considered a part of manufacturing.
- kk. "Natural barrier" means a natural object that effectively precludes or deters access. Natural barriers include physical obstacles such as cliffs, lakes, or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.
- ll. "Nonfriable asbestos-containing material" means any material containing more than one percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763, section 1, polarized light microscopy, that, when dry, can not be crumbled,

pulverized, or reduced to powder by hand pressure or mechanical forces expected to act on the material.

- mm. "Nonscheduled renovation operation" means a renovation operation necessitated by the routine failure of equipment, which is expected to occur within a given period based on past operating experience, but for which an exact date cannot be predicted.
- nn. "Outside air" means the air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.
- oo. "Owner or operator of a demolition or renovation activity" means any person who owns, leases, operates, controls, or supervises a facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operations, or both.
- pp. "Particulate asbestos material" means finely divided particles of asbestos or material containing asbestos.
- qq. "Planned renovation operations" means a renovation operation, or a number of such operations, in which some regulated asbestos-containing material will be removed or stripped within a given period of time and that can be predicted. Individual nonscheduled operations are included if a number of such operations can be predicted to occur during a given period of time based on operating experience.
- rr. "Public employee" for the purpose of this chapter means any person employed by the United States government or the state of North Dakota or any of its political subdivisions who provides service for which compensation is paid. This includes employment by appointment or election.
- ss. "Regulated asbestos-containing material (RACM)" means:
 - (1) Friable asbestos material.
 - (2) Category I nonfriable asbestos-containing material that has become friable.
 - (3) Category I nonfriable asbestos-containing material that will be or has been subjected to sanding, grinding, cutting, or abrading.
 - (f) Category II nonfriable asbestos-containing material that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces acting on or expected to act on the material

in the course of demolition or renovation operations regulated by this section.

- tt. "Remove" means to take out regulated asbestos-containing material or facility components that contain or are covered with regulated asbestos-containing material from any facility.
- uu. "Renovation" means altering in any way a facility or facility components, including the stripping or removal of regulated asbestos-containing material from a facility component. Operations in which load-supporting structural members are wrecked or taken out are demolitions.
- vv. "Repair" means returning damaged asbestos-containing materials to an undamaged condition or to an intact state so as to prevent asbestos fiber release.
- ww. "Resilient floor covering" means asbestos-containing floor tile, including asphalt and vinyl floor tiles and sheet vinyl floor covering containing more than one percent asbestos as determined using polarized light microscopy according to the methods specified in appendix A, subpart F, 40 CFR part 763, section 1, polarized light microscopy.
- xx. "Roadways" means surfaces on which motor vehicles travel. This term includes public and private highways, roads, streets, parking areas, and driveways.
- yy. "Strip" means to take off regulated asbestos-containing material from any part of any facility or facility components.
- zz. "Structural member" means any member of a facility, such as beams, walls, ceilings, floors, etc.
- aaa. "Visible emissions" means any emissions which are visually detectable without the aid of instruments, coming from regulated asbestos-containing material or asbestos-containing waste material, or from any asbestos milling, manufacturing, or fabricating operations. This does not include condensed uncombined water vapor.
- bbb. "Waste generator" means any owner or operator of a source covered by this section whose act or process produces asbestos-containing waste material.
- ccc. "Waste shipment record" means the shipping document, required to be originated and signed by the waste generator and is used to track and substantiate the disposition of asbestos-containing waste material.

ddd. "Working day" means any day Monday through Friday and includes holidays that fall on any day Monday through Friday.

3. Standard for asbestos mills.

a. Each owner or operator of an asbestos mill shall either discharge no visible emissions to the outside air from that asbestos mill, including fugitive sources, or use the methods specified by subsection 13 to clean emissions containing asbestos material before they escape to, or are vented to, the outside air.

b. Each owner or operator of an asbestos mill shall meet the following requirements:

(1) Monitor each potential source of asbestos emissions from any part of the mill facility, including air-cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day during daylight hours for visible emissions to the outside air during periods of operation. The monitoring must be by visual observation of at least fifteen seconds duration per source of emissions.

(2) Inspect each air-cleaning device at least once each week for proper operation and for changes that signal the potential for malfunction, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air-cleaning devices that can not be inspected on a weekly basis according to this paragraph, submit to the department, and revise as necessary, a written maintenance plan to include, at a minimum, the following:

(a) Maintenance schedule.

(b) Recordkeeping plan.

(3) Maintain records of the results of visible emissions monitoring and air-cleaning device inspections using a suitable form which includes the following information:

(a) Date and time of each inspection.

(b) Presence or absence of visible emissions.

- (c) Condition of fabric filters including presence of any tears, holes, and abrasions.
 - (d) Presence of dust deposits on clean side of fabric filters.
 - (e) Brief description of corrective actions taken including date and time.
 - (f) Daily hours of operation for each air-cleaning device.
- (4) Furnish upon request and make available at the affected facility during normal business hours for inspection by the department all records required under this subdivision.
 - (5) Retain a copy of all monitoring inspection records for at least two years.
 - (6) Submit quarterly a copy of visible emissions monitoring records to the department if visible emissions occurred during the report period. Quarterly reports must be postmarked by the thirtieth day following the end of the calendar quarter.
4. Standard for roadways. No person may surface a roadway with asbestos tailings or asbesto-containing waste material.
5. Standard for manufacturing.
- a. Applicability. This section applies to the following manufacturing operations using commercial asbestos.
 - (1) The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yarn, roving, lap, or other textile materials.
 - (2) The manufacture of cement products.
 - (3) The manufacture of fireproofing and insulating materials.
 - (4) The manufacture of friction products.
 - (5) The manufacture of paper, millboard, and felt.
 - (6) The manufacture of resilient floor covering.
 - (7) The manufacture of paints, coatings, caulks, adhesives, and sealants.
 - (8) The manufacture of plastics and rubber materials.

- (9) The manufacture of chlorine utilizing asbestos diaphragm technology.
 - (10) The manufacture of shotgun shell wads.
 - (11) The manufacture of asphalt concrete.
- b. Standard. Each owner or operator of any of the manufacturing operations to which this section applies shall either:
- (1) Discharge no visible emissions to the outside air from these operations or from any building or structure in which they are conducted or from any other fugitive sources; or
 - (2) Use the methods specified by subsection 13 to clean emissions containing asbestos material from these operations before they escape to, or are vented to, the outside air.
 - (3) Monitor each potential source of asbestos emissions from any part of the manufacturing facility, including air-cleaning devices, process equipment, and buildings housing material processing and handling equipment, at least once each day during daylight hours for visible emission to the outside air during periods of operation. The monitoring must be by visual observation of at least fifteen seconds duration per source of emissions.
 - (4) Inspect each air-cleaning device at least once each week for proper operation and for changes that signal the potential for malfunctions, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air-cleaning devices that cannot be inspected on a weekly basis according to this paragraph, submit to the department, and revise as necessary, a written maintenance plan to include, at a minimum, the following:
 - (a) Maintenance schedule.
 - (b) Recordkeeping plans.
 - (5) Maintain records of the results of visible emission monitoring and air-cleaning device inspections using a suitable form which includes the following information:

- (a) Date and time of each inspection.
 - (b) Presence or absence of visible emissions.
 - (c) Condition of fabric filters including presence of any tears, holes, and abrasions.
 - (d) Presence of dust deposits on clean side of fabric filters.
 - (e) Brief description of corrective action taken, including date and time.
 - (f) Daily hours of operation for each air-cleaning device.
- (6) Furnish upon request and make available at the affected facility during normal business hours for inspection by the department all records required under this subdivision.
 - (7) Retain a copy of all monitoring and inspection records for at least two years.
 - (8) Submit quarterly a copy of the visible emissions monitoring records to the department if visible emissions occurred during the report period. Quarterly reports must be postmarked by the thirtieth day following the end of the calendar quarter.

6. Standard for demolition and renovation.

- a. Applicability. To determine which requirements of subdivisions a, b, and c of this subsection apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility, or part of the facility where the demolition or renovation operation will occur, for the presence of asbestos, including category I and category II nonfriable asbestos-containing material. The requirements of subdivisions b and c of this subsection apply to each owner or operator of an asbestos demolition or renovation operation including the removal of regulated asbestos-containing material, as follows:

- (1) For a demolition or renovation project involving the stripping or removal of more than three square feet [0.28 square meters] or three linear feet [0.91 meters] of regulated asbestos-containing material, all the procedural requirements of subdivision c apply, except for ordered demolitions as provided in paragraph 4.

- (2) For any facility being demolished, all the notification requirements of subdivision b apply.
 - (3) For a renovation project where at least one hundred sixty square feet [14.9 square meters] of regulated asbestos-containing material on facility components or at least two hundred sixty linear feet [79.3 meters] of regulated asbestos-containing material on pipes or a total of thirty-five cubic feet [1 cubic meter] of regulated asbestos-containing material on or off facility components are to be stripped, removed, dislodged, cut, drilled, or similarly disturbed at a facility all the notification requirements of subdivision b apply.
 - (a) To determine whether this paragraph applies to planned renovation operations involving individual nonscheduled operations, predict the additive amount of regulated asbestos-containing material to be removed or stripped over the maximum period of time a prediction can be made, not to exceed one calendar year of January first through December thirty-first.
 - (b) To determine whether this paragraph applies to emergency renovation operations, estimate the amount of regulated asbestos-containing material to be removed or stripped as a result of the sudden unexpected event that necessitated the renovation.
 - (4) If the facility is being demolished under an order of a state or local government agency, issued because the facility is structurally unsound and in danger of imminent collapse, only the requirements of subdivision b and paragraphs 4, 5, 6, 7, and 8 of subdivision c apply.
 - (5) Owners or operators of demolition or renovation operations are exempt from the requirements of 61.05(a), 61.07, and 61.09 of the general provisions of this chapter.
- b. Notification requirements. Each owner or operator to which this section applies shall:
- (1) Provide the department with written notice of the intention to demolish or renovate.
 - (2) Indicate whether the notice is an original or a revised notification and update the notice as necessary including when the amount of asbestos affected changes by at least twenty percent.

- (3) Postmark or deliver the notice as follows:
 - (a) At least ten working days before demolition begins, except as provided in subparagraph b.
 - (b) As early as possible before, but not later than the following working day after, demolition begins if the operation is described in paragraph 4 of subdivision a or for an emergency renovation as described in subparagraph b of paragraph 3 of subdivision a of this subsection.
 - (c) At least ten working days before the end of the calendar year preceding the year for which notice is being given for renovations described in subparagraph a of paragraph 3 of subdivision a of this subsection.
 - (d) At least ten working days before renovation begins. When necessary, the department may accept a telephone notification followed by the written notification.
 - (e) In no event may an operation covered by this subsection begin on a date other than the date contained in the written notice unless the department has been supplied a properly amended notification following the timetables outlined above.
- (4) Include the following information on a notification form provided by the department:
 - (a) Name, address, and telephone number of both the owner and operator and the asbestos removal contractor.
 - (b) Description of the facility or affected part of the facility being demolished or renovated, including the size, age, and prior and present use of the facility.
 - (c) An estimate of the amount of regulated asbestos-containing material to be removed from the facility in terms of square feet, linear feet or cubic feet, as appropriate. Also estimate the approximate amount of category I and category II nonfriable asbestos-containing material in the affected part of the facility that will not be removed before demolition. Also provide the procedures and analytical methods used to detect the presence and determine the quantity of regulated

asbestos-containing material and category I and category II nonfriable asbestos-containing material.

- (d) Location of the facility being demolished or renovated to include the street address, city, county, and state.
- (e) Scheduled starting and completion dates of the asbestos abatement work or any other activity that would break up, dislodge, or similarly disturb asbestos material.
- (f) Scheduled starting and completion dates of the demolition or renovation.
- (g) Type of operation: demolition or renovation.
- (h) A description of the demolition or renovation work to be performed including the demolition or renovation techniques and methods to be employed during the activity and a description of the affected facility components.
- (i) Description of work practices and engineering controls to be used to comply with the requirements of this section, including asbestos removal and waste handling emission control procedures.
- (j) The name and location of the waste disposal site where the asbestos-containing waste material will be deposited.
- (k) The name, address, and telephone number of the waste transporter.
- (l) For emergency renovations, provide the date and hour that the emergency occurred, a description of the sudden unexpected event, and an explanation of how the event caused an unsafe condition or would cause equipment damage or an unreasonable financial burden.
- (m) Description of procedures to be followed in the event that unexpected regulated asbestos-containing material is found or category II nonfriable asbestos-containing material becomes crumbled, pulverized, or reduced to powder during the operation.
- (n) For facilities described in paragraph 4 of subdivision a, the name, title, and authority of

the state or local governmental representative who has ordered the demolition, the date that the order was issued, and the date on which the demolition was ordered to begin. A copy of the order must be attached to the notification.

- (o) A signed statement by the contractor that all asbestos abatement supervisors and asbestos workers assigned to this project are certified by the department, in accordance with subsection 16.
- c. Procedures for asbestos emission control. Each owner or asbestos contractor to whom this subsection applies shall comply with the following procedures:
- (1) Remove all regulated asbestos-containing material from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the materials or preclude access to the materials for subsequent removal. Asbestos-containing material need not be removed before demolition if:
 - (a) It is category I nonfriable asbestos-containing material that is not in poor condition and is not friable.
 - (b) It is on a facility component that is encased in concrete or other similarly hard material and adequately wetted whenever exposed during demolition and maintained wet until it is disposed of in accordance with subsection 11.
 - (c) It was not accessible for testing and therefore was not discovered before demolition began and the material cannot be safely removed. If not removed for safety reasons, these materials must be adequately wetted when exposed during demolition and maintained wet until they are disposed of in accordance with subsection 11.
 - (d) They are category II nonfriable asbestos-containing material and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.
 - (2) When a facility component that contains, is covered with, or is coated with regulated asbestos-containing material is being taken out of the facility as a unit or in sections:

- (a) Adequately wet all regulated asbestos-containing material exposed during cutting or disjoining operations; and
 - (b) Carefully wrap or otherwise contain the facility member with an impermeable covering prior to the disjoining operation; and
 - (c) Carefully lower the units or sections to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the regulated asbestos-containing material.
- (3) When regulated asbestos-containing material is being stripped from a facility component while it remains in place in a facility, adequately wet the material during the stripping operation.
- (a) In renovation operations, wetting that would unavoidably damage equipment or present a safety hazard is not required if:
 - [1] The owner or operator has obtained prior written approval from the department based on a written application that wetting to comply with this paragraph would unavoidably damage equipment or present a safety hazard; and
 - [2] The owner or operator uses one of the following emission control methods:
 - [a] A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air and be equipped with high efficiency particulate air filtration or be designed and operated in accordance with the requirements in subsection 13.
 - [b] A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.

[c] Leaktight wrapping to contain all regulated asbestos-containing material prior to dismantlement.

- (b) In renovation operations where wetting would result in equipment damage or a safety hazard and the methods allowed in subparagraph a of paragraph 3 of this subdivision cannot be used, another method may be used after obtaining written approval from the department based upon a determination that it is equivalent to wetting in controlling emissions or to the methods allowed in paragraph 3 of this subdivision.
 - (c) A copy of the department's written approval must be kept at the worksite and made available for inspection.
- (4) After a facility component covered with, coated with, or containing regulated asbestos-containing material has been taken out of the facility as units or in sections pursuant to paragraph 2 of this subdivision it must be kept contained in leaktight wrapping or:
- (a) Adequately wet the regulated asbestos-containing material during stripping; or
 - (b) Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the outside air and be equipped with high efficiency particulate air filtration or be designed and operated in accordance with the requirements in subsection 13.
- (5) For large facility components such as reactor vessels, large tanks, and steam generators, but not beams (which must be handled in accordance with paragraphs 2, 3, and 4 of this subdivision) the regulated asbestos-containing material is not required to be stripped if the following requirements are met:
- (a) The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the regulated asbestos-containing material;
 - (b) The component is encased in a leaktight wrapping; and

- (c) The leaktight wrapping is labeled according to subsection 11 during all loading and unloading operations and during storage.
- (6) For all regulated asbestos-containing material, including material that has been removed or stripped:
- (a) Adequately wet the material and ensure that it remains wet until collected for disposal in accordance with subsection 11;
 - (b) Carefully lower the materials to the ground or a lower floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material; and
 - (c) Transport the materials to the ground via leaktight chutes or containers if they have been removed or stripped more than fifty feet [15.24 meters] above ground level and were not removed as units or in sections.

Regulated asbestos-containing material contained in leaktight wrapping that has been removed in accordance with paragraph 4 of this subdivision and subitem c of item 2 of subparagraph a of paragraph 3 of this subdivision need not be wetted.

- (7) When the temperature at the point of wetting is below zero degrees Celsius [32 degrees Fahrenheit], the owner or operator:
- (a) Need not comply with the wetting requirements of subparagraph a of paragraph 2 of subdivision c of subsection 4 and paragraph 3 of this subdivision. The owner or operator shall comply with the other requirements in this subdivision; and
 - (b) Remove facility components containing, coated with or covered with friable asbestos materials as units or in sections to the maximum extent possible; and
 - (c) During periods when wetting operations are suspended due to freezing temperatures, the owner or operator must record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records. These records must be available for inspection by the department during normal business hours at the demolition or renovation site. The owner or

operator shall retain the temperature records for at least two years.

- (8) No regulated asbestos-containing material may be stripped, removed, or otherwise handled or disturbed at a facility regulated by this subsection unless at least one onsite representative such as a supervisor, foreman or management level person, or other authorized representative who has completed the supervisor training requirements of subparagraph a of paragraph 2 and paragraph 4 of subdivision b of subsection 16 is present. Evidence that the required training has been completed shall be posted and made available for inspection by the department at the demolition or renovation site.
 - (9) For facilities described in paragraph 4 of subdivision a, adequately wet the portion of the facility that contains friable asbestos materials during the wrecking operation.
 - (10) If a facility is demolished by intentional burning, all regulated asbestos-containing material including category I and category II nonfriable asbestos-containing material must be removed in accordance with this subsection before burning.
 - (11) When a demolition or renovation project that involves the disturbance of regulated asbestos-containing material is conducted in the ambient air, the owner or operator shall designate the boundaries of the work area by appropriate means.
7. **Standard for spraying.** The owner or operator of an operation in which asbestos-containing materials are spray applied shall use only those materials that contain one percent asbestos or less for spray-on application.
8. **Standard for fabricating.**
- a. **Applicability.** This subsection applies to the following fabricating operations using commercial asbestos:
 - (1) The fabrication of cement building products.
 - (2) The fabrication of friction products, except those operations that primarily install asbestos friction materials on motor vehicles.
 - (3) The fabrication of cement or silicate board for ventilation hoods; ovens; electrical panels; laboratory furniture; bulkheads, partitions, and

ceilings for marine construction; and flow control devices for the molten metal industry.

b. Standard. Each owner or operator of any of the fabricating operations to which this subsection applies shall:

- (1) Discharge no visible emissions to the outside air from any of the operations or from any building or structure in which they are conducted or from any other fugitive sources; or
- (2) Use the methods specified by subsection 13 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.
- (3) Monitor each potential source of asbestos emissions from any part of the fabricating facility, including air-cleaning devices, process equipment, and buildings that house equipment for material processing and handling, at least once each day during daylight hours, for visible emissions to the outside air during periods of operation. The monitoring must be by visual observation of at least fifteen seconds duration per source of emissions.
- (4) Inspect each air-cleaning device at least once each week for proper operation and for changes that signal the potential for malfunction, including, to the maximum extent possible without dismantling other than opening the device, the presence of tears, holes, and abrasions in filter bags and for dust deposits on the clean side of bags. For air-cleaning devices that cannot be inspected on a weekly basis according to this paragraph, submit to the department, and revise as necessary, a written maintenance plan to include at a minimum, the following:
 - (a) Maintenance schedule.
 - (b) Recordkeeping plan.
- (5) Maintain records of the results of visible emission monitoring and air-cleaning device inspections using a suitable form which includes the following information:
 - (a) Date and time of each inspection.
 - (b) Presence or absence of visible emissions.

- (c) Condition of fabric filters, including the presence of any tears, holes, and abrasions.
 - (d) Presence of dust deposits on clean side of fabric filters.
 - (e) Brief description of corrective actions taken including date and time.
 - (f) Daily hours of operation for each air-cleaning device.
- (6) Furnish upon request and make available at the affected facility during normal business hours, for inspection by the department, all records required under this section.
- (7) Retain a copy of all monitoring and inspection records for at least two years.
- (8) Submit quarterly a copy of the visible emission monitoring record to the department if visible emissions occurred during the report period. Quarterly reports must be postmarked by the thirtieth day following the end of the calendar quarter.
9. **Standard for insulating materials.** No owner or operator of a facility may install or reinstall on a facility component any insulating materials that contain commercial asbestos if the materials are either molded and friable or wet applied and friable after drying. The provisions of this subsection do not apply to spray-applied insulating materials regulated under subsection 7.
10. **Standard for waste disposal for asbestos mills.** Each owner or operator of any source covered under the provisions of subsection 3 shall:
- a. Deposit all asbestos-containing waste material at department approved waste disposal sites operated in accordance with the provisions of subsection 15.
 - b. Discharge no visible emissions to the outside air from the transfer of asbestos waste from control devices to the tailings conveyor, or use the methods specified by subsection 13 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air. Dispose of the asbestos waste from control devices in accordance with subdivision b of subsection 11 or subdivision c of this subsection.
 - c. Discharge no visible emissions to the outside air during the collection, processing, packaging, transporting, or

deposition of any asbestos-containing waste material, or use one of the disposal methods as follows:

- (1) Use a wetting agent as follows:
 - (a) Adequately mix all asbestos-containing waste material with a wetting agent recommended by the manufacturer of the agent to effectively wet dust and tailings, before depositing the material at a waste disposal site. Use the agent as recommended for the particular dust by the manufacturer of the agent.
 - (b) Discharge no visible emissions to the outside air from the wetting operation or use the methods specified by subsection 13 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.
 - (c) Wetting may be suspended when the ambient temperature at the waste disposal site is less than fifteen degrees Fahrenheit [-9.44 degrees Celsius] as determined by an appropriate measurement method with an accuracy of plus or minus two degrees Fahrenheit [1.11 degrees Celsius]. During periods when wetting operations are suspended, the temperature must be recorded at least at hourly intervals, and records must be retained for at least two years in a form suitable for inspection.
- (2) Use an alternative emission control and treatment method that has received prior written approval by the department and administrator. To obtain approval for an alternative method, a written application must be submitted to the department and the administrator of the United States environmental protection agency demonstrating that the following criteria are met:
 - (a) The alternative method will control asbestos emissions equivalent to currently required methods.
 - (b) That the alternative method is suitable for the intended application.
 - (c) The alternative method will not violate other regulations.
 - (d) The alternative method will not result in increased water pollution, land pollution, or occupational hazards.

- (3) When waste is transported by vehicle to a disposal site, all of the requirements of subdivision d of subsection 11 must be complied with.
11. Standard for waste disposal for manufacturing, demolition, renovation, and fabricating operations. Each owner or operator of any source covered under any of the provisions of subsection 5, 6, or 8 shall comply with all the provisions of this subsection. Each owner or operator of any source covered by subsection 10 shall comply with subdivision d of this subsection.
- a. Discharge no visible emissions to the outside air during the collection processing (including incineration), packaging, transporting, or deposition of any asbestos-containing waste material generated by the source, or use one of the emission control and waste treatment methods as follows:
- (1) Adequately wet asbestos-containing waste material as follows:
- (a) Mix asbestos waste from control devices with water to form a slurry; adequately wet other asbestos-containing waste material;
- (b) Discharge no visible emissions to the outside air from collection, mixing, and wetting operations, or use the methods specified by subsection 13 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air;
- (c) After wetting, seal all asbestos-containing waste material in leaktight containers while wet. For materials that will not fit into containers without additional breaking, put materials into leaktight wrapping;
- (d) Label the containers or wrapped materials specified above as follows:

DANGER

CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

Alternatively, use warning labels currently specified by occupational safety and health standards of the department of labor, occupational safety and health administration

(OSHA) under 29 CFR 1910.1001 or 29 CFR 1926.58;
and

- (e) For asbestos-containing waste material to be transported off the facility site, label containers or wrapped materials with the name of the waste generator and the location at which the waste was generated.
- (2) Process asbestos-containing waste material into nonfriable forms as follows:
 - (a) Form all asbestos-containing waste material into nonfriable pellets or other shapes.
 - (b) Discharge no visible emissions to the outside air from the collection and processing operations including incineration, or use the methods specified by subsection 13 to clean emissions containing particulate asbestos material before they escape to, or are vented to, the outside air.
 - (3) For facilities demolished where the regulated asbestos-containing material is not removed prior to demolition according to paragraph 4 of subdivision a and subparagraphs a, b, c, and d of paragraph 1 of subdivision c of subsection 6 adequately wet asbestos-containing waste material at all times during and after demolition and keep wet during handling and loading for transport to a disposal site. Asbestos-containing waste materials covered by this paragraph do not have to be sealed in leaktight containers or wrapping but may be transported by covered hauling and disposed of in bulk.
 - (4) Use an alternative disposal method that has received prior approval by the department and administrator of the United States environmental protection agency.
 - (5) As applied to demolition and renovation the requirements of subdivision a of this subsection do not apply to category I or category II nonfriable asbestos-containing material waste that is not or will not become crumbled, pulverized, or reduced to powder.
- b. Deposit all asbestos-containing waste material as soon as practical at:
- (1) Department-approved waste disposal sites operated in accordance with the provisions of subsection 15.

- (2) A United States environmental protection agency approved site that converts regulated asbestos-containing material and asbestos-containing waste material into nonasbestos (asbestos free) material according to the provisions of subsection 17.
 - (3) The requirements of this subdivision do not apply to category I nonfriable asbestos-containing material that is not or will not become regulated asbestos-containing material.
- c. All facilities used for the temporary storage of asbestos-containing waste material must be controlled and the material must be stored in leaktight containers.
- (1) Post a warning sign at the entrances to the temporary storage facility with a label as follows:

DANGER

ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

Alternatively, use warning labels currently specified by occupational safety and health standards of the department of labor, occupational safety and health administration (OSHA) under 29 CFR 1910.1001 or 29 CFR 1926.58.

- (2) Take necessary precautions to prevent or restrict access to the temporary storage facility.
 - (3) The temporary storage facility must be inspected at least once per week to ensure that good structural integrity of the storage facility is maintained and that the facility remains secure.
 - (4) The maximum length of time allowed for temporary storage of an asbestos-containing waste material may not exceed one hundred eighty days.
- d. Mark vehicles used to transport asbestos-containing waste material during the loading and unloading of waste so that the signs are visible. The markings must:
- (1) Be displayed in such a manner and location that a person can easily read the legend.
 - (2) Conform to the requirements for twenty-inch by fourteen-inch [50.8-centimeter by 35.56-centimeter]

upright format signs specified in 29 CFR 1910.145(d)(4) and this paragraph; and

- (3) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend	Notation
DANGER	2.5 cm [1 in.] Sans Serif, Gothic, or Block.
ASBESTOS DUST HAZARD	2.5 cm [1 in.] Sans Serif, Gothic, or Block.
CANCER AND LUNG DISEASE HAZARD	1.9 cm [3/4 in.] Sans Serif, Gothic, or Block.
Authorized Personnel Only	14 Point Gothic

Spacing between any two lines must be at least equal to the height of the upper of the two lines.

- e. Prior to transportation of more than three square feet [0.28 square meters] or three linear feet [0.91 meters] of asbestos-containing waste material off the facility site:
 - (1) The owner or operator and the transporter shall ensure that a waste shipment record has been appropriately completed and signed by the generator, and accompanies the waste to the disposal site. The waste shipment record must include the following information:
 - (a) Name, address, and telephone number of the facility owner or operator where the asbestos-containing waste materials were generated.
 - (b) Location of the facility where asbestos-containing waste material was generated.
 - (c) The name and address of this department as being the responsible agency for administering the asbestos NESHAP program.
 - (d) Estimated quantity of asbestos-containing waste material in cubic yards.

- (e) Name and physical site location of the waste disposal site where the asbestos-containing waste will be deposited.
 - (f) The name and telephone number of the disposal site operator.
 - (g) The date transported.
 - (h) The name, address, and telephone number of the transporters.
 - (i) A certification that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.
- (2) Provide a copy of the waste shipment record to the disposal site owner or operator at the same time as the asbestos-containing waste material is delivered to the disposal site.
 - (3) For waste shipments where a copy of the waste shipment record signed by the owner or operator of the designated disposal site is not received by the waste generator within thirty-five days of the date the waste was accepted by the initial transporter, contact the transporter or the owner or operator, or both, of the designated disposal site to determine the status of the waste shipment.
 - (4) Report in writing to this department if a copy of the waste shipment record signed by the owner or operator of the designated waste disposal site is not received by the waste generator within forty-five days of the date the waste was accepted by the initial transporter. Include in the report the following information:
 - (a) A copy of the waste shipment record for which a confirmation of delivery was not received; and
 - (b) A cover letter signed by the waste generator explaining the efforts taken to locate the asbestos waste shipment and the result of those efforts.
 - (5) Retain a copy of all waste shipment records including a copy of the waste shipment record signed by the

owner or operator of the designated waste disposal site for at least two years.

- (6) A copy of the completed waste shipment record must be submitted to the department by the owner or operator of the facility no later than ten days after the owner or operator of the facility receives the completed waste shipment record from the landfill operator.
 - f. Furnish upon request, and make available for inspection by the department, all records required under this section.
 - g. If an acceptable disposal site, as determined by subsection 15, is located on the same property as the facility where asbestos-containing waste materials were generated, then the recordkeeping requirements of subdivision e of this subsection do not apply. The owner shall maintain records which include information on the quantity, location, and date of asbestos-containing waste disposal activities.
12. Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. Each owner or operator of any inactive waste disposal site that received deposits of asbestos-containing waste material generated by sources covered under subsection 3, 5, 8, or 10, shall:
- a. Comply with one of the following:
 - (1) Discharge no visible emissions to the outside air from an inactive waste disposal site subject to this subsection;
 - (2) Cover the asbestos-containing waste material with at least fifteen centimeters [6 inches] of compacted non-asbestos-containing material, and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the asbestos-containing waste material;
 - (3) In areas where vegetation would be difficult to maintain, cover the asbestos-containing waste material with at least sixty centimeters [2 feet] of compacted non-asbestos-containing material, and maintain it to prevent exposure of the asbestos-containing waste or cover with at least six inches [15.24 centimeters] of compacted non-asbestos-containing material and at least an additional three inches [7.62 centimeters] of a nonasbestos crushed rock cover in place of the vegetation; or

- (4) For inactive waste disposal sites for asbestos tailings, apply a resinous-based or petroleum-based dust suppression agent that effectively binds dust to control surface air emissions. Use the agent in the manner and frequency recommended for the particular asbestos tailings by the manufacturer of the dust suppression agent. Obtain prior approval of the department to use other equally effective dust suppression agents. For purposes of this paragraph, used, spent, or other waste oil is not considered a dust suppression agent.
- b. Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as follows, or comply with paragraph 2 or 3 of subdivision a of this subsection.
- (1) Display warning signs at all entrances and at intervals of three hundred twenty-eight feet [100 meters] or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material was deposited. The warning signs must:
- (a) Be posted in such a manner and location that a person can easily read the legend.
 - (b) Conform to the requirements for fifty-one-centimeter by thirty-six-centimeter [20-inch by 14-inch] upright format signs specified in 29 CFR 1910.145(d)(4) and this subdivision.
 - (c) Display the following legend in the lower panel with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend	Notation
DANGER	2.5 cm [1 in.] Sans Serif, Gothic, or Block.
ASBESTOS DUST HAZARD	2.5 cm [1 in.] Sans Serif, Gothic, or Block.
CANCER AND LUNG DISEASE HAZARD	1.9 cm [3/4 in.] Sans Serif, Gothic, or Block.
Authorized Personnel Only	14 Point Gothic

Spacing between any two lines must be at least equal to the height of the upper two lines.

- (2) Fence the perimeter of the site in a manner adequate to deter access by the general public.
 - (3) Upon request and supply of appropriate information, the department will determine whether a fence or a natural barrier adequately deters access by the general public.
- c. The owner or operator may use an alternative control method that has received prior approval of the department and administrator of the United States environmental protection agency rather than comply with the requirements of subdivision a or b of this subsection.
- d. Notify the department, in writing, at least forty-five days prior to excavating or otherwise disturbing any asbestos-containing waste material that has been deposited at a waste disposal site under this section and follow the procedures specified in the notification. If the excavation will begin on a date other than the one contained in the original notice, notice of a new start date must be provided to the department at least ten days before excavation begins and in no event shall excavation begin earlier than the date specified in the original notification. Include the following information in the notice:
- (1) Scheduled starting and completion dates.
 - (2) Reason for disturbing the waste.
 - (3) Procedures to be used to control emissions during the excavation, storage, transport, and ultimate disposal of the excavated asbestos-containing waste material. If deemed necessary, the department may require changes in the emission control procedures to be used.
 - (4) Location of any temporary storage site and the final disposal site.
- e. Within sixty days of a site becoming inactive, record in accordance with state law a notation on the deed to the facility property and on any instrument that would normally be examined during a title search. This notation will in perpetuity notify any potential purchaser of the property that:
- (1) The land has been used for the disposal of asbestos-containing waste material;
 - (2) The survey plot and record of the location and quantity of asbestos-containing waste disposed of

within the disposal site required in subdivision f of subsection 15 have been filed with the department; and

(3) The site is subject to this section.

13. Air-cleaning.

a. The owner or operator who elects to use air-cleaning, as permitted in subsections 3, 5, 6, 7, 8, 10, and 11 shall:

(1) Use fabric filter collection devices except as noted in subdivision b of this subsection, doing all of the following:

(a) Ensuring that the airflow permeability, as determined by A.S.T.M. method D737-75, does not exceed nine $\text{m}^3/\text{min}/\text{m}^2$ [$30 \text{ ft}^3/\text{min}/\text{ft}^2$] for woven fabrics or eleven $\text{m}^3/\text{min}/\text{m}^2$ [$35 \text{ ft}^3/\text{min}/\text{ft}^2$] for felted fabrics, except that twelve $\text{m}^3/\text{min}/\text{m}^2$ [$40 \text{ ft}^3/\text{min}/\text{ft}^2$] for woven and fourteen $\text{m}^3/\text{min}/\text{m}^2$ [$45 \text{ ft}^3/\text{min}/\text{ft}^2$] for felted fabrics is allowed for filtering air from asbestos ore dryers.

(b) Ensuring that felted fabric weighs at least four hundred seventy-five grams per square meter [14 ounces per square yard] and is at least one and six-tenths millimeters [$1/16$ inch] thick throughout.

(c) Avoiding the use of synthetic fabrics that contain fill yarn other than that which is spun.

(2) Properly install, use, operate, and maintain all air-cleaning equipment authorized by this subsection. Bypass devices may be used only during upset or emergency conditions and then only for so long as it takes to shut down the operation generating the asbestos material.

(3) For fabric filters installed after January 10, 1989, provide for easy inspection for faulty bags.

b. There are the following exceptions to paragraph 1 of subdivision a:

(1) If the use of fabric creates a fire or explosion hazard or the department determines that a fabric filter is not feasible, the department may authorize as a substitute the use of wet collectors designed to operate with a unit contacting energy of at least 9.95 kilopascals [40 inches water gauge pressure].

- (2) Use a high efficiency particulate air filter that is certified to be at least ninety-nine and ninety-seven hundredths percent efficient for particles with a diameter size of three-tenths microns and greater.
- (3) The department and administrator of the United States environmental protection agency may authorize the use of filtering equipment other than that described in subdivisions a and b of this subsection if the owner or operator demonstrates to the administrator and the department's satisfaction that it is equivalent to the described equipment in filtering asbestos material.

14. Reporting.

- a. Any existing source to which this section applies (with the exception of sources subject to subsections 4, 7, and 9) which has not previously supplied a notice to this department or the administrator, shall provide such notice within ninety days of the effective date of this regulation. Any new source to which this section applies shall provide notice to this department within ninety days of the effective startup date of the source. Changes to the information provided in a notice must be submitted to this department within thirty days of the change taking place. The notice shall provide the following information to the department:
 - (1) A description of the emission control equipment used for each process; and
 - (2) If a fabric filter device is used to control emissions;
 - (a) The airflow permeability in $\text{m}^3/\text{min}/\text{m}^2$ if the fabric filter device uses a woven fabric and; if the fabric is synthetic, whether the fill yarn is spun or not spun.
 - (b) If the fabric filter device uses a felted fabric, the density in g/m^2 , the minimum thickness in millimeters, and the airflow permeability in $\text{m}^3/\text{min}/\text{m}^2$.
 - (3) If a high efficiency particulate air filter is used to control emissions, the certified efficiency.
 - (4) For sources subject to subsections 10 and 11:
 - (a) A brief description of each process that generates asbestos-containing waste material;

- (b) The average volume of asbestos-containing waste material disposed of in cubic yards per day;
 - (c) The emission control methods used in all stages of waste disposal; and
 - (d) The type of disposal site used for ultimate disposal, the name of the site operator, and the name and location of the disposal site.
- (5) For sources subject to subsections 12 and 15:
- (a) A brief description of the site; and
 - (b) The method or methods used to comply with the standard, or alternative procedures to be used.
- b. The information required by subdivision a of this subsection must accompany the information required by subsection 8 of section 33-15-13-01. Active waste disposal sites subject to subsection 15 shall also comply with this provision. Roadways, demolition and renovations, spraying, and insulating materials are exempted from the requirements of section 33-15-13-01.1.
15. Standard for active waste disposal sites. To be an acceptable site for disposal of asbestos-containing waste material under subsections 10, 11, and 17, an active waste disposal site must meet the requirements of this subsection.
- a. Either there shall be no visible emissions to the outside air from any active waste disposal site where asbestos-containing waste material has been deposited, or the requirements of subdivisions c and d of this subsection must be met.
 - b. Unless a natural barrier adequately deters access by the general public, either warning signs and fencing must be installed and maintained as follows, or the requirements of paragraph 1 of subdivision c of this subsection must be met.
 - (1) Warning signs must be displayed at all entrances and at intervals of three hundred twenty-eight feet [100 meters] or less along the property line of the site or along the perimeter of the sections of the site where asbestos-containing waste material is deposited. The warning signs must:
 - (a) Be posted in such a manner and location that a person may easily read the legend.

- (b) Conform to the requirements of fifty-one centimeters by thirty-six centimeters [20 inches by 14 inches] upright format signs specified in 29 CFR 1910.145(d)(4) and this subsection.
- (c) Display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to those specified in this paragraph.

Legend	Notation
Asbestos Waste Disposal Site	2.5 cm [1 in.] Sans Serif, Gothic, or Block
Avoid Creating Dust Breathing Asbestos Dust May Cause Lung Disease and Cancer	1.9 cm [3/4 in.] Sans Serif, Gothic, or Block 14 Point Gothic

Spacing between lines must be at least equal to the height of the upper two lines.

- (2) The perimeter of the disposal site must be fenced in order to adequately deter access to the general public.
 - (3) Upon request and supply of appropriate information, the department will determine whether a fence or a natural barrier adequately deters access by the general public.
- c. Rather than meet the no visible emission requirements of subdivision a of this subsection, an active waste disposal site would be an acceptable site if at the end of each operating day, or at least once every twenty-four-hour period while the site is in continuous operation, the asbestos-containing waste material which was deposited at the site during the operating day or previous twenty-four-hour period is covered with either:
- (1) At least fifteen centimeters [6 inches] of compacted non-asbestos-containing material; or
 - (2) A resinous-based or petroleum-based dust suppression agent that effectively binds dust and controls wind erosion. This agent must be used in the manner and frequency recommended for the particular dust by the manufacturer of the dust suppression agent. Other equally effective dust suppression agents may be used

upon prior approval by the department. For purposes of this paragraph, used, spent, or other waste oil is not considered a dust suppression agent.

- d. Rather than meet the no visible emission requirements of subdivision a of this subsection, use an alternative emission control method that has received prior approval by the department and administrator of the United States environmental protection agency.
- e. For all asbestos-containing waste material received, the owner or operator of the active waste disposal site shall:
 - (1) Maintain waste shipment records which include the following information:
 - (a) The name, address, and telephone number of the waste generator.
 - (b) The name, address, and telephone number of the transporters.
 - (c) The quantity of the asbestos-containing material in cubic yards.
 - (d) The presence of improperly enclosed or uncovered wastes or any asbestos-containing waste material not sealed in leaktight containers. Report in writing to this department by the following working day, the presence of a significant amount of improperly enclosed or uncovered waste. Submit a copy of the waste shipment record along with the report.
 - (e) The date of the receipt.
 - (2) As soon as possible and no longer than thirty days after receipt of the waste send a copy of the signed waste shipment record to the waste generator.
 - (3) Upon discovering a discrepancy between the quantity of waste designated on the waste shipment records and the quantity actually received, attempt to reconcile the discrepancy with the waste generator. If the discrepancy is not resolved within fifteen days after receiving the waste, immediately report in writing to this department. Describe the discrepancy and attempts to reconcile it, and submit a copy of the waste shipment record along with the report.
 - (4) Retain a copy of all records and reports required by this paragraph for at least two years.

- f. Maintain until closure, records of the location, depth and area and quantity in cubic yards of asbestos-containing waste material within the disposal site on a map or diagram of the disposal area.
 - g. Upon closure, comply with all the provisions of subsection 12.
 - h. Submit to this department, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities.
 - i. Furnish upon request and make available during normal business for inspection by this department, all records required under this section.
 - j. Comply with subdivision d of subsection 12 if it becomes necessary to excavate or otherwise disturb asbestos-containing waste material that has been previously covered.
16. Asbestos abatement licensing and certification. No public employees or employees of asbestos contractors shall engage in any asbestos abatement activity or provide asbestos abatement project monitoring unless they are certified with the department as provided in this subsection. Certification will be for a period of one year from the completion date of the initial training course or the last refresher course in the appropriate discipline. All asbestos contractors and firms who provide asbestos abatement project monitoring services, must be licensed with this department, as provided in this subsection, prior to beginning asbestos abatement or asbestos abatement project monitoring activities. At least one person having completed the requirements for supervisor certification of subdivision b of this subsection is required to be at the worksite at all times while work is in progress, if the work involves repair, removal, encapsulation, enclosure, or handling of regulated asbestos-containing material if the work is being conducted by an asbestos contractor or public employees. At least one onsite individual having completed the supervisor training requirement of subdivision b of this subsection is required to be present if the activity is regulated by subsection 6 and the work is being conducted by employees of the owner.
- a. Asbestos workers. All asbestos workers employed by asbestos abatement contractors and all public employees engaged in the repair, removal, enclosure, encapsulation, or handling of regulated asbestos-containing material, must obtain certification as outlined in all paragraphs of this subdivision except as provided in subdivision h.

- (1) Application. Any applicant desiring certification as an asbestos worker shall make an application to the department on forms supplied by the department. Each application shall be accompanied by a nonrefundable fee of twenty-five dollars except as provided in subdivision g. This fee includes the processing of the initial examination specified in paragraph 3 of this subdivision.
- (2) Initial training. Any applicant desiring certification as an asbestos worker shall complete the initial training requirements for asbestos worker accreditation under 40 CFR part 763, appendix C to subpart E - environmental protection agency model contractor accreditation plan, by attending and successfully completing a training course designed for asbestos workers. The training course must have received approval from the environmental protection agency or the department.
- (3) Examination. Any applicant for certification shall pass a written examination administered by the department. The department may accept proof of successful completion of an examination administered by an environmental protection agency or department approved training course provider. The examination and the results of the examination must be available to the department upon request. Any applicant who fails to obtain a minimum seventy percent passing score on the examination shall be eligible to take a subsequent examination no earlier than one week following the previous examination. A twenty-five dollar fee is required for each examination. No more than three examinations may be given before requiring attendance of another initial training course. Information concerning the testing arrangements can be obtained from the department.
- (4) Refresher training. Any asbestos worker who has received initial training and has established full certification with the department, and who wishes to maintain continuous certification, shall complete a refresher training course as required by the model contractor accreditation plan within one year of completing the initial training course. The course content shall include, but not be limited to, a review of the changes in federal and state regulations, a discussion of the developments in state-of-the-art procedures and equipment as well as an overview of key aspects of the initial training course. Thereafter, the asbestos worker shall complete a refresher course within one year of the last refresher course.

(5) Certification renewal. Any asbestos worker who desires to renew their certification must have attended a refresher training course within twelve months prior to submittal of the renewal application. The renewal application shall include proof of attendance at such course and a recertification fee of twenty-five dollars. If an asbestos worker does not satisfy the refresher training requirements of this subdivision within two years of the date of the initial training course or of the last refresher training course, then the individual shall complete the initial training requirements provided in paragraph 2 of this subdivision to reestablish full certification.

(6) The certification card issued by the department must be available at the worksite for each asbestos worker.

b. Other asbestos disciplines. Any individual, except asbestos workers, acting as or acting on behalf of an asbestos contractor who performs an asbestos abatement service or any individual who performs asbestos abatement project monitoring on behalf of a contracting firm or as a public employee must obtain certification as outlined in all paragraphs of this subdivision. This certification requirement applies to asbestos abatement supervisors, asbestos inspectors, asbestos management planners, asbestos abatement project designers, asbestos abatement project monitors, and to public employees performing these duties except as provided in subdivision h.

(1) Application. Any person desiring certification in the disciplines of asbestos inspector, asbestos management planner, asbestos abatement project designer, asbestos abatement project monitor, and asbestos abatement supervisor shall make an application to the department on forms supplied by the department. Each application shall be accompanied by a nonrefundable fee of twenty-five dollars for each discipline within which the applicant is seeking certification except as provided in subdivision g. This fee includes the processing of the initial examination specified in paragraph 3 of this subdivision.

(2) The initial training requirements are as follows:

(a) Any applicant desiring certification as an asbestos inspector, asbestos management planner, asbestos abatement project designer, or asbestos abatement supervisor or any individual required to meet the training requirements of paragraph 8

of subdivision c of subsection 6 shall complete the initial training requirements set forth in 40 CFR part 763, appendix C to subpart E - environmental protection agency model contractor accreditation plan, by attending and successfully completing a training course in the appropriate discipline. The training course must have received approval in the respective discipline from the environmental protection agency or the department. For the purpose of certification, the four-day asbestos abatement supervisor training course will fulfill the initial training requirements for asbestos abatement project designer.

- (b) Asbestos abatement project monitors must have a valid state certification as asbestos abatement supervisor or asbestos abatement project designer and shall have completed a NIOSH 582 or equivalent air sampling course of not less than four days in length.
- (3) Examination. Any applicant for certification in a specific discipline except asbestos abatement project monitor shall pass a written examination administered by the department for that discipline. The department may accept proof of successful completion of an examination administered by an environmental protection agency or department approved training course provider. The examination and the results of the examination must be available to the department upon request. Any applicant who fails to obtain a minimum seventy percent passing score on the examination shall be eligible to take a subsequent examination no earlier than one week following the previous examination. A twenty-five dollar fee is required for each examination. No more than three examinations shall be given before requiring attendance of another initial training course.
- (4) Refresher training. Any asbestos abatement supervisor, asbestos inspector, asbestos management planner, or asbestos abatement project designer who has received initial training and has established full certification with the department, and who wishes to maintain continuous certification, or any individual who must meet the training requirements of paragraph 8 of subdivision c of subsection 6 shall complete a refresher training course as required by the model contractor accreditation plan within one year of completing the initial training course. The course content shall include, but not be limited to, a review of the changes in the federal and state

regulations, a discussion of the developments in state-of-the-art procedures and equipment as well as an overview of key aspects of the initial training course. Thereafter, these persons shall complete a refresher course designed for the respective disciplines within one year of the last refresher course.

- (5) Certification renewal. Any asbestos abatement supervisor, asbestos inspector, asbestos management planner, asbestos abatement project designer, or asbestos abatement project monitor who desires to renew his or her certification must have attended a refresher training course in the appropriate discipline within twelve months prior to submittal of the renewal application. The renewal application shall include proof of attendance at such a course and a recertification fee of twenty-five dollars per discipline. If an individual does not satisfy the refresher training requirements of this subdivision in their respective discipline within two years of the date of the initial training or of the last refresher training, then that individual shall complete the initial training requirements provided in paragraph 2 of this subdivision to reestablish full certification. Refresher training of the air sampling course for project monitors is not required.
- (6) The certification card issued by the department must be available at the worksite.

c. Asbestos contractor license. Each contractor who performs asbestos abatement services or performs asbestos abatement project monitoring services in the state shall obtain an asbestos contractor license except as provided in subdivision h.

- (1) Submit an application to the department on forms supplied by the department. An application shall be accompanied by a nonrefundable fee of one hundred dollars.
- (2) The license fee will cover the period from January first through December thirty-first of each year unless the license is suspended, revoked, or denied as specified in subdivision f. The fee shall be one hundred dollars regardless of the application date. Following the initial submittal, the renewal fee shall be due and payable by January thirtieth of the following year.
- (3) A contractor seeking an asbestos contractor license must have completed the appropriate training and

certification requirements in subdivision b of this subsection. The contractor may designate an employee who has completed this requirement to serve as the contractor's agent for the purposes of obtaining an asbestos contractor license.

- (4) Asbestos contractors who provide multiple services are not required to pay additional license fees.
 - (5) All certifiable services offered by an asbestos contractor must be performed by persons certified in accordance with subdivisions a and b of this subsection.
 - (6) A copy of the asbestos contractor license shall be made available at the worksite.
 - (7) This license does not exempt, supersede, or replace any other state or local licensing or permitting requirements.
- d. Approved initial and refresher training courses. The department will maintain and provide a listing of approved initial and refresher training courses. Applicants seeking approval of courses, other than those present on the department list, must submit information on the course content on application forms supplied by the department. The course content must satisfy the minimum requirements of the model contractor accreditation plan. The department will advise the applicant whether the course is approved within thirty days of receipt of the necessary information.
- e. Reciprocity. Each applicant for asbestos worker or asbestos contractor certification who is licensed or certified for asbestos abatement in another state may petition the department for certification without written examination. The department shall evaluate the requirements in such other states and shall issue the certification without examination if the department determines that the requirements in such other states are at least as stringent as the requirements for certification in North Dakota. Each application for certification pursuant to this subdivision shall submit an application accompanied by a nonrefundable fee of twenty-five dollars.
- f. Suspension, revocation, or denial. An asbestos certification or license may be suspended, revoked, or denied if:
- (1) Violations of the requirements of this section are noted;

- (2) Another state has revoked, suspended, or denied a license or certification for violations of applicable standards;
 - (3) An incomplete application is filed; or
 - (4) The required fee is not submitted.
- g. Public employees will not be required to pay the twenty-five dollar certification or recertification fees.
- h. Any individual or asbestos contractor engaged in repair, removal, enclosure, or encapsulation activities involving less than or equal to three square feet [0.28 square meters] or three linear feet [0.91 meters] of asbestos-containing materials, are exempt from the certification and licensing requirements of this subsection.
- i. Upon written request, the department, at its discretion, may review training course material and conduct an audit of a training course to determine if the course and examination meet the training requirements of 40 CFR part 763, appendix C to subpart E - environmental protection agency model contractor accreditation plan. Under the authority granted to this department by the environmental protection agency on April 21, 1989, courses that this department determine to meet the model contractor accreditation plan shall be listed in the federal register list of approved courses.
- (1) Training courses seeking department approval shall submit the material necessary for the department to conduct the review including the submittal requirements listed in 40 CFR part 763, appendix C, subpart III.
 - (2) The department must be provided access, without cost, to any asbestos course conducted in this state to determine if the course meets the requirement of the environmental protection agency model contractor accreditation plan. Following such an audit, the department may rescind approval or refuse to accept as adequate any course determined not to meet the training requirements of the environmental protection agency model contractor accreditation plan.
 - (3) Any training provider requesting a review of the provider's course for approval by this department shall submit a filing fee of one hundred fifty dollars plus an application processing fee. The application processing fee will be based on the actual processing costs, including time spent by this

department to conduct the course review and course audit, and any travel and lodging expenses the department incurs conducting these items. Following the course review and audit, and after making a determination on the accreditation status of the course, a statement will be sent to the applicant listing the remaining application processing costs. The statement must be sent within fifteen months of the submittal of the initial filing fee.

17. Standard for operations that convert asbestos-containing waste material into nonasbestos (asbestos-free) material. Each owner or operator of an operation that converts regulated asbestos-containing material and asbestos-containing waste material into nonasbestos (asbestos-free) material shall:
 - a. Obtain the prior written approval of this department and the administrator of the United States environmental protection agency to construct the facility. To obtain approval, the owner or operator shall provide the department and the administrator of the United States environmental protection agency with the following information:
 - (1) Application to construct pursuant to chapter 33-15-14.
 - (2) In addition to the information requirements of chapter 33-15-14, provide a:
 - (a) Description of the waste feed handling and temporary storage.
 - (b) Description of process operating conditions.
 - (c) Description of the handling and temporary storage of the end products.
 - (d) Description of the protocol to be followed when analyzing output materials by transmission electron microscopy.
 - (3) Performance test protocol including provisions for obtaining information required under subdivision b of this subsection.
 - (4) The department may require that a demonstration of the process be performed prior to approval of the application to construct.
 - b. Conduct a startup performance test. Test results must include:

- (1) A detailed description of the types and quantities of nonasbestos material, regulated asbestos containing material, and asbestos-containing waste material processed (e.g., asbestos cement products, friable asbestos insulation, plaster, wood, plastic, wire, etc.). Test feed is to include the full range of materials that will be encountered in actual operation of the process.
 - (2) Results of analyses, using polarized light microscopy, that document the asbestos content of the wastes processed.
 - (3) Results of analyses using transmission electron microscopy, that document that the output materials are free of asbestos. Samples for analysis are to be collected as eight-hour composite samples (one 200-gram [seven-ounce] sample per hour), beginning with the initial introduction of regulated asbestos-containing material or asbestos-containing waste material and continuing until the end of the performance test.
 - (4) A description of operating parameters, such as temperature and residence times, defining the full range over which the process is expected to operate to produce nonasbestos (asbestos-free) materials. Specify the limits for each operating parameter within which the process will produce nonasbestos (asbestos-free) materials.
 - (5) The length of the test.
- c. During the initial ninety days of operation;
- (1) Continuously monitor and log the operating parameters identified during startup performance tests that are intended to ensure the production of nonasbestos (asbestos-free) output material.
 - (2) Monitor input materials to ensure that they are consistent with the test feed materials described during startup performance tests in paragraph 1 of this subdivision.
 - (3) Collect and analyze samples taken as ten-day composite samples (one 200-gram [seven-ounce] sample collected every eight hours of operation) of all output materials for the presence of asbestos. Composite samples may be for fewer than ten days. Transmission electron microscopy must be used to analyze the output materials for the presence of asbestos. During the initial ninety-day period, all

output materials must be stored onsite until analysis shows the material to be asbestos-free or be disposed of as asbestos-containing waste material according to subsection 11.

d. After the initial ninety days of operation:

(1) Continuously monitor and record the operating parameters identified during startup performance testing and any subsequent performance testing. Any output produced during a period of deviation from the range of operating conditions established to ensure the production of nonasbestos (asbestos-free) output material shall be:

(a) Disposed of as asbestos-containing waste material according to subsection 11;

(b) Recycled as waste feed during process operations within the established range of operating conditions; or

(c) Stored temporarily onsite in a leaktight container until analyzed for asbestos content. Any product material that is not asbestos-free shall either be disposed of as asbestos-containing waste material or recycled as waste feed to the process.

(2) Collect and analyze monthly composite samples (one 200-gram [seven-ounce] sample collected every eight hours of operation) of the output material. Transmission electron microscopy must be used to analyze the output material for the presence of asbestos.

e. Discharge no visible emissions to the outside air from any part of the operation or use the methods specified by subsection 13 to clean emissions containing particulate asbestos material before they escape to or are vented to the outside air.

f. Maintain records onsite and include the following information:

(1) Results of startup performance testing and all subsequent performance testing, including operating parameters, feed characteristics, and analyses of output materials.

(2) Results of the composite analysis required during the initial ninety days of operation under subdivision c of this subsection.

- (3) Results of the monthly composite analysis required under subdivision d of this subsection.
 - (4) Results of continuous monitoring and logs of process operating parameters required under subdivisions c and d of this subsection.
 - (5) Information on waste shipments received as required in subdivision e of subsection 15.
 - (6) For output materials where no analyses were performed to determine the presence of asbestos, record the name and location of the purchaser or disposal site to which output materials were sold or deposited and the date of sale or disposal.
 - (7) Retain records required by this subdivision for at least two years.
- g. Submit the following reports to the department:
- (1) A report for each analysis of product composite samples performed during the initial ninety days of operation.
 - (2) A quarterly report, including the following information concerning activities during each consecutive three-month period:
 - (a) Results of analyses of monthly product composite samples.
 - (b) A description of any deviation from the operating parameters established during performance testing, the duration of the deviation, and steps taken to correct the deviation.
 - (c) Disposition of any product produced during a period of deviation, including whether it was recycled, disposed of as asbestos-containing waste material, or stored temporarily onsite until analyzed for asbestos content.
 - (d) The information on waste disposal activities as required in subdivision f of subsection 15.
- h. Nonasbestos (asbestos-free) output material is not subject to any of the provisions of this section. Output material in which asbestos is detected, or output materials produced when the operating parameters deviated from those established during the startup performance testing, unless shown by transmission electron microscopy analysis to be

asbestos-free shall be considered to be asbestos-containing waste and must be handled and disposed of in accordance with subsections 11 and 15 or reprocessed while all of the established operating parameters are being met.

History: Amended effective October 1, 1987; January 1, 1989; June 1, 1990; June 1, 1992; March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-03, 23-25-03.1

CHAPTER 33-15-14

33-15-14-01. Designated air contaminant sources. Pursuant to subsection 1 of North Dakota Century Code section ~~23-25-04.1~~ 23-25-04, stationary sources within the following source categories are designated as air contaminant sources capable of causing or contributing to air pollution, either directly or indirectly.

1. The following chemical process facilities:
 - a. Adipic acid.
 - b. Ammonia.
 - c. Ammonium nitrate.
 - d. Carbon black.
 - e. Charcoal.
 - f. Chlorine.
 - g. Chlor-alkali manufacturing.
 - h. Detergent and soap.
 - i. Explosives (trinitrotoluene and nitrocellulose).
 - j. Hydrochloric acid.
 - k. Hydrofluoric acid.
 - l. Nitric acid.
 - m. Paint and varnish manufacturing.
 - n. Phosphoric acid.
 - o. Phthalic anhydride.
 - p. Plastics manufacturing.
 - q. Printing ink manufacturing.
 - r. Sodium carbonate.
 - s. Sulfur production and recovery.
 - t. Sulfuric acid.
 - u. Synthetic fibers.

- v. Synthetic rubber.
 - w. Terephthalic acid.
 - x. Alcohol.
 - y. Cresylic acids.
 - z. Phenol.
 - aa. Polymer manufacturing and coating operations.
2. The following food and agricultural facilities:
- a. Agricultural drying and dehydrating operations.
 - b. Ammonium nitrate.
 - c. Cheese whey drying and processing.
 - d. Coffee roasting.
 - e. Cotton ginning.
 - f. Feed, grain, and seed handling and processing.
 - g. Fermentation processes.
 - h. Fertilizers.
 - i. Fishmeal processing.
 - j. Meat smokehouses.
 - k. Orchard heaters.
 - l. Potato processing.
 - m. Rendering plants.
 - n. Starch manufacturing.
 - o. Sugarbeet processing.
3. The following metallurgical facilities:
- a. Primary metals facilities:
 - (1) Aluminum ore reduction.
 - (2) Copper smelters.
 - (3) Ferroalloy production.

- (4) Iron and steel mills.
 - (5) Lead smelters.
 - (6) Metallurgical coke manufacturing.
 - (7) Zinc.
 - b. Secondary metals facilities:
 - (1) Aluminum operations.
 - (2) Brass and bronze smelting.
 - (3) Ferroalloys.
 - (4) Ferrous foundries.
 - (5) Gray iron foundries.
 - (6) Lead smelting.
 - (7) Magnesium smelting.
 - (8) Nonferrous foundries.
 - (9) Steel foundries.
 - (10) Zinc processes.
 - c. Electrolytic plating operations.
4. The following mineral products facilities:
- a. Asphalt roofing.
 - b. Asphaltic concrete plants.
 - c. Bricks and related clay refractories.
 - d. Calcium carbide.
 - e. Ceramic and clay processes.
 - f. Clay and fly ash sintering.
 - g. Coal cleaning.
 - h. Coal drying.
 - i. Coal mining.
 - j. Coal handling and processing.

- k. Concrete batching.
 - l. Fiberglass manufacturing.
 - m. Frit manufacturing.
 - n. Glass manufacturing.
 - o. Gypsum manufacturing.
 - p. Leonardite mining, drying, and processing.
 - q. Lime manufacturing.
 - r. Mineral wool manufacturing.
 - s. Paperboard manufacturing.
 - t. Perlite manufacturing.
 - u. Phosphate rock preparation.
 - v. Portland cement manufacturing, bulk handling, and storage.
 - w. Rock, stone, gravel, and sand quarrying and processing.
 - x. Uranium mining, milling, and enrichment.
 - y. Calciners and dryers.
5. The following energy and fuel facilities:
- a. Coal gasification.
 - b. Coal liquefaction.
 - c. Crude oil and natural gas production.
 - d. Fossil fuel steam electric plants.
 - e. Fuel conversion plants.
 - f. Natural gas processing.
 - g. Petroleum refining and petrochemical operations.
 - h. Petroleum storage (storage tanks and bulk terminals).
6. The following wood processing facilities:
- a. Plywood veneer and layout operations.
 - b. Pulpboard manufacturing.

- c. Wood pulping.
 - d. Sawmills.
 - e. Wood products manufacturing.
7. The following gaseous, liquid, and solid waste disposal facilities:
- a. Afterburners.
 - b. Automobile body incinerators.
 - c. Conical burners.
 - d. Flares.
 - e. Gaseous and liquid organic compounds incinerators.
 - f. Industrial waste incinerators.
 - g. Open burning.
 - h. Open pit incinerators.
 - i. Pathological waste incinerators.
 - j. Refuse incinerators.
 - k. Scrap metal salvage incinerators.
 - l. Sewage sludge incinerators.
 - m. Wood waste incinerators.
 - n. Municipal waste combustors.
8. The following miscellaneous facilities:
- a. Drycleaning and laundry operations.
 - b. Fuel burning equipment.
 - c. Internal combustion engines.
 - d. Surface coating operations.
 - e. Wastewater treatment plants ~~(including lagoons)~~.
 - f. Water cooling towers and water cooling ponds.
 - g. Stationary gas turbines.

h. Lead acid battery manufacturing.

i. Hydrocarbon contaminated soil remediation projects.

9. Any category of sources to which a federal standard of performance applies [40 CFR 60].
10. Any source which emits a contaminant subject to a national emission standard for hazardous air pollutants [40 CFR 61].
11. Any source which is subject to review under federal prevention of significant deterioration of air quality regulations [40 CFR 51.166].
12. Any source which is determined by the department to have an emission which affects state ambient air quality standards or the other provisions of chapter 33-15-02.
13. Any source subject to title V permitting requirements in section 33-15-14-06.
14. Any source to which a national emission standard for hazardous air pollutants for source categories [40 CFR 63] would apply.
15. Other sources subject to a standard or requirement under the Federal Clean Air Act as amended.

History: Amended effective October 1, 1987; March 1, 1994.

General Authority: NDCC 23-25-03, 28-32-01

Law Implemented: NDCC ~~23-25-04~~ 23-25-04

33-15-14-01.1. Definitions. For the purposes of this chapter:

1. "Complete" means, in reference to an application for a permit, that the application contains all the information necessary for processing the application. Designating an application complete for purposes of permit processing does not preclude the department from requesting or accepting any additional information.
2. "Construction, installation, or establishment" means:
 - a. For sources subject to a standard or requirement under chapters 33-15-13 and 33-15-15 (excluding increment consumption by nonmajor sources), it shall have the meaning given for construction in each of the respective chapters.
 - b. For all other sources it means the placement or erection, including fabrication, demolition, or modification, of an air contaminant emissions unit and any equipment, process, or structure that will be used to reduce, physically or

chemically change, or transmit to the atmosphere any air contaminant. This does not include the building that houses the source, site work, foundations, or other equipment which does not affect the amount, ambient concentration, or type of air contaminants that are emitted. With respect to a physical change or a change in the method of operation it means those onsite activities which will affect an existing emissions unit or establishment of a new unit that emits to the atmosphere.

3. "Emissions unit" has the meaning given to it in section 33-15-14-06.
4. "Minor source" means any designated air contaminant source under section 33-15-14-01 which is not required to obtain a title V permit to operate under section 33-15-14-06.
5. "Potential to emit" has the meaning given to it in section 33-15-14-06.
6. "Stationary source" has the meaning given to it in section 33-15-14-06.

History: Effective March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-03

33-15-14-02. Permit to construct.

1. Permit to construct required. No construction, installation, or establishment of a new stationary source within a source category designated in section 33-15-14-01 may be commenced unless the owner or operator thereof shall file an application for, and receive, a permit to construct in accordance with this chapter. This requirement shall also apply to any source for which a federal standard of performance has been promulgated prior to such filing of an application for a permit to construct. A list of sources for which a federal standard has been promulgated, and the standards which apply to such sources, must be available at the department's offices.

The initiation of activities that are exempt from the definition of construction, installation, or establishment in section 33-15-14-01.1, prior to obtaining a permit to construct, are at the owner's or operator's own risk. These activities have no impact on the department's decision to issue a permit to construct. The initiation or completion of such activities conveys no rights to a permit to construct under this section.

2. Application for permit to construct.

- a. Application for a permit to construct a new installation or source must be made by the owner or operator thereof on forms furnished by the department.
 - b. A separate application is required for each new installation or source subject to this chapter.
 - c. Each application must be signed by the applicant, which signature shall constitute an agreement that the applicant will assume responsibility for the construction or operation of the new installation or source in accordance with this article and will notify the department, in writing, of the startup of operation of such source.
3. Alterations to source.
- a. The addition to or enlargement of or replacement of or ~~major~~ alteration in any stationary source, already existing, which is undertaken pursuant to an approved compliance schedule for the reduction of emissions therefrom, shall be exempt from the requirements of this section.
 - b. Any physical change in, or change in the method of operation of, a stationary source already existing which increases or may increase the emission rate or increase the ambient concentration by an amount greater than that specified in subdivision a of subsection 5 of section 33-15-14-02 of any pollutant for which an ambient air quality standard has been promulgated under this article or which results in the emission of any such pollutant not previously emitted must be considered to be construction, installation, or establishment of a new source, except that:
 - (1) Routine maintenance, repair, and replacement may not be considered a physical change.
 - (2) The following may not be considered a change in the method of operation:
 - (a) An increase in the production rate, if such increase does not exceed the operating design capacity of the source and it is not limited by a permit condition.
 - (b) An increase in the hours of operation if it is not limited by a permit condition.
 - (c) Changes from one operating scenario to another provided the alternative operating scenarios are identified and approved in a permit to operate.

(d) Trading of emissions within a facility provided:

[1] These trades have been identified and approved in a permit to operate; and

[2] The total facility emissions do not exceed the facility emissions cap established in the permit to operate.

(e) Trading and utilizing acid rain allowances provided compliance is maintained with all other applicable requirements.

4. Submission of plans - Deficiencies in application. As part of an application for a permit to construct, the department may require the submission of plans, specifications, siting information, emission information, descriptions and drawings showing the design of the installation or source, the manner in which it will be operated and controlled, the emissions expected from it, and the effects on ambient air quality. Any additional information, plans, specifications, evidence, or documentation that the department may require must be furnished upon request. Within twenty days of the receipt of the application, the department shall advise the owner or operator of the proposed source of any deficiencies in the application. In the event of a deficiency, the date of receipt of the application is the date upon which all requested information is received.

a. Determination of the effects on ambient air quality as may be required under this section must be based on the applicable requirements specified in the "Guideline on Air Quality Models (Revised)" (United States environmental protection agency, office of air quality planning and standards, Research Triangle Park, North Carolina 27711) as supplemented by the "North Dakota Guideline for Air Quality Modeling Analyses" (North Dakota state department of health and consolidated laboratories, division of environmental engineering). These documents are incorporated by reference.

b. Where an air quality impact model specified in the documents incorporated by reference in subdivision a is inappropriate, the model may be modified or another model substituted provided:

(1) Any modified or nonguideline model must be subject to notice and opportunity for public comment under subsection 6.

(2) The applicant must provide to the department adequate information to evaluate the applicability of the modified or nonguideline model. Such information

must include, but is not limited to, methods like those outlined in the "Interim Procedures for Evaluating Air Quality Models (Revised)" (United States environmental protection agency, office of air quality planning and standards, Research Triangle Park, North Carolina 27711).

- (3) Written approval from the department must be obtained for any modification or substitution.
- (4) Written approval from the United States environmental protection agency must be obtained for any modification or substitution prior to the granting of a permit under this chapter.

5. Review of application - Standard for granting permits to construct. The department shall review any plans, specifications, and other information submitted in application for a permit to construct and from such review shall, within thirty days of the receipt of the completed application, make the following preliminary determinations:

- a. Whether the proposed project will be in accord with this article, including whether the operation of any new stationary source at the proposed location will cause or contribute to a violation of any applicable ambient air quality standard. A new stationary source will be considered to cause or contribute to a violation of an ambient air quality standard when such source would, at a minimum, exceed the following significance levels at any locality that does not or would not meet the applicable ambient standard:

<u>Contaminant</u>	<u>Averaging Time (hours)</u>				
	Annual ($\mu\text{g}/\text{m}^3$)	24 ($\mu\text{g}/\text{m}^3$)	8 ($\mu\text{g}/\text{m}^3$)	3 ($\mu\text{g}/\text{m}^3$)	1 ($\mu\text{g}/\text{m}^3$)
SO ₂	1.0	5		25	25
PM ₁₀	1.0	5			
NO ₂	1.0				25
CO			500		2000

- b. Whether the proposed project will provide all known available and reasonable methods of emission control. Whenever a standard of performance is applicable to the source, compliance with this criterion will require provision for emission control which will, at least, satisfy such standards.

6. Public participation - Final action on application. This subsection shall apply only to those affected facilities designated under ~~chapters 33-15-12, chapter 33-15-13, and 33-15-15~~ or for construction of other sources for which the actual emissions of any contaminant would be greater than fifty tons [45.36 metric tons] per year, one thousand pounds [453.59 kilograms] per day, or one hundred pounds [45.36 kilograms] per hour, whichever is most restrictive or those that will be required to obtain a permit to operate under section 33-15-14-06, for sources which the department has determined to have a major impact on air quality or, those for which a request for a public comment period has been received from the public, sources for which a significant degree of public interest exists regarding air quality issues, or those sources which desire a federally enforceable permit which limits their potential to emit. The department shall:
- a. Within ninety days of receipt of a complete application, make a preliminary determination concerning issuance of a permit to construct.
 - b. Within ~~thirty~~ ninety days of the receipt of the ~~completed~~ complete application, make available in at least one location in the county or counties in which the proposed project is to be located, a copy of its preliminary determinations and copies of or a summary of the information considered in making such preliminary determinations.
 - ~~b.~~ c. Publish notice to the public by prominent advertisement, within ~~thirty~~ ninety days of the receipt of the ~~completed~~ complete application, in the region affected, of the opportunity for written comment on the preliminary determinations. The public notice must include the proposed location of the source.
 - ~~c.~~ d. Within ~~thirty~~ ninety days of the receipt of the ~~completed~~ complete application, deliver a copy of the notice to the applicant and to officials and agencies having cognizance over the locations where the source will be situated as follows: ~~State and local air pollution control agencies; the~~ The chief executive of the city and county; any comprehensive regional land use planning agency; ~~the regional administrator of the United States environmental protection agency;~~ and any state, federal land manager, or Indian governing body whose lands will be significantly affected by the source's emissions.
 - e. Within ninety days of receipt of a complete application, provide a copy of the proposed permit and all information considered in the development of the permit and the public notice to the regional administrator of the United States environmental protection agency.

- ~~d.~~ f. Allow thirty days for public comment.
- ~~e.~~ g. Consider all public comments properly received, in making the final decision on the application.
- ~~f.~~ h. Allow the applicant to submit written responses to public comments received by the department, within ten days of the receipt of such comments. The applicant's responses must be submitted to the department within twenty days of the close of the public comment period.
- ~~g.~~ i. Take final action on the application within thirty days of the close of the public comment period the applicant's response to the public comments.
- j. Provide a copy of the final permit, if issued, to the applicant, the regional administrator of the United States environmental protection agency and anyone who requests a copy.

For those sources subject to the requirements of chapter 33-15-15, the public participation procedures under subsection 5 of section 33-15-15-01 shall be followed.

7. Denial of permit to construct. If, after review of all information received, including public comment with respect to any proposed project, the department makes the determination of any one of subdivision a or b of subsection 5 in the negative, it shall deny the permit and notify the applicant, in writing, of the denial to issue a permit to construct.

If a permit to construct is denied, the construction, installation, or establishment of the new stationary source shall be unlawful. No permit to construct or modify may be granted if such construction, or modification, or installation, will result in a violation of these regulations or in a violation of the ambient air quality standards this article.
8. Issuance of permit to construct. If, after review of all information received, including public comment with respect to any proposed project, the department makes the determination of subdivision a or b of subsection 5 in the affirmative, the department shall issue a permit to construct. The permit may provide for conditions of operation as provided in subsection 9.
9. Permit to construct - Conditions. The department may impose any reasonable conditions upon a permit to construct, including conditions concerning:
 - a. Sampling, testing, and monitoring of the facilities or the ambient air or both.

- b. Trial operation and performance testing.
- c. Prevention and abatement of nuisance conditions caused by operation of the facility.
- d. Recordkeeping and reporting.
- e. Compliance with applicable rules and regulations in accordance with a compliance schedule.
- f. Limitation on hours of operation, production rate, processing rate, or fuel usage when necessary to assure compliance with this article.

The violation of any conditions so imposed may result in revocation or suspension of the permit or other appropriate enforcement action.

10. Scope.

- a. The issuance of a permit to construct for any source does not affect the responsibility of an owner or operator to comply with applicable portions of a control strategy affecting the source.
- b. A permit to construct shall become invalid if construction is not commenced within eighteen months after receipt of such permit, if construction is discontinued for a period of eighteen months or more; or if construction is not completed within a reasonable time. The department may extend the eighteen-month period upon a satisfactory showing that an extension is justified. This provision does not apply to the time period between construction of the approved phases of a phased construction project; each phase must commence construction within eighteen months of the projected and approved commencement date. In cases of major construction projects involving long lead times and substantial financial commitments, the department may provide by a condition to the permit a time period greater than eighteen months when such time extension is supported by sufficient documentation by the applicant.

11. Transfer of permit to construct. To ensure the responsible owners or operators, or both, are identified, the holder of a permit to construct may not transfer such permit without prior approval of the department.

12. Permit to construct fees. Any construction, installation, or establishment of a new stationary source requiring a permit to construct under subsections 1 and 3 of section 33-15-14-02 is required to pay a permit to construct application processing fee to the North Dakota state department of health and consolidated laboratories. A nonrefundable filing fee of one

hundred fifty dollars plus an application processing fee based on actual processing costs, including computer data processing costs, incurred by the department for all sources which would involve a major analysis the cost of which would exceed one hundred fifty dollars, as determined by the department. The applicant is subject to the processing fee regardless of whether a permit to construct is issued. The fee must be paid on the following basis:

- a. The filing fee of one hundred fifty dollars must be submitted with the permit application.
 - b. A record of all permit to construct application processing costs incurred must be maintained by the department.
 - c. Upon request, the department, in consultation with the applicant, will prepare an estimate of the processing fee and the billing schedule that will be utilized in processing the application. If the applicant chooses, the applicant may withdraw the application at this point without paying any processing fees.
 - d. After final determinations on the application have been made, a final statement will be sent to the applicant containing the remaining actual processing costs incurred by the department.
 - e. Any source that initiates operation under a permit to construct prior to receiving a permit to operate is subject to the fees outlined in section 33-15-14-03 or 33-15-14-06, whichever is applicable.
13. Exemptions. A permit to construct is not required for the following stationary sources provided there is no federal requirement for a permit or approval for construction or operation and there is no applicable new source performance standard, or national emission standard for hazardous air pollutants.
- a. Maintenance, structural changes, or minor repair of process equipment, fuel burning equipment, control equipment, or incinerators which do not change capacity of such process equipment, fuel burning equipment, control equipment, or incinerators and which do not involve any change in the quality, nature, or quantity of emissions therefrom.
 - b. Fossil fuel burning equipment, other than smokehouse generators, which meet all of the following criteria:
 - (1) The aggregate heat input per unit does not exceed ten million British thermal units per hour.

- (2) The total aggregate heat input from all equipment does not exceed ten million British thermal units per hour.
 - (3) The actual emissions, as defined in chapter 33-15-15, from all equipment do not exceed twenty-five tons [22.67 metric tons] per year of any air contaminant and the potential to emit any air contaminant for which an ambient air quality standard has been promulgated in chapter 33-15-02 is less than one hundred tons [90.68 metric tons] per year.
- c. Any single internal combustion engine with less than five hundred brake horsepower, or multiple engines with a combined brake horsepower rating less than five hundred brake horsepower.
 - d. Bench scale laboratory equipment used exclusively for chemical or physical analysis or experimentation.
 - e. Portable brazing, soldering, or welding equipment.
 - f. The following equipment:
 - (1) Comfort air-conditioners or comfort ventilating systems which are not designed and not intended to be used to remove emissions generated by or released from specific units or equipment.
 - (2) Water cooling towers and water cooling ponds unless used for evaporative cooling of process water, or for evaporative cooling of water from barometric jets or barometric condensers or used in conjunction with an installation requiring a permit.
 - (3) Equipment used exclusively for steam cleaning.
 - (4) Porcelain enameling furnaces or porcelain enameling drying ovens.
 - (5) Unheated solvent dispensing containers or unheated solvent rinsing containers of sixty gallons [227.12 liters] capacity or less.
 - (6) Equipment used for hydraulic or hydrostatic testing.
 - g. The following equipment or any exhaust system or collector serving exclusively such equipment:
 - (1) Blast cleaning equipment using a suspension of abrasive in water.

- (2) Bakery ovens where the products are edible and intended for human consumption.
- (3) Kilns for firing ceramic ware, heated exclusively by gaseous fuels, singly or in combinations, and electricity.
- (4) Confection cookers where the products are edible and intended for human consumption.
- (5) Drop hammers or hydraulic presses for forging or metalworking.
- (6) Diecasting machines.
- (7) Photographic process equipment through which an image is reproduced upon material through the use of sensitized radiant energy.
- (8) Equipment for drilling, carving, cutting, routing, turning, sawing, planing, spindle sanding, or disc sanding of wood or wood products, which is located within a facility that does not vent to the outside air.
- (9) Equipment for surface preparation of metals by use of aqueous solutions, except for acid solutions.
- (10) Equipment for washing or drying products fabricated from metal or glass; provided, that no volatile organic materials are used in the process and that no oil or solid fuel is burned.
- (11) Laundry dryers, extractors, or tumblers for fabrics cleaned with only water solutions of bleach or detergents.

h. Natural draft hoods or natural draft ventilators.

i. Containers, reservoirs, or tanks used exclusively for:

- (1) Dipping operations for coating objects with oils, waxes, or greases, where no organic solvents are used.
- (2) Dipping operations for applying coatings of natural or synthetic resins which contain no organic solvents.
- (3) Storage of butane, propane, or liquefied petroleum or natural gas.
- (4) Storage of lubricating oils.

- (5) Storage of petroleum liquids except those containers, reservoirs, or tanks subject to the requirements of chapter 33-15-12.
 - j. Gaseous fuel-fired or electrically heated furnaces for heat treating glass or metals, the use of which does not involve molten materials.
 - k. Crucible furnaces, pot furnaces, or induction furnaces, with a capacity of one thousand pounds [453.59 kilograms] or less each, unless otherwise noted, in which no sweating or distilling is conducted, nor any fluxing conducted utilizing chloride, fluoride, or ammonium compounds, and from which only the following metals are poured or in which only the following metals are held in a molten state:
 - (1) Aluminum or any alloy containing over fifty percent aluminum; provided, that no gaseous chlorine compounds, chlorine, aluminum chloride, or aluminum fluoride are used.
 - (2) Magnesium or any alloy containing over fifty percent magnesium.
 - (3) Lead or any alloy containing over fifty percent lead, in a furnace with a capacity of five hundred fifty pounds [249.48 kilograms] or less.
 - (4) Tin or any alloy containing over fifty percent tin.
 - (5) Zinc or any alloy containing over fifty percent zinc.
 - (6) Copper.
 - (7) Precious metals.
 - l. Open burning activities within the scope of section 33-15-04-02.
 - m. Flares used to indicate some danger to the public.
 - n. Sources or alterations to a source which are of minor significance as determined by the department.
 - o. Oil and gas production facilities as defined in chapter 33-15-20 which are not a major source as defined in subdivision n of subsection 1 of section 33-15-14-06.
- 14. Performance and emission testing.
 - a. Emission tests or performance tests or both shall be conducted by the owner or operator of a facility and data

reduced in accordance with the applicable procedure, limitations, standards, and test methods established by this article. Such tests must be conducted under the owner's or operator's permit to construct, and such permit is subject to the faithful completion of the test in accordance with this article.

b. All dates and periods of trial operation for the purpose of performance or emission testing pursuant to a permit to construct must be approved in advance by the department. Trial operation shall cease if the department determines, on the basis of the test results, that continued operation will result in the violation of this article. Upon completion of any test conducted under a permit to construct, the department may order the cessation of the operation of the tested equipment or facility until such time as a permit to operate has been issued by the department.

c. Upon review of the performance data resulting from any test, the department may require the installation of such additional control equipment as will bring the facility into compliance with this article.

d. Nothing in this article may be construed to prevent the department from conducting any test upon its own initiative, or from requiring the owner or operator to conduct any test at such time as the department may determine.

15. Responsibility to comply.

a. Possession of a permit to construct does not relieve any person of the responsibility to comply with this article.

b. The exemption of any stationary source from the requirements of a permit to construct by reason of inclusion in subsection 13 does not relieve the owner or operator of such source of the responsibility to comply with any other applicable portions of this article.

16. Portable sources. Sources which are designated to be portable and which are not subject to the requirements of chapter 33-15-15 are exempt from requirements to obtain a permit to construct. The owner or operator shall submit an application for a permit to operate prior to initiating operations.

17. Registration of exempted stationary sources. The department may require that the owner or operator of any stationary source exempted under subsection 13 shall register the source with the department within such time limits and on such forms as the department may prescribe.

18. Extensions of time. The department may extend any of the time periods specified in subsections 4, 5, and 6 of section 33-15-14-02 upon notification of the applicant by the department.
19. Amendment of permits. The department may, when the public interest requires or when necessary to ensure the accuracy of the permit, modify any condition or information contained in the permit to construct. Modification shall be made only upon the department's own motion and the procedure shall, at a minimum, conform to any requirements of federal and state law. In the event that the modification would have a significant impact as defined in chapter 33-15-15, the department shall follow the procedures established in chapter 33-15-15. For those of concern to the public, the department will provide:
- a. Reasonable notice to the public, in the area to be affected, of the opportunity for comment on the proposed modification, and the opportunity for a public hearing, upon request, as well as written public comment.
 - b. A minimum of a thirty-day period for written public comment, with the opportunity for a public hearing during that thirty-day period, upon request.
 - c. Consideration by the department of all comments received in its order for modification.

The department may require the submission of such maps, plans, specifications, emission information, and compliance schedules as it deems necessary prior to the issuance of an amendment. It is the intention of the department that this subsection shall apply only in those instances allowed by federal rules and regulations and only in those instances in which the granting of a variance pursuant to section 33-15-01-06 and enforcement of existing permit conditions are manifestly inappropriate.

History: Amended effective March 1, 1980; February 1, 1982; October 1, 1987; June 1, 1990; March 1, 1994.

General Authority: NDCC 23-25-03

Law Implemented: NDCC 23-25-04, 23-25-04.1, 23-25-04.2

33-15-14-03. ~~Permit~~ Minor source permit to operate.

1. Permit to operate required.

- a. ~~No~~ Except as provided in subdivisions c and d of this subsection, no person may operate or cause the routine operation of an installation or source designated in section 33-15-14-02 without applying for and obtaining, in accordance with this ~~chapter~~ section, a permit to operate.

Application for a permit to operate a new installation or source must be made at least thirty days prior to startup of routine operation. Those sources that received a permit to construct under section 33-15-14-02, need only submit a thirty-day prior notice of proposed startup to satisfy the requirement to apply for a permit to operate under this subdivision.

- b. No person may operate or cause the operation of an installation or source in violation of any permit to operate, any condition imposed upon a permit to operate or in violation of this article.
- c. Sources that are subject to the title V permitting requirements of section 33-15-14-06 are exempt from the requirements of this section except during the transitional period from a minor source permit to operate to a title V permit to operate. Existing sources shall comply with all the requirements of this section, except subsection 10 of section 33-15-14-03, until a title V permit to operate is issued. Fees for sources that meet the applicability requirements of section 33-15-14-06 shall be assessed based on subsection 8 of section 33-15-14-06.
- d. Sources that are exempt from the requirements to obtain a permit to construct under subsection 13 of section 33-15-14-02 are exempt from this section.
- e. Sources which are subject to the title V permitting requirements in section 33-15-14-06 based solely on their potential to emit, may apply for a federally enforceable minor source permit to operate which would limit their potential to emit to a level below the title V permit to operate applicability threshold.
- f. Permits which are issued under this section which do not conform to the requirements of this section, including public participation under subdivision a of subsection 5 of section 33-15-14-03, and the requirements of any United States environmental protection agency regulations may be deemed not federally enforceable by the United States environmental protection agency.
- g. General permits: The department may issue a general permit covering numerous similar sources. Any general permit shall comply with all requirements applicable to other minor source permits to operate and shall identify criteria by which sources may qualify for the general permit. To sources that qualify, the department shall grant the conditions and terms of the general permit. Sources that would qualify for a general permit must apply to the department for coverage under the terms of the

general permit or apply for an individual minor source permit to operate. Without repeating the public participation procedures under subsection 5 of section 33-15-14-03, the department may grant a source's request for authorization to operate under a general permit.

2. Application for permit to operate.
 - a. Application for a permit to operate must be made by the owner or operator thereof on forms furnished by the department.
 - b. Each application for a permit to operate must be accompanied by such performance tests results, information, and records as may be required by the department to determine whether the requirements of this article will be met. Such information may also be required by the department at any time when the source is being operated to determine compliance with this article.
 - c. Each application must be signed by the applicant, which signature shall constitute an agreement that the applicant will assume responsibility for the operation of the installation or source in accordance with this article.
3. Standards for granting permits to operate. No permit to operate may be granted unless the applicant shows to the satisfaction of the department that the source is in compliance with this article.
4. Performance testing. Before a permit to operate is granted, the applicant, if required by the department, shall conduct performance tests in accordance with methods and procedures required by this article or methods and procedures approved by the department. Such tests must be made at the expense of the applicant. The department may monitor such tests and may also conduct performance tests.
5. Action on applications.
 - a. ~~The~~ Public participation: This subdivision is applicable to only those sources which apply for a federally enforceable minor source permit to operate which limits their potential to emit an air contaminant. The department shall:
 - (1) Within ninety days of receipt of a complete application:
 - (a) Make a preliminary determination concerning issuance of the permit to operate.

- (b) Make available in at least one location in the county or counties in which the source is located, a copy of the proposed permit and copies of or a summary of the information considered in developing the permit.
 - (c) Publish notice to the public by prominent advertisement, in the region affected, of the opportunity for written comment on the proposed permit. The public notice must include the proposed location of the source.
 - (d) Deliver a copy of the proposed permit and public notice to the chief executive of the city and county where the source is located; the regional land use planning agency; and any state or federal land manager, or Indian governing body whose lands will be significantly affected by the source's emissions.
 - (e) Provide a copy of the proposed permit, all information considered in the development of the permit and the public notice to the regional administrator of the United States environmental protection agency.
- (2) Allow thirty days for public comment.
 - (3) Consider all public comments properly received, in making the final decision on the application.
 - (4) Allow the applicant to submit written responses to public comments received by the department. The applicant's responses must be submitted to the department within twenty days of the close of the public comment period.
 - (5) Take final action on the application within thirty days of the applicant's response to the public comments.
 - (6) Provide a copy of the final permit, if issued, to the applicant, the regional administrator of the United States environmental protection agency and anyone who requests a copy.
- b. For those sources not subject to public participation under subdivision a of this subsection, the department shall act within thirty days after receipt of an application for a permit to operate a new installation or source, and within thirty days after receipt of an application to operate an existing installation or source, and shall notify the applicant, in writing, of the

approval, conditional approval, or denial of the application.

- ~~b.~~ c. The department shall set forth in any notice of denial the reasons for denial. A denial must be without prejudice to the applicant's right to a hearing before the department or for filing a further application after revisions are made to meet objections specified as reasons for the denial.
6. **Permit to operate - Conditions.** The department may impose any reasonable conditions upon a permit to operate, including conditions concerning. All emission limitations, controls, and other requirements imposed by conditions on the permit to operate must be at least as stringent as any applicable limitation or requirement contained in this article. Permit to operate conditions may include:
- a. Sampling, testing, and monitoring of the facilities or ambient air or both.
 - b. Trial operation and performance testing.
 - c. Prevention and abatement of nuisance conditions caused by operation of the facility.
 - d. Recordkeeping and reporting.
 - e. Compliance with applicable rules and regulations in accordance with a compliance schedule.
 - f. Limits on the hours of operation of a source or its processing rate, fuel usage or production rate when necessary to assure compliance with this article.
7. **Suspension or revocation of permit to operate.**
- a. The department may suspend or revoke a permit to operate for violation of this article ~~and any,~~ violations of a permit conditions condition or failure to respond to a notice of violation or any order issued pursuant to this article.
 - b. Suspension or revocation of a permit to operate shall become final ten days after serving notice on the holder of the permit.
 - c. A permit to operate which has been revoked pursuant to this article must be surrendered forthwith to the department.

- d. No person may operate or cause the operation of an installation or source if the department denies or revokes a permit to operate.
8. Transfer of permit to operate. The holder of a permit to operate may not transfer it without the prior approval of the department.
9. Renewal of permit to operate.
- a. Every permit to operate issued by the department after February 9, 1976, shall become void upon the ~~third~~ fifth anniversary of its issuance. Applications for renewal of such permits must be submitted ~~sixty~~ ninety days prior to such anniversary date. The department shall approve or disapprove such application within ~~sixty~~ ninety days. If a source submits a complete application for a permit renewal at least ninety days prior to the expiration date, the source's failure to have a minor source permit to operate is not a violation of this section until the department takes final action on the renewal application.
- b. The department may amend permits issued prior to February 9, 1976, so as to provide for voidance upon the ~~third~~ fifth anniversary of its issuance.
10. Minor source permit to operate fees.

- a. The owner or operator of each installation subject to a permit issued under section 33-15-14-03 shall pay an annual permit fee based on the following table:

<u>Classification</u>	<u>Annual Fee (\$)</u>
<u>Designated</u>	<u>300</u>
<u>Monitor (CEMS or Ambient Site)</u>	<u>600/CEMS or site</u>
<u>Other</u>	<u>100</u>
<u>State</u>	<u>0</u>
<u>Exempt</u>	<u>0</u>

The following criteria are used to classify sources for determining minor source annual fees:

Designated: A source that is designated for scheduled inspections and whose actual emissions of any air contaminant are less than one hundred tons [90.68 metric tons] per year and whose total annual emissions of all air contaminants would exceed one hundred tons [90.68 metric tons] per year if control equipment was not operated.

Monitor: A charge in addition to the annual fee for any source operating a continuous emission monitor

system (CEMS) or an ambient monitoring site.

Other: As designated by the department.

State: Any state-owned installation.

Exempt: As designated by the department.

b. The following activities conducted by the department are not included in the annual costs and will be charged to affected sources based on the actual costs incurred by the department:

(1) Observation of source or performance specification testing, or both.

(2) Audits of source operated ambient air monitoring networks.

An accounting of the actual costs incurred under this subdivision will accompany the notice of the annual permit fee.

c. Annual emissions are derived using representative source test data, "compilation of air pollution emission factors (AP-42)" or other reliable data.

d. The classification of "other" and "exempt" shall be designated by the department on a case-by-case basis.

e. The department shall send a notice, identifying the amount of the annual permit fee, to the owner or operator of each affected source. The fee is due within sixty days following receipt of such notice.

11. Performance and emission testing.

a. Emission tests or performance tests or both shall be conducted by the owner or operator of a facility and data reduced in accordance with the applicable procedure, limitations, standards, and test methods established by this article. Issuance of a minor source permit to operate is subject to the faithful completion of the test in accordance with this article.

b. All dates and periods of trial operation for the purpose of performance or emission testing pursuant to a permit to operate, must be approved in advance by the department. Trial operation shall cease if the department determines, on the basis of the test results, that continued operation will result in the violation of this article. Upon completion of any test conducted under a permit to

construct, the department may order the cessation of the operation of the tested equipment or facility until such time as a permit to operate has been issued by the department.

c. Upon review of the performance data resulting from any test, the department may require the installation of such additional control equipment as will bring the facility into compliance with this article.

d. Nothing in this article may be construed to prevent the department from conducting any test upon its own initiative, or from requiring the owner or operator to conduct any test at such time as the department may determine.

12. Responsibility to comply.

a. Possession of a minor source permit to operate does not relieve any person of the responsibility to comply with this article.

b. The exemption of any stationary source from the requirements to obtain a minor source permit to operate does not relieve the owner or operator of such source of the responsibility to comply with any other applicable portions of this article.

13. Portable sources. Sources which are designed to be portable and which are operated at temporary jobsites across the state may not be considered a new source by virtue of location changes. One application for a permit to operate any portable source may be filed in accordance with this chapter, and subsequent applications are not required for each temporary jobsite. The permit to operate issued by the department shall be conditioned by such specific requirements as the department deems appropriate to carry out the provisions of sections 33-15-01-07 and 33-15-01-15.

14. Registration of exempted stationary sources. The department may require that the owner or operator of any stationary source exempted from the requirement to obtain a minor source permit to operate to register the source with the department within such time limits and on such forms as the department may prescribe.

15. Extensions of time. The department may extend any of the time periods specified in this section upon notification of the applicant by the department.

16. Amendment of permits. When the public interest requires or when necessary to ensure the accuracy of the permit, the department may modify any condition or information contained

in a minor source permit to operate. Modification shall be made only upon the department's own motion and the procedure shall, at a minimum, conform to any requirements of federal and state law. In the event that the modification would have a significant impact as defined in chapter 33-15-15, the department shall follow the procedures established in chapter 33-15-15. For those of concern to the public, or modify a condition which limits the potential to emit of a source which possesses a federally enforceable permit, the department will provide:

- a. Reasonable notice to the public, in the area to be affected, of the opportunity for comment on the proposed modification and the opportunity for a public hearing, upon request, as well as written public comment.
- b. A minimum of a thirty-day period for written public comment with the opportunity for a public hearing during that thirty-day period, upon request.
- c. Consideration by the department of all comments received.

The department may require the submission of such maps, plans, specifications, emission information, and compliance schedules as it deems necessary prior to the issuance of an amendment. It is the intention of the department that this subsection shall apply only in those instances allowed by federal rules and regulations and only in those instances in which the granting of a variance pursuant to section 33-15-01-06 and enforcement of existing permit conditions are manifestly inappropriate.

History: Amended effective February 1, 1982; October 1, 1987; March 1, 1994.

General Authority: NDCC ~~20-32-02~~ 23-25-03, 23-25-04.2

Law Implemented: NDCC 23-25-03, 23-25-04.1, 23-25-04.2

33-15-14-04. Permit fees.

- ~~1. Permit to construct. Any construction, installation, or establishment of a new stationary source requiring a permit to construct under subsections 1 and 3 of section 33-15-14-02 is required to pay a permit to construct application processing fee to the North Dakota state department of health and consolidated laboratories. A filing fee of one hundred fifty dollars plus an application processing fee based on actual processing costs, including computer data processing costs, incurred by the department for all sources which involve a major analysis the cost of which would exceed one hundred fifty dollars, as determined by the department. The fee must be paid on the following basis:~~

- a. The filing fee of one hundred fifty dollars must be submitted with the permit application.
- b. A record of all permits to construct application processing costs incurred must be maintained by the department.
- c. Upon request, the department will inform the applicant of the probable total processing fee and the billing schedule that will be utilized in processing the application. If the applicant chooses, the applicant may withdraw the application at this point without paying any processing fees.
- d. Following the end of the public comment period or the public hearing, or both, and after final determinations on the application have been made, a final statement will be sent to the applicant containing the remaining actual processing costs incurred by the department.

2. Permit to operate.

- a. The owner or operator of each installation operating under a permit, except state-owned installations, shall pay an annual permit fee based on the following table:

Classification	Annual Cost
A1 - 15000 tons/year emissions	\$1,500
A1 - 15000 tons/year emissions	1,100
A2	300
A1-3	100
Other	100
Ambient Monitor Site	400
Ambient Hi-Vol Station	150
Exempt	NG

The following criteria is used in classifying sources:

- A1: A source that emits more than one hundred tons per year of any pollutant regardless of whether pollution controls are operating, and is scheduled to be inspected annually.
- A2: A source that emits less than one hundred tons per year of any pollutant but has the potential to emit more than one hundred tons per year without controls, and is scheduled to be inspected at least once every two years.
- A1-3: Same as A1 except that the source is scheduled to be inspected at least once every three years.

Other: As designated by the department.

Exempt: As designated by the department.

Ambient monitoring charges for sources operating both ambient air monitoring sites and hi-vol stations at the same site will be assessed a maximum of four hundred dollars per site.

b. The following activities conducted by the department are not included in the annual costs and will be charged to affected sources based on the actual costs incurred by the department:

(1) Observation of source or performance specification testing, or both.

(2) Audits of source operated ambient air monitoring networks.

An accounting of the actual costs incurred under this subdivision must accompany the notice of the annual permit fee.

c. All sources shall be classified taking into consideration the emissions from each installation, for the emissions of hydrocarbons, particulate matter, sulfur dioxide, carbon monoxide, and nitrogen oxides. In the case of boilers with heat inputs greater than or equal to 250×10^6 Btu/hr the fee must be assessed per boiler. The department shall determine the emission factors applicable to each permit or group of permits based on representative source tests, "AP-42, Compilation of Air Pollution Emission Factors" or other more reliable data. "Emission factor" as used in this section means the amount of an air contaminant emitted per unit of time. The annual actual emissions shall be based on the emission factor and the hours of operation per year from the annual emission inventory report.

d. A notice of the annual permit fee due must be sent to the permittee by the department. The fee is due sixty days following receipt of such notice.

e. The classification of "Other" and "Exempt" must be designated by the department on a case-by-case basis.

3. Any source that initiates operation under a permit to construct prior to receiving a permit to operate is subject to the fees outlined in subsection 2. Repealed effective March 1, 1994.

History: Amended effective October 1, 1987.
General Authority: NDCE 28-32-02
Law Implemented: NDCE 23-25-04.1

33-15-14-05. Common provisions applicable to both permit to construct and permit to operate.

1. Exemptions. A permit to construct and a permit to operate are not required for the following stationary sources:
 - a. Maintenance, structural changes, or minor repair of process equipment, fuel burning equipment, control equipment, or incinerators which do not change capacity of such process equipment, fuel burning equipment, control equipment, or incinerators and which do not involve any change in the quality, nature, or quantity of emissions therefrom.
 - b. Fossil fuel burning equipment, other than smokehouse generators, which meet all of the following criteria:
 - (1) The aggregate heat input per unit does not exceed ten million British thermal units per hour.
 - (2) The total aggregate heat input from all equipment does not exceed ten million British thermal units per hour.
 - (3) The actual emissions, as defined in chapter 33-15-15, from all equipment do not exceed twenty-five tons [22.67 metric tons] per year of any air contaminant.
 - c. Any single internal combustion engine with less than five hundred brake horsepower, or multiple engines with a combined brake horsepower rating less than five hundred brake horsepower.
 - d. Bench scale laboratory equipment used exclusively for chemical or physical analysis or experimentation.
 - e. Portable brazing, soldering, or welding equipment.
 - f. The following equipment:
 - (1) Comfort air conditioners or comfort ventilating systems which are not designed and not intended to be used to remove emissions generated by or released from specific units or equipment.
 - (2) Water cooling towers and water cooling ponds unless used for evaporative cooling of process water, or for evaporative cooling of water from barometric jets or

barometric condensers or used in conjunction with an installation requiring a permit.

- (3) Equipment used exclusively for steam cleaning.
- (4) Grain, metal, plastic, or mineral extrusion presses.
- (5) Porcelain enameling furnaces or porcelain enameling drying ovens.
- (6) Unheated solvent dispensing containers or unheated solvent rinsing containers of sixty gallons {227.12 liters} capacity or less.
- (7) Equipment used for hydraulic or hydrostatic testing.

g. The following equipment or any exhaust system or collector serving exclusively such equipment:

- (1) Blast cleaning equipment using a suspension of abrasive in water.
- (2) Bakery ovens where the products are edible and intended for human consumption.
- (3) Kilns for firing ceramic ware, heated exclusively by gaseous fuels, singly or in combinations, and electricity.
- (4) Confection cookers where the products are edible and intended for human consumption.
- (5) Drop hammers or hydraulic presses for forging or metal working.
- (6) Die casting machines.
- (7) Photographic process equipment through which an image is reproduced upon material through the use of sensitized radiant energy.
- (8) Equipment for drilling, carving, cutting, routing, turning, sawing, planing, spindle sanding, or disc sanding of wood or wood products, which is located within a facility that does not vent to the outside air.
- (9) Equipment for surface preparation of metals by use of aqueous solutions, except for acid solutions.
- (10) Equipment for washing or drying products fabricated from metal or glass, provided, that no volatile

organic materials are used in the process and that no oil or solid fuel is burned.

- (11) Laundry dryers, extractors, or tumblers for fabrics cleaned with only water solutions of bleach or detergents.
 - (12) Containers, reservoirs, or tanks used exclusively for electrolytic plating with, or electrolytic polishing of, or electrolytic stripping of the following metals: brass, bronze, cadmium, copper, iron, lead, nickel, tin, zinc, and precious metals.
- h. Natural draft hoods or natural draft ventilators.
- i. Containers, reservoirs, or tanks used exclusively for:
- (1) Dipping operations for coating objects with oils, waxes, or greases, where no organic solvents are used.
 - (2) Dipping operations for applying coatings of natural or synthetic resins which contain no organic solvents.
 - (3) Storage of butane, propane, or liquefied petroleum or natural gas.
 - (4) Storage of lubricating oils.
 - (5) Storage of petroleum liquids except those containers, reservoirs, or tanks subject to the requirements of chapter 33-15-12.
- j. Gaseous fuel-fired or electrically heated furnaces for heat treating glass or metals, the use of which does not involve molten materials.
- k. Crucible furnaces, pot furnaces, or induction furnaces, with a capacity of one thousand pounds [453.59 kilograms] or less each, unless otherwise noted, in which no sweating or distilling is conducted, nor any fluxing conducted utilizing chloride, fluoride, or ammonium compounds, and from which only the following metals are poured or in which only the following metals are held in a molten state:
- (1) Aluminum or any alloy containing over fifty percent aluminum, provided, that no gaseous chlorine compounds, chlorine, aluminum chloride, or aluminum fluoride are used.

- (2) Magnesium or any alloy containing over fifty percent magnesium.
 - (3) Lead or any alloy containing over fifty percent lead, in a furnace with a capacity of five hundred fifty pounds {249.48 kilograms} or less.
 - (4) Tin or any alloy containing over fifty percent tin.
 - (5) Zinc or any alloy containing over fifty percent zinc.
 - (6) Copper.
 - (7) Precious metals.
- l. Open burning activities within the scope of section 33-15-04-02.
 - m. Flares used to indicate some danger to the public.
 - n. Other sources of minor significance as determined by the department.
2. Performance and emission testing.
- a. Emission tests or performance tests or both shall be conducted by the owner or operator of a facility and data reduced in accordance with the applicable procedure, limitations, standards, and test methods established by this article. Such tests must be conducted under the owner's or operator's permit to construct or operate, and such permit is subject to the faithful completion of the test in accordance with this article.
 - b. All dates and periods of trial operation for the purpose of performance or emission testing pursuant to a permit to construct, and all dates of performance or emission testing pursuant to a permit to operate, must be approved in advance by the department. Trial operation shall cease if the department determines, on the basis of the test results, that continued operation will result in the violation of this article. Upon completion of any test conducted under a permit to construct, the department may order the cessation of the operation of the tested equipment or facility until such time as a permit to operate has been issued by the department.
 - c. Upon review of the performance data resulting from any test, the department may require the installation of such additional control equipment as will bring the facility into compliance with this article.

- d. Nothing in this article may be construed to prevent the department from conducting any test upon its own initiative, or from requiring the owner or operator to conduct any test at such time as the department may determine.
3. Responsibility to comply.
- a. Possession of a permit to construct or a permit to operate does not relieve any person of the responsibility to comply with this article.
 - b. The exemption of any stationary source from the requirements of a permit to construct or a permit to operate by reason of inclusion in subsection † does not relieve the owner or operator of such source of the responsibility to comply with any other applicable portions of this article.
4. Portable sources. Sources which are designed to be portable and which are operated at temporary jobsites across the state may not be considered a new source by virtue of location changes. One application for a permit to operate any portable source may be filed in accordance with this chapter, and subsequent applications are not required for each temporary jobsite. The permit to operate issued by the department shall be conditioned by such specific requirements as the department deems appropriate to carry out the provisions of sections 33-15-01-07 and 33-15-01-15.
5. Registration of exempted stationary sources. The department may require that the owner or operator of any stationary source exempted under subsection † shall register the source with the department within such time limits and on such forms as the department may prescribe.
6. Extensions of time. The department may extend any of the time periods specified in subsections 4, 5, and 6 of section 33-15-14-02 and subsection 5 of section 33-15-14-03 upon notification of the applicant by the department.
7. Amendment of permits. The department may, when the public interest requires, modify any condition of a permit to operate or permit to construct. Modification shall be made only upon the department's own motion and the procedure shall, at a minimum, conform to any requirements of federal and state law. In the event that the modification would have a significant impact as defined in chapter 33-15-15 or be of concern to the public, the department will provide:
- a. Reasonable notice to the public, in the area to be affected, of the opportunity for comment on the proposed

modification at a public hearing as well as written public comment.

- b. A minimum of a thirty day period for written public comment with a public hearing during that thirty day period.
- c. Consideration by the department of all comments received in its order for modification.

The department may require the submission of such maps, plans, specifications, emission information, and compliance schedules as it deems necessary prior to the issuance of an order for modification. It is the intention of the department that this subsection shall apply only in those instances allowed by federal rules and regulations and only in those instances in which the granting of a variance pursuant to section 33-15-01-06 and enforcement of existing permit conditions are manifestly inappropriate. Repealed effective March 1, 1994.

History: Effective October 1, 1987; amended effective January 1, 1989; June 1, 1990.

General Authority: NDCC 28-32-02

Law Implemented: NDCC 23-25-04.1

33-15-14-06. Title V permit to operate.

1. Definitions. For purposes of this section:

- a. "Affected source" means any source that includes one or more affected units.
- b. "Affected state" means any state that is contiguous to North Dakota whose air quality may be affected by a source subject to a proposed title V permit, permit modification, or permit renewal or which is within fifty miles [80.47 kilometers] of the permitted source.
- c. "Affected unit" means a unit that is subject to any acid rain emissions reduction requirement or acid rain emissions limitation under title VI of the Federal Clean Air Act.
- d. "Applicable requirement" means all of the following as they apply to emissions units at a source that is subject to requirements of this section (including requirements that have been promulgated or approved by the United States environmental protection agency through rulemaking at the time of issuance but have future-effective compliance dates):

- (1) Any standard or other requirement provided for in the North Dakota state implementation plan approved or promulgated by the United States environmental protection agency through rulemaking under title I of the Federal Clean Air Act that implements the relevant requirements of the Federal Clean Air Act, including any revisions to that plan.
- (2) Any term or condition of any permit to construct issued pursuant to this chapter.
- (3) Any standard or other requirement under section 111 including section 111(d) of the Federal Clean Air Act.
- (4) Any standard or other requirement under section 112 of the Federal Clean Air Act including any requirement concerning accident prevention under section 112(r)(7) of the Federal Clean Air Act.
- (5) Any standard or other requirement of the acid rain program under title IV of the Federal Clean Air Act.
- (6) Any requirements established pursuant to section 504(b) or section 114(a)(3) of the Federal Clean Air Act.
- (7) Any standard or other requirement governing solid waste incineration, under section 129 of the Federal Clean Air Act.
- (8) Any standard or other requirement for consumer and commercial products, under section 183(e) of the Federal Clean Air Act.
- (9) Any standard or other requirement for tank vessels under section 183(f) of the Federal Clean Air Act.
- (10) Any standard or other requirement of the program to control air pollution from outer continental shelf sources, under section 328 of the Federal Clean Air Act.
- (11) Any standard or other requirement of the regulations promulgated to protect stratospheric ozone under title VI of the Federal Clean Air Act, unless the administrator of the United States environmental protection agency has determined that such requirements need not be contained in a title V permit.
- (12) Any national ambient air quality standard or increment or visibility requirement under part C of

title I of the Federal Clean Air Act, but only as it would apply to temporary sources permitted pursuant to section 504(e) of the Federal Clean Air Act.

- e. "Designated representative" means a responsible natural person authorized by the owners and operators of an affected source and of all affected units at the source, as evidenced by a certificate of representation submitted in accordance with subpart B of 40 CFR 72, to represent and legally bind each owner and operator, as a matter of federal law, in matters pertaining to the acid rain program. Whenever the term "responsible official" is used in this section, or in any other regulations implementing title V of the Federal Clean Air Act, it shall be deemed to refer to the "designated representative" with regard to all matters under the acid rain program.
- f. "Draft permit" means the version of a permit for which the department offers public participation or affected state review.
- g. "Emergency" means any situation arising from sudden and reasonably unforeseeable events beyond the control of the source, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the title V permit to operate, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.
- h. "Emissions allowable under the permit" means a federally enforceable permit term or condition determined at issuance to be required by an applicable requirement that establishes an emissions limit (including a work practice standard) or a federally enforceable emissions cap that the source has assumed to avoid an applicable requirement to which the source would otherwise be subject.
- i. "Emissions unit" means any part or activity of a stationary source that emits or has the potential to emit any regulated air contaminant or any contaminant listed under section 112(b) of the Federal Clean Air Act. This term does not alter or affect the definition of unit for purposes of title IV of the Federal Clean Air Act.
- j. "Environmental protection agency" or the "administrator" means the administrator of the United States environmental protection agency or the administrator's designee.

- k. "Federal Clean Air Act" means the Federal Clean Air Act, as amended [42 U.S.C. 7401 et seq.] or the regulations promulgated thereunder, as they existed on May 1, 1993.
- l. "Final permit" means the version of a title V permit issued by the department that has completed all review procedures required in this section.
- m. "Fugitive emissions" are those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.
- n. "General permit" means a title V permit to operate that meets the requirements of subdivision d of subsection 5.
- o. "Major source" means any stationary source (or any group of stationary sources that are located on one or more contiguous or adjacent properties, and are under common control of the same person (or persons under common control)) belonging to a single major industrial grouping and that are described in paragraph 1 or 2. For the purposes of defining "major source", a stationary source or group of stationary sources shall be considered part of a single industrial grouping if all of the contaminant emitting activities at such source or group of sources on contiguous or adjacent properties belong to the same major group (i.e., all have the same two-digit code) as described in the standard industrial classification manual, 1987.

(1) A major source under section 112 of the Federal Clean Air Act, which is defined as:

- (a) For contaminants other than radionuclides, any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit, in the aggregate, ten tons [9.07 metric tons] per year (tpy) or more of any hazardous air contaminant which has been listed pursuant to section 112(b) of the Federal Clean Air Act, twenty-five tons [22.67 metric tons] per year or more of any combination of such hazardous air contaminants, or such lesser quantity as the administrator of the United States environmental protection agency may establish by rule. Notwithstanding the preceding sentence, emissions from any oil or gas exploration or production well (with its associated equipment) and emissions from any pipeline compressor pump station shall not be aggregated with emissions from other similar units, whether or not such units are in a contiguous area or under common

control, to determine whether such units or stations are major sources.

(b) For radionuclides, "major source" shall have the meaning specified by the administrator of the United States environmental protection agency by rule.

(2) A major stationary source of air contaminants, that directly emits or has the potential to emit, one hundred tons [90.68 metric tons] per year or more of any air contaminant (including any major source of fugitive emissions of any such contaminant, as determined by rule by the administrator of the United States environmental protection agency). The fugitive emissions of a stationary source shall not be considered in determining whether it is a major stationary source for the purposes of this section, unless the source belongs to one of the following categories of stationary source:

(a) Coal cleaning plants (with thermal dryers).

(b) Kraft pulp mills.

(c) Portland cement plants.

(d) Primary zinc smelters.

(e) Iron and steel mills.

(f) Primary aluminum ore reduction plants.

(g) Primary copper smelters.

(h) Municipal incinerators capable of charging more than two hundred fifty tons [226.80 metric tons] of refuse per day.

(i) Hydrofluoric, sulfuric, or nitric acid plants.

(j) Petroleum refineries.

(k) Lime plants.

(l) Phosphate rock processing plants.

(m) Coke oven batteries.

(n) Sulfur recovery plants.

(o) Carbon black plants (furnace process).

- (p) Primary lead smelters.
 - (q) Fuel conversion plants.
 - (r) Sintering plants.
 - (s) Secondary metal production plants.
 - (t) Chemical process plants.
 - (u) Fossil-fuel boilers (or combination thereof) totaling more than two hundred fifty million British thermal units per hour heat input.
 - (v) Petroleum storage and transfer units with a total storage capacity exceeding three hundred thousand barrels.
 - (w) Taconite ore processing plants.
 - (x) Glass fiber processing plants.
 - (y) Charcoal production plants.
 - (z) Fossil-fuel-fired steam electric plants of more than two hundred fifty million British thermal units per hour heat input.
 - (aa) All other stationary source categories regulated by a standard promulgated under section 111 or 112 of the Federal Clean Air Act, but only with respect to those air contaminants that have been regulated for that category.
- p. "Permit modification" means a revision to a title V permit that meets the requirements of subdivision e of subsection 6.
- q. "Permit program costs" means all reasonable (direct and indirect) costs required to develop and administer a permit program, under this section (whether such costs are incurred by the department or other state or local agencies that do not issue permits directly, but that support permit issuance or administration).
- r. "Permit revision" means any permit modification or administrative permit amendment.
- s. "Potential to emit" means the maximum capacity of a stationary source to emit any air contaminant under its physical and operational design. Any physical or operational limitation on the capacity of a source to emit an air pollutant, including air pollution control

equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation is enforceable by the administrator of the United States environmental protection agency and the department.

t. "Proposed permit" means the version of a permit that the department proposes to issue and forwards to the administrator of the United States environmental protection agency for review.

u. "Regulated air contaminant" means the following:

(1) Nitrogen oxides or any volatile organic compounds.

(2) Any contaminant for which a national ambient air quality standard has been promulgated.

(3) Any contaminant that is subject to any standard promulgated under section 111 of the Federal Clean Air Act.

(4) Any class I or II substance subject to a standard promulgated under or established by title VI of the Federal Clean Air Act.

(5) Any contaminant subject to a standard promulgated under section 112 or other requirements established under section 112 of the Federal Clean Air Act, including sections 112(g), (j), and (r) of the Federal Clean Air Act, including the following:

(a) Any contaminant subject to requirements under section 112(j) of the Federal Clean Air Act. If the administrator fails to promulgate a standard by the date established pursuant to section 112(e) of the Federal Clean Air Act, any contaminant for which a subject source would be major shall be considered to be regulated on the date eighteen months after the applicable date established pursuant to section 112(e) of the Federal Clean Air Act; and

(b) Any contaminant for which the requirements of section 112(g)(2) of the Federal Clean Air Act have been met, but only with respect to the individual source subject to section 112(g)(2) of the Federal Clean Air Act requirement.

v. "Regulated contaminant" for fee calculation, which is used only for subsection 8, means any "regulated air contaminant" except the following:

- (1) Carbon monoxide.
 - (2) Any contaminant that is a regulated air contaminant solely because it is a class I or II substance subject to a standard promulgated under or established by title VI of the Federal Clean Air Act.
 - (3) Any contaminant that is a regulated air contaminant solely because it is subject to a standard or regulation under section 112(r) of the Federal Clean Air Act.
- w. "Renewal" means the process by which a permit is reissued at the end of its term.
- x. "Responsible official" means one of the following:
- (1) For a corporation: a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decisionmaking functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:
 - (a) The facilities employ more than two hundred fifty persons or have gross annual sales or expenditures exceeding twenty-five million dollars (in second quarter 1980 dollars).
 - (b) The delegation of authority to such representatives is approved in advance by the department.
 - (2) For a partnership or sole proprietorship: a general partner or the proprietor, respectively.
 - (3) For a municipality, state, federal, or other public agency: either a principal executive officer or ranking elected official. For the purposes of this section, a principal executive officer of a federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., a regional administrator of the United States environmental protection agency).
 - (4) For affected sources:

(a) The designated representative insofar as actions, standards, requirements, or prohibitions under title IV of the Federal Clean Air Act or the regulations promulgated thereunder are concerned.

(b) The designated representative for any other purposes under this section.

y. "Section 502(b)(10) changes" are changes that contravene an express permit term. Such changes do not include changes that would violate applicable requirements or contravene federally enforceable permit terms and conditions that are monitoring (including test methods), recordkeeping, reporting, or compliance certification requirements.

z. "Stationary source" means any building, structure, facility, or installation that emits or may emit any regulated air contaminant or any contaminant listed under section 112(b) of the Federal Clean Air Act.

aa. "Title V permit to operate or permit (unless the context suggests otherwise)" means any permit or group of permits covering a source that is subject to this section that is issued, renewed, amended, or revised pursuant to this section.

bb. "Title V source" means any source subject to the permitting requirements of this section, as provided in subsection 2.

2. Applicability.

a. This section is applicable to the following sources:

(1) Any major source.

(2) Any source, including an area source, subject to a standard, limitation, or other requirement under section 111 of the Federal Clean Air Act.

(3) Any source, including an area source, subject to a standard or other requirement under section 112 of the Federal Clean Air Act, except that a source is not required to obtain a permit solely because it is subject to regulations or requirements under section 112(r) of the Federal Clean Air Act.

(4) Any affected source.

(5) Any source in a source category designated by the administrator of the United States environmental protection agency.

b. The following source categories are exempt from the requirements of this section:

(1) All sources listed in subdivision a that are not major sources, affected sources, or solid waste incineration units required to obtain a permit pursuant to section 129(e) of the Federal Clean Air Act, are exempt from the obligation to obtain a title V permit until such time as the administrator of the United States environmental protection agency completes a rulemaking to determine how the program should be structured for nonmajor sources and the appropriateness of any permanent exemptions.

(2) In the case of nonmajor sources subject to a standard or other requirement under either section 111 or 112 of the Federal Clean Air Act after July 21, 1992, those the administrator of the United States environmental protection agency determines to be exempt from the requirement to obtain a title V source permit at the time that the new standard is promulgated.

(3) Any source listed as exempt from the requirement to obtain a permit under this section may opt to apply for a title V permit. Sources that are exempted by paragraphs 1 and 2 of this subdivision and which do not opt to apply for a title V permit to operate are subject to the requirements of section 33-15-14-03.

(4) The following source categories are exempted from the obligation to obtain a permit under this section.

(a) All sources and source categories that would be required to obtain a permit solely because they are subject to 40 CFR 60, subpart AAA - standards of performance for new residential wood heaters.

(b) All sources and source categories that would be required to obtain a permit solely because they are subject to 40 CFR 61, subpart M - national emission standard for hazardous air contaminants for asbestos, standard for demolition and renovation.

c. For major sources, the department will include in the permit all applicable requirements for all relevant emissions units in the major source.

For any nonmajor source subject to the requirements of this section, the department will include in the permit all applicable requirements applicable to the emissions units that cause the source to be subject to this section.

d. Fugitive emissions from a source subject to the requirements of this section shall be included in the permit application and the permit in the same manner as stack emissions, regardless of whether the source category in question is included in the list of sources contained in the definition of major source.

3. Scope. Nothing within this section shall relieve the owner or operator of a source of the requirement to obtain a permit to construct under section 33-15-14-02 or to comply with any other applicable standard or requirement of this article.

4. Permit applications.

a. Duty to apply. For each title V source, the owner or operator shall submit a timely and complete permit application in accordance with this subdivision.

(1) Timely application.

(a) A timely application for a source applying for a title V permit for the first time is one that is submitted within one year of the United States environmental protection agency approval of this rule or in accordance with the following schedule, whichever is earlier:

[1] The following designated air contaminant sources shall submit their initial application by February 1, 1995.

[a] Crude oil and natural gas production facilities.

[b] Natural gas processing facilities.

[c] Internal combustion engines used for natural gas transmission or distribution.

[d] Stationary gas turbines used for natural gas transmission or distribution.

[2] Except as provided in subparagraphs b, c, and d of this paragraph, all other applications shall be submitted by November 15, 1995.

- (b) Title V sources required to meet the requirements under section 112(g) of the Federal Clean Air Act, or to have a permit to construct under section 33-15-14-02, shall file a complete application to obtain the title V permit or permit revision within twelve months after commencing operation. Where an existing title V permit would prohibit such construction or change in operation, the source must obtain a permit revision before commencing operation.
- (c) For purposes of permit renewal, a timely application is one that is submitted at least six months, but not more than eighteen months, prior to the date of permit expiration.
- (d) Applications for initial phase II acid rain permits shall be submitted to the department by January 1, 1996, for sulfur dioxide, and by January 1, 1998, for nitrogen oxides.
- (2) Complete application. To be deemed complete, an application must provide all information required pursuant to subdivision c, except that applications for a permit revision need supply such information only if it is related to the proposed change. Information required under subdivision c must be sufficient to evaluate the subject source and its application and to determine all applicable requirements. A responsible official must certify the submitted information consistent with subdivision d. Unless the department determines that an application is not complete within sixty days of receipt of the application, such application shall be deemed to be complete, except as otherwise provided in paragraph 3 of subdivision a of subsection 6. If, while processing an application that has been determined or deemed to be complete, the department determines that additional information is necessary to evaluate or take final action on that application, it may request such information in writing and set a reasonable deadline for a response. The source's ability to operate without a permit, as set forth in subdivision b of subsection 6, shall be in effect from the date the application is determined or deemed to be complete until the final permit is issued, provided that the applicant submits any requested additional information by the deadline specified by the department.
- (3) Confidential information. If a source has submitted information to the department under a claim of confidentiality, the source must also submit a copy

of such information directly to the administrator of the United States environmental protection agency when directed to do so by the department.

b. Duty to supplement or correct application. Any applicant who fails to submit any relevant facts or who has submitted incorrect information in a permit application shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information. In addition, an applicant shall provide additional information as necessary to address any requirements that become applicable to the source after the date it filed a complete application but prior to release of a draft permit.

c. Standard application form and required information. All applications for a title V permit to operate shall be made on forms supplied by the department. Information as described below for each emissions unit at a title V source shall be included in the application. Emissions units or activities that have the potential to emit less than the following quantities of air contaminants need not be included in permit applications:

Particulate: 5 tons [4.54 metric tons] per year
Inhalable particulate: 5 tons [4.54 metric tons] per year
Sulfur dioxide: 10 tons [9.07 metric tons] per year
Hydrogen sulfide: 2.5 tons [2.27 metric tons] per year
Carbon monoxide: 25 tons [22.68 metric tons] per year
Nitrogen oxides: 10 tons [9.07 metric tons] per year
Ozone: 10 tons [9.07 metric tons] per year
Reduced sulfur compounds: 2.5 tons [2.27 metric tons] per year
Volatile organic compounds: 10 tons [9.07 metric tons] per year

This exemption does not apply to contaminants listed in section 112(b) of the Federal Clean Air Act.

However, for exempted activities or emissions units, a list of such activities or units must be included in the application. An applicant may not omit information needed to determine the applicability of, or to impose, any applicable requirement, or to evaluate the fee amount required under subsection 8. The application, shall, as a minimum, include the elements specified below:

(1) Identifying information, including company name and address (or plant name and address if different from the company name), owner's name and agent, and telephone number and names of plant site manager or contact.

- (2) A description of the source's processes and products (by Standard Industrial Classification Code) including any associated with each alternate scenario identified by the source.
- (3) The following emissions-related information:
- (a) All emissions of contaminants for which the source is major, and all emissions of regulated air contaminants. A permit application shall describe all emissions of regulated air contaminants emitted from any emissions unit, except where such units are exempted under this subdivision.
 - (b) Identification and description of all points of emissions described in subparagraph a in sufficient detail to establish the basis for fees and applicability of requirements of the Federal Clean Air Act and this article.
 - (c) Emissions rates in tons per year and in such terms as are necessary to establish compliance with the applicable standard.
 - (d) Fuels, fuel use, raw materials, production rates, and operating schedules.
 - (e) Identification and description of air pollution control equipment and compliance monitoring devices or activities.
 - (f) Limitations on source operation affecting emissions or any work practice standards, where applicable, for all regulated contaminants.
 - (g) Other information required by any applicable requirement including information related to stack height limitations developed pursuant to chapter 33-15-18.
 - (h) Calculations on which the information in subparagraphs a through g is based.
- (4) The following air pollution control requirements:
- (a) Citation and description of all applicable requirements; and
 - (b) Description of or reference to any applicable test method for determining compliance with each applicable requirement.

- (5) Other specific information that may be necessary to implement and enforce other applicable requirements of the Federal Clean Air Act or of this article or to determine the applicability of such requirements.
- (6) An explanation of any proposed exemptions from otherwise applicable requirements.
- (7) Information that the department determines to be necessary to define alternative operating scenarios identified by the source or to define permit terms and conditions.
- (8) A compliance plan for all title V sources that contains all the following:
- (a) A description of the compliance status of the source with respect to all applicable requirements.
- (b) A description as follows:
- [1] For applicable requirements with which the source is in compliance, a statement that the source will continue to comply with such requirements.
- [2] For applicable requirements that will become effective during the permit term, a statement that the source will meet such requirements on a timely basis.
- [3] For requirements for which the source is not in compliance at the time of permit issuance, a narrative description of how the source will achieve compliance with such requirements.
- (c) A compliance schedule as follows:
- [1] For applicable requirements with which the source is in compliance, a statement that the source will continue to comply with such requirements.
- [2] For applicable requirements that will become effective during the permit term, a statement that the source will meet such requirements on a timely basis. A statement that the source will meet in a timely manner applicable requirements that become effective during the permit term shall satisfy this provision, unless a more

detailed schedule is expressly required by the applicable requirement.

[3] A schedule of compliance for sources that are not in compliance with all applicable requirements at the time of permit issuance. Such a schedule shall include a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance with any applicable requirements for which the source will be in noncompliance at the time of permit issuance. This compliance schedule shall resemble and be at least as stringent as that contained in any judicial consent decree or administrative order to which the source is subject. Any such schedule of compliance shall be supplemental to, and shall not sanction noncompliance with, the applicable requirements on which it is based.

(d) A schedule for submission of certified progress reports no less frequently than every six months for sources required to have a schedule of compliance to remedy a violation.

(e) The compliance plan content requirements specified in this paragraph shall apply and be included in the acid rain portion of a compliance plan for an affected source, except as specifically superseded by regulations promulgated under title IV of the Federal Clean Air Act with regard to the schedule and method or methods the source will use to achieve compliance with the acid rain emissions limitations.

(9) Requirements for compliance certification, including the following:

(a) A certification of compliance with all applicable requirements by a responsible official consistent with subdivision d and section 114(a)(3) of the Federal Clean Air Act;

(b) A statement of methods used for determining compliance, including a description of monitoring, recordkeeping, and reporting requirements and test methods;

(c) A schedule for submission of compliance certifications during the permit term, to be

submitted annually, or more frequently if specified by the underlying applicable requirement; and

(d) A statement indicating the source's compliance status with any applicable enhanced monitoring and compliance certification requirements of the Federal Clean Air Act.

(10) The use of nationally standardized forms for acid rain portions of permit applications and compliance plans, as required by regulations promulgated under title IV of the Federal Clean Air Act.

d. Any application form, report, or compliance certification submitted pursuant to these rules shall contain certification by a responsible official of truth, accuracy, and completeness. This certification and any other certification required under this section shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

5. Permit content.

a. Standard permit requirements. Each permit issued under this section shall include, as a minimum, the following elements:

(1) Emission limitations and standards, including those operational requirements and limitations that assure compliance with all applicable requirements at the time of permit issuance.

(a) The permit must specify and reference the origin of and authority for each term or condition, and identify any difference in form as compared to the applicable requirement upon which the term or condition is based.

(b) The permit must state that, where an applicable requirement of the Federal Clean Air Act is more stringent than an applicable requirement of regulations promulgated under title IV of the Federal Clean Air Act, both provisions shall be incorporated into the permit and shall be enforceable by the administrator of the United States environmental protection agency and the department.

(c) Where the state implementation plan or this article allows a determination of an alternative emission limit at a title V source, equivalent

to that contained in the plan, to be made in the permit issuance, renewal, or significant modification process, and the department elects to use such process, any permit containing such equivalency determination shall contain provisions to ensure that any resulting emissions limit has been demonstrated to be quantifiable, accountable, enforceable, and based on replicable procedures.

(2) Permit duration. Each title V permit to operate shall expire upon the fifth anniversary of its issuance.

(3) Monitoring and related recordkeeping and reporting requirements.

(a) Each permit shall contain the following requirements with respect to monitoring:

[1] All emissions monitoring and analysis procedures or test methods required under the applicable requirements, including any procedures and methods promulgated pursuant to sections 504(b) or 114(a)(3) of the Federal Clean Air Act;

[2] Where the applicable requirement does not require periodic testing or instrumental or noninstrumental monitoring (which may consist of recordkeeping designed to serve as monitoring), periodic monitoring sufficient to yield reliable data from the relevant time period that are representative of the source's compliance with the permit, as reported pursuant to subparagraph c. Such monitoring requirements shall assure use of terms, test methods, units, averaging periods, and other statistical conventions consistent with the applicable requirement. Recordkeeping provisions may be sufficient to meet the requirements of this item; and

[3] As necessary, requirements concerning the use, maintenance, and, where appropriate, installation of monitoring equipment or methods.

(b) With respect to recordkeeping, the permit shall incorporate all applicable recordkeeping requirements and require, where applicable, the following:

[1] Records of required monitoring information that include the following:

[a] The date, place as defined in the permit, and time of sampling or measurements;

[b] The dates analyses were performed;

[c] The company or entity that performed the analyses;

[d] The analytical techniques or methods used;

[e] The results of such analyses; and

[f] The operating conditions as existing at the time of sampling or measurement;

[2] Retention of records of all required monitoring data and support information for a period of at least five years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation, and copies of all reports required by the permit.

(c) With respect to reporting, the permit shall incorporate all applicable reporting requirements and require the following:

[1] Submittal of reports of any required monitoring at least every six months. All instances of deviations from permit requirements must be clearly identified in such reports. All required reports must be certified by a responsible official consistent with subdivision d of subsection 4.

[2] Prompt reporting of deviations from permit requirements, including those attributable to upset conditions as defined in the permit, the probable cause of such deviations, and any corrective actions or preventive measures taken. The department shall define "prompt" in the permit

consistent with chapter 33-15-01 and the applicable requirements.

- (4) A permit condition prohibiting emissions exceeding any allowances that the source lawfully holds under title IV of the Federal Clean Air Act or the regulations promulgated thereunder.
- (a) No permit revision shall be required for increases in emissions that are authorized by allowances acquired pursuant to title IV of the Federal Clean Air Act, or the regulations promulgated thereunder, provided that such increases do not require a permit revision under any other applicable requirement.
- (b) No limit shall be placed on the number of allowances held by the source. The source may not, however, use allowances as a defense to noncompliance with any other applicable requirement.
- (c) Any such allowance shall be accounted for according to the procedures established in regulations promulgated under title IV of the Federal Clean Air Act.
- (5) A severability clause to ensure the continued validity of the various permit requirements in the event of a challenge to any portions of the permit.
- (6) Provisions stating the following:
- (a) The permittee must comply with all conditions of the title V permit. Any permit noncompliance constitutes a violation of the Federal Clean Air Act and this article and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.
- (b) It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
- (c) The permit may be modified, revoked, reopened, and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or of a notification of planned

changes or anticipated noncompliance does not stay any permit condition.

(d) The permit does not convey any property rights of any sort, or any exclusive privilege.

(e) The permittee must furnish to the department, within a reasonable time, any information that the department may request in writing to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the permittee must also furnish to the department copies of records required to be kept by the permit or, for information claimed to be confidential, the permittee must also furnish such records directly to the administrator of the United States environmental protection agency along with a claim of confidentiality.

(7) A provision to ensure that the source pays fees to the department consistent with the fee schedule approved pursuant to subsection 8.

(8) Emissions trading. No permit revision shall be required, under any approved economic incentives, marketable permits, emissions trading and other similar programs or processes for changes that are provided for in the permit and the state implementation plan or this article.

(9) Terms and conditions for reasonably anticipated operating scenarios identified by the source in its application as approved by the department. Such terms and conditions:

(a) Shall require the source, contemporaneously with making a change from one operating scenario to another, to record in a log at the permitted facility a record of the scenario under which it is operating;

(b) Shall extend the permit shield described in subdivision f to all terms and conditions under each such operating scenario; and

(c) Must ensure that the terms and conditions of each such alternative scenario meet all applicable requirements and the requirements of this section.

(10) Terms and conditions, if the permit applicant requests them, for the trading of emissions increases and decreases in the permitted facility, to the extent that the applicable requirements, including this article and the state implementation plan, provide for trading such increases and decreases without a case-by-case approval of each emissions trade. Such terms and conditions:

(a) Shall include all terms required under subdivisions a and c to determine compliance;

(b) Shall extend the permit shield described in subdivision f to all terms and conditions that allow such increases and decreases in emissions; and

(c) Must meet all applicable requirements and requirements of this section.

(11) If a permit applicant requests it, the department shall issue permits that contain terms and conditions, including all terms required under subdivisions a and c to determine compliance, allowing for the trading of emissions increases and decreases in the permitted facility solely for the purpose of complying with a federally enforceable emissions cap that is established in the permit independent of otherwise applicable requirements. The permit applicant shall include in its application proposed replicable procedures and permit terms that ensure the emissions trades are quantifiable and enforceable. The department shall not be required to include in the emissions trading provisions any emissions units for which emissions are not quantifiable or for which there are no replicable procedures to enforce the emissions trades. The permit shall also require compliance with all applicable requirements. The permittee shall supply written notification at least seven days prior to the change to the department and the administrator of the United States environmental protection agency and shall state when the change will occur and shall describe the changes in emissions that will result and how these increases and decreases in emissions will comply with the terms and conditions of the permit. The permit shield described in subdivision f shall extend to terms and conditions that allow such increases and decreases in emissions.

b. Federally enforceable requirements.

(1) All terms and conditions in a title V permit, including any provisions designed to limit a source's potential to emit, are enforceable by the administrator of the United States environmental protection agency and citizens under the Federal Clean Air Act.

(2) Notwithstanding paragraph 1, the department shall specifically designate as not being federally enforceable under the Federal Clean Air Act any terms and conditions included in the permit that are not required under the Federal Clean Air Act or under any of its applicable requirements. Terms and conditions so designated are not subject to the requirements of subsections 6 and 7, or of this subsection, other than those contained in this subdivision.

c. Compliance requirements. All title V permits shall contain the following elements with respect to compliance:

(1) Consistent with paragraph 3 of subdivision a, compliance certification, testing, monitoring, reporting, and recordkeeping requirements sufficient to assure compliance with the terms and conditions of the permit. Any document, including reports, required by a title V permit shall contain a certification by a responsible official that meets the requirements of subdivision d of subsection 4.

(2) Inspection and entry requirements that require that, upon presentation of credentials and other documents as may be required by law, the permittee shall allow the department or an authorized representative to perform the following:

(a) Enter upon the permittee's premises where a title V source is located or emissions-related activity is conducted, or where records must be kept under the conditions of the permit;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit; and

(d) As authorized by the Federal Clean Air Act and this article, sample or monitor at reasonable times substances or parameters for the purpose

of assuring compliance with the permit or applicable requirements.

(3) A schedule of compliance consistent with paragraph 8 of subdivision c of subsection 4.

(4) Progress reports consistent with an applicable schedule of compliance and paragraph 8 of subdivision c of subsection 4 to be submitted at least semiannually, or at a more frequent period if specified in the applicable requirement or by the department. Such progress reports shall contain the following:

(a) Dates for achieving the activities, milestones, or compliance required in the schedule of compliance, and dates when such activities, milestones, or compliance were achieved; and

(b) An explanation of why any dates in the schedule of compliance were not or will not be met, and any preventive or corrective measures adopted.

(5) Requirements for compliance certification with terms and conditions contained in the permit, including emission limitations, standards, or work practices. Permits shall include each of the following:

(a) The frequency, which is annually or such more frequent periods as specified in the applicable requirement or by the department, of submissions of compliance certifications;

(b) In accordance with paragraph 3 of subdivision a, a means for monitoring the compliance of the source with its emissions limitations, standards, and work practices. The means for monitoring shall be contained in applicable requirements or United States environmental protection agency guidance;

(c) A requirement that the compliance certification include the following:

[1] The identification of each term or condition of the permit that is the basis of the certification;

[2] The compliance status;

[3] Whether compliance was continuous or intermittent;

[4] The methods used for determining the compliance status of the source, currently and over the reporting period consistent with paragraph 3 of subdivision a; and

[5] Such other facts as the department may require to determine the compliance status of the source;

(d) A requirement that all compliance certifications be submitted to the administrator of the United States environmental protection agency as well as to the department; and

(e) Such additional requirements as may be specified pursuant to sections 114(a)(3) and 504(b) of the Federal Clean Air Act.

(6) Such other provisions as the department may require.

d. General permits.

(1) The department may, after notice and opportunity for public participation provided under subdivision h of subsection 6, issue a general permit covering numerous similar sources. Any general permit shall comply with all requirements applicable to other title V permits and shall identify criteria by which sources may qualify for the general permit. To sources that qualify, the department shall grant the conditions and terms of the general permit notwithstanding the shield provisions of subdivision f, the source shall be subject to enforcement action for operation without a title V permit to operate if the source is later determined not to qualify for the conditions and terms of the general permit. General permits shall not be authorized for affected sources under the acid rain program unless otherwise provided in regulations promulgated under title IV of the Federal Clean Air Act. The department is not required to issue a general permit in lieu of individual title V permits.

(2) Title V sources that would qualify for a general permit must apply to the department for coverage under the terms of the general permit or must apply for a title V permit to operate consistent with subsection 4. The department may, in the general permit, provide for applications which deviate from the requirements of subsection 4, provided that such applications meet the requirements of title V of the Federal Clean Air Act, and include all information necessary to determine qualification for, and to

assure compliance with, the general permit. Without repeating the public participation procedures required under subdivision h of subsection 6, the department may grant a source's request for authorization to operate under a general permit, but such a grant shall not be a final permit action for purposes of judicial review.

e. Temporary sources. The department may issue a single permit authorizing emissions from similar operations by the same source owner or operator at multiple temporary locations. The operation must be temporary and involve at least one change of location during the term of the permit. No affected source shall be permitted as a temporary source. Permits for temporary sources shall include the following:

- (1) Conditions that will assure compliance with all applicable requirements at all authorized locations;
- (2) Requirements that the owner or operator notify the department at least ten days in advance of each change in location; and
- (3) Conditions that assure compliance with all other provisions of this section.

f. Permit shield.

- (1) Except as provided in this section, upon written request by the applicant, the department shall include in a title V permit to operate a provision stating that as of the date of permit issuance, the source is considered to be in compliance with any applicable requirements provided that:
 - (a) Such applicable requirements are included and are specifically identified in the permit; or
 - (b) The department, in acting on the permit application or revision, determines in writing that other requirements specifically identified are not applicable to the source, and the permit includes the determination or a concise summary thereof.
- (2) A title V permit that does not expressly state that a permit shield exists shall be presumed not to provide such a shield.
- (3) Nothing in this subdivision or in any title V permit shall alter or affect the following:

- (a) The provisions of section 303 of the Federal Clean Air Act (emergency orders), including the authority of the administrator of the United States environmental protection agency under that section;
- (b) The liability of an owner or operator of a source for any violation of applicable requirements prior to or at the time of permit issuance;
- (c) The applicable requirements of the acid rain program, consistent with section 408(a) of the Federal Clean Air Act; or
- (d) The ability of the United States environmental protection agency to obtain information from a source pursuant to section 114 of the Federal Clean Air Act.

g. Emergency provision.

- (1) An "emergency" means any situation arising from sudden and reasonably unforeseeable events beyond the control of the source, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the title V permit to operate, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.
- (2) Effect of an emergency. An emergency constitutes an affirmative defense to an action brought for noncompliance with such technology-based emission limitations if the conditions of paragraph 3 are met.
- (3) The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - (a) An emergency occurred and that the permittee can identify the causes of the emergency;
 - (b) The permitted facility was at the time being properly operated;
 - (c) During the period of the emergency the permittee took all reasonable steps to minimize levels of

emissions that exceeded the emission standards, or other requirements in the permit; and

(d) The permittee submitted notice of the emergency to the department within one working day of the time when emission limitations were exceeded due to the emergency. This notice fulfills the requirement of item 2 of subparagraph c of paragraph 3 of subdivision a of subsection 5. This notice must contain a description of the emergency, any steps taken to mitigate emissions, and corrective actions taken.

(4) In any enforcement proceeding, the permittee seeking to establish the occurrence of an emergency has the burden of proof.

(5) This provision is in addition to any emergency or upset provision contained in any applicable requirement and the malfunction notification required under subdivision b of subsection 2 of section 33-15-01-13 when a threat to health and welfare would exist.

6. Permit issuance, renewal, reopenings, and revisions.

a. Action on application.

(1) A permit, permit modification, or renewal may be issued only if all of the following conditions have been met:

(a) The department has received a complete application for a permit, permit modification, or permit renewal, except that a complete application need not be received before issuance of a general permit under subdivision d of subsection 5.

(b) Except for modifications qualifying for minor permit modification procedures under paragraphs 1 and 2 of subdivision e, the department has complied with the requirements for public participation under subdivision h;

(c) The department has complied with the requirements for notifying and responding to affected states under subdivision b of subsection 7;

(d) The conditions of the permit provide for compliance with all applicable requirements and the requirements of this section; and

(e) The administrator of the United States environmental protection agency has received a copy of the proposed permit and any notices required under subdivisions a and b of subsection 7, and has not objected to issuance of the permit under subdivision c of subsection 7 within the time period specified therein.

(2) Except for applications received during the initial transitional period described in 40 CFR 70.4(b)(11) or under regulations promulgated under title IV or title V of the Federal Clean Air Act for the permitting of affected sources under the acid rain program, the department shall take final action on each permit application, including a request for permit modification or renewal, within eighteen months after receiving a complete application.

(3) The department shall provide notice to the applicant of whether the application is complete. Unless the department requests additional information or otherwise notifies the applicant of incompleteness within sixty days of receipt of an application, the application shall be deemed complete. For modifications processed through minor permit modification procedures, such as those in paragraphs 1 and 2 of subdivision e, a completeness determination is not required.

(4) The department shall provide a statement that sets forth the legal and factual basis for the draft permit conditions, including references to the applicable statutory or regulatory provisions. The department shall send this statement to the United States environmental protection agency and to any other person who requests it.

(5) The submittal of a complete application shall not affect the requirement that any source have a permit to construct under section 33-15-14-02.

b. Requirement for a permit.

(1) Except as provided in the following sentence, paragraphs 2 and 3, subparagraph e of paragraph 1 of subdivision e, and subparagraph e of paragraph 2 of subdivision e, no title V source may operate after the time that it is required to submit a timely and complete application under this section, except in compliance with a permit issued under this section. If a title V source submits a timely and complete application for permit issuance, including for

renewal, the source's failure to have a title V permit is not a violation of this section until the department takes final action on the permit application, except as noted in this subsection. This protection shall cease to apply if, subsequent to the completeness determination made pursuant to paragraph 3 of subdivision a, and as required by paragraph 2 of subdivision a of subsection 4, the applicant fails to submit by the deadline specified in writing by the department any additional information identified as being needed to process the application. For timely and complete renewal applications for which the department has failed to issue or deny the renewal permit before the expiration date of the previous permit, all the terms and conditions of the permit, including the permit shield that was granted pursuant to subdivision f of subsection 5 shall remain in effect until the renewal permit has been issued or denied.

(2) A permit revision is not required for section 502(b)(10) changes provided:

(a) The changes are not modifications under chapters 33-15-12, 33-15-13, and 33-15-15 or title I of the Federal Clean Air Act.

(b) The changes do not exceed the emissions allowable under the title V permit whether expressed therein as a rate of emissions or in terms of total emissions.

(c) A permit to construct under section 33-15-14-02 has been issued, if required.

(d) The facility provides the department and the administrator of the United States environmental protection agency with written notification at least seven days in advance of the proposed change. The written notification shall include a description of each change within the permitted facility, the date on which the change will occur, any change in emissions, and any permit term or condition that is no longer applicable as a result of the change.

The permit shield described in subdivision f of subsection 5 shall not apply to any change made pursuant to this paragraph.

(3) A permit revision is not required for changes that are not addressed or prohibited by the permit provided:

- (a) Each such change shall meet all applicable requirements and shall not violate any existing permit term or condition.
- (b) The source must provide contemporaneous written notice to the department and the administrator of the United States environmental protection agency of each such change, except for changes that qualify as insignificant under the provisions of subdivision c of subsection 4. Such written notice shall describe each such change, including the date, any change in emissions, contaminants emitted, and any applicable requirement that would apply as a result of the change.
- (c) The permittee shall keep a record describing changes made at the source that result in emissions of a regulated air contaminant subject to an applicable requirement, but not otherwise regulated under the permit, and the emissions resulting from those changes.
- (d) The changes are not subject to any requirements under title IV of the Federal Clean Air Act.
- (e) The changes are not modifications under chapters 33-15-12, 33-15-13, and 33-15-15 or any provision of title I of the Federal Clean Air Act.
- (f) A permit to construct under section 33-15-14-02 has been issued, if required.

The permit shield described in subdivision f of subsection 5 shall not apply to any change made pursuant to this paragraph.

c. Permit renewal and expiration.

- (1) Permits being renewed are subject to the same procedural requirements, including those for public participation, affected state and the United States environmental protection agency review, that apply to initial permit issuance; and
- (2) Permit expiration terminates the source's right to operate unless a timely and complete renewal application has been submitted consistent with subdivision b of subsection 6 and subparagraph c of paragraph 1 of subdivision a of subsection 4.

d. Administrative permit amendments.

- (1) An "administrative permit amendment" is a permit revision that:
- (a) Corrects typographical errors;
 - (b) Identifies a change in the name, address, or phone number of any person identified in the permit, or provides a similar minor administrative change at the source;
 - (c) Requires more frequent monitoring or reporting by the permittee;
 - (d) Allows for a change in ownership or operational control of a source where the department determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the department;
 - (e) Incorporates into the title V permit the requirements from a permit to construct, provided that the permit to construct review procedure is substantially equivalent to the requirements of subsections 6 and 7 that would be applicable to the change if it were subject to review as a permit modification, and compliance requirements substantially equivalent to those contained in subsection 5; or
 - (f) Incorporates any other type of change which the administrator of the United States environmental protection agency has approved as part of the approved title V operating permit program.
- (2) Administrative permit amendments for purposes of the acid rain portion of the permit shall be governed by regulations promulgated under title IV of the Federal Clean Air Act.
- (3) Administrative permit amendment procedures. An administrative permit amendment may be made by the department consistent with the following:
- (a) The department shall take no more than sixty days from receipt of a request for an administrative permit amendment to take final action on such request, and may incorporate such changes without providing notice to the public or affected states provided that it designates

any such permit revisions as having been made pursuant to this subdivision.

(b) The department shall submit a copy of the revised permit to the administrator of the United States environmental protection agency.

(c) The source may implement the changes addressed in the request for an administrative amendment immediately upon submittal of the request provided a permit to construct under section 33-15-14-02 has been issued, if required.

(4) The department may, upon taking final action granting a request for an administrative permit amendment, allow coverage by the permit shield in subdivision f of subsection 5 for administrative permit amendments made pursuant to subparagraph e of paragraph 1 of subdivision d which meet the relevant requirements of subsections 5, 6, and 7 for significant permit modifications.

e. Permit modification. A permit modification is any revision to a title V permit that cannot be accomplished under the provisions for administrative permit amendments under subdivision d of this subsection. A permit modification for purposes of the acid rain portion of the permit shall be governed by regulations promulgated under title IV of the Federal Clean Air Act.

(1) Minor permit modification procedures.

(a) Criteria.

[1] Minor permit modification procedures may be used only for those permit modifications that:

[a] Do not violate any applicable requirement;

[b] Do not involve significant changes to existing monitoring, reporting, or recordkeeping requirements in the permit;

[c] Do not require or change a case-by-case determination of an emission limitation or other standard, or a source-specific determination for temporary sources of ambient impacts, or a visibility or increment analysis;

[d] Do not seek to establish or change a permit term or condition for which there is no corresponding underlying applicable requirement and that the source has assumed to avoid an applicable requirement to which the source would otherwise be subject. Such terms and conditions include a federally enforceable emissions cap assumed to avoid classification as a modification under any provision of title I of the Federal Clean Air Act; and an alternative emissions limit approved pursuant to regulations promulgated under section 112(i)(5) of the Federal Clean Air Act;

[e] Are not modifications under chapters 33-15-12, 33-15-13, and 33-15-15 or any provision of title I of the Federal Clean Air Act; and

[f] Are not required to be processed as a significant modification.

[2] Notwithstanding item 1 of this subparagraph and subparagraph a of paragraph 2 of subdivision e, minor permit modification procedures may be used for permit modifications involving the use of economic incentives, marketable permits, emissions trading, and other similar approaches, to the extent that such minor permit modification procedures are explicitly provided for in the state implementation plan, this article or in applicable requirements promulgated by the United States environmental protection agency.

(b) Application. An application requesting the use of minor permit modification procedures shall meet the requirements of subdivision c of subsection 4 and shall include the following:

[1] A description of the change, the emissions resulting from the change, and any new applicable requirements that will apply if the change occurs;

[2] The source's suggested draft permit;

[3] Certification by a responsible official, consistent with subdivision d of

subsection 4, that the proposed modification meets the criteria for use of minor permit modification procedures and a request that such procedures be used; and

[4] Completed forms for the department to use to notify the administrator of the United States environmental protection agency and affected states as required under subsection 7.

(c) United States environmental protection agency and affected state notification. Within five working days of receipt of a complete permit modification application, the department shall notify the administrator of the United States environmental protection agency and affected states of the requested permit modification. The department shall promptly send any notice required under paragraph 2 of subdivision b of subsection 7 to the administrator of the United States environmental protection agency.

(d) Timetable for issuance. The department may not issue a final permit modification until after the United States environmental protection agency forty-five-day review period or until the United States environmental protection agency has notified the department that the United States environmental protection agency will not object to issuance of the permit modification, whichever is first, although the department can approve the permit modification prior to that time. Within ninety days of the department's receipt of an application under minor permit modification procedures or fifteen days after the end of the administrator's forty-five-day review period under subdivision c of subsection 7, whichever is later, the department shall:

[1] Issue the permit modification as proposed;

[2] Deny the permit modification application;

[3] Determine that the requested modification does not meet the minor permit modification criteria and should be reviewed under the significant modification procedures; or

[4] Revise the draft permit modification and transmit to the administrator the new

proposed permit modification as required by subdivision a of subsection 7.

(e) Source's ability to make change. A source may make the change proposed in its minor permit modification application only after it files such application and the department approves the change in writing. If the department allows the source to make the proposed change prior to taking action specified in items 1, 2, and 3 of subparagraph d, the source must comply with both the applicable requirements governing the change and the proposed permit terms and conditions. During this time period, the source need not comply with the existing permit terms and conditions it seeks to modify. However, if the source fails to comply with its proposed permit terms and conditions during this time period, the existing permit terms and conditions it seeks to modify may be enforced against it.

(f) The permit shield under subdivision f of subsection 5 shall not extend to minor permit modifications.

(2) Group processing of minor permit modifications. Consistent with this paragraph, the department may modify the procedure outlined in paragraph 1 to process groups of a source's applications for certain modifications eligible for minor permit modification processing.

(a) Criteria. Group processing of modifications may be used only for those permit modifications:

[1] That meet the criteria for minor permit modification procedures under item 1 of subparagraph a of paragraph 1 of subdivision e; and

[2] That collectively are below the threshold level which is ten percent of the emissions allowed by the permit for the emissions unit for which the change is requested, twenty percent of the applicable definition of major source in subsection 1, or five tons [4.54 metric tons] per year, whichever is least.

(b) Application. An application requesting the use of group processing procedures shall meet the requirements of subdivision c of subsection 4 and shall include the following:

[1] A description of the change, the emissions resulting from the change, and any new applicable requirements that will apply if the change occurs.

[2] The source's suggested draft permit.

[3] Certification by a responsible official, consistent with subdivision d of subsection 4, that the proposed modification meets the criteria for use of group processing procedures and a request that such procedures be used.

[4] A list of the source's other pending applications awaiting group processing, and a determination of whether the requested modification, aggregated with these other applications, equals or exceeds the threshold set under item 2 of subparagraph a of paragraph 2 of subdivision e.

[5] Certification, consistent with subdivision d of subsection 4, that the source has notified the United States environmental protection agency of the proposed modification. Such notification need only contain a brief description of the requested modification.

[6] Completed forms for the department to use to notify the administrator of the United States environmental protection agency and affected states as required under subsection 7.

(c) United States environmental protection agency and affected state notification. On a quarterly basis or within five business days of receipt of an application demonstrating that the aggregate of a source's pending applications equals or exceeds the threshold level set under item 2 of subparagraph a of paragraph 2 of subdivision e, whichever is earlier, the department shall meet its obligation under paragraph 1 of subdivision a of subsection 7 and paragraph 1 of subdivision b of subsection 7 to notify the administrator of the United States environmental protection agency and affected states of the requested permit modifications. The department shall send any notice required under paragraph 2 of subdivision b of subsection 7 to the

administrator of the United States environmental protection agency.

- (d) Timetable for issuance. The provisions of subparagraph d of paragraph 1 of subdivision e shall apply to modifications eligible for group processing, except that the department shall take one of the actions specified in items 1 through 4 of subparagraph d of paragraph 1 of subdivision e within one hundred eighty days of receipt of the application or fifteen days after the end of the administrator's forty-five-day review period under subdivision c of subsection 7, whichever is later.
- (e) Source's ability to make change. The provisions of subparagraph e of paragraph 1 apply to modifications eligible for group processing.
- (f) The permit shield under subdivision f of subsection 5 shall not extend to group processing of minor permit modifications.

(3) Significant modification procedures.

- (a) Criteria. Significant modification procedures shall be used for applications requesting permit modifications that do not qualify as minor permit modifications or as administrative amendments. Every significant change in existing monitoring permit terms or conditions and every relaxation of reporting or recordkeeping permit terms or conditions shall be considered significant. Nothing herein shall be construed to preclude the permittee from making changes consistent with this subsection that would render existing permit compliance terms and conditions irrelevant.
- (b) Significant permit modifications shall meet all requirements of this section, including those for applications, public participation, review by affected states, and review by the United States environmental protection agency, as they apply to permit issuance and permit renewal. The department shall complete review of significant permit modifications within nine months after receipt of a complete application.

f. Reopening for cause.

- (1) Each issued permit shall include provisions specifying the conditions under which the permit will

be reopened prior to the expiration of the permit. A permit shall be reopened and revised under any of the following circumstances:

- (a) Additional applicable requirements under the Federal Clean Air Act become applicable to a major title V source with a remaining permit term of three or more years. Such a reopening shall be completed not later than eighteen months after promulgation of the applicable requirement. No such reopening is required if the effective date of the requirement is later than the date on which the permit is due to expire, unless the original permit or any of its terms and conditions has been extended.
 - (b) Additional requirements, including excess emissions requirements, become applicable to an affected source under title IV of the Federal Clean Air Act or the regulations promulgated thereunder. Upon approval by the administrator of the United States environmental protection agency, excess emissions offset plans shall be deemed to be incorporated into the permit.
 - (c) The department or the United States environmental protection agency determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit.
 - (d) The administrator of the United States environmental protection agency or the department determines that the permit must be revised or revoked to assure compliance with the applicable requirements.
- (2) Proceedings to reopen and issue a permit shall follow the same procedures as apply to initial permit issuance and shall affect only those parts of the permit for which cause to reopen exists. Such reopening shall be made as expeditiously as practicable.
- (3) Reopenings under paragraph 1 shall not be initiated before a notice of such intent is provided to the title V source by the department at least thirty days in advance of the date that the permit is to be reopened, except that the department may provide a shorter time period in the case of an emergency.

g. Reopenings for cause by the United States environmental protection agency.

- (1) If the administrator of the United States environmental protection agency finds that cause exists to terminate, modify, or revoke and reissue a permit pursuant to subdivision f, within ninety days after receipt of such notification, the department shall forward to the United States environmental protection agency a proposed determination of termination, modification, or revocation and reissuance, as appropriate.
- (2) The administrator of the United States environmental protection agency will review the proposed determination from the department within ninety days of receipt.
- (3) The department shall have ninety days from receipt of the United States environmental protection agency objection to resolve any objection that the United States environmental protection agency makes and to terminate, modify, or revoke and reissue the permit in accordance with the administrator's objection.
- (4) If the department fails to submit a proposed determination or fails to resolve any objection, the administrator of the United States environmental protection agency will terminate, modify, or revoke and reissue the permit after taking the following actions:
 - (a) Providing at least thirty days' notice to the permittee in writing of the reasons for any such action.
 - (b) Providing the permittee an opportunity for comment on the administrator's proposed action and an opportunity for a hearing.

h. Public participation. Except for modifications qualifying for minor permit modification procedures, all permit proceedings, including initial permit issuance, significant modifications, and renewals, shall be subject to procedures for public notice including offering an opportunity for public comment and a hearing on the draft permit. These procedures shall include the following:

- (1) Notice shall be given by publication in a newspaper of general circulation in the area where the source is located or in a state publication designed to give general public notice; to persons on a mailing list developed by the department, including those who

request in writing to be on the list; and by other means if necessary to assure adequate notice to the affected public;

- (2) The notice shall identify the affected facility; the name and address of the permittee; the name and address of the department; the activity or activities involved in the permit action; the emissions change involved in any permit modification; the name, address, and telephone number of a person from whom interested persons may obtain additional information, including copies of the permit draft, the application, all relevant supporting materials, and all other materials available to the department that are relevant to the permit decision; a brief description of the comment procedures required by this subsection; and the time and place of any hearing that may be held, including a statement of procedures to request a hearing, unless a hearing has already been scheduled;
- (3) The department shall provide such notice and opportunity for participation by affected states as is provided for by subsection 7;
- (4) The department shall provide at least thirty days for public comment and shall give notice of any public hearing at least thirty days in advance of the hearing; and
- (5) The department shall keep a record of the commenters and also of the issues raised during the public participation process. These records shall be available to the public.

7. Permit review by the United States environmental protection agency and affected states.

a. Transmission of information to the administrator.

- (1) The department shall provide a copy of each permit application including any application for a permit modification (including the compliance plan), to the administrator of the United States environmental protection agency except that the applicant shall provide such information directly to the administrator of the United States environmental protection agency when directed to do so by the department. The department shall provide a copy of each proposed permit and each final title V permit to operate to the administrator of the United States environmental protection agency. To the extent practicable, the preceding information shall be

provided in computer-readable format compatible with the United States environmental protection agency's national data base management system.

(2) The department may waive the requirements of paragraph 1 and paragraph 1 of subdivision b for any category of sources (including any class, type, or size within such category) other than major sources upon approval by the administrator of the United States environmental protection agency.

(3) The department shall keep these records for at least five years.

b. Review by affected states.

(1) The department shall give notice of each draft permit to any affected state on or before the time that the notice to the public under subdivision h of subsection 6 is given, except to the extent paragraphs 1 and 2 of subdivision e of subsection 6 requires the timing of the notice to be different.

(2) As part of the submittal of the proposed permit to the administrator of the United States environmental protection agency (or as soon as possible after the submittal for minor permit modification procedures allowed under paragraphs 1 and 2 of subdivision e of subsection 6) the department shall notify the administrator of the United States environmental protection agency and any affected state in writing of any refusal by the department to accept all recommendations for the proposed permit that the affected state submitted during the public or affected state review period. The notice shall include the department's reasons for not accepting any such recommendation. The department is not required to accept recommendations that are not based on applicable requirements or the requirements of this section.

c. United States environmental protection agency objection: No permit for which an application must be transmitted to the administrator of the United States environmental protection agency under subdivision a shall be issued if the administrator of the United States environmental protection agency objects to its issuance in writing within forty-five days of receipt of the proposed permit and all necessary supporting information.

d. Public petitions to the administrator of the United States environmental protection agency. If the administrator of the United States environmental protection agency does not

object in writing under subdivision c, any person may petition the administrator of the United States environmental protection agency within sixty days after the expiration of the administrator's forty-five-day review period to make such objection. Any such petition shall be based only on objections to the permit that were raised with reasonable specificity during the public comment period provided for in subdivision h of subsection 6, unless the petitioner demonstrates that it was impracticable to raise such objections within such period, or unless the grounds for such objection arose after such period. If the administrator of the United States environmental protection agency objects to the permit as a result of a petition filed under this subdivision, the department shall not issue the permit until the United States environmental protection agency's objection has been resolved, except that a petition for review does not stay the effectiveness of a permit or its requirements if the permit was issued after the end of the forty-five-day review period and prior to the United States environmental protection agency objection. If the department has issued a permit prior to receipt of the United States environmental protection agency objection under this subdivision, the department may thereafter issue only a revised permit that satisfies the United States environmental protection agency's objection. In any case, the source will not be in violation of the requirement to have submitted a timely and complete application.

e. Prohibition on default issuance. The department shall issue no title V permit to operate, including a permit renewal or modification, until affected states and the United States environmental protection agency have had an opportunity to review the proposed permit as required under this subsection.

8. Permit to operate fees.

a. The owner or operator of each installation that meets the applicability requirements of subsection 2 shall pay an annual fee. The fee is determined by the actual annual emissions of regulated contaminants.

b. The annual fee shall be assessed at a rate of twenty-five dollars per ton of emissions of each regulated contaminant identified in section 112(b) of the Federal Clean Air Act. All other regulated contaminants will be assessed a fee at a rate of eight dollars per ton. The minimum fee will be five hundred dollars per source. The maximum fee will be one hundred thousand dollars per source.

- c. In determining the amount due, that portion of any regulated contaminant which is emitted in excess of four thousand tons [3628.74 metric tons] per year will be exempt from the fee calculation.
- d. Each boiler with a heat input greater than two hundred fifty million British thermal units per hour will be assessed fees on an individual basis and independent of the fees associated with the rest of the installation. The four thousand tons [3628.74 metric tons] per year cap referenced in subdivision c is applied to each boiler.
- e. Any state-owned facility is exempt from the fee.
- f. The initial fee calculation will be based upon actual annual emissions from calendar year 1993.
- g. The fee rates and the limits established under subdivision b shall be adjusted on an annual basis to account for any increase in the consumer price index published by the department of labor, as of the close of the twelve-month period ending on August thirty-first of each calendar year.
- h. Any source issued a general permit under this section is subject to the minor source permit to operate fees under subsection 10 of section 33-15-14-03.
- i. Any source that qualifies as a "small business" under section 507 of the Federal Clean Air Act may petition the department to reduce or exempt any fee required under this section. Sufficient documentation of the petitioner's financial status must be submitted with the request to allow the department to evaluate the request.
- j. The department shall send a notice, identifying the amount of the annual permit fee, to the owner or operator of each affected source. The fee is due within sixty days following receipt of such notice.

9. Enforcement.

The department may suspend, revoke, or terminate a permit for violations of this article, violation of any permit condition or for failure to respond to a notice of violation or any order issued pursuant to this article. A permit to operate which has been revoked or terminated pursuant to this article must be surrendered forthwith to the department. No person may operate or cause the operation of a source if the department denies, terminates, revokes, or suspends a permit to operate.

History: Effective March 1, 1994.

General Authority: NDCC 23-25-03, 23-25-04.2
Law Implemented: NDCC 23-25-03, 23-25-04.1, 23-25-04.2

CHAPTER 33-15-15

33-15-15-01. General provisions.

1. Definitions. For the purposes of this chapter:

a. "Actual emissions" means the actual rate of emissions of a contaminant from an emissions unit, as determined in accordance with paragraphs 1 through ~~3~~ 4.

- (1) In general, actual emissions as of a particular date must equal the average rate, in tons per year, at which the unit actually emitted the contaminant during a two-year period which precedes the particular date and which is representative of normal source operation. The department may allow the use of a different time period upon a determination that it is more representative of normal source operation. Actual emissions must be calculated using the unit's actual operating hours, production rates, and types of materials processed, stored, or combusted during the selected time period.
- (2) The department may presume that source-specific allowable emissions for the unit are equivalent to the actual emissions of the unit.
- (3) ~~For any emissions unit which has not begun normal operations on the particular date, actual emissions must equal the potential to emit of the unit on that date.~~ For any emissions unit (other than an electric utility steam generating unit specified in paragraph 4) which has not begun normal operations on the particular date, actual emissions shall equal the potential to emit of the unit on that date.
- (4) For an electric utility steam generating unit (other than a new unit or the replacement of an existing unit) actual emissions of the unit following the physical or operational change shall equal the representative actual annual emissions of the unit following the physical or operational change, provided the source owner or operator maintains and submits to the reviewing authority, on an annual basis for a period of five years from the date the unit resumes regular operation, information demonstrating that the physical or operational change did not result in an emissions increase. A longer period, not to exceed ten years, may be required by the department if it determines such a period to be

more representative of normal source postchange operations.

- b. "Allowable emissions" means the emission rate of a stationary source calculated using the maximum rated capacity of the source (unless the source is subject to enforceable construction permit conditions which restrict the operating rate, or hours of operation, or both) and the most stringent of the following:
- (1) Applicable standards of performance or emission limitations as set forth in this article.
 - (2) The emission rate specified as an enforceable permit condition.
- c. "Baseline area" means any intrastate area (and every part thereof) designated as attainment or unclassifiable under section 107 (d)(1)(D) or (E) of the Federal Clean Air Act [Pub. L. 95-95] in which the major source or major modification establishing the minor source baseline date would construct or would have an air quality impact equal to or greater than one $\mu\text{g}/\text{m}^3$ (annual average) of the contaminant for which the minor source baseline date is established. Any baseline area established originally for the total suspended particulate increments shall remain in effect and shall apply for purposes of determining the amount of available PM_{10} increments, except that such baseline area shall not remain in effect if the department rescinds the corresponding minor source baseline date in accordance with paragraph 4 of subdivision e. North Dakota is divided into two intrastate areas under section 107 (d)(1)(D) or (E) of the Federal Clean Air Act [Pub. L. 95-95]: the Cass County portion of Region No. 130, the Metropolitan Fargo-Moorhead Interstate Air Quality Control Region; and Region No. 172, the North Dakota Intrastate Air Quality Control Region (the remaining fifty-two counties).
- d. (1) "Baseline concentration" means that ambient concentration level which exists in the baseline area at the time of the applicable minor source baseline date. A baseline concentration is determined for each contaminant for which a minor source baseline date is established and includes:
- (a) The actual emissions representative of sources in existence on the applicable minor source baseline date, except as provided in paragraph 2;
 - (b) The allowable emissions of major stationary sources which commenced construction before the

major source baseline date but were not in operation by the applicable minor source baseline date.

- (2) The following will not be included in the baseline concentration and will affect the applicable maximum allowable increases:
 - (a) Actual emissions from any major stationary source on which construction commenced after the major source baseline date; and
 - (b) Actual emissions increases and decreases at any stationary source occurring after the minor source baseline date.
- e. (1) "Major source baseline date" means:
- (a) In the case of particulate matter and sulfur dioxide, January 6, 1975; and
 - (b) In the case of nitrogen dioxide, February 8, 1988.
- (2) "Minor source baseline date" means the earliest date after the trigger date on which a major stationary source or a major modification subject to requirements of this chapter submits a complete application under the relevant regulations. The trigger date is:
- (a) In the case of particulate matter and sulfur dioxide, August 7, 1977; and
 - (b) In the case of nitrogen dioxide, February 8, 1988.
- (3) The baseline date is established for each contaminant for which increments or other equivalent measures have been established if:
- (a) The area in which the proposed source or modification would construct is designated as attainment or unclassifiable under section 107 (d)(1)(D) or (E) of the Federal Clean Air Act [Pub. L. 95-95] for the contaminant on the date of its complete application under this chapter; and
 - (b) In the case of a major stationary source, the contaminant would be emitted in significant amounts or, in the case of a major modification,

there would be a significant net emissions increase of the contaminant.

(4) Any minor source baseline date established originally for the total suspended particulate increments shall remain in effect and shall apply for purposes of determining the amount of available PM₁₀ increments, except that the department may rescind any such minor source baseline date where it can be shown by the applicant, to the satisfaction of the department, that the emissions increase from the major stationary source, or the net emissions increase from the major modification, responsible for triggering that date did not result in a significant amount of PM₁₀ emissions.

(5) The department shall provide a list of baseline dates for each contaminant for each baseline area.

f. "Begin actual construction" means, in general, initiation of physical onsite construction activities on an emissions unit which are of a permanent nature. Such activities include, ~~but are not limited to,~~ installation of building supports and foundations, laying of underground pipework, and construction of permanent storage structures. With respect to a change in method of operation, this term refers to those onsite activities, other than preparatory activities, which mark the initiation of the change.

g. "Best available control technology" means an emission limitation (including a visible emission standard) based on the maximum degree of reduction for each contaminant subject to regulation under North Dakota Century Code chapter 23-25 which would be emitted from any proposed major stationary source or major modification which the department, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques including fuel cleaning or treatment or innovative fuel combustion techniques for control of such contaminant. In no event may application of "best available control technology" result in emissions of any contaminant which would exceed the emissions allowed by any applicable standards of performance under chapters 33-15-12 and 33-15-13. If the department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emission standard infeasible, a design, equipment, work practice or operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control

technology. Such standard must, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice, or operation, and shall provide for compliance by means which achieve equivalent results.

- h. "Clean coal technology" means any technology, including technologies applied at the precombustion, combustion, or postcombustion stage, at a new or existing facility which will achieve significant reductions in air emissions of sulfur dioxide or oxides of nitrogen associated with the utilization of coal in the generation of electricity, or process steam which was not in widespread use as of November 15, 1990.
- i. "Clean coal technology demonstration project" means a project using funds appropriated under the heading "department of energy-clean coal technology", up to a total amount of two billion five hundred million dollars for commercial demonstration of clean coal technology, or similar projects funded through appropriations for the United States environmental protection agency. The federal contribution for a qualifying project shall be at least twenty percent of the total cost of the demonstration project.
- j. "Commence" as applied to construction of a major stationary source or major modification means that the owner or operator has obtained all necessary preconstruction permits and either has (1) begun, or caused to begin, a continuous program of actual onsite construction of the source, to be completed within a reasonable time; or (2) entered into binding agreements or contractual obligations, which cannot be canceled or modified without substantial loss to the owner or operator, to undertake a program of construction of the source to be completed within a reasonable time.
- ~~±~~ k. "Complete" means, in reference to an application for a permit, that the application contains all of the information necessary for processing the application. Designating an application complete for purposes of permit processing does not preclude the reviewing authority from requesting or accepting any additional information.
- ~~±~~ l. "Construction" means any physical change or change in the method of operation (including fabrication, erection, installation, demolition, or modification of an emissions unit) which would result in a change in actual emissions.
- m. "Electric utility steam generating unit" means any steam electric generating unit that is constructed for the purpose of supplying more than one-third of its potential

electric output capacity and more than twenty-five megawatts electrical output to any utility power distribution system for sale. Any steam supplied to a steam distribution system for the purpose of providing steam to a steam-electric generator that would produce electrical energy for sale is also considered in determining the electrical energy output capacity of the affected facility.

- ~~k.~~ n. "Emissions unit" means any part of a stationary source which emits or would have the potential to emit any air contaminant regulated under North Dakota Century Code chapter 23-25.
- ~~l.~~ o. "Enforceable" means all limitations and conditions which are enforceable by the department pursuant to this article and any applicable requirements within the North Dakota state implementation plan.
- ~~m.~~ p. "Facility, building, structure, or installation" means all of the air contaminant emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control). Air contaminant emitting activities shall be considered as part of the same industrial grouping if they belong to the same "major group" (i.e., which have the same two-digit code) as described in the Standard Industrial Classification Manual, 1972, as amended by the 1977 Supplement (United States Government Printing Office stock numbers 4101-0066 and 003-005-00176-0, respectively).
- ~~n.~~ q. "Federal land manager" means, with respect to any lands in the United States, the secretary of the department with authority over such lands.
- ~~o.~~ r. "Fugitive emissions" means those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.
- ~~p.~~ s. "High terrain" means any area having an elevation nine hundred feet [271.32 meters] or more above the base of the stack of a source.
- ~~q.~~ t. "Indian governing body" means the governing body of any tribe, band, or group of Indians subject to the jurisdiction of the United States and recognized by the United States as possessing power of self-government.
- ~~r.~~ u. "Indian reservation" means any federally recognized reservation established by treaty, agreement, executive order, or Act of Congress.

s. v. "Innovative control technology" means any system of air pollution control that has not been adequately demonstrated in practice, but would have a substantial likelihood of achieving greater continuous emissions reduction than any control system in current practice or of achieving at least comparable reductions at lower cost in terms of energy, economics, or nonair quality environmental impacts.

t. w. "Low terrain" means any area other than high terrain.

u. x. "Major modification" means any physical change in, or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any air contaminant subject to regulation under North Dakota Century Code chapter 23-25.

(1) Any net emissions increase that is significant for volatile organic compounds must be considered significant for ozone.

(2) A physical change or change in the method of operation does not include:

(a) Routine maintenance, repair, and replacement.

(b) Use of an alternate fuel or raw material by reason of any order under sections 2(a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (or any superseding legislation) or by reason of a natural gas curtailment plan pursuant to the Federal Power Act.

(c) Use of an alternate fuel or raw material by a stationary source which:

[1] The source was capable of accommodating before January 6, 1975, unless such change would be prohibited under any state enforceable permit condition which was established after January 6, 1975, pursuant to this chapter or under regulations approved pursuant to North Dakota Century Code chapter 23-25-; or

[2] The source is approved to use under any permit issued under regulations approved pursuant to North Dakota Century Code chapter 23-25.

(d) An increase in the hours of operation or in the production rate, unless such change would be

prohibited under any enforceable permit condition which was established after January 6, 1975, pursuant to this chapter under regulations approved pursuant to North Dakota Century Code chapter 23-25.

- (e) Any change in ownership of a stationary source.
- (f) Use of an alternative fuel by reason of an order or rule under section 125 of the Federal Clean Air Act [Pub. L. 95-95].
- (g) Use of an alternative fuel at a steam generating unit to the extent that the fuel is generated from municipal solid waste.

(h) The addition, replacement, or use of a pollution control project at an existing electric utility steam generating unit, unless the administrator of the environmental protection agency determines that such addition, replacement, or use renders the unit less environmentally beneficial, or except:

[1] When the administrator of the environmental protection agency has reason to believe that the pollution control project would result in a significant net increase in representative actual annual emissions of any criteria pollutant over levels used for that source in the most recent air quality impact analysis in the area conducted, if any; and

[2] The administrator of the environmental protection agency determines that the increase will cause or contribute to a violation of any national ambient air quality standard or PSD increment, or visibility limitation.

(i) The installation, operation, cessation, or removal of a temporary clean coal technology demonstration project, provided that the project complies with:

[1] The North Dakota state implementation plan; and

[2] Other requirements necessary to attain and maintain the national ambient air quality standards during the project and after it is terminated.

(j) The installation or operation of a permanent clean coal technology demonstration project that constitutes repowering, provided that the project does not result in an increase in the potential to emit of any regulated pollutant emitted by the unit. This exemption shall apply on a pollutant-by-pollutant basis.

(k) The reactivation of a very clean coal-fired electric utility steam generating unit.

v. y. "Major stationary source" means:

- (1) Any of the following stationary sources of air contaminants which emit, or have the potential to emit, one hundred tons [90718.17 kilograms] per year or more of any air contaminant regulated under North Dakota Century Code chapter 23-25: coal cleaning plants (with thermal dryers), kraft pulp mills, portland cement plants, primary zinc smelters, iron and steel mills, primary aluminum ore reduction plants, primary copper smelters, municipal incinerators capable of charging more than two hundred fifty tons [226796.19 kilograms] of refuse per day, hydrofluoric, sulfuric, and nitric acid plants, petroleum refineries, lime plants, phosphate rock processing plants, coke oven batteries, sulfur recovery plants, carbon black plants (furnace process), primary lead smelters, fuel conversion plants, sintering plants, secondary metal production facilities, chemical process plants, fossil-fuel boilers and fossil fuel-fired steam electric plants (or combinations thereof) of more than two hundred fifty million British thermal units per hour heat input, petroleum storage and transfer units with a total storage capacity exceeding three hundred thousand barrels, taconite ore processing facilities, glass fiber processing plants, and charcoal production facilities.
- (2) Notwithstanding the source sizes in paragraph 1, such term also includes any stationary source which emits, or has the potential to emit, two hundred fifty tons [226796.19 kilograms] per year or more of any air contaminant regulated under North Dakota Century Code chapter 23-25 or as outlined in paragraph 3.
- (3) Any physical change that would occur at a stationary source not otherwise qualifying under paragraph 1 as a major stationary source, if the changes would constitute a major stationary source by itself.

- (4) A major source that is major for volatile organic compounds shall be considered major for ozone.
- (5) The fugitive emissions of a stationary source may not be included in determining for any of the purposes of this subdivision whether it is a major stationary source unless the source belongs to one of the categories of stationary sources in paragraph 1 and any other stationary source category which as of August 7, 1980, is being regulated under section 111 or 112 of the Federal Clean Air Act.

w. z. "Necessary preconstruction permits" means those permits required under this article.

x. aa. "Net emissions increase" means the amount by which the sum of the following exceeds zero:

- (1) Any increase in actual emissions from a particular physical change or change in the method of operation at a stationary source; and

- (2) Any other increases and decreases in actual emissions at the source that are contemporaneous with the particular change and are otherwise creditable.

- (a) An increase or decrease in actual emissions is contemporaneous with the increase from the particular change only if it occurs between:

- [1] The date five years before construction on the particular change commences; and

- [2] The date that the increase from the particular change occurs.

- (b) An increase or decrease in actual emissions is creditable only if the department has not relied on it in issuing a permit for the source under this article, which permit is in effect when the increase in actual emissions from the particular change occurs.

- (c) An increase or decrease in actual emissions of sulfur dioxide, particulate matter, or nitrogen oxides which occurs before the applicable minor source baseline date is creditable only if it is required to be considered in calculating the amount of maximum allowable increases remaining available. With respect to particulate matter, only PM₁₀ emissions can be used to evaluate the net emissions increase for PM₁₀.

- (d) An increase in actual emissions is creditable only to the extent that the new level of actual emissions exceeds the old level.
- (e) A decrease in actual emissions is creditable only to the extent that:
 - [1] The old level of actual emissions or the old level of allowable emissions, whichever is lower, exceeds the new level of actual emissions;
 - [2] It is enforceable at and after the time that actual construction on the particular change begins; and
 - [3] It has approximately the same qualitative significance for public health and welfare as that attributed to the increase from the particular change.
- (f) An increase that results from a physical change at a source occurs when the emissions unit on which construction occurred becomes operational and begins to emit a particular pollutant. Any replacement unit that requires shakedown becomes operational only after a reasonable shakedown period, not to exceed one hundred eighty days.

bb. "Pollution control project" means any activity or project undertaken at an existing electric utility steam generating unit for purposes of reducing emissions from each unit. Such activities or projects are limited to:

- (1) The installation of conventional or innovative pollution control technology, including advanced flue gas desulfurization, sorbent injection for sulfur dioxide and nitrogen oxides controls and electrostatic precipitators.
- (2) An activity or project to accommodate switching to a fuel which is less polluting than the fuel used prior to the activity or project, including natural gas or coal reburning, or the cofiring of natural gas and other fuels for the purpose of controlling emissions.
- (3) A permanent clean coal technology demonstration project conducted under title II, section 101(d) of the Further Continuing Appropriations Act of 1985 (section 5903(d) of title 42 of the United States Code), or subsequent appropriations, up to a total amount of two billion five hundred million dollars for commercial demonstration of clean coal

technology, or similar projects funded through appropriations for the United States environmental protection agency.

(4) A permanent clean coal technology demonstration project that constitutes a repowering project.

y- cc. "Potential to emit" means the maximum capacity of a stationary source to emit an air contaminant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, must be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable. Secondary emissions do not count in determining the potential to emit of a stationary source.

dd. "Reactivation of a very clean coal-fired electric utility steam generating unit" means any physical change or change in the method of operation associated with the commencement of commercial operations by a coal-fired utility unit after a period of discontinued operation where the unit:

(1) Has not been in operation for the two-year period prior to the enactment of the Clean Air Act Amendments of 1990, and the emissions from such unit continue to be carried in the department's emissions inventory at the time of enactment.

(2) Was equipped prior to shutdown with a continuous system or emissions control that achieves a removal efficiency of sulfur dioxide of no less than eighty-five percent and a removal efficiency of particulates of no less than ninety-eight percent.

(3) Is equipped with low-nitrogen oxide burners prior to the time of commencement of operations following reactivation.

(4) Is otherwise in compliance with the requirements of the Clean Air Act.

ee. "Representative actual annual emissions" means the average rate, in tons per year, at which the source is projected to emit a pollutant for the two-year period after a physical change or change in the method of operation of a unit (or a different consecutive two-year period within ten years after that change, where the department determines that such period is more representative of

normal source operations), considering the effect any such change will have on increasing or decreasing the hourly emissions rate and on projected capacity utilization. In projecting future emissions the department shall:

- (1) Consider all relevant information, including historical operational data, the company's own representations, filings with the state or federal regulatory authorities, and compliance plans under title IV of the Federal Clean Air Act.
- (2) Exclude, in calculating any increase in emissions that results from the particular physical change or change in the method of operation at an electric utility steam generating unit, that portion of the unit's emissions following the change that could have been accommodated during the representative baseline period and is attributable to an increase in projected capacity utilization at the unit that is unrelated to the particular change, including any increased utilization due to the rate of electricity demand growth for the utility system as a whole.

ff. "Repowering" means replacement of an existing coal-fired boiler with one of the following clean coal technologies: atmospheric or pressurized fluidized bed combustion, integrated gasification combination cycle, magnetohydrodynamics, direct and indirect coal-fired turbines, integrated gasification fuel cells, or as determined by the administrator of the environmental protection agency, in consultation with the secretary of energy, a derivative of one or more of these technologies, and any other technology capable of controlling multiple combustion emissions simultaneously with improved boiler or generation efficiency and with significantly greater waste reduction relative to the performance of technology in widespread commercial use as of November 15, 1990.

- (1) Repowering shall also include any unit fired by oil or gas, or both, which has been awarded clean coal technology demonstration funding as of January 1, 1991, by the department of energy.
- (2) The administrator of the environmental protection agency shall give expedited consideration to permit applications for any source that satisfies the requirements of this subsection and is granted an extension under section 409 of the Federal Clean Air Act.

z. gg. "Secondary emissions" means emissions which occur as a result of the construction or operation of a major stationary source or major modification, but do not come

from the major stationary source or major modification itself. Secondary emissions must be specific, well-defined, quantifiable, and impact the same general areas as the major stationary source or major modification which causes the secondary emissions. Secondary emissions include emissions from any offsite support facility which would not otherwise be constructed or increase its emissions except as a result of the construction or operation of the major stationary source or major modification. Secondary emissions do not include any emissions which come directly from a mobile source.

aa. hh. "Significant" means:

- (1) In reference to a net emissions increase or the potential of a source to emit any of the following air contaminants, a rate of emissions that would equal or exceed any of the following rates:

Air Contaminant and Emissions Rate

Carbon monoxide: 100 tons per year
Nitrogen oxides: 40 tons per year
Sulfur dioxide: 40 tons per year
Particulate matter: 25 tons per year
of particulate matter emissions;
15 tons per year of PM₁₀ emissions
Ozone: 40 tons per year of volatile
organic compounds
Lead: 0.6 ton per year
Asbestos: 0.007 ton per year
Beryllium: 0.0004 ton per year
Mercury: 0.1 ton per year
Vinyl chloride: 1 ton per year
Fluorides: 3 tons per year
Sulfuric acid mist: 7 tons per year
Hydrogen sulfide (H₂S): 10 tons per
year

Total reduced sulfur (including H₂S):

10 tons per year

Reduced sulfur compounds (including
H₂S): 10 tons per year

Municipal waste combustor organics

(measured as total tetra- through
octa-chlorinated dibenzo-p-dioxins

and dibenzofurans): 3.2 10⁻⁶ megagrams
per year (3.5 10⁻⁶ tons per year)

Municipal waste combustor metals

(measured as particulate matter):

14 megagrams per year (15 tons per year)

Municipal waste combustor acid gases

(measured as sulfur dioxide and hydrogen

chloride): 36 megagrams per year
(40 tons per year)

- (2) In reference to a net emissions increase or the potential of a source to emit an air contaminant subject to regulation under North Dakota Century Code chapter 23-25 that paragraph 1 does not list, any emissions rate.
- (3) Notwithstanding paragraph 1, any emissions rate or any net emissions increase associated with a major stationary source or major modification, which would construct within ten kilometers [6.21 miles] of a class I area, and have an impact on such area equal to or greater than one $\mu\text{g}/\text{m}^3$ (twenty-four-hour average).

~~bb-~~ ii. "Stationary source" means any building, structure, facility, or installation which emits or may emit any air contaminant regulated under North Dakota Century Code chapter 23-25.

~~cc-~~ jj. "Total suspended particulate (TSP)" means particulate matter as measured by the method described in appendix B of 40 CFR 50.

2. Significant deterioration of air quality - Area designation and deterioration increment.

- a. The provisions of this chapter apply to those counties or other functionally equivalent areas that are designated as attainment or unclassifiable for any of the national ambient air quality standards.
- b. For purposes of this chapter, areas designated as class I, II, or III shall be limited to the following increases in contaminant concentration over the baseline concentration:

Area Designations

Pollutant	Class I ($\mu\text{g}/\text{m}^3$)	Class II ($\mu\text{g}/\text{m}^3$)	Class III ($\mu\text{g}/\text{m}^3$)
Particulate matter:			
FSP <u>PM₁₀</u> , Annual <u>geometric</u> <u>arithmetic mean</u>	<u>54</u>	<u>117</u>	<u>334</u>
FSP <u>PM₁₀</u> , 24-hour maximum	<u>108</u>	<u>330</u>	<u>760</u>
Sulfur dioxide:			
Annual arithmetic mean	2	<u>520</u>	40
24-hour maximum	5	<u>91</u>	182
3-hour maximum	25	<u>512</u>	700

Nitrogen dioxide:

Annual arithmetic mean 2.5 25 50

For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any receptor site.

Any conflict between an applicable increment and an applicable ambient air quality standard shall be resolved in favor of the more stringent limitation and the source shall be limited to such more stringent limitation.

c. All of the following areas which were in existence on August 7, 1977, are hereby designated class I areas and may not be redesignated:

(1) The Theodore Roosevelt National Park - north and south units in Billings and McKenzie Counties, and the Theodore Roosevelt Elkhorn Ranch Site in Billings County.

(2) The Lostwood National Wilderness Area in Burke County.

All other areas of the state are hereby designated class II areas but may be redesignated as provided in this subsection.

d. The following areas may be redesignated only as class I or II:

(1) An area which as of August 7, 1977, exceeds ten thousand acres [4046.86 hectares] in size and is a national monument, a national primitive area, a national preserve, a national recreational area, a national wild and scenic river, a national wildlife refuge, a national lakeshore, or seashore.

(2) A national park or national wilderness area established after August 7, 1977, which exceeds ten thousand acres [4046.86 hectares] in size.

e. Exclusions from increment consumption:

(1) The following concentrations shall be excluded in determining compliance with a maximum allowable increase in contaminant concentration:

(a) Concentrations attributable to the increase in emissions from stationary sources which have converted from the use of petroleum products, natural gas, or both, by reason of an order in

effect under sections 2(a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (or any superseding legislation) over the emissions from such sources before the effective date of such order;

- (b) Concentrations attributable to the increase in emissions from sources which have converted from using natural gas by reason of natural gas curtailment plan in effect pursuant to the Federal Power Act over the emissions from such sources before the effective date of such plan;
 - (c) Concentrations of particulate matter attributable to the increase in emissions from construction or other temporary emission-related activities of new or modified sources;
 - (d) The increase in concentrations attributable to new sources outside the United States over the concentrations attributable to existing sources which are included in the baseline concentration; and
 - (e) Concentrations attributable to the temporary increase in emissions of sulfur dioxide, particulate matter, or nitrogen oxides from stationary sources which increases have been approved in advance by the department under an approved state implementation plan revision.
- (2) No exclusion of such concentrations shall apply more than five years after the effective date of the order to which subparagraph a or b of paragraph 1 refers, whichever is applicable. If both such order and plan are applicable, no such exclusion applies more than five years after the later of such effective dates.
- (3) For purposes of excluding concentrations pursuant to subparagraph e of paragraph 1:
- (a) The time over which the temporary emissions increase of sulfur dioxide, particulate matter, or nitrogen oxides would occur must be specified. Such time may not exceed two years in duration unless a longer time is approved by the administrator of the United States environmental protection agency.
 - (b) The time period for excluding certain contributions in accordance with subparagraph a is not renewable.

- (c) No emissions increase from a stationary source may:
 - [1] Impact a class I area or an area where an applicable increment is known to be violated; or
 - [2] Cause or contribute to the violation of any ambient air quality standards.
 - (d) The emission levels from the stationary sources effected at the end of the time period specified in accordance with subparagraph a may not exceed those levels occurring from such sources before the temporary increases in emissions were approved.
- f. The class I area increment limitations of the Theodore Roosevelt Elkhorn Ranch Site of the Theodore Roosevelt National Park shall apply to sources or modifications for which complete applications were filed after July 1, 1982. The impact of emissions from sources or modifications for which permits under this chapter have been issued or complete applications have already been filed will be counted against the increments after July 1, 1982.
- g. Any applicant whose emissions will consume more than one-half of the available increment in another state may not be granted a permit in accordance with this chapter, unless approved by the department after consultation with the other state.
3. **Stack heights.** The stack height for any source subject to this chapter must meet the requirements of chapter 33-15-18.
4. **Review of new major stationary sources and major modifications.**
- a. **Applicability.** The requirements of this chapter shall apply to any major new stationary source or modification which:
 - (1) Had not been issued a permit to construct or modify prior to March 1, 1978;
 - (2) Had not commenced construction prior to March 19, 1979; or
 - (3) Has discontinued construction for a period of eighteen months or more and has not completed construction within a reasonable time.

Review of these sources or modifications must be conducted in conjunction with the issuance of permits to construct pursuant to section 33-15-14-02.

b. Permits - general.

- (1) No source subject to this chapter may be constructed in any area unless:
 - (a) A permit has been issued for such proposed source in accordance with this chapter setting forth emission limitations or equipment standards for such source which conform to the requirements of this chapter and any conditions necessary to ensure that the proposed source will meet such limits or standards;
 - (b) The requirements of subdivisions c through k, as applicable, have been met; and
 - (c) The proposed permit has been subject to a review in accordance with this chapter, the required analysis has been conducted in accordance with the requirements of this chapter, and the procedures for public participation as defined in subsection 5 have been followed.
- (2) Provided that all necessary requirements of this article have been met, permits will be issued on a first-come, first-served basis as determined by the completion date of the applications.

c. Control technology review.

- (1) A major stationary source or major modification shall meet all applicable emission limitations under the state implementation plan and all applicable emission standards and standards of performance of this article.
- (2) A new major stationary source shall apply best available control technology for each air contaminant subject to regulation under North Dakota Century Code chapter 23-25 that it would have the potential to emit in significant amounts.
- (3) A major modification shall apply best available control technology for each air contaminant subject to regulation under North Dakota Century Code chapter 23-25 for which it would result in a significant net emissions increase at the source. This requirement applies to each proposed emissions unit at which a net emissions increase in the air contaminant would

occur as a result of a physical change or change in the method of operation in the unit.

- (4) For phased construction projects, the determination of best available control technology must be reviewed and modified as appropriate at the latest reasonable time which occurs no later than eighteen months prior to commencement of construction of each independent phase of the project. At such time, the owner or operator of the applicable stationary source may be required to demonstrate the adequacy of any previous determination of best available control technology for the source.

d. Exemptions from impact analysis.

- (1) The requirements of subdivisions e, g, and i do not apply to a major stationary source or major modification with respect to a particular air contaminant, if the allowable emissions from the source, or the net emissions increase of that contaminant from the modification:

- (a) Would impact no class I area and no area where an applicable increment is known to be violated; and

- (b) Would be temporary.

- (2) The requirements of subdivisions e, g, and i as they relate to any maximum allowable increase for a class II area do not apply to a major modification at a stationary source that was in existence on March 1, 1978, if the net increase in allowable emissions of each air contaminant regulated under North Dakota Century Code chapter 23-25 from the modification after the application of best available control technology would be less than fifty tons [45359.24 kilograms] per year.

- (3) The department may exempt a stationary source or modification from the requirements of subdivision g with respect to monitoring for a particular air contaminant if:

- (a) The emissions increase of the air contaminant from the new source or the net emissions increase of the air contaminant from the modification would cause, in any area, air quality impacts less than the following amounts:

Carbon monoxide - 575 $\mu\text{g}/\text{m}^3$, 8-hour average
Nitrogen dioxide - 14 $\mu\text{g}/\text{m}^3$, annual average

Particulate matter - $10 \mu\text{g}/\text{m}^3$, TSP, of
PM₁₀, 24-hour average; ~~$10 \mu\text{g}/\text{m}^3$,~~
~~PM₁₀~~, 24-hour average

Sulfur dioxide - $13 \mu\text{g}/\text{m}^3$, 24-hour average

Ozone - No de minimus level

Lead - $0.1 \mu\text{g}/\text{m}^3$, 3-month average

Mercury - $0.25 \mu\text{g}/\text{m}^3$, 24-hour average

Beryllium - $0.001 \mu\text{g}/\text{m}^3$, 24-hour average

Fluorides - $0.25 \mu\text{g}/\text{m}^3$, 24-hour average

Vinyl chloride - $15 \mu\text{g}/\text{m}^3$, 24-hour average

Total reduced sulfur - $10 \mu\text{g}/\text{m}^3$, 1-hour
average

Hydrogen sulfide - $0.2 \mu\text{g}/\text{m}^3$, 1-hour
average

Reduced sulfur compounds - $10 \mu\text{g}/\text{m}^3$, 1-hour
average; or

- (b) The concentrations of the air contaminant in the area that the source or modification would ~~effect~~ affect are less than the concentrations listed in subparagraph a or the air contaminant is not listed in subparagraph a.
- (4) The requirements for best available control technology in subdivision c and the requirements for air quality analyses in paragraph 1 of subdivision g do not apply to a particular stationary source or modification that was subject to this chapter if the owner or operator of the source or modification submitted an application for a permit before May 7, 1981, and the department subsequently determines the application as submitted before that date was complete. Instead, the requirements of subdivisions c and h as in effect prior to May 7, 1981, apply to any such source or modification.
- (5) The requirements for air quality monitoring in subparagraphs b, c, and d of paragraph 1 of subdivision g do not apply to:
- (a) A particular source or modification that was subject to this chapter as in effect prior to May 7, 1981, if the owner or operator of the source or modification submitted an application for a permit under this chapter on or before June 8, 1981, and the department subsequently determined that the application as submitted before that date was complete with respect to the requirements of this chapter other than those in subparagraphs b, c, and d of paragraph 1 of subdivision g and with respect to the requirements for such analyses in paragraph 2 of subdivision g as in effect prior

to May 7, 1981. Instead, the requirements of this chapter prior to May 7, 1981, shall apply to any source or modification.

- (b) A particular source or modification that was not subject to this chapter as in effect prior to May 7, 1981, if the owner or operator of the source or modification submitted an application for a permit under this chapter on or before June 8, 1981, and the department subsequently determined that the application as submitted before that date was complete, except with respect to the requirements in subparagraphs b, c, and d of paragraph 1 of subdivision g.
- (6) The requirements of subdivisions c, e, f, g, h, i, and j and subsections 5 and 6 in their entirety do not apply to a particular major stationary source or major modification, if:
- (a) The source or modification would be a major stationary source or major modification only if fugitive emissions, to the extent quantifiable, are considered in calculating the potential to emit of the stationary source or modification and the source does not belong to any of the stationary sources of air contaminants listed in subdivision u of subsection 1 and any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Federal Clean Air Act [Pub. L. 95-95].
 - (b) The source is a portable stationary source which has previously received a permit under this chapter and:
 - [1] The owner or operator proposes to relocate the source and emissions of the source at the new location would be temporary.
 - [2] The emissions from the source would not exceed its allowable emissions.
 - [3] The emissions from the source would impact no class I area and no area where an applicable increment is known to be violated.
 - [4] Reasonable notice is given to the department prior to the relocation identifying the proposed new location and the probable duration of operation at the

new location. Such notice shall be given to the department not less than ten days in advance of the proposed relocation unless a different time duration is previously approved by the department.

- (c) With respect to a particular air contaminant, the owner or operator demonstrates that the source or modification is located in an area designated as nonattainment by the administrator of the United States environmental protection agency, as to that air contaminant, under this article.
 - (d) The source or modification would be a nonprofit health or nonprofit educational institution, or a major modification would occur at such an institution, and the governor requests that it be exempt from such requirements.
- e. Source impact analysis. The owner or operator of the proposed source or modification shall demonstrate that allowable emission increases from the source or modification, in conjunction with all other applicable emissions increases or reductions (including secondary emissions) from any other sources, will not cause or contribute to air pollution in violation of:
- (1) Any ambient air quality standard in any area; or
 - (2) Any applicable maximum allowable increase over the baseline concentration in any area.
- f. Air quality models.
- (1) All estimates of ambient concentrations required under this section must be based on the applicable air quality models, data bases, and other requirements specified in the "Guidelines on Air Quality Models" (United States environmental protection agency, office of air quality planning and standards, Research Triangle Park, North Carolina 27711) as supplemented by the "North Dakota Guideline for Air Quality Modeling Analyses" (North Dakota state department of health and consolidated laboratories, division of environmental engineering). These documents are incorporated by reference.
 - (2) Where an air quality impact model specified in the documents incorporated by reference in paragraph 1 is inappropriate, the model may be modified or another model substituted provided:

- (a) Any modified or nonguideline model must be subjected to notice and opportunity for public comment under subsection 5.
- (b) The applicant must provide to the department adequate information to evaluate the applicability of the modified or nonguideline model. Such information must include, ~~but not be limited to,~~ methods like those outlined in the "Workbook for the Comparison of Air Quality Models" (United States environmental protection agency, office of air quality planning and standards, Research Triangle Park, North Carolina 27711).
- (c) Written approval from the department must be obtained for any modification or substitution prior to an application being designated complete by the department.
- (d) Written approval from the United States environmental protection agency must be obtained for any modification or substitution prior to the granting of a permit under this chapter.

g. Air quality analysis.

(1) Preapplication analysis.

- (a) Any application for a permit under this section must contain an analysis of ambient air quality in the area that the major stationary source or major modification would affect for each of the following air contaminants:
 - [1] For the source, each air contaminant that it would have the potential to emit in a significant amount;
 - [2] For the modification, each air contaminant for which it would result in a significant net emissions increase.
- (b) With respect to any such air contaminant for which no ambient air quality standard exists, the analysis must contain such air quality monitoring data as the department determines is necessary to assess ambient air quality for that air contaminant in any area that the emissions of that air contaminant would affect.
- (c) With respect to any such air contaminant (other than nonmethane hydrocarbons) for which such a

standard does exist, the analysis must contain continuous air quality monitoring data gathered for purposes of determining whether emissions of that air contaminant would cause or contribute to a violation of the standard or any maximum allowable increase.

- (d) In general, the continuous air quality monitoring data that are required shall have been gathered over a period of at least one year and shall represent at least the year preceding receipt of the application except that if the department determines that a complete and adequate analysis can be accomplished with monitoring data gathered over a period shorter than one year (but not to be less than four months), the data that are required shall have been gathered over at least that shorter period.
- (e) For any application which becomes complete, except as to the requirements of subparagraphs c and d, between June 8, 1981, and February 9, 1982, the data that subparagraph c requires shall have been gathered over at least the period from February 9, 1981, to the date the application becomes otherwise complete, except that:

[1] If the source or modification would have been major for that air contaminant under this chapter as in effect prior to May 7, 1981, any monitoring data shall have been gathered over at least the period required by those rules.

[2] If the department determines that a complete and adequate analysis can be accomplished with monitoring data over a shorter period (not to be less than four months), the data that subparagraph c requires shall have been gathered over at least that shorter period.

[3] If the monitoring data would relate exclusively to ozone and would not have been required under this chapter as in effect prior to May 7, 1981, the department may waive the otherwise applicable requirements of this subparagraph to the extent that the applicant shows that the monitoring data would be unrepresentative of air quality over a full year.

- (f) The owner or operator of a proposed stationary source or modification of volatile organic compounds who satisfies all conditions of 40 CFR, part 51, appendix S, section IV may provide postapproved monitoring data for ozone in lieu of providing preconstruction data as required under paragraph 1.
- (2) Postconstruction monitoring. The owner or operator of a major stationary source or major modification shall, after construction of the stationary source or modification, conduct such ambient monitoring as the department determines is necessary to determine the effect emissions from the stationary source or modification may have, or are having, on air quality in any area.
- (3) Operations of monitoring stations. The owner or operator of a major stationary source or major modification shall meet the requirements of 40 CFR, part 58, appendix B during the operation of monitoring stations for purposes of satisfying subdivision g.
- h. Source information. The owner or operator of a proposed major stationary source or major modification shall submit all information necessary to perform any analysis to make any determination required under this article. Such information must include:
- (1) A description of the nature, location, design capacity, and typical operating schedule of the proposed source or modification, including specifications and drawings showing the design and plant layout.
- (2) A detailed schedule for construction of the source or modification.
- (3) A detailed description as to what system of continuous emission reduction is planned by the source or modification, emission estimates, and any other information necessary to determine that best available control technology as specified in the "North Dakota Guidelines for Determining Best Available Control Technology" (North Dakota state department of health and consolidated laboratories, division of environmental engineering). This document is incorporated by reference.
- (4) The air quality impact of the source or modification, including meteorological and topographical data necessary to estimate such impact.

- (5) Information on the air quality impacts and the nature and extent of general commercial, residential, industrial, and other growth which has occurred since the baseline date in the area the source or modification would affect.
- i. Additional impact analyses.
 - (1) The owner or operator shall provide an analysis of the impairment to visibility, (in accordance with chapter 33-15-19) soils and vegetation, and wildlife that would occur as a result of the source or modification and general commercial, residential, industrial, and other growth associated with the source or modification. The owner or operator need not provide an analysis on vegetation or wildlife having no significant commercial or recreational value except for endangered and threatened species as identified by the United States fish and wildlife service.
 - (2) The owner or operator shall provide an analysis of the air quality impact projected for the area as a result of the general commercial, residential, industrial, and other growth associated with the source or modification.
 - j. Sources impacting federal class I areas - additional requirements.
 - (1) Notice to the environmental protection agency. The department shall transmit to the administrator of the United States environmental protection agency region VIII regional administrator a copy of each permit application relating to a major stationary source or major modification received by the department and provide notice to the administrator of every action related to the consideration of such permit.
 - (2) Notice to federal land managers. The department shall provide written notice of any permit application for a proposed major stationary source or major modification, the emissions from which may affect a class I area, to the federal land manager and the federal official charged with direct responsibility for management of any lands within any such area. Such notification must include a copy of all information relevant to the permit application and must be given within thirty days of receipt and at least sixty days prior to any public hearing on the application for a permit to construct. Such notification must include an analysis of the proposed

source's anticipated impacts on visibility in the federal class I area. The department shall also provide the federal land manager and such federal officials with a copy of the preliminary determination required under subsection 5 and shall make available to them any materials used in making that determination, promptly after the department makes such determination. Finally, the department shall also notify all affected federal land managers within thirty days of receipt of any advance notification of any such permit application.

- (3) Denial - impact on air quality-related values. A federal land manager may present to the department, after reviewing the department's preliminary determination required under subsection 5, a demonstration that the emission from an applicable source will have an adverse impact on the air quality-related values (including visibility) of federal mandatory class I lands, notwithstanding that the change in air quality resulting from emissions from such source or modification will not cause or contribute to concentrations which exceed the maximum allowable increases for a class I area. If the department concurs with such demonstration, the permit may not be issued.
- (4) Class I variances.
 - (a) The owner or operator of a proposed source may demonstrate to the federal land manager that the emissions from such source or modification will have no adverse impact on the air quality-related values of any such lands (including visibility), notwithstanding that the change in air quality resulting from emissions from such source or modification will cause or contribute to concentrations which exceed the maximum allowable increases for a class I area. If the federal land manager concurs with such demonstration and the manager so certifies to the department, the department may issue the permit pursuant to the requirements of subparagraph b; provided, that the applicable requirements of this chapter are otherwise met.
 - (b) In the case of a permit issued pursuant to subparagraph a, such source or modification shall comply with such emission limitations under such permit as may be necessary to assure that emissions of sulfur dioxide, particulate matter, and nitrogen oxides will not exceed the following maximum allowable increases over the

minor source baseline concentration for such
contaminants:

	Maximum allowable increase (micrograms per cubic meter)
Particulate matter:	
TSP <u>PM₁₀</u> , Annual arithmetic geometric	
arithmetic mean	19 17
TSP <u>PM₁₀</u> , 24-hour maximum	37 30
Sulfur dioxide:	
Annual arithmetic mean	15 20
24-hour maximum	91
3-hour maximum	325
Nitrogen dioxide:	
Annual arithmetic mean	25

- (5) Sulfur dioxide variance by governor with federal land manager's concurrence. The owner or operator of a proposed source or modification which cannot be approved under paragraph 4 may demonstrate to the governor, that the source or modification cannot be constructed by reason of any maximum allowable increase for sulfur dioxide for periods of twenty-four hours or less applicable to any class I area and, in the case of federal mandatory class I areas, that a variance under this clause would not adversely affect the air quality-related values of the area (including visibility). The governor, after consideration of the federal land manager's recommendation (if any) and subject to the federal land manager's concurrence, may, after notice and public hearing, grant a variance from such maximum allowable increase. If such variance is granted, the department shall issue a permit to such source or modification pursuant to the requirements of paragraph 7; provided, that the applicable requirements of this chapter are otherwise met.
- (6) Variance by the governor with the president's concurrence. In any case where the governor recommends a variance under this subdivision in which the federal land manager does not concur, the recommendations of the governor and the federal land manager must be transmitted to the president. The president may approve the governor's recommendation if the president finds that such variance is in the national interest. If such a variance is approved, the department shall issue a permit pursuant to the requirements of paragraph 7; provided, that the applicable requirements of this chapter are otherwise met.

- (7) Emission limitations for presidential or gubernatorial variances. In the case of a permit issued pursuant to paragraph 5 or 6, the source or modification shall comply with emission limitations under such permit as may be necessary to assure that emissions of sulfur dioxide from such source or modification will not (during any day on which the otherwise applicable maximum allowable increases are exceeded) cause or contribute to concentrations which exceed the following maximum allowable increases over the baseline concentration and to assure that such emissions will not cause or otherwise contribute to concentrations which exceed the otherwise applicable maximum allowable increases for periods of exposure of twenty-four hours or less for more than eighteen days, not necessarily consecutive, during any annual period:

Maximum allowable increase
(micrograms per cubic meter)

Period of exposure	Low terrain areas	High terrain areas
24-hour maximum	36	62
3-hour maximum	130	221

- k. Proposed redesignations. Where an owner or operator applies for permission to construct pursuant to this chapter and the proposed source or modification would impact on an area which has previously been proposed for redesignation to a more stringent class by the department, an Indian governing body, or another state (or the state or Indian governing body has announced such consideration), approval may not be granted until the proposed redesignation has been acted upon. However, approval must be granted if, in the department's judgment, the proposed source would not violate the increments that would be applicable if the redesignation is approved. The department shall withhold approval under this subdivision only so long as another state or Indian governing body is actively and expeditiously proceeding toward redesignation.

Where an owner or operator has applied for permission to construct pursuant to this chapter and whose application has been deemed complete by the department prior to the public announcement of a proposed redesignation of an area to a more stringent class and where such facility would impact on the area proposed for redesignation, the application shall be processed considering the

classification of the area which existed at the time the application was deemed complete.

5. Public participation.

- a. Within thirty days after receipt of an application to construct a source or modification subject to this chapter, or any addition to such application, the department shall advise the applicant as to the completeness of the application or of any deficiency in the application or information submitted. In the event of such a deficiency, the date of receipt of the application, for the purpose of this chapter, shall be the date on which all required information to form a complete application is received by the department.
- b. Within one year after receipt of a completed application, the department shall:
 - (1) Make a preliminary determination whether the source should be approved, approved with conditions, or disapproved pursuant to the requirements of this chapter.
 - (2) Make available in at least one location in each region in which the proposed source or modification would be constructed, a copy of all materials submitted by the applicant, a copy of the department's preliminary determination, and a copy or summary of other materials, if any, considered by the department in making a preliminary determination.
 - (3) Notify the public, by prominent advertisement in newspapers of general circulation in each region in which the proposed source or modification would be constructed, of the application, the preliminary determination, the degree of increment consumption that is expected from the source or modification, and the opportunity for comment at a public hearing as well as written public comment on the information submitted by the owner or operator and the department's preliminary determination on the approvability of the source.
 - (4) Send a copy of the notice required in paragraph 3 to the applicant, the United States environmental protection agency administrator, and to officials and agencies having cognizance over the locations where the source or modification will be situated as follows: local air pollution control agencies, the chief executive of the city and county where the source or modification would be located; any comprehensive regional land use planning agency; and

any state, federal land manager, or Indian governing body whose lands may be significantly affected by emissions from the source or modification.

- (5) Hold a public hearing whenever, on the basis of written requests, a significant degree of public interest exists or at its discretion when issues involved in the permit decision need to be clarified. A public hearing would be held during the public comment period for interested persons (including representatives of the United States environmental protection agency administrator) to appear and submit written or oral comments on the air quality impact of the source or modification, alternatives to the source or modification, the control technology required and other appropriate considerations.
- (6) Consider all public comments submitted in writing within a time specified in the public notice required in paragraph 3 and all comments received at any public hearing conducted pursuant to paragraph 5 in making its final decision on the approvability of the application. No later than ten days after the close of the public comment period, the applicant may submit a written response to any comments submitted by the public. The department shall consider the applicant's response in making its final decision. All comments must be made available for public inspection in the same locations where the department made available preconstruction information relating to the source or modification.
- (7) Make a final determination whether the source should be approved, approved with conditions, or disapproved pursuant to the requirements of this chapter.
- (8) Notify the applicant in writing of the department's final determination. The notification must be made available for public inspection in the same locations where the department made available preconstruction information and public comments relating to the source or modification.

6. Source obligation.

- a. Any owner or operator who constructs or operates a stationary source or modification not in accordance with the application, submitted pursuant to subsection 4 or with the terms of any permit to construct; or any owner or operator of a stationary source or modification subject to this chapter who commences construction after the effective date of this chapter without applying for and receiving a permit to construct hereunder, shall be

subject to enforcement action under North Dakota Century Code section 23-25-10.

- b. A permit to construct shall become invalid if construction is not commenced within eighteen months after receipt of such permit, if construction is discontinued for a period of eighteen months or more, or if construction is not completed within a reasonable time. The department may extend the eighteen-month period upon a satisfactory showing that an extension is justified. This provision does not apply to the time period between construction of the approved phases of a phased construction project; each phase must commence construction within eighteen months of the projected and approved commencement date. In cases of major construction projects involving long lead times and substantial financial commitments, the department may provide by a condition to the permit a time period greater than eighteen months when such time extension is supported by sufficient documentation by the applicant.
- c. A permit to construct does not relieve any owner or operator of the responsibility to comply fully with the applicable provisions of the state implementation plan and any other requirements under local, state, or federal law.
- d. At such time that a particular source or modification becomes a major stationary source or modification solely by virtue of a relaxation in any enforceable limit which was established after May 7, 1980, on the capacity of the source or modification otherwise to emit an air contaminant, such as a restriction on hours of operation, then the requirements of subdivisions c, e, f, g, h, i, and j and the requirements of subsections 5, 6, and 7 shall apply to the source or modification as though construction had not yet commenced on the source or modification.

7. Innovative control technology.

- a. An owner or operator of a proposed major stationary source or major modification may request the department in writing to approve a system of innovative control technology.
- b. The department shall, with the consent of the governors of all affected states, determine that the source or modification may employ a system of innovative control technology, if:
 - (1) The proposed control system would not cause or contribute to an unreasonable risk to public health, welfare, or safety in its operation or function.

- (2) The owner or operator agrees to achieve a level of continuous emissions reduction equivalent to that which would have been required under paragraph 2 of subdivision c of subsection 4 by a date specified by the department. Such date may not be later than four years from the time of startup or seven years from permit issuance.
 - (3) The source or modification would meet the requirements of subdivisions c and e of subsection 4 based on the emissions rate that the stationary source employing the system of innovative control technology would be required to meet on the date specified by the department.
 - (4) The source or modification would not before the date specified by the department:
 - (a) Cause or contribute to a violation of an applicable ambient air quality standard; or
 - (b) Impact any area where an applicable increment is known to be violated.
 - (5) The provisions of subdivision j of subsection 4 (relating to class I areas) have been satisfied with respect to all periods during the life of the source or modification.
 - (6) All other applicable requirements including those for public participation have been met.
- c. The department shall withdraw any approval to employ a system of innovative control technology made under this section, if:
- (1) The proposed system fails by the specified date to achieve the required continuous emissions reduction rate;
 - (2) The proposed system fails before the specified date so as to contribute to an unreasonable risk to public health, welfare, or safety; or
 - (3) The department decides at any time that the proposed system is unlikely to achieve the required level of control or to protect the public health, welfare, or safety.
- d. If a source or modification fails to meet the required level of continuous emission reduction within the specified time period or the approval is withdrawn in accordance with subdivision c, the department may allow

the source or modification up to an additional three years to meet the requirement for the application of best available control technology through use of a demonstrated system of control.

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