WISCONSIN DEPARTMENT OF HEALTH SERVICES
PROPOSED ORDER TO ADOPT PERMANENT RULES

The Wisconsin Department of Health Services ("the department") proposes an order to **repeal** DHS 157.44 (6) (a) 4., and 157.74 (2) (e)**; renumber** DHS 157.13 (4) (i) 7., and 157.9719 (1) (Note 1); **renumber and amend** DHS 157.03 (251m), 157.67 (1) (b), (18)**; amend** DHS 157.01 (10), 157.03 (22), (143), (204), (267), (295m), (374) (c), and (391), 157.09 (2) (c) 2. a. to c., (2) (c) 7., and (2) (g) (title), 157.10 (3) (table), 157.11 (1) (a) 1. b. and c., (2) (b) 3. g., (2) (d) (Note), (2) (h) 1. e., and (2) (h) 3. d., 157.13 (4) (i) 4., (4) (i) 6. d., and (8) (d), 157.15 (3) (d), 157.21 (3), 157.35, 157.44 (6) (a), (a) 3., (6) (d) and (f), 157.45 (11) (c), 157.51 (1) (a) 2., 157.52 (4) (a), 157.53 (3) (a), 157.61 (1) (b) and (c), (4) (a) 1., (5) (b) 3. and 4., (7) (intro.), (a), (b) 2., and (c) 1. and 2., (9) (intro.), (a), (a) 1. and (12) (a) to (c), 157.62 (2) (b) 3. (Note), 157.63 (4) (intro.), (a), (b), (c) 2., (5) (intro.), (a) (intro.), (b), and (c) 2., 157.64 (1), (4) (intro.), (b) 1., 2. and 2. g., (5) (intro.), (b), (c) (intro.) and (c) 2., (6) (intro.), (b) and (c) (intro.) and (c) 2., and (7) (intro.), (a) to (c), (c) 1. and 2., and (c) 2. f., 157.65 (1) (a) and (b), 157.65 (8) (intro.), (a), (a) 1., (b) 2. and 3., and (10) (a) and (b), 157.66 (2) (intro.) 157.67 (1) (intro.) and (1) (a), (4) (d) and (e), (15) (title) and (a), and (17) (intro.), (a) (intro) and 1., (b) 2. and 3., 157.68 (2) (a), 157.71 (4) (b) 3, and (5) (c), 157.72 (1) (a) (intro.) and (a) 3., and (2) (f) 1. b., 157.73 (12) (d) (intro.), (e) and (g), (14) (a), (c), (18) (b), and (22) (e), 157.74 (2) (f) 1., 157.76 (intro.), (8), and (2) (b), 157.80 (1) (c) 2., 157.81 (4), 157.93 (4) (am) and (b) 1. and 2., 157.94 (5) (a) (Note), (am) (Note), and (d), (6) (c), (f) 1., 1. a. and b., and (f) (2) and (2) a., 157.9701 (6) (b), 157.9702 (2) (b) 1., 157.9706 (1), 157.9708 (4) (b), (4) (c) (intro.) and (c) 1., (e), (f), (g) and (h) 2., 157.9714 (1), 157.9719 (1) (a), Appendix B, and Appendix D; **repeal and recreate** DHS 157.13 (5), 157.61 (4) (b), (8), and (10), 157.62 (4), 157.63 (3) (b) 1., 157.63 (6), 157.64 (8), 157.65 (6), 157.65 (9), 157.66 (1), Table DHS 157.75, Subchapter IX (title), 157.87. 157.9703 (3), Appendix A, Appendix F, Appendix H, Appendix L, Appendix O, Appendix T**;** and **to create** DHS 157.03 (30m), (40m), (45m), (57c), (57w), (66m), (193e), (235m), (239m), (252r), (288m), (331m), and (336m), 157.13 (4) (i) 7., 157.61 (5) (b) 5. and 6., (7) (b) 3., (c) 3., and (9) (b) 3., 157.62 (5) (b) 3., 157.63 (3) (b) 3. and (d),157.63 (4) (c) 3. and (5) (c) 3., 157.64 (4) (b) 3., (5) (c) 3., (6) (c) 3., and (7) (c) 3., 157.65 (6m), (8) (b) 4., and (10) (a) 1. and 2., 157.66 (2) (c), 157.67 (1) (a) 1., (1) (b) (intro.), (1) (b) 1. and 2. , (4) (g) and (e), (17) (b) 4., and (18) (a) and (b), 157.71 (1) (c), 157.72 (1) (am) and (4), 157.74 (2) (fm) and (5), 157.9719 (1) (Note 1), relating to radiation protection requirements for radiation-producing machines and radioactive materials.

RULE SUMMARY

Statute interpreted
Sections 254.31 to 254.45, Stats., and 42 USC 2011 to 2114.

Statutory authority
Sections 227.11 (2) (a), 254.34 (1) (a) and (b), 254.35 (3) (g), 254.365 (4), and 254.37 (3), Stats.

Explanation of agency authority
As specified under s. 254.34 (1), Stats., the department is the state radiation control agency and is required under ss. 254.34 (1) (a), 254.365 (4), and 254.37 (3), Stats., to promulgate rules pertaining to the use of radiation in Wisconsin. Specifically, the department is required to promulgate and enforce rules pertaining to sources of ionizing radiation and for registration and licensing sources of ionizing radiation, and enforcement as may be necessary to prohibit and prevent unnecessary radiation exposure. The department's rules for by-product material, source material, and special nuclear material are required to be in accordance with 42 USC 2021 (o) and be otherwise compatible with the requirements under 42 USC 2011 to 2114 and regulations adopted under 42 USC 2011 to 2114. As specified under s. 254.33, Stats., it is further the policy

for the department to advise, consult and cooperate with other agencies of the state, the federal government, other states and interstate agencies and with affected groups, political subdivisions and industries; and, in general, to conform as nearly as possible to nationally accepted standards in the promulgation and enforcement of rules.

Related statute or rule

Chapter NR 809 incorporates the radioactivity standards for community water systems and the exemptions and requirements established in ss. DHS 157.95 and 157.96. The department of natural resources applies these standards to community drinking water systems.

Chapter DHS 163 establishes requirements for identification, removal and reduction of lead-based paint hazards. Lead in paint analysis requires use of a portable device containing radioactive material or x-ray tube which is required to be licensed or registered under ch. DHS 157. Section DHS 157.05 (4) also requires any person providing training for certified lead inspectors or risk assessors to meet the training requirements of s. DHS 163.24 (a) 1. and 3. and to complete an additional eight hours of radiation safety training.

Chapter 462, Stats., requires radiographers to be licensed and limited x-ray machine operators to be permitted by the state. Sections DHS 157.74 (2) (m) and 157.80 (2) (a) 1. also require individuals operating x-ray equipment for diagnostic purposes to possess a current radiography license or limited x-ray machine operator's permit from the state of Wisconsin.

Plain language analysis

Under s. 254.34 (1) (a) and (b) Stats., the department is responsible for developing and enforcing rules, including registration and licensing of sources of ionizing radiation, to prohibit and prevent unnecessary radiation exposure. Section 254.33, Stats., further directs the department to "conform as nearly as possible to nationally accepted standards in the promulgation and enforcement of rules." The department is also responsible for maintaining compliance with the Agreement Between The United States Nuclear Regulatory Commission and The State of Wisconsin for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of 1954("the agreement"), signed by Governor Doyle and the Nuclear Regulatory Commission ("NRC") in 2003. The agreement transferred regulatory authority over certain radioactive materials from the NRC to the state. Under the agreement, the department is responsible for licensing and inspecting radioactive materials commonly used in medicine, industry, research and education. The state regulatory program is periodically evaluated by NRC staff. The agreement provides that the state will revise the radioactive material provisions of ch. DHS 157 within three years of any applicable changes to Title 10 CFR. Title 10 CFR was revised as recently as 2019, whereas ch. DHS 157 was last revised in 2016. The department proposes to revise the radioactive material requirements in ch. DHS 157 in order to comply with the agreement. No reasonable alternative exists to revising provisions in ch. DHS 157 pertaining to radioactive material, because the agreement remains in effect. The proposed revisions are anticipated to bring the state into compliance with the agreement.

In addition, the department proposes to revise provisions of ch. DHS 157 pertaining to x-rays. These revisions are necessary to prohibit and prevent unnecessary radiation exposure, and to conform to nationally accepted standards for technologies employing x-rays. Revisions reflect new diagnostic and therapeutic technologies, the department's experience with implementing and administering the current rule, changes in comparable federal regulations, suggested national standards from the Conference of Radiation Control Program Directors, and input provided to the department by an advisory group that included representatives of academic and medical facilities, radioactive materials users, x-ray users and large and small businesses. No reasonable alternative exists to revising the provisions of ch. DHS 157 pertaining to x-rays, because pursuant to ss. 254.33 and 254.34, Stats., the department must promulgate and enforce rules, including

registration and licensing of sources of ionizing radiation, as may be necessary to prohibit and prevent unnecessary radiation exposure. The proposed revisions are anticipated to accomplish this purpose.

Entities that may be affected by the proposed revisions to ch. DHS 157 are hospitals, academic facilities, medical clinics, dental facilities, chiropractic offices, veterinary facilities and industrial facilities that use radioactive materials or x-ray devices.

The proposed revisions to ch. DHS 157 would accomplish the following:

1. Update the radiation protection and regulatory requirements for radioactive materials to ensure compatibility with current applicable regulations of the federal Nuclear Regulatory Commission (NRC) in 10 CFR pp. 19, 20, 31-37, 39, 40, 70, 71, and 150 and 49 CFR, relating to notices, instructions and reports to workers regarding inspections and investigations; standards for protection against radiation; general domestic licenses for byproduct material, specific domestic licenses to manufacture or transfer certain items containing byproduct material; specific domestic licenses of broad scope for byproduct material; licenses for industrial radiography and radiation safety requirements for industrial radiographic operations; physical protection of byproduct material; medical use of byproduct material; licenses and radiation safety requirements for irradiators; licenses and radiation safety requirements for well logging; domestic licensing of special nuclear material; packaging and transportation of radioactive material; and exemptions and continued regulatory authority in agreement states and in offshore waters.

2. Add one radioactive material license fee category and modify one fee category to reflect the difference in program effort and cost for licensees that use large amounts vs smaller amount of radioactive material in research and development.

3. Add one additional fee category for radioactive materials licenses that are authorized for three or more sites of locations of use or storage. There have been no fee increases or category changes since 2003. The number of licensees authorized for multiple sites under the same license has increased since 2003. This site fee category reflects the additional operating revenue needed for the radioactive materials program to sufficiently license and inspect licensees with multiple sites.

4. Achieve compatibility with current applicable regulations of the federal Food and Drug Administration (FDA) in 21 CFR pp. 900, 1020, 1030, and 1040, relating to mammography quality standards, performance standards for ionizing radiation emitting products; microwave and radio frequency emitting products; and light-emitting products for the protection against hazards of radiation.

5. Codify suggested national standards for x-ray device imaging from the Conference of Radiation Control Program Directors in the Suggested State Regulations for the Control of Radiation.

6. Correct outdated, imprecise, and inconsistent rule language based on the department's experience administering the current rule.

The proposed revision to ch. DHS 157 will have the following economic impact on radioactive material regulated entities:

1. Increase the annual and application fee from $1800 to $3600 for licensees that are authorized to use a total of 5 curies or more of radioactive material for research and development.

2. The annual fee for each noncontiguous site listed on a license, starting at three, has a fee equal to 25% of the applicable fee category of use per each additional site. For example:

-licensee A has 2 sites with an applicable fee category of $1000, there is no change and the total fee is

$1000;
-licensee B has 3 sites with an applicable fee category of $1000, the fee increases 25% per site greater than 2 and the total fee is $1250;
-licensee C has 3 sites with an applicable fee category of $1000 and 1 site with an applicable fee category of $500, a total of 4 sites and two different applicable fee categories. The total fee is $1750 ($1000 for sites one and two + $250 for site three + $500 for site four).

These fee changes apply to a small percentage of current licensees and is proportional to their operations.

Summary of, and comparison with, existing or proposed federal regulations

Wisconsin's agreement with the Nuclear Regulatory Commission requires the department to incorporate relevant changes to federal radioactive material regulations into its radiation protection rules within three years of the effective date of the federal regulations. The proposed changes to ch. DHS 157 ensure continued compatibility with new federal radioactive material regulations in 10 CFR pp.. 19, 20, 31, 33-36, 37, 39, 40, 70, 71 and 150, and 49 CFR as required by s. 254.34 (1), Stats.

The proposed changed to ch. DHS 157 are equivalent to 21 CFR pp. 900, 1020, and 1040, which set quality standards for mammography, diagnostic, therapeutic, and cabinet x-ray devices.

Comparison with rules in adjacent states

Illinois:

Illinois is an agreement state with the NRC. As a result, Illinois law in effect April 21, 2021 contains radiation protection and regulatory requirements similar to those contained in ch. DHS 157 and compatible with equivalent federal regulations in Titles 10 and 49, CFR.

Illinois's annual fee structure for radioactive materials licenses includes an additional site fee for every site that isn't the main location of the licensee. The site fee is based on the category authorized at the site and ranges from 20-55% of the full cost of the fee category.

Illinois does not have a fee category for research and development licensees based on the amount of radioactive authorization.

Reference: Illinois Regulation Title 32: Energy chapter II: Illinois emergency management agency Subchapter b: radiation protection Part 331 fees for radioactive material licensees

Iowa:

Iowa is an agreement state with the NRC. As a result, Iowa law in effect April 21, 2021 contains radiation protection and regulatory requirements similar to those in ch. DHS 157 and compatible with equivalent federal regulations in Titles 10 and 49, CFR.

Iowa's annual fee structure for radioactive materials licenses includes and additional site fee for every additional license site. Licensees with more than two authorized locations of are charged an additional 10% of the annual fee per location.

Iowa does not have a license fee category for research and development licensees based on the amount of radioactive authorization.

Reference: Iowa Administrative Code 641-38.8(2)

Michigan:

Michigan is not an agreement state with the NRC. Michigan law in effect April 21, 2021 contains some regulatory requirements similar to those in ch. DHS 157. The Nuclear Regulatory Commission is currently responsible for regulating the majority of radioactive material use in Michigan under Titles 10 and 49 CFR.

The Nuclear Regulatory Commission determines license fees within Michigan. There are specific fee categories that limit the number of sites authorized under the license. The ranges are 1-5 locations, 6-20 locations, more than 20 locations. The fee for 6-20 locations and more than 20 locations is an additional 32% and 65% of the 1-5 location fee, respectively.

The Nuclear Regulatory Commission does not have a license fee category for research and development licensees based on the amount of radioactive authorization.

Reference; 10 CFR section 170.31 Table 1.

Minnesota:

Minnesota is an agreement state with the NRC. As a result, Minnesota law in effect April 21, 2021 contains radiation protection and regulatory requirements similar to those in ch. DHS 157 and compatible with equivalent federal regulations in Titles 10 and 49, CFR.

Minnesota does not have a license fee structure that differs based on the number of sites.

Minnesota does not have a license fee category for research and development licensees base the amount of radioactive authorization.

Reference: Minnesota Rules, Chapter 4731.

Summary of factual data and analytical methodologies

The department referred to all of the following to draft the proposed rules:

1. The input of an advisory committee that included stakeholders affected by the proposed rules. These included representatives of academic and medical facilities, radioactive materials users, x-ray users, and large and small businesses.

2. An agreement state rule template called the "Suggested State Regulations for the Control of Radiation" (SSRCR) developed by the Conference of Radiation Control Program Directors, Inc. ("CRCPD"). The CRCPD is a national organization of primarily state radiation control staff that supports and represents state radiation control programs. The SSRCR is developed with the involvement of federal radiation agencies, such as the NRC, FDA, and the Environmental Protection Agency. The SSRCR is also continually updated and used by most of the existing agreement states to help meet federal requirements.

3. Requirements of Titles 10, 21, and 49 CFR; 42 USC; Sections 254.31 to 254.45, Stats., and the Agreement Between The United States Nuclear Regulatory Commission and The State of Wisconsin for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, as Amended.

4. The department maintains a database of all radioactive material licensees. This data includes the number sites, quantities of radioactive material, and categories of use. The department used this information as the bases to analyze the impact of the proposed license fee changes.

5. Section 227.114 (1) (a), Stats., which defines "small business" as a business entity, including its affiliates, which is independently owned and operated and not dominant in its field, and which employs 25 or fewer full-time employees or which has gross annual sales of less than $5,000,000.

Analysis and supporting documents used to determine effect on small business

The methods specified in s. 227.114 (2), Stats., for reducing a rule's impact on small business were considered by the department, but have not been adopted in the proposed rules because they are not feasible. Adopting the methods specified in s. 227.114 (2), Stats., would be contrary to the state's public policy on radiation control stated in s. 254.33, Stats., as well as federal requirements, and the agreement between the state and the NRC, which are the basis for the proposed rule. The department's analysis of the effect of rulemaking on small businesses regulated by ch. DHS 157 is therefore confined to proposed revisions addressing x-ray regulatory requirements and fee changes.

The department's x-ray registration and inspection program, and radioactive materials licensing and inspection program, are both entirely supported by the annual fees authorized under ss. 254.35 (3) and 254.365 (5), Stats. The department applied the fee changes as proposed to current licensees. The site fee equal to 25% of the applicable use category would apply to 67 of the 442 licensed sites. This would affect 42 licensees and total $48,075. There are five licensees that hold a license for research and development purposes that authorize greater than 5 curies of radioactive material. The proposed fee change for those five licensees would total $9,000. Out of the 285 current licensees, 47 would be subject to a fee change as proposed. Smaller businesses do not typically have large possession authorizations or more than two sites of use. Of the 47 licensed businesses affected by the proposed fee change, it is estimated that 23 do not meet the small business definition in s. 227.114(1) based on being a large health care provider, government entity, national company, or large publicly traded company. In the absence of further information, if it is assumed that the remaining affected business meet the small business definition, the proposed license fee changes would apply to 24 businesses and total $22,750. This analysis conservatively shows that total impact on small business would be less than $50,000.

There is expected to be little to no fiscal impact to x-ray registrants from proposed requirements.

Effect on small business

Based on the foregoing analysis, the permanent rule is anticipated to have little to no economic impact on small businesses. The entities that will be affected by the proposed rule are not "small businesses" as defined in s. 227.114 (1), Stats.

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Statement on quality of agency data

The data used by the department to prepare these proposed rules and analysis comply with ss.227.12 (2m), Stats.

Place where comments are to be submitted and deadline for submission

Comments may be submitted to the agency contact person that is listed above until the deadline given in the upcoming notice of public hearing. The notice of public hearing and deadline for submitting comments will be published in the Wisconsin Administrative Register and to the department's website, at https://www.dhs.wisconsin.gov/rules/permanent.htm. Comments may

also be submitted through the Wisconsin Administrative Rules Website, at: https://docs.legis.wisconsin.gov/code/chr/active.

RULE TEXT

SECTION 1. DHS 157.01 (10) is amended to read:

DHS 157.01 (10) Subchapter IX establishes radiation safety requirements for the use of ~~cabinet and analytical x-ray systems~~ radiation generating devices.

SECTION 2. DHS 157.03 (22) is amended to read:

DHS 157.03 (22) Analytical x-ray system" means x-ray equipment ~~designed to analyze the~~ that generates ionizing radiation by electronic means for the purpose of examining the microstructure and composition of materials.

SECTION 3. DHS 157.03 (30m), (40m), (45m), (57c), (57w), and (66m) are created to read:

DHS 157.03 (30m) "Associate radiation safety officer" means an individual who meets all of the following qualifications:

(a) Satisfies the requirements in s. DHS 157.61 (7) and (11).

(b) Is currently identified as an associate radiation safety officer for the types of use of radioactive material for which the individual has been assigned duties and tasks by the radiation safety officer on a specific medical use license issued by the department, the NRC, or another agreement state or medical use permit issued by an NRC master material licensee.

DHS 157.03 (40m) (a) "Beam port" means an opening on the x-ray apparatus designed to emit a primary beam.

(b) "Beam port" does not include accessible openings on a security screening unit.

DHS 157.03 (45m) (a) "Bomb detection radiographic equipment" means x-ray generating equipment used solely for the purpose of remotely detecting explosive devices.

(b)"Bomb detection radiographic equipment" does not include hand-held x-ray bomb detection equipment.

DHS 157.03 (57c) "Certifiable cabinet x-ray system" means an existing uncertified radiation generating device that has been modified to meet the certification requirements specified in 21 CFR 1020.40.

DHS 157.03 (57w) "Certified cabinet x-ray system" means a radiation generating device certified by the manufacturer in accordance with 21 CFR 1010.2 as being manufactured and assembled pursuant to the provisions of applicable federal radiation safety performance standards 21 CFR 1010 and 1020.40.

DHS 157.03 (66m) "Closed-beam x-ray equipment" means a system in which the beam path cannot be entered by any part of the body during normal operation.

SECTION 4. DHS 157.03 (143) is amended to read:

DHS 157.03 (143) “Fit test" means the use of a protocol to qualitatively ~~it~~ or quantitatively evaluate the fit of a respirator on an individual.

SECTION 5. DHS 157.03 (193e) is created to read:

DHS 157.03 (193e) "Local components" means parts of a radiation generating device x-ray system and include areas that are struck by x-rays such as radiation source housings, beam port and shutter assemblies, collimators, sample holders, cameras, goniometers, detectors, and shielding, but do not include power supplies, transformers, amplifiers, readout devices, and control panels.

SECTION 6. DHS 157.03 (204) is amended to read:

DHS 157.03 (204) “Management" means the chief executive officer or other individual having the authority to manage, direct or administer the licensee’s or registrant’s activities, or those persons’ delegate or delegates.

SECTION 7. DHS 157.03 (235m) and (239m) are created to read:

DHS 157.03 (235m) "Open-beam x-ray equipment" means an open-beam x-ray system in which the beam path could be entered by any part of the body at any time.

DHS 157.03 (239m) “Ophthalmic physicist” means an individual who meets all of the following qualifications:

(a) Meets the requirements in s. DHS 157.65 (6m) (a) 2. and s. DHS 157.61 (11).

(b) Is identified as an ophthalmic physicist on a specific medical use license, or other equivalent permit or license issued by the department, the NRC or an agreement state, or broad scope medical use licensee.

SECTION 8. DHS 157.03 (251m) is renumbered to DHS 157.03 (252g) and amended to read:

DHS 157.03 (252g) “Personnel dosimeter" means a dosimeter~~,~~ assigned to an individual~~, that is processed and evaluated by an accredited national voluntary laboratory accreditation program (NVLAP) processor~~.

SECTION 9. DHS 157.03 (252r) is created to read:

DHS 157.03 (252r) "Personnel security screening system" means any x-ray equipment used on humans for security evaluation.

SECTION 10. DHS 157.03 (267) is amended to read:

DHS 157.03 (267) “Preceptor" means an individual who provides, directs or verifies training and experience required for an individual to become an authorized user, an authorized medical physicist, an authorized nuclear pharmacist, ~~or~~ a radiation safety officer for medical use, or an associate radiation safety officer.

SECTION 11. DHS 157.03 (288m) is created to read:

DHS 157.03 (288m) "Radiation generating device" or "RGD" means any system, device, subsystem, or component thereof, which may generate x-rays or particle radiation between 5 keV and 1 MeV, and not intended for healing arts use for humans or animals. RGD may be fixed or portable with any of the following characteristics:

(a) Mobile-means RGD equipment mounted on a permanent base with wheels and/or casters for moving while completely assembled.

(b) Portable-means RGD equipment designed to be hand-carried.

(c) Stationary-means RGD equipment that is installed or placed in a fixed location.

(d) Transportable-means RGD equipment to be installed in a vehicle or that may be readily disassembled for transport or use in a vehicle.

SECTION 12. DHS 157.03 (295m) is amended to read:

DHS 157.03 (295m) "Radiation safety officer for medical use" means an individual that meets the requirements of ss. DHS 157.61 (7) (a)~~, or (c) 1. and 157.61 (11),~~ or who is identified as a radiation safety officer on a department, NRC or another agreement state medical use license or other equivalent license or permit recognized by the department for similar types and uses of radioactive material.

SECTION 13. DHS 157.03 (331m) and (336m) are created to read:

DHS 157.03 (331m) "Security screening unit" means a non-human use open-beam or cabinet x-ray system with accessible openings designed for the detection of weapons, bombs, or contraband concealed in baggage, mail, packages or other commodities or structure.

DHS 157.03 (336m) (a) "Shielded room" means a room housing a radiation generating device where, with the device at maximum technique factors, the exterior room environs meets the unrestricted area dose limits of 0.02 mSv (2 mrem) in any one hour and 1 mSv (100 mrem) in a year at 30 cm from the surface of the barrier.

(b) "Shielded room" does not include any of the following:

1. A radiation generating device that meets the definition of cabinet x-ray system.

2. A permanent radiographic installation.

3. A radiation room.

SECTION 14. DHS 157.03 (374) (c) is amended to read:

DHS 157.03 (374) (c) For CT equipment designed for pulsed operation, peak tube potential in kV, scan time in seconds, and either tube current in ~~millamperes~~milliamperes (mA), x-ray pulse width in milliseconds, and the number of x-ray pulses per scan; or the product of tube current, x-ray pulse width, and the number of x-ray pulses per scan expressed as mAs.

SECTION 15. DHS 157.03 (391) is amended to read:

DHS 157.03 (391) "Transuranic waste" means waste containing elements having an atomic number greater than 92, a half-life greater than 5 years and in quantities greater than 3.7 kBq/g~~m~~ (100 nCi/g~~m~~).

SECTION 16. DHS 157.09 (2) (c) 2. a., to c. are amended to read:

DHS 157.09 (2) (c) 2 a. For wrist watches, one ~~microGy~~microgray (0.1 millirad) per hour at 10 centimeters from any surface.

DHS 157.09 (2) (c) 2 b. For pocket watches, one ~~microGy~~microgray (0.1 millirad) per hour at one centimeter from any surface.

DHS 157.09 (2) (c) 2 c. For any other timepiece, 2 ~~microGy~~microgray (0.2 millirad) per hour at 10 centimeters from any surface.

SECTION 17. DHS 157.09 (2) (c) 7. is amended to read:

DHS 157.09 (2) (c) 7. Electron tubes, including spark gap tubes, power tubes, gas tubes including glow lamps, receiving tubes, microwave tubes, indicator tubes, pick-up tubes, radiation detection tubes, and any other completely sealed tube that is designed to conduct or control electrical currents, provided that the radiation dose rate from each electron tube containing radioactive material does not exceed 10 ~~microgy~~microgray (1 millirad) per hour at one centimeter from any surface when measured through 7 milligrams per square centimeter of absorber and that each tube does not contain more than one of the following specified quantities of radioactive material:

SECTION 18. DHS 157.09 (2) (g) (title) is amended to read:

DHS 157.09 (2) (g) (title) *Industrial use devices containing exempt quantities or ~~disturbed~~ distributed under a general license.*

SECTION 19. DHS 157.10 (3) (table) is amended to read:

Category	License Type	Application & Annual Fee
1.	**Special Nuclear Material (SNM)**	
A.	License for possession and use of SNM in sealed sources contained in devices used in measuring systems	$1,000
B.	License for use of SNM to be used as calibration and reference sources	$300
C.	SNM – all other, except license authorizing special nuclear material in unsealed form that would constitute a critical mass [Fee waived if facility holds additional license category]	$1,500
2.	**Source Material**	

A.	Source material processing and distribution	$4,000
B.	Source material in shielding [Fee waived if facility holds additional license category]	$400
C.	Source material – all other, excluding depleted uranium used as shielding or counterweights	$3,000
3.	**Byproduct, NARM**	
A.	License of broad scope for processing or manufacturing of items for commercial distribution	$20,000
B.	License for processing or manufacturing and commercial distribution of radiopharmaceuticals, generators, reagent kits and sources or devices	$12,000
C.	License for commercial distribution or redistribution of radiopharmaceuticals, generators, reagent kits and sources or devices	$3,000
D.	Other licenses for processing or manufacturing of items for commercial distribution	$4,000
E.	License for industrial radiography operations performed only in a shielded radiography installation	$3,000
F.	License for industrial radiography performed only at the address indicated on the license, and at temporary job sites	$5,000
G.	License for possession and use of less than 370 TBq (10,000 curies) of radioactive material in sealed sources for irradiation of materials where the source is not removed from the shield [Fee waived if facility holds additional irradiator license category]	$2,000
H.	License for possession and use of less than 370 TBq (10,000 curies) of radioactive material in sealed sources for	$3,000

	irradiation of materials where the source is exposed for irradiation purposes. The category also includes underwater irradiators for irradiation of materials in which the source is not exposed for irradiation	
I.	License for possession and use of at least 370 TBq (10,000 curies) and less than 3.7 PBq (100,000 curies) of radioactive material in sealed sources for irradiation of materials	$5,000
J.	License for possession and use of 3.7 PBq (100,000 curies) or more of radioactive material in sealed sources for irradiation of materials	$12,000
K.	License to distribute items containing radioactive materials to persons under a general license	$2,000
L.	License to possess radioactive materials intended for distribution to persons exempt from licensing	$2,500
M.	License of broad scope for research and development that does not authorize commercial distribution	$6,000
N.	Other licenses for possession and use of less than 0.185 TBq (5 curies) of radioactive material in research and development that do not authorize commercial distribution	$1,800
O.	License for installation, repair, maintenance leak testing or other service of devices or items containing radioactive material, or to perform services for other persons, including testing of sealed sources for leakage or contamination, instrument calibration, and sample analysis, excluding waste transportation or broker services	$1,800

P.	License for portable gauges, including industrial Lixiscope ®	$1,400
Q.	License for portable x-ray fluorescence analyzer calibration flood source, dewpointer or gas chromatograph	$200
R.	All other byproduct, naturally - occurring or accelerator- produced material licenses, except as otherwise noted	$2,000
S.	Other license for possession and use of 0.185 TBq (5 curies) or more of radioactive material in research and development that do not authorize commercial distribution	$3600
4.	**Waste Processing**	
A.	Commercial waste treatment facilities, including incineration	$200,000
B.	All other commercial facilities involving waste compaction, repackaging, storage or transfer	$25,000
C.	Waste processing – all other, including decontamination service	$5,000
5.	**Well Logging**	
A.	License for well logging using sealed sources or sub-surface tracer studies	$4,000
B.	License for well logging using sealed sources and sub-surface tracer studies	$5,000
6.	**Nuclear Laundry**	
A.	License for commercial collection and laundry of items contaminated with radioactive material	$16,000
7.	**Medical/Veterinary**	
A.	License for human use of byproduct, source, special nuclear or NARM material in sealed sources contained in teletherapy or stereotactic radiosurgery devices, including mobile therapy	$12,000
B.	License of broad scope for human use of byproduct, source, special nuclear or NARM materials used in medical diagnosis, treatment, research and	$20,000

	development, excluding teletherapy, or stereotactic radiosurgery devices	
C.	License for mobile nuclear medicine	$2,500
D.	Medical – all others, including SNM pacemakers and high dose rate remote afterloading devices	$5,000
E.	License for veterinary use of radioactive materials	$2,000
8.	**Academic**	
A.	License for possession and use of byproduct, naturally-occurring or accelerator produced radioactive material for educational use or academic research and development that does not authorize commercial distribution, excluding broad scope or human use licenses, with a combined possession limit of 12 isotopes and 37 GBq (1 curie) total activity	$1,000
9.	**Accelerator**	
A.	License for accelerator production of radioisotopes with commercial distribution	$4,000
B.	Accelerator isotope production - all other [Fee waived if facility holds medical broad scope license with no commercial distribution]	$2,000
10.	**Reciprocity**	
A.	Reciprocal recognition of an out-of-state specific license	50% of annual fee of applicable category
11.	**Amendments**	
A.	Request to amend specific license-no license review	$0
Note: Examples include spelling corrections and adding or removing previously authorized users.		
B.	Request to amend specific license - license review required	$200
Note: Examples include new isotopes, license termination not requiring a site visit and procedural changes.		
C.	Request to amend specific license - license review and site visit required	$400

Note: Examples include a facility move, license termination requiring a site visit and new processes.		
12.	**Multiple Sites**	
A.	Each noncontiguous location listed on a license above two where licensed material is used or stored. Temporary job sites and broad scope licensees are exempt from this fee category.	25% of annual fee of applicable category authorized at the site

SECTION 20. DHS 157.11(1) (a) 1. b. and c. are amended to read:

DHS 157.11(1) (a) 1. b. No more than a total of 7 kg (15.4 lbs) of uranium and thorium at any one time. A person authorized to possess, use, and transfer source material under this paragraph may not receive more than a total of 70 kg (154 ~~lb~~ lbs) of uranium and thorium in any one calendar year. A person may not alter the chemical or physical form of the source material possessed under this subsection unless it is accounted for under the limits of subd. 1. a.

DHS 157.11(1) (a) 1. c. No more than 7 kg (15.4 lbs) of uranium, removed during the treatment of drinking water, at any one time. A person may not remove more than 70 kg (154 ~~lb~~ lbs) of uranium from drinking water during a calendar year under this paragraph.

SECTION 21. DHS 157.11 (2) (b) 3. g. is amended to read:

DHS 157.11(2) (b) 3. g. Except as provided in subd. 3. h. and j., transfer or dispose of the device containing radioactive material only by transfer to a specific licensee of the department, the NRC, an agreement state or a licensing state whose specific license authorizes that person to receive the device and within 30 calendar days after transfer of a device to a specific licensee or export of the device shall furnish to the department a written report containing identification of the device by manufacturer's or initial ~~transferer's~~ transferor's name, model and serial number, the name, address and license number of the person receiving the device, and the date of the transfer.

SECTION 22. DHS 157.11 (2) (d) (Note) is amended to read:

DHS 157.11(2) (d) (Note) A person may own radioactive material without the material being in their immediate possession. This general license does not allow the person to manufacture, produce devices containing material, transfer, receive, ~~posses~~ possess or use the material. A specific license is required for these activities.

SECTION 23. DHS 157.11 (2) (h) 1. e. is amended to read:

DHS 157.11(2) (h) 1. e. Small radium sources, such as discrete survey instrument check sources, sources contained in radiation measuring instruments, sources used in educational demonstrations, electron tubes, lightning rods, ionization sources or static eliminators, containing no more than 37 kBq (1 microcurie) of ~~radium-226~~ radium-226.

SECTION 24. DHS 157.11 (2) (h) 3. d. is amended to read:

DHS 157.11(2)(h) 3. d. Respond to written requests from the department to provide information relating to the general license within 30 calendar days of the date of the request, or other time specified in the request.

If the general licensee cannot provide the requested information within the allotted time, it shall, within the same time period, request in writing a longer time period and provide written justification why it cannot comply.

SECTION 25. DHS 157.13 (4) (i) 4. is amended to read:

DHS 157.13 (4) (i) 4. The applicant commits to ~~satisfies~~ all of the following labeling requirements:

SECTION 26. DHS 157.13 (4) (i) 6. d. is amended to read:

DHS 157.13 (4) (i) 6. d. Measure the concentration of radionuclide contaminant in the first eluate after receipt of a molybdenum-99/technetium-99m or strontium-82/rubidium-82 generator, test the generator eluates for molybdenum-99 breakthrough or strontium-82 and strontium-85 contamination, respectively, according to s. DHS 157.63 (3), and retain a record of each measurement under s. DHS 157.71 (14). The licensee shall report the results of any test that exceeds the permissible concentration listed in s. DHS 157.63 (3) (a) at the time of generator elution, in accordance with s. DHS 157.72 (4).

SECTION 27. DHS 157.13 (4) (i) 7. is renumbered to DHS 157.13 (4) (i) 8.

SECTION 28. DHS 157.13 (4) (i) 7. is created to read:

DHS 157.13 (4) (i) 7. A licensee shall satisfy the labeling requirements in subd. 4.

SECTION 29. DHS 157.13 (5) is repealed and recreated to read:

DHS 157.13 (5) SPECIAL REQUIREMENTS FOR A SPECIFIC LICENSE FOR MEDICAL USE OF RADIOACTIVE MATERIAL.

(a) *License application.* The department shall approve an application for a specific license for medical use of radioactive material if all of the following conditions are satisfied:

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

2. The applicant submits procedures required by s. DHS 157.67, as applicable.

3. In addition to the requirements in this paragraph and par. (b), an application for a license or amendment for medical use of radioactive material as described in s. DHS 157.70 shall also include information regarding any radiation safety aspects of the medical use of the material that is not addressed in ss. DHS 157.59 to 157.62, identification of and commitment to follow the applicable radiation safety program requirements in ss. DHS 157.63 (1) to 157.67 (1) that are appropriate for the specific s. DHS 157.70 medical use, as well as any specific information on each of the following:

a. Radiation safety precautions and instructions.

b. Training and experience of proposed users.

c. Methodology for measurement of dosages or doses to be administered to patients or human research subjects.

d. Calibration, maintenance and repair of instruments and equipment necessary for radiation safety.

4. An applicant for a license for mobile services shall assure that release of individuals or human research subjects to whom radioactive drugs or implants containing radioactive material are administered will be released under s. DHS 157.62 (8).

5. The applicant or licensee shall provide any other information requested by the department in its review of the application.

(b) *License amendment.* An application for a license amendment shall meet all of the following requirements:

1. A licensee shall apply for and must receive a license amendment before the licensee does any of the following:

a. Receives or uses radioactive material for a type of use that is permitted under this subchapter, but that is not authorized on the licensee's current license issued under this subchapter.

b. Permits anyone to work as an authorized user, authorized nuclear pharmacist, ophthalmic physicist, or authorized medical physicist under the license, except an individual who is certified by a specialty board appropriate to the intended use of radioactive material and recognized by the NRC; or is named as an authorized user, authorized nuclear pharmacist, ophthalmic physicist, or authorized medical physicist on a department, NRC or other agreement state license, or on a permit issued by a licensee who is authorized by a Type A license of broad scope to permit the medical use of radioactive material.

c. Changes radiation safety officers, except as provided in s. DHS 157.61 (1) (c).

d. Permits anyone to work as an associate radiation safety officer, or before the radiation safety officer assigns duties and tasks to an associate radiation safety officer that differ from those for which the associate radiation safety officer is authorized on the license.

e. Receives radioactive material in excess of the amount or in a different form or receives a different radionuclide than is authorized on the license

f. Adds to or changes the areas identified in the application or on the license, except for areas where radioactive material is used only under ss. DHS 157.63 (1) and (2).

g. Changes the address of use identified on the application or on the license.

h. Revises procedures required by ss. DHS 157.67 (4) and (10) to (12), as applicable, where such revision reduces radiation safety.

i. Receives a sealed source from a different manufacturer or of a different model number than authorized by its license unless the sealed source is used for manual brachytherapy, is listed in the Sealed Source and Device Registry, and is in a quantity and for an isotope authorized by the license.

2. An application for a license amendment shall include procedures required by s. DHS 157.67, as applicable.

(c) *Notifications.* A licensee shall make all of the following notifications:

1. Provide to the department a copy of the board certification, the NRC or agreement state license, or other equivalent permit or license for each individual no later than 30 days after the date that the licensee permits the individual to work as an authorized user, an authorized nuclear pharmacist, an ophthalmic physicist, or an authorized medical physicist under par. (b) 1. b. For individuals permitted to work under par. (b) 1. b., within the same 30 day time frame, the licensee shall also provide, as appropriate, verification of completion of all the following:

a. Any additional case experience required in s. DHS 157.64 (4) (b) 2. g. for an authorized user under s. DHS 157.64 (1).

b. Training in device operation, safety procedures, and clinical use for the type of use for which authorization is sought. This training requirement may be satisfied by satisfactory completion of a training program provided by the vendor for new users or by receiving training supervised by an authorized user or authorized medical physicist, as appropriate, who is authorized for the type of use for which the individual is seeking authorization as an authorized user under s. DHS 157.67 (1).

c. Training for the type of use for which authorization is sought that includes hands-on device operation, safety procedures, clinical use, and the operation of a treatment planning system. This training requirement may be satisfied by satisfactorily successfully completing either a training program provided by the vendor or by training supervised by an authorized medical physicist authorized for the type of use for which the individual is seeking authorization as an authorized medical physicist.

2. Notify the department in writing no later than 30 days after any of the following occurs:

a. An authorized user, an authorized nuclear pharmacist, a radiation safety officer, an associate radiation safety officer, an authorized medical physicist, or an ophthalmic physicist permanently discontinues performance of duties under the license or has a name change.

b. The licensee's mailing address changes.

c. The licensee's name changes but the name change does not constitute a transfer of control of the license.

d. The licensee has added to or changed the areas where radioactive material is used under ss. DHS 157.63 (1) or (2) if the change does not include addition or relocation of either an area where PET radionuclides are produced or a PET radioactive drug delivery line from a PET radionuclide/PET radioactive drug production area.

e. The licensee permits an individual qualified to be a radiation safety officer under ss. DHS 157.61 (7) and (11) to function as a temporary radiation safety officer and to perform the functions of a radiation safety officer in accordance with s. DHS 157.61 (1) (c).

f. The licensee obtains a sealed source for use in manual brachytherapy from a different manufacturer or with a different model number than authorized by its license for which it did not require a license amendment as provided in par. (b) 1. i. The notification must include the manufacturer and model number of the sealed source, the isotope, and the quantity per sealed source.

(d) *Exemptions for Type A broad scope licensees.* A licensee possessing a Type A specific license of broad scope for medical use is exempt from all of the following requirements:

1. The provisions of par. (a) 3. regarding the need to file an amendment to the license for medical uses of radioactive material as described in s. DHS 157.70.

2. The provisions of par. (b) 1. b.

3. The provisions of par. (b) 1. f. regarding additions to or changes in the areas of use only at the addresses identified in the application or on the license.

4. The provisions of par. (c) 1.

5. The provisions of par. (c) 2. a. for an authorized user, an authorized nuclear pharmacist, an authorized medical physicist, or an ophthalmic physicist.

6. The provisions of s. DHS 157.61 (6) (a).

SECTION 30. DHS 157.13 (8) (d) is amended to read:

DHS 157.13 (8) (d) The applicant establishes and submits to the department the applicant's program for annual inspections, at intervals not to exceed 13 months, of the job performance of each well logging supervisor to ensure that the department's rules, license requirements, and the applicant's operating and emergency procedures are followed. The applicant's inspection records shall be retained for 3 years after each annual internal inspection.

SECTION 31. DHS 157.15 (3) (d) is amended to read:

DHS 157.15 (3) (d) A licensee's financial assurance arrangements may be reviewed ~~annually~~ by the department to recognize any increases or decreases resulting from inflation or deflation, changes in engineering plans, activities performed or any other condition affecting costs for decommissioning to ensure that sufficient funding is available to cover liability that remains until license termination.

SECTION 32. DHS 157.21(3) is amended to read:

DHS 157.21 (3) A licensee or registrant shall, at intervals not to exceed ~~12~~ 13 months, review the radiation protection program content and implementation.

SECTION 33. DHS 157.35 is amended to read:

DHS 157.35 Exemptions**.** Industrial uses of hand-held imaging intensification devices are exempt from the requirements of this subchapter if the dose rate 0.45 meters (18 inches) from the source of radiation to any individual does not exceed .02 ~~mSv~~ mGy (2.0 mR) per hour. Industrial x-ray tubes are exempt from the inventory, leak testing and materials labeling requirements of this subchapter. All other requirements apply.

SECTION 34. DHS 157.44 (6) (a) and (a) 3. are amended to read:

DHS 157.44 (6) (a) A licensee or registrant may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears on the trunk of his or her body a combination of direct reading dosimeter, an alarming ratemeter and a personnel

dosimeter ~~that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program processor~~. At permanent radiographic installations where other appropriate alarming or warning devices are in routine use or during radiographic operations using radiation machines, the use of an alarming ratemeter is not required. Dosimeters shall comply with all of the following conditions:

DHS 157.44 (6) (a) 3. ~~Personnel dosimeters shall be exchanged at periods not to exceed one month.~~ Film badges shall be replaced at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.

SECTION 35. DHS 157.44 (6) (a) 4. is repealed.

SECTION 36. DHS 157.44 (6) (d) and (f) are amended to read:

DHS 157.44 (6) (d) If an individual's pocket dosimeter is ~~determined~~ found to be off-scale, or if the electronic personal dosimeter reads greater than 2 millisieverts (200 mrem), and the possibility of radiation exposure cannot be ruled out as the cause, ~~the individual's film badge, TLD or similar approved device shall~~ the personnel dosimeter that requires processing shall be sent for processing and evaluation within 24 hours. If a personnel dosimeter does not require processing, evaluation of the dosimeter shall be started within 24 hours. In addition, the individual may not resume work associated with the use of sources of radiation until a determination of the individual's radiation ~~exposure~~ dose has been made. The determination shall be made by the radiation safety officer or the radiation safety officer's designee. The results of the determination shall be included in the records maintained under s. DHS 157.45 (11).

DHS 157.44 (6) (f) Dosimetry reports ~~received from the accredited National Voluntary Laboratory Accreditation Program personnel dosimeter processor~~ shall be retained as specified under s. DHS 157.45 (11).

SECTION 37. DHS 157.45 (11) (c) is amended to read:

DHS 157.45 (11) (c) Personnel dosimeter results ~~received from the accredited National Voluntary Laboratory Accreditation Program processor~~ until the department terminates the license or registration

SECTION 38. DHS 157.51 (1) (a) 2. is amended to read:

DHS 157.51 (1) (a) 2. If a decision is made to abandon the sealed source in the well, the licensee shall meet the requirements of s. DHS 157.56 (3) and any requirements of the department of natural resources under chs. NR 141, 500 to ~~555~~ 544, and 812.

SECTION 39. DHS 157.52 (4) (a) is amended to read:

DHS 157.52 (4) (a) A licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments at each field station and temporary job site to make physical radiation surveys as required by this subchapter and by s. DHS 157.25 (1). Instrumentation shall be capable of measuring one ~~uSv~~microsieverts (0.1 ~~milliroentgen~~millirem) per hour through at least 0.5 ~~mSv~~millisieverts (50 ~~milliroentgen~~millirem) per hour.

SECTION 40. DHS 157.53 (3) (a) is amended to read:

DHS 157.53 (3) (a) A licensee or registrant may not permit an individual to act as a well logging supervisor or ~~to assit~~ logging assistant ~~in the handling of sources of radiation~~ unless the individual wears ~~either a film badge or a thermoluminescent dosimeter or similar approved device~~a personnel dosimeter at all times during the handling of licensed radioactive materials. Each ~~film badge or TLD~~ personnel dosimeter shall be assigned to and worn by only one individual. Film badges shall be replaced at least monthly and ~~TLDs~~ all other personnel dosimeters that require replacement shall be replaced at least quarterly. ~~After replacement, each film badge or TLD shall be promptly processed.~~All personnel dosimeters shall be evaluated at least quarterly or promptly after replacement, whichever is more frequent.

SECTION 41. DHS 157.61 (1) (b) and (c) are amended to read:

DHS 157.61 (1) (b) A licensee's management shall appoint a radiation safety officer who agrees in writing to be responsible for implementing the radiation protection program. A licensee, through the radiation safety officer, shall ensure that radiation safety activities are being performed under licensee-approved procedures and regulatory requirements. A licensee's management may appoint, in writing, one or more associate radiation safety officers to support the radiation safety officer. The radiation safety officer, with written agreement of the licensee's management, must assign the specific duties and tasks to each associate radiation safety officer. These duties and tasks are restricted to the types of use for which the associate radiation safety officer is listed on a license. The radiation safety officer may delegate duties and tasks to the associate radiation safety officer but shall not delegate the authority or responsibilities for implementing the radiation protection program.

DHS 157.61 (1) (c) For up to 60 days each year, a licensee may permit an individual qualified to be a radiation safety officer to function as a temporary radiation safety officer and to perform the functions of a radiation safety officer, as provided in par. (f), provided the licensee takes the actions required in pars. (b), (d), (f), and (g) and notifies the department in accordance with s. DHS 157.13 (5) (c) 2. e. A licensee may simultaneously appoint more than one temporary radiation safety officer if needed to ensure that the licensee has a temporary radiation safety officer that satisfies the requirements to be a radiation safety officer for each of the different uses of radioactive material permitted by the license.

SECTION 42. DHS 157.61 (4) (a) 1. is amended to read:

DHS 157.61 (4) WRITTEN DIRECTIVES. (a) 1. A written directive must be dated and signed by an authorized user prior to administration of I-131 sodium iodide greater than 1.11 ~~Megabequerels~~ Megabecquerels (30 microcuries), any therapeutic dosage of unsealed radioactive material or any therapeutic dose of radiation from radioactive material.

SECTION 43. DHS 157.61 (4) (b) is repealed and recreated to read:

DHS 157.61 (4) (b) The written directive shall contain the patient or human research subject's name and all of the following information:

1. For the administration of a dosage of a radioactive drug, the name, dosage and administration route of the radioactive drug.

2. For each anatomically distinct treatment site exposed to gamma stereotactic radiosurgery, total dose, treatment site and number of target settings per treatment.

3. For teletherapy, the total dose, dose per fraction, number of fractions, treatment site and overall treatment period.

4. For high dose rate remote afterloading brachytherapy: the radionuclide, treatment site, dose per fraction, number of fractions and total dose.

5. For permanent implant brachytherapy:

a. Before implantation, the written directive shall include the treatment site, the radionuclide, and the total source strength.

b. After implantation but before the patient leaves the post-treatment recovery area, the written directive shall include the treatment site, the number of sources implanted, the total source strength implanted, and the date.

6. For all other brachytherapy including low dose rate, medium dose rate and pulsed dose rate afterloaders:

a. Before implantation, the written directive shall include the treatment site, radionuclide, and dose.

b. After implantation but before completion of the procedure, the written directive shall include the radionuclide, treatment site, number of sources, and total source strength and exposure time (or the total dose), and date.

SECTION 44. DHS 157.61 (5) (b) 3. and 4. are amended to read:

DHS 157.61 (5) (b) 3. Checking both manual and computer-generated dose calculations~~, if performed~~.

DHS 157.61 (5) (b) 4. Verifying that any computer-generated dose calculations are correctly transferred into the consoles of therapeutic ~~remote afterloader, teletherapy or gamma stereotactic radiosurgery units~~ medical units authorized by s. DHS 157.67 or 70.

SECTION 45. DHS 157.61 (5) (b) 5. and 6. are created to read:

DHS 157.61 (5) (b) 5. Determining if a medical event, under in s. DHS 157.72 (1), has occurred.

DHS 157.61 (5) (b) 6. Determining, for permanent implant brachytherapy, within 60 calendar days from the date the implant was performed, the total source strength administered outside of the treatment site compared to the total source strength documented in the post-implantation portion of the written directive, unless a written justification of patient unavailability is documented.

SECTION 46. DHS 157.61 (7) (intro.), (7) (a), and (7) (b) 2. are amended to read:

DHS 157.61 (7) (intro.) TRAINING FOR RADIATION SAFETY OFFICER AND ASSOCIATE RADIATION SAFETY OFFICER. Except as provided in sub. (10), a licensee shall ensure that an individual fulfilling the responsibilities of the radiation safety officer, or an individual assigned duties and tasks as an associate radiation safety officer as provided in s. DHS 157.61, is an individual who has training in radiation safety, regulatory issues and emergency procedures for the types of use for which a licensee seeks approval. This training requirement may be satisfied by completing training that is supervised by a radiation safety officer, an associate radiation safety officer, authorized medical physicist, authorized nuclear pharmacist or authorized user, as appropriate, who is authorized for the type of use for which the licensee is seeking

approval. A licensee shall also require the radiation safety officer or an associate radiation safety officer to be a person who ~~has obtained written attestation under sub. (12) (a) and~~ meets any of the following requirements:

DHS 157.61 (7) (a) Is certified by a specialty board whose certification process has been recognized by the department, the NRC or another agreement state. To have its certification process ~~be~~ recognized, a specialty board shall require all candidates for certification to have either of the following:

DHS 157.61 (7) (b) 2. One year of full-time radiation safety experience under the supervision of the individual identified as the radiation safety officer on a department, NRC or another agreement state license, or a permit issued by a NRC master material licensee that authorizes similar types of uses of radioactive material. An associate radiation safety officer may provide supervision for those areas for which the associate radiation safety officer is authorized on a department, NRC, or an agreement state license or permit issued by a NRC master material licensee. The full-time radiation safety experience must involve all of ~~involving all~~ the following:

SECTION 47. DHS 157.61 (7) (b) 3. is created to read:

DHS 157.61 (7) (b) 3. Has obtained written attestation under sub. (12) (a).

SECTION 48. DHS 157.61 (7) (c) 1., and 2., are amended to read:

DHS 157.61 (7) (c) 1. A medical physicist who has been certified by a specialty board whose certification process has been recognized by the department, NRC, or another agreement state under sub. (8) (a), and has experience in radiation safety aspects of similar types of use of radioactive material for which the licensee seeks the approval of the individual as the radiation safety officer or an associate radiation safety officer.

DHS 157.61 (7) (c) 2. An authorized user, authorized medical physicist, or authorized nuclear pharmacist identified on ~~the licensee's license~~ a department, NRC, or an agreement state license, or medical use permit issued by an NRC master material licensee, and has experience with the radiation safety aspects of similar types of use of radioactive material for which ~~the individual has radiation safety officer responsibilities~~ the licensee seeks the approval of the individual as the radiation safety officer or associate radiation safety officer.

SECTION 49. DHS 157.61 (7) (c) 3. is created to read:

DHS 157.61 (7) (c) 3. An individual who has experience with the radiation safety aspects of the types of use of radioactive material for which the individual is seeking simultaneous approval both as the radiation safety officer and the authorized user on the same new medical use license.

SECTION 50. DHS 157.61 (8) is repealed and recreated to read:

DHS 157.61 (8) TRAINING FOR AN AUTHORIZED MEDICAL PHYSICIST. Except as provided in sub. (10), a licensee shall require the authorized medical physicist to have training for the type of use for which authorization is sought that includes hands-on device operation, safety procedures, clinical use, and the operation of a treatment planning system. This training requirement may be satisfied by successfully completing either a training program provided by the vendor of the applicable system or device, or by training supervised by an authorized medical physicist authorized for the type of use for which the

individual is seeking authorization. A licensee shall also require the authorized medical physicist to be an individual who meets either of the following requirements:

(a) Is certified by a specialty board whose certification process has been recognized by the department, the NRC, or an agreement state. To have its certification process recognized, a specialty board shall require all candidates for certification to have all of the following:

1. A master's or doctor's degree in physics, medical physics, other physical science, engineering, or applied mathematics from an accredited college or university.

2. Attained two years full-time practical training or supervised experience in medical physics that meets either of the following requirements:

a. Completed under the supervision of a medical physicist who is certified in medical physics by a specialty board recognized under this section by the department, the NRC, or an agreement state.

b. Completed in clinical radiation facilities providing high-energy, external beam therapy (photons and electrons with energies greater than or equal to 1 million electron volts) and brachytherapy services under the direction of physicians who meet the requirements for authorized users in s. DHS 157.61 (10), 157.65 (8) or 157.67 (17).

3. Passed an examination, administered by diplomates of the specialty board, that assesses knowledge and competence in clinical radiation therapy, radiation safety, calibration, quality assurance, and treatment planning for external beam therapy, brachytherapy, and stereotactic radiosurgery.

Note: Specialty boards whose certification processes have been recognized by the department, the NRC or an agreement state will be posted on the NRC's web site at www.nrc.gov.

(b) 1. Holds a master's or doctorate degree in physics, medical physics, other physical science, engineering, or applied mathematics from an accredited college or university and completed one year of full-time training in medical physics and an additional year of full-time work experience under the supervision of an individual who meets the requirements for an authorized medical physicist for the type of use for which the individual is seeking authorization. This training and work experience shall be conducted in clinical radiation facilities that provide high energy, external beam therapy (photons and electrons with energies greater than or equal to 1 million electron volts) and brachytherapy services and shall include all of the following:

a. Performing sealed source leak tests and inventories.

b. Performing decay corrections.

c. Performing full calibration and periodic spot checks of external beam treatment units, stereotactic radiosurgery units, and remote afterloading units as applicable.

d. Conducting radiation surveys around external beam treatment units, stereotactic radiosurgery units, and remote afterloading units as applicable.

2. Has obtained written attestation under sub. (12) (b).

SECTION 51. DHS 157.61 (9) (intro.) is amended to read:

DHS 157.61 (9) (intro.) TRAINING FOR AN AUTHORIZED NUCLEAR PHARMACIST. Except as provided in sub. (10), the licensee shall require the authorized nuclear pharmacist to be a pharmacist who ~~has obtained written attestation under sub. (12) (c) and~~ meets either of the following requirements:

SECTION 52. DHS 157.61 (9) (a) and (9) (a) 1. are amended to read:

DHS 157.61 (9) (a) Is certified by a specialty board whose certification process has been recognized by the department, the NRC, or an agreement state. ~~and who has obtained written attestation, signed by a preceptor authorized nuclear pharmacist, that the individual has satisfactorily completed the requirements in sub. (12) (c) and has achieved a level of competency sufficient to independently operate a nuclear pharmacy.~~ To have its certification process ~~be~~ recognized, a specialty board shall require all candidates for certification to have all of the following:

DHS 157.61 (9) (a) 1. Graduated from a pharmacy program accredited by the ~~American council on pharmaceutical education~~ Accreditation Council for Pharmacy Education or have passed the foreign pharmacy graduate examination committee examination

SECTION 53. DHS 157.61 (9) (b) 3. is created to read:

DHS 157.61 (9) (b) 3. Has obtained written attestation under sub. (12) (c).

SECTION 54. DHS 157.61 (10) is repealed and recreated to read:

DHS 157.61 (10) TRAINING FOR EXPERIENCED RADIATION SAFETY OFFICER, TELETHERAPY OR MEDICAL PHYSICIST, AUTHORIZED USER, NUCLEAR PHARMACIST, AND AUTHORIZED NUCLEAR PHARMACIST.

(a) 1. An individual identified as a radiation safety officer, a teletherapy or medical physicist, an authorized medical physicist, a nuclear pharmacist, or an authorized nuclear pharmacist on a department, NRC or another agreement state license, or permit issued by a NRC or agreement state broad scope licensee or master material license permit or by a master material license permittee of broad scope on or before January 14, 2019, is exempt from the training requirements of subs. (7) to (9), respectively, except the radiation safety officers and authorized medical physicists identified in this paragraph must meet the training requirements of subs. (7) or (8), as appropriate, for any material uses for which they were not authorized prior to this date.

2. Any individual certified by the American Board of Health Physics in Comprehensive Health Physics; American Board of Radiology; American Board of Nuclear Medicine; American Board of Science in Nuclear Medicine; Board of Pharmaceutical Specialties in Nuclear Pharmacy; American Board of Medical Physics in radiation oncology physics; Royal College of Physicians and Surgeons of Canada in nuclear medicine; American Osteopathic Board of Radiology; or American Osteopathic Board of Nuclear Medicine on or before October 24, 2005, is exempt from the training requirements of subs. (7) to be identified as a radiation safety officer or as an associate radiation safety officer on a department, NRC, or an agreement state license or NRC master material license permit for those materials and uses that these individuals performed on or before October 24, 2005.

3. Any individual certified by the American Board of Radiology in therapeutic radiological physics, Roentgen ray and gamma ray physics, x-ray and radium physics, or radiological physics, or certified by the American Board of Medical Physics in radiation oncology physics, on or before October 24, 2005, is exempt from the training requirements for an authorized medical physicist described in subs. (8), for those materials and uses that these individuals performed on or before October 24, 2005.

4. A radiation safety officer, a medical physicist, or a nuclear pharmacist, who used only accelerator-produced radioactive materials, discrete sources of radium-226, or both, for medical uses or in the practice of nuclear pharmacy at a government agency or federally recognized Indian Tribe before November 30, 2007, or at all other locations of use before August 8, 2009, or an earlier date as noticed by the department, is exempt from the training requirements of subs. (7) to (9), respectively, when performing the same uses. A nuclear pharmacist, who prepared only radioactive drugs containing accelerator-produced radioactive materials, or a medical physicist, who used only accelerator-produced radioactive materials, at the locations and during the time period identified in this paragraph, qualifies as an authorized nuclear pharmacist or an authorized medical physicist, respectively, for those materials and uses performed before these dates, for the purposes of this chapter.

(b) An individual identified as a radiation safety officer, an authorized medical physicist, or an authorized nuclear pharmacist on a department, NRC or another agreement state license, the permit issued by a licensee of broad scope or the permit issued by NRC master material licensee between October 24, 2002 and April 29, 2005 is exempt from the training requirements of s. DHS 157.61 (7), (8) or (9).

(c) 1. Physicians, dentists, or podiatrists who are identified as authorized users for the medical use of radioactive material on a license issued by the department, the NRC, an agreement state, a permit issued by a NRC master material licensee, a permit issued by a NRC or an agreement state broad scope licensee, or a permit issued by a NRC master material license broad scope permittee on or before January 14, 2019, who perform only those medical uses for which they were authorized on or before that date is exempt from the training requirements of ss. DHS 157.63 to 157.67.

2. Physicians, dentists, or podiatrists not identified as authorized users for the medical use of radioactive material on a license issued by the department, the NRC, an agreement state, a permit issued by a NRC master material licensee, a permit issued by a NRC or an agreement a state broad scope licensee, or a permit issued in accordance with a NRC master material broad scope license on or before October 24, 2005, is exempt from the training requirements of ss. DHS 157.63 to 157.67 for any of the following materials and uses that these individuals performed on or before October 24, 2005:

a. For uses authorized under ss. DHS 157.63 (1) or DHS 157.63 (2), or oral administration of sodium iodide I–131 requiring a written directive for imaging and localization purposes, a physician who was certified on or before October 24, 2005, by the American Board of Nuclear Medicine in nuclear medicine, the American Board of Radiology in diagnostic radiology, the American Osteopathic Board of Radiology in diagnostic radiology or radiology the Royal College of Physicians and Surgeons of Canada in nuclear medicine, or American Osteopathic Board of Nuclear Medicine in nuclear medicine.

b. For uses authorized under s. DHS 157.64 (1), a physician who was certified on or before October 24, 2005, by the American Board of Nuclear Medicine, the American Board of Radiology in radiology, therapeutic radiology, or radiation oncology, the Royal College of Physicians and Surgeons of Canada in nuclear medicine, or the American Osteopathic Board of Radiology after 1984.

c. For uses authorized under ss. DHS 157.65 (1) or DHS 157.67 (1), a physician who was certified on or before October 24, 2005, by the American Board of Radiology in radiology, therapeutic radiology or radiation oncology, the American Osteopathic Board of Radiology in radiation oncology, or the Canadian Royal College of Physicians and Surgeons in therapeutic radiology, or as a British "Fellow of the Faculty of Radiology" or "Fellow of the Royal College of Radiology" in radiology, with specialization in radiotherapy.

d. For uses authorized under s. DHS 157.66 (1), a physician who was certified on or before October 24, 2005, by the American Board of Radiology, in radiology, diagnostic radiology, therapeutic radiology, or radiation oncology, the American Board of Nuclear Medicine in nuclear medicine, the American Osteopathic Board of Radiology in diagnostic radiology or radiology, or the Royal College of Physicians and Surgeons of Canada in nuclear medicine.

3. Physicians, dentists, or podiatrists who used only accelerator-produced radioactive materials, discrete sources of radium-226, or both, for medical uses performed at a government agency or federally recognized Indian Tribe before November 30, 2007, or at all other locations of use before August 8, 2009, or an earlier date as noticed by the department, is exempt from the training requirements of ss. DHS 157.63 to 157.67 when performing the same medical uses. A physician, dentist, or podiatrist, who used only accelerator-produced radioactive materials, discrete sources of radium-226, or both, for medical uses at the locations and time period identified in this paragraph, qualifies as an authorized user for those materials and uses performed before these dates, for the purposes of this chapter.

(d) Individuals who are not required to comply with the training requirements as described in this section may serve as preceptors for, and supervisors of, applicants seeking authorization on department licenses for the same uses for which these individuals are authorized.

SECTION 55. DHS 157.61 (12) (a) to (c) are amended to read:

DHS 157.61 (12) (a) *Radiation safety officer or associate radiation safety officer*. As required by sub. (7) (b) 3., the ~~The~~ licensee shall ensure that an individual fulfilling the responsibilities of the radiation safety officer or associate radiation safety officer has obtained written attestation, signed by a preceptor radiation safety officer or associate radiation safety officer who has experience with the radiation safety aspects of similar types of use of byproduct material for which the individual is seeking approval as a radiation safety officer or an associate radiation safety officer. ~~,~~ The written attestation must state that the individual has ~~satisfactorily~~successfully completed the requirements in sub. (7) (b) ~~(a) 1. a. and b., 2. a. and b., (b), or (c)~~, has training in the radiation safety, regulatory issues, and emergency procedures for the types of use for which a licensee seeks approval and ~~has achieved a level of radiation safety knowledge sufficient to independently function as a radiation safety officer for a medical use of radioactive material~~ is able to independently fulfill the radiation safety-related duties as a radiation safety officer or as an associate radiation safety officer for a medical use license.

DHS 157.61 (12) (b) *Authorized medical physicist.* As required by sub. (8) (b) 2., the ~~A~~ licensee shall ensure that the individual has obtained written attestation that the individual has ~~satisfactorily~~successfully completed the requirements in sub. (8) (b) 1. ~~(a) 1. a. and b. or (b)~~, has training for the type of use for which authorization is sought that includes hands-on device operation, safety procedures, clinical use, and the operation of a treatment planning system, and is able to independently fulfill the radiation safety-related duties ~~has achieved a level of competency sufficient to function independently~~ as an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical

physicist status. The written attestation shall be signed by a preceptor authorized medical physicist who meets the requirements in sub. (8) or (10), or equivalent NRC or agreement state requirements, for an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status.

DHS 157.61 (12) (c) *Authorized nuclear pharmacist.* As required by sub. (9) (b) 3., the ~~A~~ licensee shall ensure that the individual has obtained written attestation, signed by a preceptor authorized nuclear pharmacist, that the individual has ~~satisfactorily~~successfully completed the requirements in sub. (9) ~~(a) or~~ (b) and is able to independently fulfill the radiation safety-related duties ~~has achieved a level of competency sufficient to function independently~~ as an authorized nuclear pharmacist.

SECTION 56. DHS 157.62 (2) (b) 3. (Note) is amended to read:

DHS 157.62 (2) (b) 3. (Note) Two separated readings on each scale or decade are typically used ~~used~~ for linear scale instruments.

SECTION 57. DHS 157.62 (4) is repealed and recreated to read:

DHS 157.62 (4) AUTHORIZATION FOR CALIBRATION, TRANSMISSION AND REFERENCE SOURCES. (a) Any person authorized by s. DHS 157.13 (5) for medical use of radioactive material may receive, possess and use any of the following radioactive material for check, calibration, transmission and reference use:

1. A sealed source that does not exceed 1.11 GBq (30 mCi) that is manufactured and distributed by a person licensed under s. DHS 157.13 (4) (j) or equivalent NRC or agreement state regulations or redistributed by a person authorized to redistribute sealed sources, provided that the redistributed sealed sources are in the original packaging and shielding and are accompanied by the manufacturer's approved instructions.

2. Any radioactive material with a half-life not longer than 120 days in individual amounts not to exceed 0.555 GBq (15 mCi).

3. Any radioactive material with a half-life longer than 120 days in individual amounts not to exceed the smaller of 7.4 MBq (200 microcuries) or 1000 times the quantities in ch. DHS 157 Appendix F.

4. Technetium-99m in amounts as needed.

5. Flourine-18 in amounts as needed.

(b) Radioactive material in sealed sources authorized by this subsection shall not be used in either of the following:

1. For medical use as defined in s. DHS 157.03 (211), except in accordance with the requirements in s. DHS 157.66 (1).

2. Bundled or aggregated to create activity greater than the maximum activity of any single sealed source authorization under this section.

(c) A licensee using calibration, transmission, and reference sources in accordance with the requirements in this subsection need not list these sources on a specific medical use license.

SECTION 58. DHS 157.62 (5) (b) 3. is created to read:

DHS 157.62 (5) (b) 3. Test the source for leakage at any time there is reason to suspect that the sealed source might have been damaged or might be leaking.

SECTION 59. DHS 157.63 (3) (b) 1. is repealed and recreated to read:

DHS 157.63 (3) (b) 1. If using a molybdenum-99/technetium-99m generator for preparing a technetium-99m radiopharmaceutical, measure the molybdenum-99 concentration in each eluate from a generator to demonstrate compliance with par. (a).

SECTION 60. DHS 157.63 (3) (b) 3. is created to read:

DHS 157.63 (3) (b) 3. If using a strontium-82/rubidium-82 generator for preparing a rubidium-82 radiopharmaceutical shall, before the first patient use of the day, measure the concentration of radionuclides strontium-82 and strontium-85 to demonstrate compliance with par. (a).

SECTION 61. DHS 157.63 (3) (d) is created to read:

DHS 157.63 (3) (d) The licensee shall report any measurement that exceeds the limits in par. (a) at the time of generator elution, in accordance with s. DHS 157.72 (4).

SECTION 62. DHS 157.63 (4) (intro.), (a), (b), and (c) 2. are amended to read:

DHS 157.63 (4) (intro.) TRAINING FOR UPTAKE, DILUTION AND EXCRETION STUDIES. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user of unsealed radioactive material for the uses authorized under sub. (1) ~~to have obtained written attestation under sub. (6) (a) and~~ to be a physician who meets any of the following requirements:

DHS 157.63 (4) (a) Is certified by a medical specialty board whose certification process has been recognized by the department, the NRC, or an agreement state. To have its certification process ~~be~~ recognized, a specialty board shall require all candidates for certification to do all of the following:

DHS 157.63 (4) (b) Is an authorized user under sub. (5), s. DHS 157.64 (4), or equivalent NRC or agreement state requirements.

DHS 157.63 (4) (c) 2. Work experience, under the supervision of an authorized user who meets the requirements in this subsection, sub. (4) or (5), s. DHS 157.61 (10) or 157.64 (4), or equivalent NRC or agreement state requirements, involving all the following:

SECTION 63. DHS 157.63 (4) (c) 3. is created to read:

DHS 157.63 (4) (c) 3. A written attestation under sub. (6) (a).

SECTION 64. DHS 157.63 (5) (intro.), (a) (intro.) and (b) are amended to read:

DHS 157.63 (5) (intro.) TRAINING FOR IMAGING AND LOCALIZATION STUDIES. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user of unsealed radioactive material for the uses authorized under sub. (2) ~~to have obtained written attestation under sub. (6) (b) and~~ to be a physician who meets any of the following requirements:

DHS 157.63 (5) (a) (intro.) Is certified by a medical special board whose certification process has been recognized by the department, the NRC, or an agreement state. To have its certification process ~~be~~ recognized, a specialty board shall require all candidates for certification to do both of the following:

DHS 157.63 (5) (b) Is an authorized user under s. DHS 157.64 (4) and meets the requirements in par. (c) 2. g., or equivalent NRC or agreement state requirements.

SECTION 65. DHS 157.63 (5) (c) 2. is amended to read:

DHS 157.63 (5) (c) 2. Work experience, under the supervision of an authorized user, who meets the requirements in this subsection, s. DHS 157.61 (10), or subd. 2. g. and s. DHS 157.64 (4), or equivalent NRC or agreement state requirements~~, involving all the~~. An authorized nuclear pharmacist who meets the requirements in s. DHS 157.61(9) or (10) may provide the supervised work experience under subd. 2. g.. Work experience must include all of the following:

SECTION 66. DHS 157.63 (5) (c) 3. is created to read:

DHS 157.63 (5) (c) 3. A written attestation under sub. (6) (b).

SECTION 67. DHS 157.63 (6) is repealed and recreated to read:

DHS 157.63 (6) WRITTEN ATTESTATION. (a) *Unsealed radioactive material for uptake, dilution, and excretion studies for which a written directive is not required.* As required by sub. (4) (c) 3., the licensee shall require an authorized user of unsealed radioactive material for the uses authorized under sub. (1) to have obtained written attestation that the individual has successfully completed the requirements of sub. (4) (c) and is able to independently fulfill the radiation safety-related duties as an authorized user for the medical uses authorized under sub. (1). The attestation must be obtained from either of the following:

1. A preceptor authorized user who meets the requirements of sub. (4) or (5), s. DHS 157.61 (10), s. DHS 157.64 (4), or equivalent NRC or agreement state requirements.

2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements sub. (4) or (5), s. DHS 157.61 (10), s. DHS 157.64 (4), or equivalent NRC or agreement state requirements, and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (4) (c).

(b) *Unsealed radioactive material for imaging and localization studies for which a written directive is not required.* As required by sub. (5) (c) 3., the licensee shall require an authorized user of unsealed radioactive material for uses under sub. (2) to have written attestation that the individual has successfully completed the requirements in sub. (5) (c) and is able to independently fulfill the radiation safety-related duties as an authorized user for the medical uses authorized under subs. (1) and (2). The attestation must be obtained from either of the following:

1. A preceptor authorized user who meets the requirements in sub. (5), s. DHS 157.61 (10), ss. DHS 157.64 (4) and 157.63 (5) (c) 2. g., or equivalent NRC or agreement state requirements.

2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements sub. (5), s. DHS 157.61 (10), ss. DHS 157.64 (4) and 157.63 (5) (c) 2. g., or equivalent NRC or agreement state requirements, and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (5) (c).

SECTION 68. DHS 157.64 (1) is amended to read:

DHS 157.64 (1) USE OF UNSEALED RADIOACTIVE MATERIAL FOR WHICH A WRITTEN DIRECTIVE IS REQUIRED. A licensee may use any unsealed radioactive material identified in s. DHS 157.64 (4) (b) 2. g., prepared for medical use, and for which a written directive is required that is any of the following:

SECTION 69. DHS 157.64 (4) (intro.), (b) 1. and 2., and (b) 2. g. are amended to read:

DHS 157.64 (4) (intro.) TRAINING FOR USE OF UNSEALED RADIOACTIVE MATERIAL FOR WHICH A WRITTEN DIRECTIVE IS REQUIRED. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user of unsealed radioactive material for the uses authorized under sub. (1) ~~to have obtained written attestation under sub. (8) (a) and~~ to be a physician who meets either of the following requirements:

DHS 157.64 (4) (b) 1. Successfully complete residency training in a radiation therapy or nuclear medicine training program or a program in a related medical specialty. These residency training programs shall include 700 hours of training and experience as described in par. (b) 1. and (b) 2. a., b., c., d., and e. Eligible training programs shall be approved by the ~~residency review committee of the accreditation council for graduate medical education, the royal college of physicians and surgeons of Canada, or the committee on post-graduate training of the American osteopathic association~~ Residency Review Committee of the Accreditation Council for Graduate Medical Education, the Royal College of Physicians and Surgeons of Canada, or the Council on Postdoctoral Training of the American Osteopathic Association.

DHS 157.64 (4) (b) 2. Work experience under the supervision of an authorized user who meets the requirements in this subsection, s. DHS 157.61 (10), or equivalent NRC or agreement state requirements. A supervising authorized user who meets the requirements of this paragraph shall also have experience under subd. 2. g. in administering dosages in the same dosage category or categories as the individual requesting authorized user status. The work experience shall involve all of the following:

DHS 157.64 (4) (b) 2. g. Administering dosages of radioactive drugs to patients or human research subjects involving a minimum of 3 cases in each of the following categories for which the individual is requesting authorized user status: oral administration of less than or equal to 1.22 GBq (33 millicurie) of sodium iodide I-131 for which a written directive is required; oral administration of greater than 1.22 GBq (33 millicuries) of sodium iodide I-131; ~~parenteral administration of any beta emitter or a photon emitting radionuclide with a photon energy less than 150 keV, for which a written directive is required; and/or parenteral administration of any other radionuclide for which a written directive is required~~ and parenteral

administration of any radioactive drug that contains a radionuclide that is primarily used for its electron emission, beta radiation characteristics, alpha radiation characteristics, or photon energy of less than 150 keV, for which a written directive is required. Experience with at least 3 cases of oral administration of greater than 1.22 GBq (33 millicuries) of I-131 also satisfies the requirement for experience with 3 cases of oral administration of less than or equal to 1.22 GBq (33 millicuries) of I-131.

SECTION 70. DHS 157.64 (4) (b) 3. is created to read:

DHS 157.64 (4) (b) 3. A written attestation under sub. (8) (a).

SECTION 71. DHS 157.64 (5) (intro.) and (b) are amended to read:

DHS 157.64 (5) (intro.) TRAINING FOR THE ORAL ADMINISTRATION OF SODIUM IODIDE I-131 REQUIRING A WRITTEN DIRECTIVE IN QUANTITIES LESS THAN OR EQUAL TO 1.22 GIGABECQUERELS (33 MILLICURIES). Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user for the oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 1.22 Gigabecquerels (33 millicuries), ~~to have obtained written attestation under sub. (8) (b) and~~ to be a physician who meets any of the following requirements:

DHS 157.64 (5) (b) Is an authorized user under sub. (4) (a) or (b) for specified uses of I-131 listed in subs. (4) (b) 2. g. and (6), or equivalent NRC or agreement state requirements.

SECTION 72. DHS 157.64 (5) (c) (intro.) and (c) 2. are amended to read:

DHS 157.64 (5) (c) (intro.) Has successfully completed training and work experience, applicable to the medical use of sodium iodide I-131 for procedures requiring a written directive that includes ~~both~~ all of the following:

DHS 157.64 (5) (c) 2. Work experience, under the supervision of an authorized user who meets the requirements in sub. (4) (a) or (b), (5) or (6), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements. A supervising authorized user who meets the requirements in sub. (4) (b) or s. DHS 157.61 (10), shall also have experience in administering the same category of sodium iodide I-131 use as specified in sub. (4) (b) 2. g. The work experience shall involve all of the following:

SECTION 73. DHS 157.64 (5) (c) 3. is created to read:

DHS 157.64 (5) (c) 3. A written attestation under sub. (8) (b).

SECTION 74. DHS 157.64 (6) (intro.), (b), and (c) (intro.) and (c) 2. are amended to read:

DHS 157.64 (6) (intro.) TRAINING FOR THE ORAL ADMINISTRATION OF SODIUM IODIDE I-131 REQUIRING A WRITTEN DIRECTIVE IN QUANTITIES GREATER THAN 1.22 GIGABECQUERELS (33 MILLICURIES). Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user for the oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 1.22 Gigabecquerels (33 millicuries) ~~to have obtained written attestation under sub. (8) (c) and~~ to be a physician who meets any of the following requirements:

DHS 157.64 (6) (b) Is an authorized user under sub. (4) (a) or (b) for use of I-131 greater than 1.22 Gigabecquerel (33 millicuries) under sub. (4) (b) 2. g., or equivalent NRC or agreement state requirements.

DHS 157.64 (6) (c) (intro.) Has successfully completed training and experience, applicable to the medical use of sodium iodide I-131 for procedures requiring a written directive that includes ~~both~~ all of the following:

DHS 157.64 (6) (c) 2. Work experience, under the supervision of an authorized user who meets the requirements in sub. (4) (a) or (b), this subsection, s. DHS 157.61 (10), or equivalent NRC or agreement state requirements. A supervising authorized user, who meets the requirements in sub. (4) (b), or s. DHS 157.61 (10), shall also have experience in administering dosages of I-131 greater than 1.22 Gigabecquerels (33 millicuries) as specified in sub. (4) (b) 2. g. The work experience shall involve all the following

SECTION 75. DHS 157.64 (6) (c) 3. is created to read:

DHS 157.64 (6) (c) 3. A written attestation under sub. (8) (c).

SECTION 76. DHS 157.64 (7) (intro.), (a) to (c), (c) 1. and 2., and (c) 2. f. are amended to read:

DHS 157.64 (7) (intro.) TRAINING FOR THE PARENTERAL ADMINISTRATION OF UNSEALED RADIOACTIVE MATERIAL REQUIRING A WRITTEN DIRECTIVE. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user for the parenteral administration requiring a written directive ~~to have obtained written attestation under sub. (8) (d) and~~ to be a physician who meets any of the following requirements:

DHS 157.64 (7) (a) Is an authorized user under sub. (4) for the specific parenteral uses listed in sub. (4) (b) 2. g., or equivalent NRC or agreement state requirements.

DHS 157.64 (7) (b) Is an authorized user under s. DHS 157.65 (8) or 157.67 (17), or equivalent NRC or agreement state requirements and who meets the requirements in par. (c) 1. and 2.

DHS 157.64 (7) (c) Is certified by a medical specialty board whose certification process has been recognized by the department under s. DHS 157.65 (8) or 157.67 (17) or equivalent NRC or agreement state requirements; and who meets the following requirements:

DHS 157.64 (7) (c) 1. Has successfully completed 80 hours of classroom and laboratory training, applicable to parenteral administrations~~, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV, and/or parenteral administration of any other radionuclide for,~~ of any radioactive drug that contains a radionuclide that is primarily used for its electron emission, beta radiation characteristics, alpha radiation characteristics, or photon energy of less than 150 keV for which a written directive is required. The training shall include all of the following:

DHS 157.64 (7) (c) 2. Has work experience with any ~~beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV, and/or parenteral administration of any other radionuclide~~ radioactive drug that contains a radionuclide that is primarily used for its electron emission, beta radiation characteristics, alpha radiation characteristics, or photon energy of less than 150 keV for which a written directive is required. This work experience shall be under the supervision of an authorized user with experience in parenteral administration under sub. (4) (b) 2. g., for which a written directive is required, and who meets the requirements in sub. (4), s. DHS 157.61 (10), this subsection, or equivalent NRC or

agreement state requirements. The supervising authorized user who meets the requirements in sub. (4), s., this subsection, or equivalent NRC or agreement state requirements, must have experience in administering dosages in the same category or categories as the individual requesting authorized user status. The work experience shall involve all the following:

DHS 157.64 (7) (c) 2. f. Administering dosages to patients or human research subjects, that include at least 3 cases involving the ~~parenteral administration, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV and/or at least 3 cases involving the parenteral administration of any other radionuclide, for which a written directive is required~~ parenteral administration of any radioactive drug that contains a radionuclide that is primarily used for its electron emission, beta radiation characteristics, alpha radiation characteristics, or photon energy of less than 150 keV, for which a written directive is required.

SECTION 77. DHS 157.64 (7) (c) 3. is created to read:

DHS 157.64 (7) (c) 3. Has obtained written attestation under sub. (8) (d).

SECTION 78. DHS 157.64 (8) is repealed and recreated to read:

DHS 157.64 (8) WRITTEN ATTESTATION.

(a) *Unsealed radioactive material for which a written directive is required.* As required by sub. (4) (b) 3., the licensee shall require an authorized user of unsealed radioactive material for the uses authorized under sub. (1) to have obtained written attestation that the individual has successfully completed the requirements in in sub. (4) (b) and is able to independently fulfill the radiation safety-related duties as an authorized user for the medical uses authorized under sub. (1) for which the individual is requesting authorized user status. The attestation must be obtained from either of the following:

1. A preceptor authorized user who meets the requirements in sub. (4), s. DHS 157.61(10), or equivalent NRC or agreement state requirements and has experience in administering dosages in the same dosage category or categories as the individual requesting authorized user status.

2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements in sub. (4), s. DHS 157.61(10),or equivalent NRC or agreement state requirements, has experience in administering dosages in the same dosage category or categories as the individual requesting authorized user status, and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (4) (b).

(b) *Oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 1.22 Gigabecquerels (33 millicuries).* As required by sub. (5) (c) 3., the licensee shall require an authorized user of sodium iodide I-131 for oral administration to have obtained written attestation that the individual has successfully completed the requirements in sub. (5) (c), and is able to independently fulfill the radiation safety-related duties as an authorized user for oral administration of less than or equal to 1.22

Gigabecquerels (33 millicuries) of sodium iodide I-131 for medical uses authorized under sub. (1). The attestation must be obtained from either of the following:

1. A preceptor authorized user who meets the requirements in sub. (4), (5) or (6), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements and has experience in administering sodium iodide I-131 dosages as specified in sub. (4) (b) 2. g.

2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements in sub. (4), (5) or (6), s. DHS 157.61 (10). or equivalent NRC or agreement state requirements, has experience in administering sodium iodide I-131 dosages as specified in sub. (4) (b) 2. g., and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (5)(c).

(c) *Oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 1.22 Gigabecquerels (33 millicuries).* As required by sub. (6) (c) 3., a licensee shall require an authorized user of sodium iodide I-131 requiring a written directive in quantities greater than 1.22 Gigabecquerels (33 millicuries) to have obtained written attestation that the individual has successfully completed the requirements in sub. (6) (c), and is able to independently fulfill the radiation safety-related duties as an authorized user for oral administration of greater than 1.22 Gigabecquerels (33 millicuries) of sodium iodide I-131 under sub. (1). The attestation must be obtained from either of the following:

1. A preceptor authorized user who meets the requirements in sub. (4) or (6), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements and has experience in administering dosages of I-131 greater than 1.22 Gigabecquerels (33 millicuries) as specified in sub. (4) (b) 2. g.

2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements in sub. (4) or (6), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements, has experience in administering dosages of I-131 greater than 1.22 Gigabecquerels (33 millicuries) as specified in sub. (4) (b) 2. g. and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (6) (c).

(d) *Parenteral administration of unsealed radioactive material requiring a written directive.* As required by sub. (7) (c) 3., the licensee shall require a user for the parenteral administration of unsealed radioactive material requiring a written directive to have obtained written attestation that the individual has successfully completed the requirements in sub. (7) (c), and is able to independently fulfill the radiation safety-related duties as an authorized user for the parenteral administration of unsealed radioactive material requiring a written directive as specified in sub (4) (b) 2. g. The attestation must be obtained from either of the following:

1. A preceptor authorized user who meets the requirements in sub. (4) or (7), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements. A preceptor authorized user who meets the requirements in sub. (4) or (7), or equivalent NRC or agreement state requirements, must have experience in administering dosages in the same category or categories as the individual requesting authorized user status.

2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements in sub. (4) or (7), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements, has experience in administering parenteral dosages as specified in sub. (4) (b) 2. g., and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (7) (c).

SECTION 79. DHS 157.65 (1) (a) and (b) are amended to read:

DHS 157.65 (1) (a) As approved in the sealed source and device registry for manual brachytherapy medical use. The manual brachytherapy sources may be used for manual brachytherapy uses that are not explicitly listed in the Sealed Source and Device Registry, but must be used in accordance with the radiation safety conditions and limitations described in the SSDR.

DHS 157.65 (1) (b) In research ~~under an effective investigational device exemption application accepted by the FDA~~ to deliver therapeutic doses for medical use in accordance with an active investigational device exemption application accepted by the FDA, provided the requirements of s. DHS 157.61 (6) (a) are met.

SECTION 80. DHS 157.65 (6) is repealed and recreated to read:

DHS 157.65 (6) CALIBRATION MEASUREMENTS OF BRACHYTHERAPY SOURCES.

(a) Prior to the first medical use of brachytherapy sources, a licensee shall either comply with par. (b) or do all of the following:

1. Determine the source output or activity using a dosimetry system that meets the requirements of s. DHS 157.67 (6).

2. Determine source positioning accuracy within applicators.

3. Use published protocols accepted by nationally recognized bodies to meet the requirements of subds. 1. and 2.

(b) Instead of a licensee making its own measurements as required in par. (a), the licensee may use measurements provided by the source manufacturer or by a calibration laboratory accredited by the American Association of Physicists in Medicine that are made in accordance with par. (a).

(c) A licensee shall mathematically correct the outputs or activities determined in par. (a) for physical decay at intervals consistent with one percent physical decay.

(d) A license shall retain a record of each calibration under s. DHS 157.71(18).

SECTION 81. DHS 157.65 (6m) is created read:

DHS 157.65 (6m) STRONTIUM-90 SOURCES FOR OPHTHALMIC TREATMENTS.

(a) Licensees who use strontium-90 for ophthalmic treatments must ensure that certain activities as specified in par. (b) of this section are performed by either of the following:

1. An authorized medical physicist.

2. An individual who meets all of the following:

a. Is identified as an ophthalmic physicist on a specific medical use license issued by the department, the NRC or an agreement state, or permit issued by the NRC or an agreement state broad scope medical use licensee, medical use permit issued by an NRC master material licensee, or permit issued by an NRC master material licensee broad scope medical use permittee.

b. Holds a master's or doctor's degree in physics, medical physics, other physical sciences, engineering, or applied mathematics from an accredited college or university.

c. Has successfully completed one year of full-time training in medical physics and an additional year of full-time work experience under the supervision of a medical physicist.

d. Has documented training in the creation, modification, and completion of written directives.

e. Has documented training in procedures for administrations requiring a written directive.

f. Has documented training in performing the calibration measurements of brachytherapy sources as detailed in sub. (6).

(b) The individuals who are identified in par. (a) 1. or 2. shall do all of the following:

1. Calculate the activity of each strontium-90 source that is used to determine the treatment times for ophthalmic treatments. The decay must be based on the activity determined under sub. (6).

2. Assist the licensee in developing, implementing, and maintaining written procedures to provide high confidence that the administration is in accordance with the written directive. These procedures shall include the frequencies that the individual meeting the requirements in paragraph (a) of this section will observe treatments, review the treatment methodology, calculate treatment time for the prescribed dose, and review records to verify that the administrations were in accordance with the written directives.

(c) Licensees shall retain a record of the activity of each strontium-90 source in accordance with s. DHS 157.71(18).

SECTION 82. DHS 157.65 (8) (intro.), (a), (a) 1., (b) 2. and 3. are amended to read:

DHS 157.65 (8) (intro.) TRAINING FOR USE OF MANUAL BRACHYTHERAPY SOURCES. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user of a manual brachytherapy source for the uses authorized under sub. (1) ~~to have obtained written attestation under sub. (10) (a) and~~ to be a physician who meets any of the following requirements:

DHS 157.65 (8) (a) Is certified by a medical specialty board whose certification process has been recognized by the department, the NRC or an agreement state. To ~~be~~ have its certification process recognized, a specialty board shall require all candidates for certification to do all of the following:

DHS 157.65 (8) (a) 1. Successfully complete a minimum of 3 years of residency training in a radiation oncology program approved by the residency review committee of the accreditation council for graduate medical education or royal college of physicians and surgeons of Canada or the council on postdoctoral training ~~committee on post-graduate training~~ of the American osteopathic association.

DHS 157.65 (8) (b) 2. Five hundred hours of work experience, under the supervision of an authorized user who meets the requirements in this subsection, s. DHS 157.61 (10), or equivalent NRC or agreement state requirements at a medical ~~institution~~ facility authorized to use byproduct materials under sub. (1), involving all of the following:

DHS 157.65 (8) (b) 3. Three years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in this subsection, s. DHS 157.61 (10), or equivalent NRC or agreement state requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training ~~committee on postdoctoral training~~ of the American Osteopathic Association. The experience may be obtained concurrently with the supervised work experience required by subd. 2.

SECTION 83. DHS 157.65 (8) (b) 4. is created to read:

DHS 157.65 (8) (b) 4. A written attestation under sub. (10) (a).

SECTION 84. DHS 157.65 (9) is repealed and recreated to read:

DHS 157.65 (9) TRAINING FOR OPHTHALMIC USE OF STRONTIUM-90. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user of strontium-90 for ophthalmic radiotherapy to be a physician who meets any of the following requirements:

(a) Is an authorized user under sub. (8) or equivalent NRC or agreement state requirement.

(b) Has had classroom and laboratory training applicable to the use of strontium-90 for ophthalmic radiotherapy and a period of supervised clinical training in ophthalmic radiotherapy that includes all of the following:

1. Twenty-four hours of classroom and laboratory training that includes all of the following:

a. Radiation physics and instrumentation.

b. Radiation protection.

c. Mathematics pertaining to the use and measurement of radioactivity.

d. Radiation biology.

2. Supervised clinical training in ophthalmic radiotherapy under the supervision of an authorized user at a medical institution, clinic, or private practice that includes the use of strontium-90 for the ophthalmic treatment of 5 individuals. The supervised clinical training shall include all of the following:

a. Examination of each person to be treated.

b. Calculation of the dose to be administered.

c. Administration of the dose.

d. Follow up and review of each individual's case history.

3. A written attestation under sub. (10) (b).

SECTION 85. DHS 157.65 (10) (a) is amended to read:

DHS 157.65 (10) WRITTEN ATTESTATION. (a) *Manual brachytherapy sources.* As required by sub. (8) (b) 4., a~~A~~ licensee shall require an authorized user of a manual brachytherapy source for the uses authorized under sub. (1) to have obtained written attestation, signed by a preceptor authorized user who meets the requirements in sub. (8), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements, that the individual has ~~satisfactorily~~successfully completed the requirements in sub. (8) ~~(a) 1. or~~ (b) and ~~has achieved a level of competency sufficient to function independently~~ is able to independently fulfill the radiation safety-related duties as an authorized user of manual brachytherapy sources for the medical uses authorized under sub. (1)~~(8)~~. The attestation must be obtained from any of the following:

SECTION 86. DHS 157.65 (10) (a) 1. and 2. are created to read:

DHS 157.65 (10) (a) 1. A preceptor authorized user who meets the requirements in sub. (8), s. DHS 157.61(10), or equivalent NRC or agreement state requirements.

DHS 157.65 (10) (a) 2. A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements in sub. (8), s. DHS 157.61(10), or equivalent NRC or agreement state requirements and concurs with the attestation provided by the residency program director. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub (8) (b).

SECTION 87. DHS 157.65 (10) (b) is amended to read:

DHS 157.65 (10) (b) *Ophthalmic use of strontium-90.* ~~A~~ As required by sub. (9) (b) 3., a licensee shall require an authorized user for ophthalmic use of strontium-90 to have obtained written attestation, signed by a preceptor authorized user who meets the requirements in sub. (8) or (9), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements, that the individual has ~~satisfactorily~~successfully completed the requirements in sub. (9) ~~(a) and~~ (b) and ~~has achieved a level of competency sufficient to function independently~~ is able to independently fulfill the radiation safety-related duties as an authorized user of strontium-90 for ophthalmic use.

SECTION 88. DHS 157.66 (1) is repealed and recreated to read:

DHS 157.66 (1) USE OF SEALED SOURCES FOR DIAGNOSIS.

(a) A licensee may use sealed sources that are not in medical devices for diagnostic medical uses if all of the following are met:

1. The sealed sources are approved in the sealed source and device registry for diagnostic medicine.

2. If the diagnostic medical uses are not explicitly listed in the sealed source and device registry, the sealed sources are used in accordance with the radiation safety conditions and limitations described in the sealed source and device registry.

(b) A licensee may use medical devices containing sealed sources for diagnostic medical uses if all the following are met:

1. Both the sealed sources and medical devices are approved in the sealed source and device registry for diagnostic medical uses.

2, If the diagnostic medical uses are not explicitly listed in the sealed source and device registry, the diagnostic medical devices are used in accordance with the radiation safety conditions and limitations described in the sealed source and device registry.

(c) Sealed sources and devices for diagnostic medical uses may be used for research in accordance with an active investigational device exemption application accepted by the U.S. Food and Drug Administration, and provided the requirements of s. DHS 157.61 (6) are met.

SECTION 89. DHS 157.66 (2) (intro.) is amended to read:

DHS 157.66 (2) TRAINING FOR USE OF SEALED SOURCES FOR DIAGNOSIS. Except as provided in s. DHS 157.61 (10), a licensee shall require the authorized user of a diagnostic sealed source for use in a device authorized under sub. (1) to have received training in the use of the device for the uses requested. The licensee shall also require the authorized user to be a physician, dentist or podiatrist who meets ~~either~~ any of the following requirements:

SECTION 90. DHS 157.66 (2) (c) is created to read:

DHS 157.66 (2) (c) Is an authorized user under s. DHS 157.63 (2), or equivalent NRC or agreement state requirements.

SECTION 91. DHS 157.67 (1) (intro.) and (1) (a) are amended to read:

DHS 157.67 (1) USE OF A SEALED SOURCE IN A REMOTE AFTERLOADER, TELETHERAPY OR GAMMA STEREOTACTIC RADIOSURGERY UNIT. ~~A licensee shall use sealed sources in photon-emitting remote afterloader units, teletherapy units or gamma stereotactic units for therapeutic medical uses that meet one of the following criteria:~~

DHS 157.67 (1) (a) ~~Is approved in the sealed source and device registry.~~ A licensee shall use sealed sources in photon emitting remote afterloader units, teletherapy units or gamma stereotactic units for therapeutic medical uses that meet any of the following criteria:

SECTION 92. DHS 157.67 (1) (a) 1. is created to read:

DHS 157.67 (1) (a) 1. Is approved in the sealed source and device registry.

SECTION 93. DHS 157.67 (1) (b) is renumbered DHS 157.67 (1) (a) 2. and is amended read:

DHS 157.67 (1) (a) 2. In research ~~under an~~ involving photon-emitting remote afterloader units, teletherapy units, or gamma stereotactic radiosurgery units in accordance with an active effective investigational device exemption application accepted by the FDA provided the requirements of s. DHS 157.61 (6) (a) are met.

Note: The FDA requirements for investigational devices may be found at: https://www.fda.gov/radiation-emitting-products.

SECTION 94. DHS 157.67 (1) (b) (intro.), 1. and 2. are created to read:

DHS 157.67 (1) (b) A licensee shall use photon-emitting remote afterloader units, teletherapy units, or gammastereotactic radiosurgery units that meet any of the following criteria:

DHS 157.67 (1) (b) 1. Is approved in the sealed source and device registry to deliver a therapeutic dose for medical use. These devices may be used for therapeutic medical treatments that are not explicitly provided for in the sealed source and device registry, but must be used in accordance with radiation safety conditions and limitations described in the sealed source and device registry.

DHS 157.67 (b) 2. In research in accordance with an active investigational device exemption application accepted by the FDA and provided the requirements of s. DHS 157.61(6) are met.

SECTION 95. DHS 157.67 (4) (d) and (e) are amended to read:

DHS 157.67 (4) (d) A licensee shall provide operational and safety instruction, initially and at least annually, at intervals not to exceed 13 months, to all persons who operate the unit, as appropriate to the person's assigned duties, in all of the following:

DHS 157.67 (4) (e) A licensee shall ensure that operators, authorized medical physicists and authorized users participate in drills of the emergency procedures, initially and at least annually, at intervals not to exceed 13 months, thereafter.

SECTION 96. DHS 157.67 (4) (g) and (e) are created to read:

DHS 157.67 (4) (g) Prior to the first use for patient treatment of a new unit or an existing unit with a manufacturer upgrade that affects the operation and safety of the unit, a licensee shall ensure that vendor operational and safety training is provided to all individuals who will operate the unit. The vendor operational and safety training must be provided by the device manufacturer or by an individual certified by the device manufacturer to provide the operational and safety training.

DHS 157.67 (4) (e) A licensee shall retain a copy of the procedures required by pars. (a) 4. and (d) 2. until the licensee no longer possesses the remote afterloader, teletherapy unit, or gamma stereotactic radiosurgery unit.

SECTION 97. DHS 157.67 (15) (title) and (a) are amended to read:

DHS 157.67 (15) (title) ~~FIVE-YEAR~~ FULL INSPECTION FOR TELETHERAPY AND GAMMA STEREOTACTIC RADIOTHERAPY UNITS.

DHS 157.67 (15)(a) A licensee shall have each teletherapy unit and gamma stereotactic radiosurgery unit inspected for proper operation and serviced during source replacement to assure proper functioning of the source exposure mechanism. The ~~or at~~ intervals between full inspection and servicing shall not to exceed 5 years for each teletherapy unit and shall not exceed 7 years for each gamma stereotactic radiosurgery unit~~, whichever comes first, to assure proper functioning of the source exposure mechanism~~.

SECTION 98. DHS 157.67 (17) (intro.), (a) (intro.) and 1., (b) 2. and 3. are amended to read:

DHS 157.67 (17) (intro.) TRAINING FOR USE OF REMOTE AFTERLOADER, TELETHERAPY AND GAMMA STEREOTACTIC RADIOSURGERY UNITS. A licensee shall require an authorized user of a sealed source for a use authorized under sub. (1) to have received training in device operation, safety procedures, and clinical use for the type of use for which authorization is sought. This training requirement may be satisfied by ~~satisfactorily~~successful completion of a training program provided by the vendor for new users or by receiving training supervised by an authorized user or authorized medical physicist, as appropriate, who is authorized for the type of use for which the individual is seeking authorization. Except as provided in s. DHS 157.61 (10), a licensee shall require an authorized user of a sealed source for a use authorized under sub. (1) ~~to have obtained written attestation under sub. (18) and~~ to be a physician who meets ~~either~~ any of the following requirements:

DHS 157.67 (17) (a) (intro.) Is certified by a medical specialty board whose certification process has been recognized by the department, the NRC or an agreement state. To ~~be~~ have its certification process recognized, a specialty board shall require all candidates for certification to do all of the following:

DHS 157.67 (17) (a) 1. Successfully complete a minimum of 3 years of residency training in a radiation therapy program approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council of Postdoctoral Training ~~committee on post-graduate training~~ of the American Osteopathic Association.

DHS 157.67 (17) (b) 2. Five hundred hours of work experience, under the supervision of an authorized user who meets the requirements in this subsection, s. DHS 157.61 (10), or equivalent NRC or agreement state requirements at a medical ~~institution~~ facility authorized to use byproduct materials under sub. (1), involving all of the following:

DHS 157.67 (17) (b) 3. Three years of supervised clinical experience in radiation therapy under an authorized user who meets the requirements in this subsection, s. DHS 157.61 (10), or equivalent NRC or agreement state requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or Royal College of Physicians and Surgeons of Canada or the Committee on Postdoctoral Training of the American

Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subd. 2.

SECTION 99. DHS 157.67 (17) (b) 4. is created to read:

DHS 157.67 (17) (b) 4. A written attestation obtained under sub. (18).

SECTION 100. DHS 157.67 (18) is renumbered DHS 157.67 (18) (intro.) and amended to read:

DHS 157.67 (18) (intro.) WRITTEN ATTESTATION. A licensee shall require an authorized user of a sealed source for a use authorized under sub. (17) to have obtained written attestation that the individual has ~~satisfactorily~~successfully completed the requirements in sub. (17) ~~(a) 1. or~~ (b), and has achieved a level of competency sufficient to function independently as an authorized user of each type of therapeutic medical unit for which the individual is requesting authorized user status. ~~The written attestation shall be signed by a preceptor authorized user who meets the requirements in sub. (17), s. DHS 157.61 (10), or equivalent agreement state requirements for an authorized user for each type of therapeutic medical unit for which the individual is requesting authorized user status.~~ The attestation must be obtained from either of the following:

SECTION 101. DHS 157.67 (18) (a) and (b) are created to read:

DHS 157.67 (18) (a) A preceptor authorized user who meets the requirements in sub. (17), s. DHS 157.61 (10), or equivalent NRC or agreement state requirements for an authorized user for each type of therapeutic medical unit for which the individual is requesting authorized user status.

DHS 157.67 (18) (b). A residency program director who affirms in writing that the attestation represents the consensus of the residency program faculty where at least one faculty member is an authorized user who meets the requirements in sub. (17), s. DHS 157.61(10), or equivalent NRC or agreement state requirements user for each type of therapeutic medical unit for which the individual is requesting authorized user status. The residency training program must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Council on Postdoctoral Training of the American Osteopathic Association and must include training and experience specified in sub. (17) (b).

SECTION 102. DHS 157.68 (2) (a) is amended to read:

DHS 157.68 (2) (a) ~~Each~~ A copy of each individual's certification by ~~the board of pharmaceutical specialties~~ a specialty board whose certification process has been recognized by the department, the NRC, or an agreement state as specified in s. DHS 157.61 (9).

SECTION 103. DHS 157.71 (1) (c) is created to read:

DHS 157.71 (1) (c) For each Associate Radiation Safety Officer appointed under s. DHS 157.61 (1) (b), the licensee shall retain, for 5 years after the Associate Radiation Safety Officer is removed from the license, a copy of the written document appointing the Associate Radiation Safety Officer signed by the licensee's management.

SECTION 104. DHS 157.71 (4) (b) 3. and (5) (c) are amended to read:

DHS 157.71 (4) (b) 3. ~~The social security number or other identification number, if one has been assigned,~~ An identification number assigned by the licensee or, if no other identification number is available, the social security number of any person who is the subject of a medical event.

DHS 157.71 (5) (c) ~~The social security number or other identification number, if one has been assigned~~ An identification number assigned by the licensee or, if no other identification number is available, the social security number of the pregnant individual or nursing child who is the subject of the event.

SECTION 105. DHS 157.72 (1) (a) (intro.) and (a) 3. are amended to read:

DHS 157.72 (1) (a) A licensee shall report to the department any event, except for events that result from intervention by a patient or human research subject, in which the administration of radioactive material or resulting radiation, except for permanent implant brachytherapy, results in any of the following:

DHS 157.72 (1) (a) 3. A dose to the skin or an organ or tissue other than the treatment site that exceeds by 0.5 Sv (50 rem) to an organ or tissue and 50% or more of the dose expected from the administration defined in the written directive ~~(excluding, for permanent implants, seeds that were implanted in the correct site but migrated outside the treatment site)~~.

SECTION 106. DHS 157.72 (1) (am) is created to read:

DHS 157.72 (1) (am) For permanent implant brachytherapy, a licensee shall report to the department any event, except for events that result from intervention by a patient or human research subject, in which the administration of byproduct material or radiation from byproduct material, excluding sources that were implanted in the correct site but migrated outside the treatment site, results in any of the following:

1. The total source strength administered that differs by 20% or more from the total source strength documented in the post-implantation portion of the written directive.

2. The total source strength administered outside of the treatment site exceeding 20% of the total source strength documented in the post-implantation portion of the written directive.

3. Administration of the wrong radionuclide.

4. Administration to the wrong individual or human research subject.

5. Sealed source implanted directly into a location discontiguous from the treatment site, as documented in the post-implantation portion of the written directive.

6. A leaking sealed source resulting in a dose that exceeds 0.5 Sv (50 rem) to an organ or tissue.

SECTION 107. DHS 157.72 (2) (f) 1. b. is amended to read:

DHS 157.72 (2) (f) 1. b. ~~Social security number or other identification number, if one has been assigned,~~ Identification number or if no other identification number is available, the social security number of the pregnant individual or the nursing child who is the subject of the event.

SECTION 108. DHS 157.72 (4) is created to read:

DHS 157.72 (4) REPORTS FOR AN ELUATE EXCEEDING PERMISSIBLE MOLYBDENUM-99, STRONTIUM-82, AND STRONTIUM-85 CONCENTRATION

(a) The licensee shall notify by telephone the department and the distributor of the generator within 7 calendar days after discovery that an eluate exceeded the permissible concentration listed in s. DHS 157.63 (3) (a) at the time of generator elution. The telephone report to the department must include all of the following information:

1. The manufacturer, model number, and serial or lot number of the generator.

2. The results of the measurement and the date of the measurement.

3. Whether dosages were administered to patients or human research subjects.

4. When the distributor was notified.

5. The action taken in response.

Note: A report may be submitted to the department via telephone at (608) 267-4797.

(b) A licensee who makes a report required by par. (a) shall submit a written report within 30 days of the initial telephone report containing all of the following information:

1. The action taken by the licensee.

2. The patient dose assessment.

3. The methodology used to make the dose assessment if the eluate was administered to patients or human research subjects.

4. The probable cause and an assessment of failure in the licensee's equipment, procedures or training that contributed to the excessive readings if an error occurred in the licensee's breakthrough determination.

5. The information in the telephone report as required by par. (a).

Note: A written report may be submitted to: Department of Health Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659

SECTION 109. DHS 157.73 (12) (d) (intro.), (e), and (g) are amended to read:

DHS 157.73 (12) (d) (intro.) A licensee shall conduct safety reviews for irradiator operators at least annually, at intervals not to exceed 13 months. At the review, the licensee shall give each operator a written test on the information presented during annual safety training. Each safety review shall include, to the extent appropriate, all of the following:

DHS 157.73 (12) (e) A licensee shall evaluate the safety performance of each irradiator operator at least annually, at intervals not to exceed 13 months, to ensure that regulations, license conditions and operating, safety and emergency procedures are followed. The licensee shall discuss the results of the evaluation with the operator and shall instruct the operator on how to correct any mistakes or deficiencies observed.

DHS 157.73 (12) (g) Persons who must be prepared to respond to alarms required by subs. (2) (b) and (i), (4) (a), (5) (a) and (b), and (16) (b) shall be trained and tested on how to respond. Each person shall be retested at least annually, at intervals not to exceed 13 months. Tests may be oral.

SECTION 110. DHS 157.73 (14) (a) is amended to read:

DHS 157.73 (14) (a) Any irradiator operator shall wear ~~either a film badge, a thermoluminescent dosimeter or similar approved device~~ a personnel dosimeter while operating a panoramic irradiator or while in the area around the pool of an underwater irradiator. The ~~film badge or TLD processor shall be accredited by the national voluntary laboratory accreditation program for~~ personnel dosimeter shall be capable of detecting high energy photons in the normal and accident dose ranges. Each ~~film badge or TLD~~ personnel dosimeter shall be assigned to and worn by only one person. Film badges shall be ~~processed~~ replaced at least monthly and ~~TLDs~~ all other personnel dosimeters that require replacement shall be ~~processed~~ replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.

SECTION 111. DHS 157.73 (14) (c) is amended to read:

DHS 157.73 (14) (c) If pocket dosimeters are used to meet the requirements of par. (b), a check of their response to radiation shall be performed at least annually, at intervals not to exceed 13 months. Acceptable dosimeters shall read within plus or minus 20% of the true radiation dose.

SECTION 112. DHS 157.73 (18) (b) is amended to read:

DHS 157.73 (18) (b) A licensee shall measure the pool water conductivity frequently enough, but no less than weekly, to assure that the conductivity remains below 20 microsieverts per centimeter. Conductivity meters must be calibrated at least annually, at intervals not to exceed 13 months.

SECTION 113. DHS 157.73 (22) (e) is amended to read:

DHS 157.73 (22) (e) ~~Dosimetery~~Dosimetry results required by sub. (14) (a) and (b) until the department terminates the license.

SECTION 114. DHS 157.74 (2) (e) is repealed.

SECTION 115.DHS 157.74 (2) (f) 1. is amended to read:

DHS 157.74 (2) (f) 1. Exposure of a person for training, demonstration or other non-healing arts purpose, except as authorized by the department.

SECTION 116. DHS 157.74 (2) (fm) is created to read:

DHS 157.74 (2) (fm) Registrants may conduct medical research that includes exposure to radiation and are exempt from obtaining individual project authorization from the department under all the following conditions:

1. The use of radiation-generating equipment to conduct research on human beings has been approved by an institutional review board as required by 45 CFR 46 and 21 CFR 56.

2. The institutional review board's review of the research project includes a radiation safety review by qualified radiation personnel.

3. All research projects using radiation need to be identified and documentation shall be made available to the department upon request.

4. The number of facilities and exam types used by the registrant are reported to the department annually.

5. Nothing in this paragraph relieves registrants from complying with the other requirements of this subchapter.

SECTION 117. DHS 157.74 (5) is created to read:

(5) HOSPITALS.

(a) Hospitals using registered radiation machines shall comply with all of the following:

1. Keep the radiological service free of hazards for patients and personnel.

2. Maintain safety precautions against fire and explosion hazards, electrical hazards, and radiation hazards.

3. Inspect registered facilities and equipment at least once every 2 years for compliance with this chapter. This inspection shall be completed by one of the following:

a. A qualified radiation physicist.

b. A designee of a qualified radiation physicist.

c. The department as outlined in s. DHS 157.89.

4. Correct radiation hazards identified by a qualified radiation physicist or their designee within 30 days of identification.

SECTION 118. Table DHS 157.75 is repealed and recreated to read:

Table DHS 157.75
Half-Value Layer Requirements

X-Ray Tube Voltage in kilovolt peak		Half-Value Layer in mm Aluminum		
Designed Operating Range	Measured Operating Potential	Specified Dental Systems[1]	I - Other X-Ray Systems[2]	II - Other X-Ray Systems[3]
Below 51	30	1.5	0.3	0.3
	40	1.5	0.4	0.4
	50	1.5	0.5	0.5
51 to 70	51	1.5	1.2	1.3

	60	1.5	1.3	1.5
	70	1.5	1.5	1.8
Above 70	71	2.1	2.1	2.5
	80	2.3	2.3	2.9
	90	2.5	2.5	3.2
	100	2.7	2.7	3.6
	110	3.0	3.0	3.9
	120	3.2	3.2	4.3
	130	3.5	3.5	4.7
	140	3.8	3.8	5.0
	150	4.1	4.1	5.4

[1] Dental x-ray systems designed for use with intraoral image receptors and manufactured after December 1, 1980.

[2]. Dental x-ray systems designed for use with intraoral image receptors and manufactured before or on December 1, 1980, and all other x-ray systems subject to 21 CFR 1020 and manufactured before June 10, 2006.

[3] All x-ray systems, except dental x-ray systems designed for use with intraoral image receptors, subject to 21 CFR 1020 and manufactured on or after June 10, 2006.

SECTION 119. DHS 157.76 (intro.) and (8) are amended to read:

DHS 157.76 (intro.) **Fluoroscopic equipment.** Only image-intensified or direct-digital receptor fluoroscopic equipment shall be used for fluoroscopy. Equipment for fluoroscopic imaging or for recording images from the fluoroscopic image receptor, except computed tomography x-ray systems manufactured on or after November 29, 1984, shall meet all the following requirements:

DHS 157.76 (8) MOBILE AND PORTABLE FLUOROSCOPES. Mobile and portable fluoroscopes shall ~~incorporate an image intensifier~~ use image-intensification or a direct-digital receptor.

SECTION 120. DHS 157.76 (2) (b) is amended to read:

DHS 157.76 (2) (b) Means shall be provided to permit further limitation of the x-ray field to sizes smaller than the limits of par. (e) 1. and 2. Beam limiting devices manufactured after May 22, 1979, and incorporated in equipment with a variable source to image distance ~~and/or~~ , the capability of a visible area of greater than 300 square cm, or both, shall be provided with means for stepless adjustment of the x-ray field. Equipment with a fixed source to image distance and the capability of a visible area of no greater

than 300 square cm shall be provided with either stepless adjustment of the x-ray field or with a means to further limit the x-ray field size at the plane of the image receptor to 125 square cm or less. Stepless adjustment shall, at the greatest source to image distance, provide continuous field sizes from the maximum obtainable to a field size containable in a square of 5 cm by 5 cm. This paragraph does not apply to ~~nonimage~~ intensified fluoroscopy units without image intensification.

SECTION 121. DHS 157.80 (1) (c) 2. is amended to read:

DHS 157.80 (1) (c) 2. For systems that allow high voltage to be applied to the x-ray tube continuously and that control the emission of x-ray with a shutter, the radiation emitted may not exceed 0.88 mGy (100 mR~~em~~) in one hour at any point 5 cm outside the external surface of the housing of the scanning mechanism when the shutter is closed.

SECTION 122. DHS 157.81 (4) is amended to read:

DHS 157.81 (4) OPERATIONAL ANALYSIS. The department may require additional modifications to a shielding plan after initial approval of the plan if a subsequent analysis of operating conditions indicates the possibility of a person receiving a dose in excess of the limits prescribed in ss. DHS 157.22 (1) and (5) to (8) and 157.23 (1) and (2). An existing x-ray room constructed using 5 mSv (500 ~~mR~~ mrem) as the public exposure limit may continue to operate without modification until the x-ray equipment is replaced or the room is modified.

SECTION 123. DHS 157 Subchapter IX (title) and DHS 157.87 are repealed and recreated to read:

Subchapter IX — Radiation Generating Devices

DHS 157.87 **Radiation safety requirements.** (1) GENERAL REQUIREMENTS. Unless otherwise provided in this chapter, this subchapter applies to all radiation generating devices. Certified and certifiable cabinet x-ray systems shall also meet the requirements of 21 CFR 1020.40.

(a) *Warning devices.*

1. Warning devices shall be labeled so that their purpose is easily identified.

2. An easily visible warning device light labeled with the words "X-RAY ON," or words having a similar meaning and intent, shall be located near any switch that energizes an x-ray tube and shall be illuminated only when the tube is energized. This warning light shall be of a fail-safe design.

(b) *Labeling.*

1. All radiation generating devices equipment shall be labeled near any switch that energizes an x-ray tube with either:

a. A readily visible and discernible sign or signs bearing the radiation symbol

b. A readily visible and discernible sign or signs bearing "CAUTION RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED," or words having a similar meaning and intent.

2. For radiation generating devices with designed openings for object entries, such as baggage security screening units, the following shall be posted at or near each opening: “CAUTION – X-RAY HAZARD:

DO NOT INSERT ANY PART OF THE BODY WHEN SYSTEM IS ENERGIZED", or words having similar meaning and intent.

(c) *Radiation source housing.* Each x-ray tube housing shall comply with all of the following requirements:

1. 'Interlock.' When the x-ray tube housing is the primary shielding for the x-ray tube, and is intended to be opened for normal use or maintenance, the housing shall be equipped with an interlock that shuts off the high voltage to the x-ray tube if the housing is opened.

2. 'Radiation emission limit.' Each x-ray tube housing shall be so constructed that, with all shutters closed, the leakage radiation measured at a distance of 5 centimeters from the x-ray tube housing surface does not exceed 0.025 mSv (2.5 mrem) per hour. This limit shall be met at the maximum tube rating. For closed-beam systems, this requirement may be met by complying with the radiation emission limit provided in sub. (2) (d). For a radiation generating device in a shielded room, this limit may be met by measuring from any accessible surface outside the room housing the radiation generating device. For hand-held, open-beam radiation generating devices, this requirement may be met by complying with the limits in sub. (4) (c) radiation emission limit.

(d) *Generator cabinet or high voltage source radiation emission limits.* Each x-ray generator or high-voltage source shall be supplied with a protective cabinet which limits leakage radiation to 2.5 microSv (0.25 mrem) per hour at a distance of 5 centimeters measured at the nearest accessible surface. For closed-beam systems, this requirement may be met by complying with radiation emission limits in sub. (2)(d). For a radiation generating device in a shielded room with the high-voltage generator also inside the shielded room, this limit may be met by measuring from any accessible surface outside the room housing the radiation generating device. For hand-held, open-beam radiation generating devices, this requirement may be met by complying with the radiation emission limits in sub. (4)(c).

(e) *Surveys.* 1. Radiation surveys of all radiation generating devices shall be sufficient to show compliance with radiation emission requirements of this subchapter and as required by ss. DHS 157.22 and 157.25. The radiation surveys shall be sufficient to evaluate the magnitude and extent of radiation emissions and the potential radiological hazards that could be present. At a minimum, surveys shall be performed:

a. Upon installation of the equipment, and at least once every 12 months thereafter.

b. Following any change in the initial arrangement, number, or type of local components in the system.

c. Following any maintenance requiring the disassembly, removal, or repair of a local component in the system.

d. During the performance of maintenance, calibration, and other procedures if the procedures require the presence of a primary x-ray beam while any local component in the system is disassembled or removed.

e. After bypassing a safety device or interlock as required in sub. (1)(h).

f. Any time a visual inspection of the local components in the system reveals an abnormal condition.

g. Whenever a personnel monitoring device shows a significant increase over previous monitoring period or readings are approaching the limits specified in s. DHS 157.22.

2. The registrant shall have access to sufficiently calibrated, appropriate, and operable radiation survey instruments to make physical radiation surveys as required by this subchapter. The instruments shall be capable of detecting and measuring the types and levels of radiation involved including primary, scattered, and leakage radiation.

3. The registrant shall assure the maintenance and calibration of all monitoring and survey instruments used by the registrant or service provider per s. DHS 157.25.

4. The department may approve alternatives to the survey requirements of subd.1., if the registrant submits to the department a request for approval of an alternative method that otherwise demonstrates compliance with this subchapter and ss. DHS 157.22 and 157.25.

(f) *Posting*. Each area or room containing a radiation generating device where an individual may receive 0.02 mSv (2 mrem) in any one hour or 1 mSv (100 mrem) per year shall be conspicuously posted with a sign or signs bearing the radiation symbol described in s. DHS 157.29 (1) and the words "CAUTION - X-RAY EQUIPMENT," "CAUTION – RADIATION GENERATING DEVICE," or words having a similar meaning and intent.

(g) *Security*. Radiation generating devices shall be secured in such a way as to be only accessible to, or operable by, authorized personnel when not in operation.

(h) *Operating requirements*.

1. 'Procedures.' Normal operating procedures shall be written and available to all radiation generating device workers. No individual shall be permitted to operate a radiation generating device in any manner other than that specified in the procedures unless the individual has obtained written approval of the person in control.

2. 'Bypassing.'

a. No individual shall bypass a safety device or interlock, or remove shielding unless the individual has obtained the approval of the person in control. The approval shall be for a specified period of time.

b. When a safety device or interlock has been bypassed, a readily discernible sign bearing the words "SAFETY DEVICE NOT WORKING," or words having a similar meaning and intent, shall be placed on the radiation source housing and at the control switch.

c. A record of any bypass of a safety device or interlock shall be maintained. The record shall contain information such as the date the alteration was made, type of alteration, length of time the unit remained in the altered condition, and post bypass survey. The record shall be signed by the person in control, the individual who made the alteration, and the individual who restored the unit to original manufacturer's specifications.

3. 'Control panel.'

a. The radiation generating devices hall only be activated from a control panel.

b. All indicators and controls that control the primary beam shall be identifiable and discernible through the use of labels, symbols, software displays or the equivalent.

4. ‘Interlocks.’

a. An interlock shall not be used to de-activate the x-ray tube or radiation generating device, except in an emergency or during testing of the interlock system.

b. After triggering any interlock, it shall only be possible to reset the radiation generating device to full operation from a control panel. All interlocks shall be of a fail-safe design.

5. ‘Multiple sources.’ If more than one x-ray tube assembly or focal spot can be operated sequentially or simultaneously from a control panel, visual indicators shall identify which tube assembly or focal spot has been selected. The selectors shall be identified as to their function. If a letter or number is used, a reference card or table explaining the code shall be affixed to the control panel.

(i) *Repair or modification of x-ray tube or radiation generating device systems.* Only trained personnel or registered service providers shall be permitted to install, repair, or make modifications to the radiation generating device. No operation involving removal of covers, shielding materials or tube housings or modifications to shutters, collimators, or beam stops shall be performed without ensuring that the tube is off and will remain off until safe conditions have been restored. The main power switch with a lockout tagout, rather than interlocks, shall be used for routine shutdown in preparation for repairs. It is the responsibility of the registrant to assure that qualified personnel install, repair, or make modifications to the radiation generating device.

(j) *Testing of safety devices.*

1. Tests of all safety devices, such as interlocks, shutters, warning lights, and required emergency shut-off switches shall be conducted at intervals not to exceed 6 months on all operable radiation generating devices.

2. If any safety device fails during testing, the radiation generating device shall be removed from service until the safety device failure is corrected or proper temporary administrative controls are established and approved in writing by the person in control.

3. Records of safety device tests, check dates, findings and corrective actions shall be available for inspection and maintained for 5 years.

4. Records shall include the date of each test, a list of the safety devices tested, survey instrument information, calibration date, the results of each test, the name of the person performing each test and corrective actions taken for safety devices that fail each required test.

5. Testing of safety devices may be deferred if the unit or installation is clearly marked and kept out of service. Units or installations brought back into service after exceeding a 6 month interval shall be tested prior to use.

6. If testing of a safety device cannot be performed due to manufacturer design, the registrant shall document that the safety device will not be tested and why the safety device cannot be tested.

(k) *Instruction and training.* The registrant shall document the scope of training required for the radiation generating device they possess in accordance with this section. No individual shall be permitted to operate or maintain a radiation generating device, or enter a shielded room without appropriate instruction and training. Records shall be maintained onsite of all required training and instruction, and made available for

review by the department. Each individual permitted to operate or maintain a radiation generating device shall receive instruction, hands-on training with the radiation generating device and equipment, and demonstrate competence in all of the following:

1. Types of radiation and identification of radiation hazards associated with the use of the radiation generating device and associated equipment and precautions or measures to take to minimize radiation exposure.

2. 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 those cases.

3. Commensurate with potential hazards of use, biological effects of radiation, radiation risks, and recognition of symptoms of an acute localized exposure.

4. Normal operating procedures and procedures to prevent unauthorized use for each type of radiation generating device and associated equipment.

5. Procedures for reporting an actual or suspected accidental exposure or other radiation safety concerns, such as any unusual occurrence or malfunction that may involve exposure to radiation.

6. Performing surveys where applicable.

(L) *Radiation protection responsibility*.

1. The registrant's management shall make the final decision to use any radiation generating device and bear responsibility for radiation safety.

2. The registrant's management shall designate an individual responsible for radiation safety. This individual shall have direct access to management for radiation safety issues. This individual shall have training and experience commensurate with the scope of the radiation safety program to carry out all of the following responsibilities:

a. Ensuring that all radiation generating devices are operated within the limitations of the established radiation safety program and operating procedures.

b. Instructing personnel with regard to safe working practices and ensuring all personnel are trained in radiation safety commensurate with the hazards of the job.

c. Investigating any incident of abnormal operation or exposure or suspected overexposure of personnel to determine the cause, take remedial action, and report the incident to the proper authorities.

d. Ensuring that safety devices, interlocks, warning signals, labels, postings, and signs are functioning and located where required.

e. Maintaining all radiation safety records.

(2) ADDITIONAL REQUIREMENTS FOR CLOSED-BEAM RADIATION GENERATING DEVICES. In addition to the requirements of sub. (1), all of the following apply to all closed-beam x-ray radiation generating devices:

(a) *System enclosure.* The radiation source, sample or object, detector, and, if used, analyzing crystal shall be enclosed in a chamber or coupled chambers that cannot be entered by any part of the body during normal operation.

(b) *Interlocks.* All doors and panels accessing the radiation generating device shall be interlocked. The interlocks shall be of a fail-safe design.

(c) *Interlock functions.* The system enclosure and sample chamber closure shall be interlocked with the x–ray tube high voltage supply or a shutter in the primary beam so that no x-ray beam can enter the sample or object chamber while it is open unless the interlock has been conspicuously and deliberately defeated. The interlock shall be of fail-safe design or adequate administrative controls shall be exercised to ensure operations will not continue without a proper functioning interlock.

(d) *Radiation emission limit.* The radiation emission for all closed beam radiation generating devices shall not exceed a dose rate of 0.005 mSv (0.5 mrem) in one hour at five centimeters outside any accessible surface.

(e) *Security screening units.* Security screening units shall be provided with means to ensure operator presence at the control area in a position which permits surveillance of the openings and doors during generation of x-ray radiation. The means provided shall meet any of the following conditions:

1. During an exposure or preset succession of exposures of one-half second or greater duration, the operator is able to terminate the exposure or preset succession of exposures at any time.

2. During an exposure or preset succession of exposures of less than one-half second duration, the operator is able to prevent additional exposures after the completion of the exposure in progress.

(3) ADDITIONAL REQUIREMENTS FOR OPEN-BEAM RADIATION GENERATING DEVICES. The registrant shall submit a written explanation of the need to utilize the open beam configuration instead of closed-beam systems and receive the written approval of the department prior to use. In addition to the requirements in sub. (1) all of the following apply to all open-beam radiation generating devices not otherwise addressed in this subchapter:

(a) *Safety device.*

1. The registrant shall use a safety device which prevents the entry of any portion of the operator's body into the path of the primary beam or which causes the primary beam to be shut off upon entry into its path, unless otherwise authorized by the department or this subchapter.

2. If the registrant's use of the open-beam radiation generating device does not permit the use of a safety device described in subd. 1. or 4., the registrant shall submit a written justification for why such a safety device cannot be used and receive the written approval of the department prior to use. The documented request and approval, include information about the absence of safety devices, shall be available for inspection as long the open-beam radiation generating device is in use. A record of this documentation shall be retained for 5 years after the open-beam radiation generating device is used.

3. If the registrant does not use a safety device described in subd. 1., the registrant shall employ alternative methods such as policies and procedures to minimize the possibility of unnecessary exposure. These

alternative methods shall be documented and available for inspection as long as these methods are employed. A record of this documentation shall be retained for 5 years after the method is no longer employed.

4. For portable open-beam radiation generating devices that are manufactured to be used hand-held, or potentially used as a hand-held, without a safety device described in subd. 1, this safety device requirement shall be met by complying with all the requirements in sub. (4) prior to use.

(b) *X-ray on status.* For open-beam equipment, radiation generating devices shall be provided with a readily discernible and active indication of all of the following:

1. 'X-ray tube "on-off" status.' An on-off status indicator shall be of a fail-safe design and be located near the radiation source housing. The warning lights as required by sub. (1) (a) 2. may meet this requirement if the warning lights are readily discernible and viewable by anyone near the primary beam.

2. 'Shutter "open-closed" status.' An open-closed status indicator shall be of a fail-safe design and be located at the control panel. If the primary beam is controlled with a shutter, it shall be near each beam port on the radiation source housing. The shutter status indicator shall be clearly labeled as to the meaning of the status of the device. The status indicator at the control panel may meet the requirement for the status indicator at the beam port if the status indicator at the control panel is readily discernible and viewable by anyone near the primary beam.

(c) *Labeling.* Each unit shall be labeled at or near the x-ray exit beam port to identify the location of the beam with the words, "CAUTION - X-RAY BEAM", "CAUTION – HIGH INTENSITY X-RAY BEAM", or words having a similar meaning and intent.

(d) *Beam ports.* Unused beam ports on radiation source housings shall be secured in the closed position in a manner which will prevent inadvertent opening.

(e) *Shutters.* On open-beam radiation generating device configurations that are designed to accommodate interchangeable components, such as apertures, filters, or target materials, each beam port on the radiation source housing shall be equipped with a shutter that cannot be opened unless a collimator or a component coupling has been connected to the beam port.

(f) *Radiation emission limits.* The local components of an open-beam radiation generating device, such as portable shielding, room walls, and designed housing, shall be located and arranged and shall include sufficient shielding or access control such that no radiation emissions exist, exclusive of the primary beam, 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 as outlined in s. DHS 157.25. These emissions shall be met at any specified tube rating.

(g) *Primary beam attenuation.* In cases where the primary x-ray beam is not intercepted by the detector device under all conditions of operation, protective measures shall be provided, such as auxiliary shielding or administrative procedures, to avoid exposure to any individual from the transmitted primary x-ray beam.

(h) *Operator attendance.* The operator shall be in immediate attendance at all times when the equipment is in operation except when the area is locked, or the equipment is secured to protect against unauthorized or accidental entry.

(i) *Control of access.* If the radiation generating device is not in a restricted area, the operator shall be able to control access to the radiation generating device at all times during operation. If the radiation generating device is not in a restricted area and the radiation generating device is capable of creating a radiation area or, the operator shall be able to control access to the radiation generating device at all times during operation, and do all the following:

1. Conspicuously identify radiation areas. The radiation source shall be within a conspicuous perimeter that identifies the area in which the dose equivalent rate exceeds 0.05 mSv (5 mrem) per hour. The area identified shall be suitably posted with "CAUTION -RADIATION AREA" signs at the perimeter. The operator shall ensure that no one is inside or enters the radiation area during operation of the radiation generating device.

2. Conspicuously identify high radiation areas. The radiation source shall be within a conspicuous perimeter that identifies the area in which the dose equivalent rate exceeds 1 mSv (100 mrem) per hour. The area identified shall be suitably posted with "CAUTION - HIGH RADIATION AREA" signs at the perimeter. The operator shall ensure that no one is inside or enters the high radiation area during operation of the radiation generating device.

3. Perform a visual check of the controlled area to ensure it is free of all unauthorized personnel immediately prior to activating or exposing the radiation source.

4. Maintain surveillance of the exposure area during operation, either visually or by other reliable means to ensure that no person enters the area.

5. With the exception of hand-held x-ray systems, when approaching the radiation source, following the conclusion of an exposure, use a suitable calibrated and operable radiation detection instrument to verify that the radiation source is in its fully shielded condition or that the x-ray tube has been de-energized.

6. Wear a personal alarming dose rate meter to approach the work area. The radiation field in the work area must be uniform such that the personal alarming dose rate meter responds to radiation exposure to any part of the body. The personal alarming dose rate meter shall not be used to measure radiation levels required under subds. 7. to 9., nor shall it be used to indicate the presence of a radiation source for potential non-uniform exposure, such as may occur during machine maintenance or work in a radiation generating device target area. The personal alarming dose rate meter shall meet all of the following:

a. Is appropriately designed and calibrated for the type of x-ray emitted, such as pulse or continuous.

b. Is set at an appropriate level to detect the presence of the radiation source, for example 0.02 mSv (2 mrem) per hour.

c. Has been source-checked for response prior to use.

7. Perform measurement of radiation levels for a radiation survey using an appropriate calibrated radiation survey meter required by subs. (1) (e) 1. and 2. A radiation survey meter shall also be used when there is potential for non-uniform exposure to personnel, such as may occur during machine maintenance or work in a radiation generating device target area.

8. During the first exposure for each set up of the device, measure the radiation levels around the perimeter of the controlled area. The perimeter shall be adjusted accordingly to meet the access control requirement for radiation areas or high radiation areas before subsequent exposures are made.

9. Conduct the survey around the perimeter for each new operating condition and adjust the perimeter accordingly. The area of operation shall be monitored periodically if radiation levels are variable.

(j) *Instruction and training*. In addition to the requirements in sub. (1)(k), each individual permitted to operate or maintain an open-beam radiation generating device shall receive more specific and detailed instruction in and demonstrate competence in all of the following topics:

1. Sources and magnitude of common radiation exposure.

2. Units of radiation measurement.

3. Radiation protection concepts of time, distance, shielding, and ALARA.

4. Procedures and rights relating to a declared pregnancy.

5. Regulatory requirements and area postings.

6. Worker, embryo or fetus, and public dose limits.

7. Proper use of survey instruments and dosimetry.

8. The policies and procedures required by this subsection.

(k) *Personnel monitoring*. In addition to the requirements of s. DHS 157.25, extremity dosimetry shall be provided and used by all of the following:

1. Personnel working with or routinely working near and having potential for exposure to, the primary beam of an open-beam radiation generating device.

2. Personnel maintaining radiation generating devices if the maintenance procedures require the presence of a primary radiation beam when any local component in the radiation generating device is disassembled or removed.

(4) ADDITIONAL REQUIREMENTS FOR OPEN-BEAM, HAND-HELD RADIATION GENERATING DEVICES. In addition to the requirements in subs. (1) and (3) the following applies to open-beam, hand-held radiation generating devices:

(a) *Procedures*. All registrants possessing open-beam, hand-held radiation generating device shall make their operating policies and procedures available for review by the department. Operating policies and procedures shall contain measures to ensure that all of the following occur:

1. Radiation protection is provided to meet public dose limits in s. DHS 157.23.

2. Radiation protection is provided equivalent to that afforded in sub. (3) (g).

3. The operator will not hold the sample during operation of the radiation generating device and the operator's hands will not approach the primary beam.

4. The operator will not aim the primary beam at themselves or at any individual during operation of the radiation generating device.

5. Operator radiation exposure is as low as reasonably achievable, for example, by use of ancillary equipment that will reduce exposure.

(b) *Training*. In addition to the training requirements of subs. (1) (k) and (3) (j), the registrant shall provide training for all users and operators on the subjects in par. (a). Records shall be maintained of all user and operator training.

(c) *Radiation Emission Limit*. For hand-held radiation generating devices, the limits in subs. (1) (c) 2. and (d), excluding the primary beam, shall be met if the radiation emission at any accessible surface of the radiation generating device does not exceed 0.025 mSv (2.5 mrem) per hour at 5 cm.

(d) *Extremity Monitoring.* For the purposes of the requirements sub. (3) (k) 1., operators of hand-held radiation generating devices shall be considered as working near the primary beam.

(5) SHIELDED ROOM RADIATION GENERATING DEVICES. For radiation generating devices that do not meet the dose limits of s. DHS 157.25, the radiation generating device may be maintained inside a shielded room such that the exterior of the room meets the dose limits of s. DHS 157.25 when the radiation generating device is activated. Radiation generating devices in a shielded room shall meet the requirements in sub. (1) and the following:

(a) *Posting*. The door to the room containing the radiation generating device shall be posted "CAUTION – RADIATION AREA", or "CAUTION – HIGH RADIATION AREA", or "GRAVE DANGER – VERY HIGH RADIATION AREA", as required by s. DHS 157.29 (2).

(b) *Entrance interlocks*. All entrances into the shielded room shall be provided with interlocks. After an interlock has been interrupted, broken, or tripped, it shall be possible to cause x-rays to be produced again only from the control panel. Interlocks shall not be used to shut off the x-ray equipment except in an emergency or during testing.

(c) *Entrance warning devices*. All entrances into the shielded room shall be equipped with a conspicuously visible warning device, which need not be flashing or rotating but which operates only when radiation is being produced. The warning device shall be labeled in accordance sub. (1) (a).

(d) *Room warning lights*. The interior of the shielded room shall be provided with flashing or rotating warning lights that operate when, and only when, radiation is being produced. These lights shall be positioned so that they can be observed from any position or orientation within the room. The lights shall be posted indicating the meaning of the warning signal and instructions of actions to take when the light is lit. The posting shall be legible, conspicuous, and accessible to view.

(e) *Audible room warning device*. An audible warning signal within the room shall be actuated for at least 10 seconds immediately prior to the first initiation of radiation after the closing of any opening that can admit personnel. The registrant shall post the meaning of the warning signal and instructions of action to take when the alarm sounds. The posting shall be legible, conspicuous, and accessible to view.

(f) *Emergency shut-off.* If dose rates exceed the high radiation area limits in s. DHS 157.26, emergency shut-off switches shall be located within the high radiation areas so as to be accessible to individuals therein within 10 seconds. These switches and their mode of operation shall be identified by a conspicuously posted sign adjacent to the switch. The emergency shut-off switches shall include a manual reset that must be reset at the switch before x-rays are produced from the control panel. After an emergency shut-off switch has been activated, it shall only be possible to produce x-rays again from the control panel.

(g) *Separate electrical systems*. The interlock system and the emergency shut-off system shall be separate electrical and mechanical systems.

(h) *Egress from shielded room.* A person within the room housing a radiation generating device shall be able to egress at all times.

(i) *Entry into the shielded room.*

1. After each exposure and before entry of any personnel, a survey shall be performed upon entry to the shielded room to determine that the radiation generating device is no longer producing radiation.

2. Personnel devices providing an audible signal when activated by radiation shall be acceptable for the survey requirement of subd. 1 if all of the following conditions are met:

a. Personnel devices are to be checked daily for proper operation and a record of this check is maintained.

b. The personnel device is designed to clearly indicate entry into a 0.02 mSv (2 mrem) per hour or greater radiation field.

c. All personnel working with the radiation generating device are provided with a personnel device.

3. Stationary area monitors providing an audible signal when activated by radiation shall be acceptable for the survey requirement of subd. 1 if all of the following conditions are met:

a. Stationary detection devices are checked daily for proper operation and a record of this check is maintained.

b. The stationary device is designed to clearly indicate entry into a 0.02 mSv (2 mrem) per hour or greater radiation field.

c. Stationary area monitors are calibrated annually to determine that the audible signal operates at a 0.02 mSv (2 mrem) per hour radiation field.

(j) *Personnel monitoring.* All personnel associated with the x-ray equipment are provided with personnel monitoring devices that are calibrated for the x-ray energies being utilized. Records of personnel exposure are maintained.

(k) *Training*. No registrant shall permit any individual to operate a radiation generating device in a shielded room until the individual has received a copy of, instruction in, and demonstrated an understanding of, operating and emergency procedures for the unit and competence in its use. Records are maintained of all operator training.

(L) *Control panel security*. The equipment control panel is provided with a locking device to prevent unauthorized use. The locking device shall, when locked, prevent the production of radiation by the equipment.

(m) *Malfunctions.* If a safety or warning device malfunctions, the control panel shall be locked in the "off" position. The control panel shall not be used, except as may be necessary for repair or replacement of the malfunctioning safety or warning device, until the safety or warning device is functioning properly.

(6) BOMB DETECTION RADIOGRAPHIC EQUIPMENT. In addition to the requirements of sub. (1), all of the following requirements apply to bomb detection radiographic equipment:

(a) *Control panel security*. When not in use, each bomb detection radiographic machine shall be locked to prevent unauthorized use. This is in addition to the requirements of sub. (1)(g).

(b) *Utilization log*. The registrant shall maintain for each bomb detection radiographic machine a utilization log. This log shall record the description of the unit, the date removed from storage, the date returned to storage, the identity and signature of the person to whom the device is assigned, the dates of use and the site of use.

(c) *Area control.* The registrant shall provide security to prevent entry by individuals from any point when the machine is energized during training.

(7) RADIATION GENERATING DEVICES USED IN PERSONNEL SECURITY SCREENING OR VEHICLE SCREENING FOR PUBLIC PROTECTION. In addition to sub. (1), a registrant requesting department approval for a radiation generating device to be used in personnel security screening or vehicle screening with intended exposure of human occupants to the primary beam for public protection shall submit in writing all of the following information to the department for evaluation and approval, and show how the dose limits in this subsection will be met:

(a) *Efficacy evaluation*. An evaluation of all known alternate methods that could achieve the goals of the security screening program, and why these methods will not be used.

(b) *Equipment evaluation.* Radiation generating devices used for personnel security screening of humans shall be evaluated every 12 months by a qualified individual, such as the manufacture's trained service engineer, for optimization of image quality and radiation dose.

(c) *Dose limits for general-use systems.* For screening systems where the system is used without regard to the number of individuals scanned or number of scans per individual in a year, an effective dose for a single complete screening shall be limited to 0.25 microSv (25 microrem).

(d) *Dose limits for limited-use systems.* For screening systems where equipment is capable of operation greater than 0.25 microSv (25 microrem) per screening, the effective dose per screening shall be less than or equal to 0.01 mSv (1 mrem). These systems shall only be use under the following conditions:

1. Used only when the additional radiation is required to create the image.

2. Not used routinely on individuals.

(e) *Dose limits for repeat security screenings.* Individuals subject to repeat security screening at a single facility shall not receive an effective dose greater than 0.25 mSv (25 mrem) in any one year at the registrant's facility.

(f) *Vehicle limitations.*

1. When the procedures for operation of a mobile or fixed radiation generating device used for security screening of vehicles includes knowingly exposing human occupants to the primary beam when screening vehicles, structures or containers, the system shall be subject to the same requirements as general-use or limited-use systems as provided in pars. (a) to (e).

2. If the requirements in pars. (a) to (e) cannot be met, and if vehicle occupants are knowingly exposed to the primary beam of a security screening system, then there shall be means to assure the occupied portion of the vehicle is outside of the scan area while the primary beam is emitted, or procedures shall be established and implemented to assure that no occupants are present in the vehicle during screening.

3. The effective dose to an individual for a single inadvertent exposure to the primary beam shall not exceed one mSv (100 mrem). The reliability of the procedure used to assure that there are no occupants of a vehicle to be scanned shall be commensurate with the potential severity of an inadvertent exposure. If the one mSv (100 mrem) limit cannot be assured, a pre-screening with a mode or system which may meet the limits in pars. (7) (c) to (e) shall be used to verify there are no occupants in the vehicle being examined.

(8) APPLICATION FOR EXEMPTIONS. Any radiation generating device user or manufacturer that cannot meet the applicable requirements of this subchapter may submit to the department a request for an exemption to the specific requirement in question. The exemption request shall demonstrate to the department all of the following:

(a) That the use of the radiation generating device will not result in undue hazard to public health and safety or property.

(b) That compliance would require replacement or substantial modification of the radiation generating device.

(c) That the registrant will achieve, through other means, radiation protection equivalent to that required by the regulation.

(d) Why the regulatory standard or requirement could not be met.

SECTION 124. DHS 157.93 (4) (am), (b) 1. and 2. are amended to read:

DHS 157.93 (4) (am) The general license issued in par. (a) applies only to a licensee who has a quality assurance program approved by the ~~commission~~ department as satisfying the provision of subpart H of 10 CFR 71.

DHS 157.93 (4) (b) 1. Maintain a copy of the specific license, NRC-issued certificate of compliance, or other approval ~~by the Nuclear Regulatory Commission~~ of the package and the drawings and other documents referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken prior to shipment.

DHS 157.93 (4) (b) 2. Comply with the terms and conditions of the license, certificate, or other approval ~~by the Nuclear Regulatory Commission~~, as applicable, and the applicable requirements of ch. DHS 157 and subparts A, G, and H of 10 CFR 71.

SECTION 125. DHS 157.94 (5) (a) (Note), (am) (Note) and (d) are amended to read:

DHS 157.94 (5) (a) (Note) Notification of transport of nuclear waste may be sent to: Division of Emergency Management, 2400 Wright Street, Madison, Wisconsin, 53704. Notification may also be made by telephone at: 608-242-3232; or fax at: 608-242-3247. The telephone number of the 24-hour duty officer is 1-800-943-0003. A list of the names and mailing addresses of the governors' designees receiving advance notification of transportation of nuclear waste was published in the Federal Register on June 30, 1995 (60 FR 34306).

DHS 157.94 (5) (am) (Note) Notification of transport of nuclear waste may be sent to: Division of Emergency Management, 2400 Wright Street, Madison, Wisconsin, 53704. Notification may also be made by: telephone at 608-242-3232; or fax at 608-242-3247. The telephone number of the 24-hour duty officer is 1-800-943-0003. A list of the names and mailing addresses of the governors' designees receiving advance notification of transportation of nuclear waste was published in the Federal Register on June 30, 1995 (60 FR 34306).

DHS 157.94 (5) (d) The notification required by par. (a) shall be made in writing to the office of each appropriate governor or governor's designee, the office of each appropriate tribal official or tribal official's designee, and to the ~~department~~ Director, Office of Nuclear Security and Incident Response. A notification delivered by mail shall be postmarked at least 7 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur. A notification delivered by any other means than mail shall reach the office of the governor or governor's designee, the Indian tribal official or Indian tribal official's designee, and the department at least 4 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur. A copy of the notification shall be retained by the licensee for 3 years.

SECTION 126. DHS 157.94 (6) (c), (f) 1., 1. a. and b., (f) 2., and (f) 2. a. are amended to read:

DHS 157.94 (6) (c) Before the use of any package for the shipment of licensed material subject to this subsection, a licensee shall obtain approval of its quality assurance program from the department ~~nuclear regulatory commission approval for its quality assurance program.~~

DHS 157.94 (6) (f) 1. Each quality assurance program approval holder shall submit ~~in accordance with 10 CFR 71.1(a),~~ to the department a description of a proposed change to its ~~NRC~~ department-approved quality assurance program that will reduce commitments in the program description as approved by the ~~NRC~~ department. The quality assurance program approval holder shall not implement the change before receiving the department's approval. The description of a proposed change to the department-approved quality assurance program must identify the change, the reason for the change, and the basis for concluding that the revised program incorporating the change continues to satisfy the applicable requirements of 10 CFR 71 subpart H.

DHS 157.94 (6) (f) 1. a. ~~The quality assurance program approval holder shall not implement the change before receiving NRC approval.~~

DHS 157.94 (6) (f) 1. b. ~~The description of a proposed change to the NRC approved quality assurance program must identify the change, the reason for the change, and the basis for concluding that the revised program incorporating the change continues to satisfy the applicable requirements of 10 CFR 71 subpart H.~~

DHS 157.94 (6) (f) 2. Each quality assurance program approval holder may change a previously approved quality assurance program without the prior ~~NRC~~ approval of the department, if the change does not reduce the commitments in the quality assurance program previously approved by the ~~NRC~~department. Changes to the quality assurance program that do not reduce the commitments shall be submitted to the ~~NRC~~ department every 24 months~~, in accordance with 10 CFR 71.1(a)~~. In addition to quality assurance program changes involving administrative improvements and clarifications, spelling corrections, and non-substantive changes to punctuation or editorial items, the following changes are not considered reductions in commitment:

DHS 157.94 (6) (f) 2. a. The use of a quality assurance standard approved by the ~~NRC~~ department that is more recent than the quality assurance standard in the certificate holder's or applicant's current quality assurance program at the time of the change.

SECTION 127. DHS 157.9701(6) (b) is amended to read:

DHS 157.9701(6) (b) The notification required under par. (a) shall include the grounds for denial or termination and the licensee's procedures on how the individual may request a review of the decision to deny or terminate the individual's unescorted access authorization.

SECTION 128. DHS 157.9702 (2) (b) 1. is amended to read:

DHS 157.9702 (2) (b) 1. Except as provided under subd. 2. an individual who has been determined to be trustworthy and reliable under 10 CFR 73 or the security orders for access to safeguards information, safeguards information-modified handling, or risk-significant material, may have unescorted access to category 1 and category 2 quantities of radioactive material without further investigation. A licensee shall document that the individual was determined to be trustworthy and reliable under 10 CFR 73 or a security order.

SECTION 129.DHS 157.9703 (3) is repealed and recreated to read:

DHS 157.9703 (3) PROCEDURES FOR PROCESSING OF FINGERPRINT CHECKS.

(a) To comply with this subchapter, a licensee shall submit all of the following to the NRC:

1. One completed, legible standard fingerprint card.

2. An electronic fingerprint scan or, where practicable, other fingerprint record for each individual requiring unescorted access to category 1 or category 2 quantities of radioactive material.

Note: Materials shall be submitted to : U.S. Nuclear Regulatory Commission, Director, Division of Physical and Cyber Security Policy, ATTN: Criminal History Program/Mail Stop T-07D04M, 11545

Rockville Pike, Rockville, Maryland 20852. The standard fingerprint card, Form FD–258, ORIMDNRCOOOZ), may be obtained by emailing MAILSVS.Resource@nrc.gov. Guidance on submitting electronic fingerprints can be found at https://www.nrc.gov/security/chp.html.

(b) Fees for the processing of fingerprint checks are due upon application. The licensee shall submit payment with the application for the processing of fingerprints through corporate check, certified check, cashier's check, money order, or electronic payment, made payable to "U.S. NRC."

Note: For guidance on making electronic payments, contact the Division of Physical and Cyber Security Policy by emailing Crimhist.Resource@nrc.gov. Combined payment for multiple applications is acceptable. The nuclear regulatory commission publishes the amount of the fingerprint check application fee on the NRC's public website. To find the current fee amount, visit https://www.nrc.gov/security/chp.html, and follow the link titled "How do I determine how much to pay for the request?"

(c) The nuclear regulatory commission will forward to the submitting licensee all data received from the FBI as a result of a licensee's application for criminal history records checks.

SECTION 130. DHS 157.9706 (1) is amended to read:

DHS 157.9706 (1) Each licensee shall be responsible for the continuing effectiveness of its access authorization program. Each licensee shall ensure that its access authorization program is reviewed for compliance with the requirements of this subchapter and that comprehensive actions are taken to correct any noncompliance that is identified. The licensee shall evaluate all program performance objectives and requirements. Each licensee shall periodically, and at least annually, at intervals not to exceed 13 months, review its access authorization program content and implementation.

SECTION 131. DHS 157.9708 (4) (b) is amended to read:

DHS 157.9708(4) (b) Efforts to limit access shall include the development, implementation, and maintenance of written policies and procedures for controlling access to, and for proper handling and protection against unauthorized disclosure of, the security plan, ~~and~~ implementing procedures, and the list of individuals that have been approved for unescorted access.

SECTION 132. DHS 157.9708 (4) (c) (intro.) and (c) 1. are amended to read:

DHS 157.9708 (4) (c) (intro.) Before granting an individual access to the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access, a licensee shall do all of the following:

DHS 157.9708 (4) (c) 1. Evaluate an individual's need to know the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access.

SECTION 133.DHS 157.9708 (4) (e), (f), (g), and (h) 2. are amended to read:

DHS 157.9708 (4) (e) A licensee shall document the basis for concluding that an individual is trustworthy and reliable and should be granted access to the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access.

DHS 157.9708 (4) (f) A licensee shall maintain a list of persons currently approved for access to the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access. When a licensee determines that a person no longer needs access to the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access, or no longer meets the access authorization requirements for access to the information, the licensee shall remove the person from the approved list as soon as possible, but no later than 7 working days, and take prompt measures to ensure that the individual cannot obtain the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access.

DHS 157.9708 (4) (g) When not in use, a licensee shall store its security plan, ~~or~~ implementing procedures, and the list of individuals that have been approved for unescorted access in a manner to prevent unauthorized access. Information stored in non-removable electronic form shall be password protected.

DHS 157.9708 (4) (h) 2. The list of individuals approved for access to the security plan, ~~or~~ implementing procedures, or the list of individuals that have been approved for unescorted access.

SECTION 134. DHS 157.9714 (1) is amended to read:

DHS 157.9714 (1) Each licensee shall be responsible for the continuing effectiveness of the security program. Each licensee shall review the security program to confirm compliance with the requirements of this subchapter and to ensure that comprehensive actions are taken to correct any noncompliance. The licensee shall review the radioactive material security program content and implementation periodically, and at least annually, at intervals not to exceed 13 months.

SECTION 135. DHS 157.9719 (1) (a) is amended to read:

DHS 157.9719 (1) (a) The notification shall be made to the department and to the office of each governor or governor's designee of any state to, within, or through which the material is shipped. ~~The contact information, including telephone and mailing addresses, of governors and governors' designees, is available on the U.S. Nuclear Regulatory Commission website at http://scp.nrc.gov/special/designee.pdf. A list of the contact information is also available upon request from the Director, Division of Material Safety, State, Tribal, and Rulemaking Programs, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001.~~

SECTION 136. DHS 157.9719 (1) (Note 1) is renumbered DHS 157.9719 (1) (Note 2).

SECTION 137. DHS 157.9719 (1) (Note 1) is created to read:

DHS 157.9719 (1) (Note 1) The contact information, including telephone and mailing addresses, of governors and governors' designees, is available on the U.S. Nuclear Regulatory Commission website at http://scp.nrc.gov/special/designee.pdf. A list of the contact information is also available upon request from the Director, Division of Materials Safety, Security, State, and Tribal Programs, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001.

SECTION 138. DHS 157 Appendix A is repealed and recreated to read:

Chapter DHS 157
APPENDIX A

Exempt Concentrations

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/
Antimony (51)	Sb-122		$3X10^{-4}$
	Sb-124		$2X10^{-4}$
	Sb-125		$1X10^{-3}$
Argon (18)	Ar-37	$1X10^{-3}$	
	Ar-41	$4X10^{-7}$	
Arsenic (33)	As-73		$5X10^{-3}$
	As-74		$5X10^{-4}$
	As-76		$2X10^{-4}$
	As-77		$8X10^{-4}$
Barium (56)	Ba-131		$2X10^{-3}$
	Ba-140		$3X10^{-4}$
Beryllium (4)	Be-7		$2X10^{-2}$
Bismuth (83)	Bi-206		$4X10^{-4}$
Bromine (35)	Br-82	$4X10^{-7}$	$3X10^{-3}$
Cadmium (48)	Cd-109		$2X10^{-3}$
	Cd-115m		$3X10^{-4}$
	Cd-115		$3X10^{-4}$
Calcium (20)	Ca-45		$9X10^{-5}$
	Ca-47		$5X10^{-4}$
Carbon (6)	C-14	$1X10^{-6}$	$8X10^{-3}$
Cerium (58)	Ce-141		$9X10^{-4}$
	Ce-143		$4X10^{-4}$
	Ce-144		$1X10^{-4}$
Cesium (55)	Cs-131		$2X10^{-2}$
	Cs-134m		$6X10^{-2}$
	Cs-134		$9X10^{-5}$
Chlorine (17)	Cl-38	$9X10^{-7}$	$4X10^{-3}$
Chromium (24)	Cr-51		$2X10^{-2}$
Cobalt (27)	Co-57		$5X10^{-3}$
	Co-58		$1X10^{-3}$
	Co-60		$5X10^{-4}$
Copper (29)	Cu-64		$3X10^{-3}$
Dysprosium (66)	Dy-165		$4X10^{-3}$
	Dy-166		$4X10^{-4}$
Erbium (68)	Er-169		$9X10^{-4}$
	Er-171		$1X10^{-3}$
Europium (63)	Eu-152(9.2 h)		$6X10^{-4}$
	Eu-155		$2X10^{-3}$
Fluorine (9)	F-18	$2X10^{-6}$	$8X10^{-3}$

1/ Values are given in Column I only for those materials normally used as gases.
2/ microcuries /g for solids

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/
Gadolinium (64)	Gd-153		$2X10^{-3}$
	Gd-159		$8X10^{-4}$
Gallium (31)	Ga-72		$4X10^{-4}$
Germanium (32)	Ge-71		$2X10^{-2}$
Gold (79)	Au-196		$2X10^{-3}$
	Au-198		$5X10^{-4}$
	Au-199		$2X10^{-3}$
Hafnium (72)	Hf-181		$7X10^{-4}$
Hydrogen (1)	H-3	$5X10^{-6}$	$3X10^{-2}$
Indium (49)	In-113m		$1X10^{-2}$
	In-114m		$2X10^{-4}$
Iodine (53)	I-126	$3X10^{-9}$	$2X10^{-5}$
	I-131	$3X10^{-9}$	$2X10^{-5}$
	I-132	$8X10^{-8}$	$6X10^{-4}$
	I-133	$1X10^{-8}$	$7X10^{-5}$
	I-134	$2X10^{-7}$	$1X10^{-3}$
Iridium (77)	Ir-190		$2X10^{-3}$
	Ir-192		$4X10^{-4}$
	Ir-194		$3X10^{-4}$
Iron (26)	Fe-55		$8X10^{-3}$
	Fe-59		$6X10^{-4}$
Krypton (36)	Kr-85m	$1X10^{-6}$	
	Kr-85	$3X10^{-6}$	
Lanthanum (57)	La-140		$2X10^{-4}$
Lead (82)	Pb-203		$4X10^{-3}$
Lutetium (71)	Lu-177		$1X10^{-3}$
Manganese (25)	Mn-52		$3X10^{-4}$
	Mn-54		$1X10^{-3}$
	Mn-56		$1X10^{-3}$
Mercury (80)	Hg-197m		$2X10^{-3}$
	Hg-197		$3X10^{-3}$
	Hg-203		$2X10^{-4}$
Molybdenum (42)	Mo-99		$2X10^{-3}$
Neodymium (60)	Nd-147		$6X10^{-4}$
	Nd-149		$3X10^{-3}$
Nickel (28)	Ni-65		$1X10^{-3}$
Niobium (Columbium) (41)	Nb-95		$1X10^{-3}$
	Nb-97		$9X10^{-3}$
Osmium (76)	Os-185		$7X10^{-4}$
	Os-191m		$3X10^{-2}$
	Os-191		$2X10^{-3}$
	Os-193		$6X10^{-4}$
Palladium (46)	Pd-103		$3X10^{-3}$
	Pd-109		$9X10^{-4}$
Phosphorus (15)	P-32		$2X10^{-4}$
Platinum (78)	Pt-191		$1X10^{-3}$
	Pt-193m		$1X10^{-2}$

1/ Values are given in Column I only for those materials normally used as gases.

2/ microcuries /g for solids

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries /ml 2/
	Pt-197m		$1X10^{-2}$
	Pt-197		$1X10^{-3}$
Potassium (19)	K-42		$3X10^{-3}$
Praseodymium (59)	Pr-142		$3X10^{-4}$
	Pr-143		$5X10^{-4}$
Promethium (61)	Pm-147		$2X10^{-3}$
	Pm-149		$4X10^{-4}$
Rhenium (75)	Re-183		$6X10^{-3}$
	Re-186		$9X10^{-4}$
	Re-188		$6X10^{-4}$
Rhodium (45)	Rh-103m		$1X10^{-1}$
	Rh-105		$1X10^{-3}$
Rubidium (37)	Rb-86		$7X10^{-4}$
Ruthenium (44)	Ru-97		$4X10^{-4}$
	Ru-103		$8X10^{-4}$
	Ru-105		$1X10^{-3}$
	Ru-106		$1X10^{-4}$
Samarium (62)	Sm-153		$8X10^{-4}$
Scandium (21)	Sc-46		$4X10^{-4}$
	Sc-47		$9X10^{-4}$
	Sc-48		$3X10^{-4}$
Selenium (34)	Se-75		$3X10^{-3}$
Silicon (14)	Si-31		$9X10^{-3}$
Silver (47)	Ag-105		$1X10^{-3}$
	Ag-110m		$3X10^{-4}$
	Ag-111		$4X10^{-4}$
Sodium (11)	Na-24		$2X10^{-3}$
Strontium (38)	Sr-85		$1X10^{-4}$
	Sr-89		$1X10^{-4}$
	Sr-91		$7X10^{-4}$
	Sr-92		$7X10^{-4}$
Sulfur (16)	S-35	$9X10^{-8}$	$6X10^{-4}$
Tantalum (73)	Ta-182		$4X10^{-4}$
Technetium (43)	Tc-96m		$1X10^{-1}$
	Tc-96		$1X10^{-3}$
Tellurium (52)	Te-125m		$2X10^{-3}$
	Te-127m		$6X10^{-4}$
	Te-127		$3X10^{-3}$
	Te-129m		$3X10^{-4}$
	Te-131m		$6X10^{-4}$
	Te-132		$3X10^{-4}$
Terbium (65)	Tb-160		$4X10^{-4}$
Thallium (81)	Tl-200		$4X10^{-3}$
	Tl-201		$3X10^{-3}$
	Tl-202		$1X10^{-3}$
	Tl-204		$1X10^{-3}$

Thulium (69)	Tm-170		$5X10^{-4}$

1/ Values are given in Column I only for those materials normally used as gases.
2/ microcuries/g for solids

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/
	Tm-171		$5X10^{-3}$
Tin (50)	Sn-113		$9X10^{-4}$
	Sn-125		$2X10^{-4}$
Tungsten (Wolfram) (74)	W-181		$4X10^{-3}$
	W-187		$7X10^{-4}$
Vanadium (23)	V-48		$3X10^{-4}$
Xenon (54)	Xe-131m	$4X10^{-6}$	
	Xe-133	$3X10^{-6}$	
	Xe-135	$1X10^{-6}$	
Ytterbium (70)	Yb-175		$1X10^{-3}$
Yttrium (39)	Y-90		$2X10^{-4}$
	Y-91m		$3X10^{-2}$
	Y-91		$3X10^{-4}$
	Y-92		$6X10^{-4}$
	Y-93		$3X10^{-4}$
Zinc (30)	Zn-65		$1X10^{-3}$
	Zn-69m		$7X10^{-4}$
	Zn-69		$2X10^{-2}$
Zirconium (40)	Zr-95		$6X10^{-4}$
	Zr-97		$2X10^{-4}$
Beta- and gamma-emitting radioactive material not listed above with half-life of less than 3 years.		$1X10^{-10}$	$1X10^{-6}$

Note 1: Many radionuclides transform into other radionuclides. In expressing the concentrations in Appendix A, the activity stated is that of the parent radionuclide and takes into account the radioactive decay products.
Note 2: For purposes of s. DHS 157.09 (2) where there is involved a combination of radionuclides, the limit for the combination should be derived as follows: Determine for each radionuclide in the product the ratio between the radioactivity concentration present in the product and the exempt radioactivity concentration established in Appendix A for the specific radionuclide when not in combination. The sum of such ratios may not exceed "1".

Example: $$\frac{Concentration\ of\ Radionuclide\ A\ in\ Product}{Exempt\ concentration\ of\ Radionuclide\ A} + \frac{Concentration\ of\ Radionuclide\ B\ in\ Product}{Exempt\ concentration\ of\ Radionuclide\ B} \leq 1$$

Note 3: To convert microcuries-/ml to SI units of megabecquerels per liter multiply the above values by 37.

Example: Zirconium (40) Zr-97 ($2x10^{-4}$ microcuries/ml multiplied by 37 is equivalent to 74×10^{-4} MBq/l).
1/ Values are given in Column I only for those materials normally used as gases.
2/ microcuries/g for solids.

SECTION 139. DHS 157 Appendix B is amended to read:

Chapter DHS 157

APPENDIX B

Exempt Quantities

Radioactive Material	Microcuries	Radioactive Material	Microcuries
Antimony-122 (Sb 122)	100	Gallium-67 (Ga 67)	100
Antimony-124 (Sb 124)	10	Gallium-72 (Ga 72)	10
Antimony-125 (Sb 125)	10	Germanium-68 (Ge 68)	10
Arsenic-73 (As 73)	100	Germanium-71 (Ge 71)	100
Arsenic-74 (As 74)	10	Gold-195 (Au 195)	10
Arsenic-76 (As 76)	10	Gold-198 (Au 198)	100
Arsenic-77 (As 77)	100	Gold-199 (Au 199)	100
Barium-131 (Ba 131)	10	Hafnium-181 (Hf 181)	10
Barium-133 (Ba 133)	10	Holmium-166 (Ho 166)	100
Barium-140 (Ba 140)	10	Hydrogen-3 (H 3)	1,000
Bismuth-210 (Bi 210)	1	Indium-111 (In 111)	100
Bromine-82 (Br 82)	10	Indium-113m (In 113m)	100
Cadmium-109 (Cd 109)	10	Indium-114m (In 114m)	10
Cadmium-115m (Cd 115m)	10	Indium-115m (In 115m)	100
Cadmium-115 (Cd 115)	100	Indium-115 (In 115)	10
Calcium-45 (Ca 45)	10	Iodine-123 (I 123)	100
Calcium-47 (Ca 47)	10	Iodine-125 (I 125)	1
Carbon-14 (C 14)	100	Iodine-126 (I 126)	1
Cerium-141 (Ce 141)	100	Iodine-129 (I 129)	0.1
Cerium-143 (Ce 143)	100	Iodine-131 (I 131)	1
Cerium-144 (Ce 144)	1	Iodine-132 (I 132)	10
Cesium-129 (Cs 129)	100	Iodine-133 (I 133)	1
Cesium-131 (Cs 131)	1,000	Iodine-134 (I 134)	10
Cesium-134m (Cs 134m)	100	Iodine-135 (I 135)	10
Cesium-134 (Cs 134)	1	Iridium-192 (Ir 192)	10
Cesium-135 (Cs 135)	10	Iridium-194 (Ir 194)	100
Cesium-136 (Cs 136)	10	Iron-52 (Fe 52)	10
Cesium-137 (Cs 137)	10	Iron-55 (Fe 55)	100
Chlorine-36 (Cl 36)	10	Iron-59 (Fe 59)	10
Chlorine-38 (Cl 38)	10	Krypton-85 (Kr 85)	100
Chromium-51 (Cr 51)	1,000	Krypton-87 (Kr 87)	10
Cobalt-57 (Co 57)	100	Lanthanum-140 (La 140)	10
Cobalt-58m (Co 58m)	10	Lutetium-177 (Lu 177)	100
Cobalt-58 (Co 58)	10	Manganese-52 (Mn 52)	10
Cobalt-60 (Co 60)	1	Manganese-54 (Mn 54)	10
Copper-64 (Cu 64)	100	Manganese-56 (Mn 56)	10
Dysprosium-165 (Dy 165)	10	Mercury-197m (Hg 197m)	100
Dysprosium-166 (Dy 166)	100	Mercury-197 (Hg 197)	100
Erbium-169 (Er 169)	100	Mercury-203 (Hg 203)	10
Erbium-171 (Er 171)	100	Molybdenum-99 (Mo 99)	100
Europium-152 (Eu 152)9.2h	100	Neodymium-147 (Nd 147)	100
Europium-152 (Eu 152)13 yr	1	Neodymium-149 (Nd 149)	100
Europium-154 (Eu 154)	1	Nickel-59 (Ni 59)	100
Europium-155 (Eu 155)	10	Nickel-63 (Ni 63)	10
Fluorine-18 (F 18)	1,000	Nickel-65 (Ni 65)	100
Gadolinium-153 (Gd 153)	10	Niobium-93m (Nb 93m)	10
Gadolinium-159 (Gd 159)	100	Niobium-95 (Nb 95)	10
		Niobium-97 (Nb 97)	10

Radioactive Material	Microcuries	Radioactive Material	Microcuries
Osmium-185 (Os 185)	10	Technetium-96 (Tc 96)	10
Osmium-191m (Os 191m)	100	Technetium-97m (Tc 97m)	100
Osmium-191 (Os 191)	100	Technetium-97 (Tc 97)	100

Osmium-193 (Os 193)	100
Palladium-103 (Pd 103)	100
Palladium-109 (Pd 109)	100
Phosphorus-32 (P 32)	10
Platinum-191 (Pt 191)	100
Platinum-193m (Pt 193m)	100
Platinum-193 (Pt 193)	100
Platinum-197m (Pt 197m)	100
Platinum-197 (Pt 197)	100
Polonium-210 (Po 210)	0.1
Potassium-42 (K 42)	10
Potassium-43 (K 43)	10
Praseodymium-142 (Pr 142)	100
Praseodymium-143 (Pr 143)	100
Promethium-147 (Pm 147)	10
Promethium-149 (Pm 149)	10
Rhenium-186 (Re 186)	100
Rhenium-188 (Re 188)	100
Rhodium-103m (Rh 103m)	100
Rhodium-105 (Rh 105)	100
Rubidium-81 (Rb 81)	10
Rubidium-86 (Rb 86)	10
Rubidium-87 (Rb 87)	10
Ruthenium-97 (Ru 97)	100
Ruthenium-103 (Ru 103)	10
Ruthenium-105 (Ru 105)	10
Ruthenium-106 (Ru 106)	1
Samarium-151 (Sm 151)	10
Samarium-153 (Sm 153)	100
Scandium-46 (Sc 46)	10
Scandium-47 (Sc 47)	100
Scandium-48 (Sc 48)	10
Selenium-75 (Se 75)	10
Silicon-31 (Si 31)	100
Silver-105 (Ag 105)	10
Silver-110m (Ag 110m)	1
Silver-111 (Ag 111)	100
Sodium-22 (Na 22)	10
Sodium-24 (Na 24)	10
Strontium-85 (Sr 85)	10
Strontium-89 (Sr 89)	1
Strontium-90 (Sr 90)	0.1
Strontium-91 (Sr 91)	10
Strontium-92 (Sr 92)	10
~~Sulphur~~ Sulfur-35 (S 35)	100
Tantalum-182 (Ta 182)	10
Technetium-99m (Tc 99m)	100
Technetium-99 (Tc 99)	10
Tellurium-125m (Te 125m)	10
Tellurium-127m (Te 127m)	10
Tellurium-127 (Te 127)	100
Tellurium-129m (Te 129m)	10
Tellurium-129 (Te 129)	100
Tellurium-131m (Te 131m)	10
Tellurium-132 (Te 132)	10
Terbium-160 (Tb 160)	10
Thallium-200 (Tl 200)	100
Thallium-201 (Tl 201)	100
Thallium-202 (Tl 202)	100
Thallium-204 (Tl 204)	10
Thulium-170 (Tm 170)	10
Thulium-171 (Tm 171)	10
Tin-113 (Sn 113)	10
Tin-125 (Sn 125)	10
Tungsten-181 (W 181)	10
Tungsten-185 (W 185)	10
Tungsten-187 (W 187)	100
Vanadium-48 (V 48)	10
Xenon-131m (Xe 131m)	1,000
Xenon-133 (Xe 133)	100
Xenon-135 (Xe 135)	100
Ytterbium-175 (Yb 175)	100
Yttrium-87 (Y 87)	10
Yttrium-88 (Y 88)	10
Yttrium-90 (Y 90)	10
Yttrium-91 (Y 91)	10
Yttrium-92 (Y 92)	100
Yttrium-93 (Y 93)	100
Zinc-65 (Zn 65)	10
Zinc-69m (Zn 69m)	100
Zinc-69 (Zn 69)	1,000
Zirconium-93 (Zr 93)	10
Zirconium-95 (Zr 95)	10
Zirconium-97 (Zr 97)	10
Any radioactive material not listed above other than alpha-emitting radioactive material	0.1
Any alpha-emitting radioactive material not listed above other than transuranic radioactive material	0.01

Note 1:

To convert microcuries ~~(μCi)~~ to SI units of kilobecquerels (kBq), multiply the above values by 37.
Example: Zirconium-97 (10 ~~μCi~~ microcuries multiplied by 37 is equivalent to 370 kBq).

SECTION 140. DHS 157 Appendix D is amended to read:

Chapter DHS 157

APPENDIX D

Assigned Protection Factors for Respirators[a]

	Operating mode	Assigned Protection Factors
I. Air Purifying Respirators [Particulate1A[b] only]1A[c]:		
Filtering facepiece ~~disposabled~~ disposable[d]	Negative Pressure	([d])
Facepiece, half[e]	Negative Pressure	10
Facepiece, full	Negative Pressure	100
Facepiece, half	Powered air-purifying respirators	50
Facepiece, full	Powered air-purifying respirators	1000
Helmet/hood	Powered air-purifying respirators	1000
Facepiece, loose-fitting	Powered air-purifying respirators	25
II. Atmosphere Supplying Respirators [Particulate, gases and vapors1A[f]]:		
1. Air-line respirator:		
Facepiece, half	Demand	10
Facepiece, half	Continuous Flow	50
Facepiece, half	Pressure Demand	50
Facepiece, full	Demand	100
Facepiece, full	Continuous Flow	1000
Facepiece, full	Pressure Demand	1000
Helmet/hood	Continuous Flow	1000
Facepiece, loose-fitting	Continuous Flow	25
Suit	Continuous Flow	([g])
2. Self-contained breathing apparatus (SCBA):		
Facepiece, full	Demand	[i]100
Facepiece, full	Pressure Demand	[i]10,000
Facepiece, full	Demand, Recirculating	[i]100
Facepiece, full	Positive Pressure Recirculating	[i]10,000
III. Combination Respirators:		
Any combination of air-purifying and atmosphere-supplying respirators	(1) Assigned protection factor for type and mode of operation as listed above.	

[a] These assigned protection factors apply only in a respiratory protection program that meets the requirements of subchapter III of this chapter. The protection factors are applicable only to airborne radiological hazards and may not be appropriate to circumstances when chemical or other respiratory hazards exist instead of, or in addition to, radioactive hazards. Selection and use of respirators for such circumstances must also comply with U.S. Department of Labor regulations.

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

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

[c] A licensee may apply to the department for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors, for example, radioiodine.

[d] A licensee may permit individuals who have not been medically screened or fit tested on the device to use this type of respirator, provided that no credit be taken for their use in estimating intake or dose. It is also recognized that it is difficult to perform an effective positive or negative pressure pre-use user seal check on this type of device. All other respiratory protection program requirements listed in s. DHS 157.27 (3) apply. An assigned protection factor has not been assigned for these devices. However, an APF equal to 10 may be used if the licensee demonstrates a fit factor of at least 100 by use of a validated or evaluated, qualitative or quantitative fit test.

[e] Under-chin type only. No distinction is made in this Appendix between elastomeric half-masks with replaceable cartridges and those designed with the filter medium as an integral part of the facepiece, for example, disposable or reusable disposable. Both types are acceptable so long as the seal area of the latter contains some substantial type of seal-enhancing material such as rubber or plastic, the 2 or more suspension straps are adjustable, the filter medium is at least 95 percent efficient and all other requirements of subchapter III of this chapter are met.

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

[g] No National Institute of Occupational Safety and Health approval schedule is currently available for atmosphere supplying suits. This equipment may be used in an acceptable respiratory protection program as long as all the other minimum program requirements, with the exception of fit testing, are met.

Note: See s. DHS 157.27 (3).

[h] A licensee should implement institutional controls to assure that these devices are not used in areas immediately dangerous to life or health.

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

SECTION 141. DHS 157 Appendix F is repealed and recreated to read:

Chapter DHS 157

APPENDIX F

Quantities of Licensed Material Requiring Labeling (in Atomic Order)

Note: **To convert microcuries to kBq, multiply the microcurie value by 37.**

Radionuclide	Microcuries	Radionuclide	Microcuries
Hydrogen-3	1,000	Potassium-43	1,000
Beryllium-7	1,000	Potassium-44	1,000
Beryllium-10	1	Potassium-45	1,000
Carbon-11	1,000	Calcium-41	100
Carbon-14	100	Calcium-45	100
Fluorine-18	1,000	Calcium-47	100
Sodium-22	10	Scandium-43	1,000
Sodium-24	100	Scandium-44m	100
Magnesium-28	100	Scandium-44	100
Aluminum-26	10	Scandium-46	10
Silicon-31	1,000	Scandium-47	100
Silicon-32	1	Scandium-48	100
Phosphorus-32	10	Scandium-49	1,000
Phosphorus-33	100	Titanium-44	1
Sulfur-35	100	Titanium-45	1,000
Chlorine-36	10	Vanadium-47	1,000
Chlorine-38	1,000	Vanadium-48	100
Chlorine-39	1,000	Vanadium-49	1,000
Argon-39	1,000	Chromium-48	1,000
Argon-41	1,000	Chromium-49	1,000
Potassium-40	100	Chromium-51	1,000
Potassium-42	1,000	Manganese-51	1,000

Manganese-52m..... 1,000
Manganese-52..... 100
Manganese-53..... 1,000
Manganese-54..... 100
Manganese-56..... 1,000
Iron-52 100
Iron-55 100
Iron-59 10
Iron-60 1
Cobalt-55 100
Cobalt-56 10
Cobalt-57 100
Cobalt-58m..... 1,000
Cobalt-58 100
Cobalt-60m..... 1,000
Cobalt-60 1
Cobalt-61 1,000
Cobalt-62m..... 1,000
Nickel-56 100
Nickel-57 100
Nickel-59 100
Nickel-63 100
Nickel-65 1,000
Nickel-66 10
Copper-60 1,000
Copper-61 1,000
Copper-64 1,000
Copper-67 1,000
Zinc-62 100
Zinc-63 1,000
Zinc-65 10
Zinc-69m 100
Zinc-69 1,000
Zinc-71m 1,000
Zinc-72 100
Gallium-65..... 1,000
Gallium-66..... 100
Gallium-67..... 1,000
Gallium-68..... 1,000
Gallium-70..... 1,000
Gallium-72..... 100
Gallium-73..... 1,000

Radionuclide	Microcuries	Radionuclide	Microcuries
Germanium-66	1,000	Rubidium-84	100
Germanium-67	1,000	Rubidium-86	100
Germanium-68	10	Rubidium-87	100
Germanium-69	1,000	Rubidium-88	1,000
Germanium-71	1,000	Rubidium-89	1,000
Germanium-75	1,000	Strontium-80	100
Germanium-77	1,000	Strontium-81	1,000
Germanium-78	1,000	Strontium-83	100
Arsenic-69	1,000	Strontium-85m	1,000
Arsenic-70	1,000	Strontium-85	100
Arsenic-71	100	Strontium-87m	1,000
Arsenic-72	100	Strontium-89	10
Arsenic-73	100	Strontium-90	0.1
Arsenic-74	100	Strontium-91	100
Arsenic-76	100	Strontium-92	100
Arsenic-77	100	Yttrium-86m	1,000
Arsenic-78	1,000	Yttrium-86	100
Selenium-70	1,000	Yttrium-87	100
Selenium-73m	1,000	Yttrium-88	10
Selenium-73	100	Yttrium-90m	1,000
Selenium-75	100	Yttrium-90	10
Selenium-79	100	Yttrium-91m	1,000
Selenium-81m	1,000	Yttrium-91	10
Selenium-81	1,000	Yttrium-92	100
Selenium-83	1,000	Yttrium-93	100
Bromine-74m	1,000	Yttrium-94	1,000
Bromine-74	1,000	Yttrium-95	1,000
Bromine-75	1,000	Zirconium-86	100
Bromine-76	100	Zirconium-88	10
Bromine-77	1,000	Zirconium-89	100
Bromine-80m	1,000	Zirconium-93	1
Bromine-80	1,000	Zirconium-95	10
Bromine-82	100	Zirconium-97	100
Bromine-83	1,000	Niobium-88	1,000
Bromine-84	1,000	Niobium-89m (66 min)	1,000
Krypton-74	1,000	Niobium-89 (122 min)	1,000
Krypton-76	1,000	Niobium-90	100
Krypton-77	1,000	Niobium-93m	10
Krypton-79	1,000	Niobium-94	1
Krypton-81	1,000	Niobium-95m	100
Krypton-83m	1,000	Niobium-95	100
Krypton-85m	1,000	Niobium-96	100
Krypton-85	1,000	Niobium-97	1,000
Krypton-87	1,000	Niobium-98	1,000
Krypton-88	1,000	Molybdenum-90	100
Rubidium-79	1,000	Molybdenum-93m	100
Rubidium-81m	1,000	Molybdenum-93	10
Rubidium-81	1,000	Molybdenum-99	100
Rubidium-82m	1,000	Molybdenum-101	1,000
Rubidium-83	100	Technetium-93m	1,000

Technetium-93	1,000	Technetium-94	1,000
Technetium-94m	1,000	Technetium-96m	1,000

Radionuclide	Microcuries	Radionuclide	Microcuries
Technetium-96	100	Cadmium-117m	1,000
Technetium-97m	100	Cadmium-117	1,000
Technetium-97	1,000	Indium-109	1,000
Technetium-98	10	Indium-110 (69.1 min)	1,000
Technetium-99m	1,000	Indium-110 (4.9 h)	1,000
Technetium-99	100	Indium-111	100
Technetium-101	1,000	Indium-112	1,000
Technetium-104	1,000	Indium-113m	1,000
Ruthenium-94	1,000	Indium-114m	10
Ruthenium-97	1,000	Indium-115m	1,000
Ruthenium-103	100	Indium-115	100
Ruthenium-105	1,000	Indium-116m	1,000
Ruthenium-106	1	Indium-117m	1,000
Rhodium-99m	1,000	Indium-117	1,000
Rhodium-99	100	Indium-119m	1,000
Rhodium-100	100	Tin-110	100
Rhodium-101m	1,000	Tin-111	1,000
Rhodium-101	10	Tin-113	100
Rhodium-102m	10	Tin-117m	100
Rhodium-102	10	Tin-119m	100
Rhodium-103m	1,000	Tin-121m	100
Rhodium-105	100	Tin-121	1,000
Rhodium-106m	1,000	Tin-123m	1,000
Rhodium-107	1,000	Tin-123	10
Palladium-100	100	Tin-125	10
Palladium-101	1,000	Tin-126	10
Palladium-103	100	Tin-127	1,000
Palladium-107	10	Tin-128	1,000
Palladium-109	100	Antimony-115	1,000
Silver-102	1,000	Antimony-116m	1,000
Silver-103	1,000	Antimony-116	1,000
Silver-104m	1,000	Antimony-117	1,000
Silver-104	1,000	Antimony-118m	1,000
Silver-105	100	Antimony-119	1,000
Silver-106m	100	Antimony-120 (16 min)	1,000
Silver-106	1,000	Antimony-120 (5.76 d)	100
Silver-108m	1	Antimony-122	100
Silver-110m	10	Antimony-124m	1,000
Silver-111	100	Antimony-124	10
Silver-112	100	Antimony-125	100
Silver-115	1,000	Antimony-126m	1,000
Cadmium-104	1,000	Antimony-126	100
Cadmium-107	1,000	Antimony-127	100
Cadmium-109	1	Antimony-128 (10.4 min)	1,000
Cadmium-113m	0.1	Antimony-128 (9.01 h)	100
Cadmium-113	100	Antimony-129	100
Cadmium-115m	10	Antimony-130	1,000
Cadmium-115	100	Antimony-131	1,000

Tellurium-116	1,000	Tellurium-123	100
Tellurium-121m	10	Tellurium-125m	10
Tellurium-121	100	Tellurium-127m	10
Tellurium-123m	10	Tellurium-127	1,000

Radionuclide	Microcuries	Radionuclide	Microcuries
Tellurium-129m	10	Cesium-135	100
Tellurium-129	1,000	Cesium-136	10
Tellurium-131m	10	Cesium-137	10
Tellurium-131	100	Cesium-138	1,000
Tellurium-132	10	Barium-126	1,000
Tellurium-133m	100	Barium-128	100
Tellurium-133	1,000	Barium-131m	1,000
Tellurium-134	1,000	Barium-131	100
Iodine-120m	1,000	Barium-133m	100
Iodine-120	100	Barium-133	100
Iodine-121	1,000	Barium-135m	100
Iodine-123	100	Barium-139	1,000
Iodine-124	10	Barium-140	100
Iodine-125	1	Barium-141	1,000
Iodine-126	1	Barium-142	1,000
Iodine-128	1,000	Lanthanum-131	1,000
Iodine-129	1	Lanthanum-132	100
Iodine-130	10	Lanthanum-135	1,000
Iodine-131	1	Lanthanum-137	10
Iodine-132m	100	Lanthanum-138	100
Iodine-132	100	Lanthanum-140	100
Iodine-133	10	Lanthanum-141	100
Iodine-134	1,000	Lanthanum-142	1,000
Iodine-135	100	Lanthanum-143	1,000
Xenon-120	1,000	Cerium-134	100
Xenon-121	1,000	Cerium-135	100
Xenon-122	1,000	Cerium-137m	100
Xenon-123	1,000	Cerium-137	1,000
Xenon-125	1,000	Cerium-139	100
Xenon-127	1,000	Cerium-141	100
Xenon-129m	1,000	Cerium-143	100
Xenon-131m	1,000	Cerium-144	1
Xenon-133m	1,000	Praseodymium-136	1,000
Xenon-133	1,000	Praseodymium-137	1,000
Xenon-135m	1,000	Praseodymium-138m	1,000
Xenon-135	1,000	Praseodymium-139	1,000
Xenon-138	1,000	Praseodymium-142m	1,000
Cesium-125	1,000	Praseodymium-142	100
Cesium-127	1,000	Praseodymium-143	100
Cesium-129	1,000	Praseodymium-144	1,000
Cesium-130	1,000	Praseodymium-145	100
Cesium-131	1,000	Praseodymium-147	1,000
Cesium-132	100	Neodymium-136	1,000
Cesium-134m	1,000	Neodymium-138	100
Cesium-134	10	Neodymium-139m	1,000
Cesium-135m	1,000	Neodymium-139	1,000

Neodymium-141	1,000
Neodymium-147	100
Neodymium-149	1,000
Neodymium-151	1,000
Promethium-141	1,000
Promethium-143	100
Promethium-144	10
Promethium-145	10
Promethium-146	1
Promethium-147	10
Promethium-148m	10
Promethium-148	10

Radionuclide	Microcuries
Promethium-149	100
Promethium-150	1,000
Promethium-151	100
Samarium-141m	1,000
Samarium-141	1,000
Samarium-142	1,000
Samarium-145	100
Samarium-146	1
Samarium-147	100
Samarium-151	10
Samarium-153	100
Samarium-155	1,000
Samarium-156	1,000
Europium-145	100
Europium-146	100
Europium-147	100
Europium-148	10
Europium-149	100
Europium-150 (12.62 h)	100
Europium-150 (34.2 y)	1
Europium-152m	100
Europium-152	1
Europium-154	1
Europium-155	10
Europium-156	100
Europium-157	100
Europium-158	1,000
Gadolinium-145	1,000
Gadolinium-146	10
Gadolinium-147	100
Gadolinium-148	0.001
Gadolinium-149	100
Gadolinium-151	10
Gadolinium-152	100
Gadolinium-153	10
Gadolinium-159	100
Terbium-147	1,000
Terbium-149	100
Terbium-150	1,000
Terbium-151	100
Terbium-153	1,000
Terbium-154	100
Terbium-155	1,000
Terbium-156m (5.0 h)	1,000

Radionuclide	Microcuries
Terbium-156m (24.4 h)	1,000
Terbium-156	100
Terbium-157	10
Terbium-158	1
Terbium-160	10
Terbium-161	100
Dysprosium-155	1,000
Dysprosium-157	1,000
Dysprosium-159	100
Dysprosium-165	1,000
Dysprosium-166	100
Holmium-155	1,000
Holmium-157	1,000
Holmium-159	1,000
Holmium-161	1,000
Holmium-162m	1,000
Holmium-162	1,000
Holmium-164m	1,000
Holmium-164	1,000
Holmium-166m	1
Holmium-166	100
Holmium-167	1,000
Erbium-161	1,000
Erbium-165	1,000
Erbium-169	100
Erbium-171	100
Erbium-172	100
Thulium-162	1,000
Thulium-166	100
Thulium-167	100
Thulium-170	10
Thulium-171	10
Thulium-172	100
Thulium-173	100
Thulium-175	1,000
Ytterbium-162	1,000
Ytterbium-166	100
Ytterbium-167	1,000
Ytterbium-169	100
Ytterbium-175	100
Ytterbium-177	1,000
Ytterbium-178	1,000
Lutetium-169	100
Lutetium-170	100

Lutetium-171	100
Lutetium-172	100
Lutetium-173	10
Lutetium-174m	10
Lutetium-174	10
Lutetium-176m	1,000
Lutetium-176	100
Lutetium-177m	10
Lutetium-177	100
Lutetium-178m	1,000
Lutetium-178	1,000
Lutetium-179	1,000
Hafnium-170	100
Hafnium-172	1
Hafnium-173	1,000
Hafnium-175	100

Radionuclide	Microcuries
Hafnium-177m	1,000
Hafnium-178m	0.1
Hafnium-179m	10
Hafnium-180m	1,000
Hafnium-181	10
Hafnium-182m	1,000
Hafnium-182	0.1
Hafnium-183	1,000
Hafnium-184	100
Tantalum-172	1,000
Tantalum-173	1,000
Tantalum-174	1,000
Tantalum-175	1,000
Tantalum-176	100
Tantalum-177	1,000
Tantalum-178	1,000
Tungsten-188	10
Rhenium-177	1,000
Rhenium-178	1,000
Rhenium-181	1,000
Rhenium-182 (12.7 h)	1,000
Rhenium-182 (64.0 h)	100
Rhenium-184m	10
Rhenium-184	100
Rhenium-186m	10
Rhenium-186	100
Rhenium-187	1,000
Rhenium-188m	1,000
Rhenium-188	100
Rhenium-189	100
Osmium-180	1,000
Osmium-181	1,000
Osmium-182	100
Osmium-185	100
Osmium-189m	1,000
Osmium-191m	1,000
Osmium-191	100
Osmium-193	100
Osmium-194	1
Iridium-182	1,000
Iridium-184	1,000
Iridium-185	1,000
Iridium-186	100
Iridium-187	1,000
Iridium-188	100
Iridium-189	100
Iridium-190m	1,000
Iridium-190	100
Iridium-192m (1.4 min)	10
Iridium-192 (73.8 d)	1
Iridium-194m	10
Iridium-194	100
Iridium-195m	1,000
Iridium-195	1,000
Platinum-186	1,000
Platinum-188	100
Platinum-189	1,000
Platinum-191	100
Platinum-193m	100
Platinum-193	1,000
Platinum-195m	100
Platinum-197m	1,000
Platinum-197	100
Platinum-199	1,000
Platinum-200	100
Gold-193	1,000
Gold-194	100
Gold-195	10
Gold-198m	100
Gold-198	100
Gold-199	100
Gold-200m	100
Gold-200	1,000
Gold-201	1,000
Mercury-193m	100
Mercury-193	1,000
Mercury-194	1
Mercury-195m	100
Mercury-195	1,000
Mercury-197m	100
Mercury-197	1,000
Mercury-199m	1,000
Mercury-203	100
Thallium-194m	1,000

Thallium-194	1,000
Thallium-195	1,000
Thallium-197	1,000
Thallium-198m	1,000
Thallium-198	1,000
Thallium-199	1,000
Thallium-201	1,000
Thallium-200	1,000
Thallium-202	100
Thallium-204	100
Lead-195m	1,000
Lead-198	1,000
Lead-199	1,000
Lead-200	100
Lead-201	1,000
Lead-202m	1,000
Lead-202	10
Lead-203	1,000
Lead-205	100
Lead-209	1,000

Radionuclide	Microcuries	Radionuclide	Microcuries
Lead-210	0.01	Thorium-229	0.001
Lead-211	100	Thorium-230	0.001
Lead-212	1	Thorium-231	100
Lead-214	100	Thorium-232	100
Bismuth-200	1,000	Thorium-234	10
Bismuth-201	1,000	Thorium-natural	100
Bismuth-202	1,000	Protactinium-227	10
Bismuth-203	100	Protactinium-228	1
Bismuth-205	100	Protactinium-230	0.1
Bismuth-206	100	Protactinium-231	0.001
Bismuth-207	10	Protactinium-232	1
Bismuth-210m	0.1	Protactinium-233	100
Bismuth-210	1	Protactinium-234	100
Bismuth-212	10	Uranium-230	0.01
Bismuth-213	10	Uranium-231	100
Bismuth-214	100	Uranium-232	0.001
Polonium-203	1,000	Uranium-233	0.001
Polonium-205	1,000	Uranium-234	0.001
Polonium-207	1,000	Uranium-235	0.001
Polonium-210	0.1	Uranium-236	0.001
Astatine-207	100	Uranium-237	100
Astatine-211	10	Uranium-238	100
Radon-220	1	Uranium-239	1,000
Radon-222	1	Uranium-240	100
Francium-222	100	Uranium-natural	100
Francium-223	100	Neptunium-232	100
Radium-223	0.1	Neptunium-233	1,000
Radium-224	0.1	Neptunium-234	100
Radium-225	0.1	Neptunium-235	100
Radium-226	0.1	Neptunium-236 (1.15E+5 y)	0.001
Radium-227	1,000	Neptunium-236 (22.5 h)	1
Radium-228	0.1	Neptunium-237	0.001
Actinium-224	1	Neptunium-238	10
Actinium-225	0.01	Neptunium-239	100
Actinium-226	0.1	Neptunium-240	1,000
Actinium-227	0.001	Plutonium-234	10
Actinium-228	1	Plutonium-235	1,000
Thorium-226	10	Plutonium-236	0.001
Thorium-227	0.01	Plutonium-237	100
Thorium-228	0.001	Plutonium-238	0.001

Plutonium-239	0.001	Americium-242m	0.001
Plutonium-240	0.001	Americium-242	10
Plutonium-241	0.01	Americium-243	0.001
Plutonium-242	0.001	Americium-244m	100
Plutonium-243	1,000	Americium-244	10
Plutonium-244	0.001	Americium-245	1,000
Plutonium-245	100	Americium-246m	1,000
Americium-237	1,000	Americium-246	1,000
Americium-238	100	Curium-238	100
Americium-239	1,000	Curium-240	0.1
Americium-240	100	Curium-241	1
Americium-241	0.001		

Radionuclide	**Microcuries**	**Radionuclide**	**Microcuries**
Curium-242	0.01	Californium-250	0.001
Curium-243	0.001	Californium-251	0.001
Curium-244	0.001	Californium-252	0.001
Curium-245	0.001	Californium-253	0.1
Curium-246	0.001	Californium-254	0.001
Curium-247	0.001	Einsteinium-250	100
Curium-248	0.001	Einsteinium-251	100
Curium-249	1,000	Einsteinium-253	0.1
Berkelium-245	100	Einsteinium-254m	1
Berkelium-246	100	Einsteinium-254	0.01
Berkelium-247	0.001	Fermium-252	1
Berkelium-249	0.1	Fermium-253	1
Berkelium-250	10	Fermium-254	10
Californium-244	100	Fermium-255	1
Californium-246	1	Fermium-257	0.01
Californium-248	0.01	Mendelevium-257	10
Californium-249	0.001	Mendelevium-258	0.01

Any alpha-emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition 0.001

Any radionuclide other than alpha-emitting radionuclides not listed above, or mixtures of beta emitters of unknown composition 0.01

Note: For purposes of s. DHS 157.29 (2) (e), (5) (a) and s. DHS 157.32 (1) (a) 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.

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

SECTION 142. DHS 157 Appendix H is repealed and recreated to read:

Chapter DHS 157

APPENDIX H

Classification and Characteristics of Low-level
Radioactive Waste

Section I. — Classification of Radioactive Waste for Land Disposal.

(a) Considerations. Determination of the classification of radioactive waste involves 2 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 Section II (a). If Class A waste also meets the stability requirements set forth in Section II (b), 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 Section II.

(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 Section II.

(4) Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods shall be different, and in general more stringent, than those specified for Class C waste. Such waste must be disposed of in a geologic repository as defined in 10 CFR 60.

(c) Classification determined by long-lived radionuclides. If the radioactive waste contains only radionuclides listed in Table IV, classification shall be determined as follows:

(1) If the concentration does not exceed 0.1 times the value in Table IV, the waste is Class A.

(2) If the concentration exceeds 0.1 times the value in Table IV, but does not exceed the value in Table IV, the waste is Class C.

(3) If the concentration exceeds the value in Table IV, the waste is not generally acceptable for land disposal.

(4) For wastes containing mixtures of radionuclides listed in Table IV, the total concentration shall be determined by the sum of fractions rule described in Section I (g).

TABLE IV

Radionuclide	Concentration	
	Curie/Cubic Meter[a/]	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 5 years		100
Pu-241		3,500
Cm-242		20,000
Ra-226		100

a/ *To convert the Ci/m^3 values to gigabecquerel (GBq) per cubic meter, multiply the Ci/m^3 value by 37.*

b/ *To convert the nCi/g values to becquerel (Bq) per gram, multiply the nCi/g value by 37.*

(d) Classification determined by short-lived radionuclides. If the waste does not contain any of the radionuclides listed in Table IV, classification shall be determined based on the concentrations shown in Table V. However, as specified in Section I (f), if radioactive waste does not contain any nuclides listed in either Table IV or V, 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 V, the total concentration shall be determined by the sum of fractions rule described in Section I (g).

TABLE V

Radionuclide	Concentration Curie/Cubic Meter[a/]		
	~~Column 1~~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

a/ *Note: To convert the Ci/m^3 value to gigabecquerel (GBq) per cubic meter, multiply the Ci/m^3 value by 37. There are no limits established for these radionuclides in Class B or 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 V determine the waste to be Class C independent of these radionuclides.*

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

(1) If the concentration of a radionuclide listed in Table IV does not exceed 0.1 times the value listed in Table IV, the class shall be that determined by the concentration of radionuclides listed in Table V.

(2) If the concentration of a radionuclide listed in Table IV exceeds 0.1 times the value listed in Table IV, but does not exceed the value in Table IV, the waste shall be Class C, provided the concentration of radionuclides listed in Table V does not exceed the value shown in Column 3 of Table V.

(f) Classification of wastes with radionuclides other than those listed in Tables IV and V. If the waste does not contain any radionuclides listed in either Table IV or V, 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 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 1.85 TBq/m^3 (50 Ci/m^3) and Cs-137 in a concentration of 814 GBq/m^3 (22 Ci/m^3). Since the concentrations both exceed the values in Column 1, Table V, they must be compared to Column 2 values. For Sr-90 fraction, 50/150 = 0.33., for Cs-137 fraction, 22/44 = 0.5; the sum of the fractions = 0.83. Since the sum is less than 1.0, 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.

Section II. — 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 this section, the site license conditions shall govern.

(2) Wastes may 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 free-standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume.

(5) Waste may 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 may 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 under Section II (a) (8).

(7) Waste must not be pyrophoric. Pyrophoric materials contained in wastes shall be treated, prepared, and packaged to be nonflammable.

(8) Wastes in a gaseous form shall be packaged at an absolute pressure that does not exceed 1.5 atmospheres at 20□C. Total activity may not exceed 3.7 TBq (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 non-radiological 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 may 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 Section II (a) (3) and (4), liquid wastes, or wastes containing liquid, shall be converted into a form that contains as little free-standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 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.

Section III. — Labeling.

Each package of waste shall be clearly labeled to identify whether it is Class A, Class B or Class C waste, under Section I.

SECTION 143. DHS 157 Appendix L is repealed and recreated to read:

Chapter DHS 157

APPENDIX L

Topics to be Covered in the Cross-training of Operators of PET/CT Systems

I. The CT Computer
- A. Hardware differences between CT and PET
- B. The data acquisition system
- C. Software
- D. Algorithms
- E. Postprocessing techniques
- F. Keyboard layout
- G. Peripheral device orientation
- H. Image display, manipulation, recording and archiving
- I. Image quality in CT
- J. The computed tomography process
- K. Spiral computed tomography
- L. CT, applied terminology
- M. Procedure protocols
- N. CT exam procedures
- O. DICOM/PACS

II. Contrast Media Used in CT Procedures
- A. Contrast media agents
- B. Adverse reactions

C. Emergency response equipment and procedures

III. Image Quality in CT
- A. Determinants
- B. Influencing factors
- C. Measurements
- D. Quality control procedures

IV. The CT Process
- A. Data acquisition methods
- B. The data acquisition systemand components

V. Spiral CT Protocols and Procedures (if appropriate)

VI. Radiation Protection in CT
- A. Dose reduction techniques
- B. Technique determination

VII. CT Sectional Anatomy

SECTION 144. DHS 157 Appendix O is repealed and recreated to read:

Chapter DHS 157

APPENDIX O

Determination of A_1 and A_2

I. Values of A_1 and A_2 for individual radionuclides, which are the bases for many activity limits elsewhere in these regulations, are given in TABLE VI. The curie (Ci) values specified are obtained by converting from the Terabecquerel (TBq) figure. The curie values are expressed to 3 significant figures to assure that the difference in the TBq and Ci quantities is one tenth of one percent or less. Where values of A_1 or A_2 are unlimited, it is for radiation control purposes only. For nuclear criticality safety, some materials are subject to controls placed on fissile material.

II. (a) For individual radionuclides whose identities are known, but which are not listed in TABLE VI, the determination of the values of A_1 and A_2 requires department approval, except that the values of A_1 and A_2 in TABLE VIII may be used without obtaining department approval.

(b) For individual radionuclides whose identities are known, but which are not listed in Table VII, the exempt material activity concentration and exempt consignment activity values contained in Table VIII may be used. Otherwise, the licensee shall obtain prior department approval of the exempt material activity concentration and exempt consignment activity values for radionuclides not listed in Table VII, before shipping the material.

(c) The licensee shall submit requests for prior approval, described under paragraphs II(a) and II(b) of this Appendix, in writing to the department.

III. In the calculations of A_1 and A_2 for a radionuclide not in TABLE VI, a single radioactive decay chain, in which radionuclides are present in their naturally occurring proportions, and in which no daughter nuclide

has a half-life either longer than 10 days, or longer than that of the parent nuclide, shall be considered as a single radionuclide, and the activity to be taken into account, and the A_1 or A_2 value to be applied shall be those corresponding to the parent nuclide of that chain. In the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days, or greater than that of the parent nuclide, the parent and those daughter nuclides shall be considered as mixtures of different nuclides.

IV. For mixtures of radionuclides whose identities and respective activities are known, the following conditions apply:

(a) For special form radioactive material, the maximum quantity transported in a Type A package is as follows:

$$\sum_i \frac{B(i)}{A_1(i)} \leq 1$$

where $B(i)$ is the activity of radionuclide i in special form, and $A_1(i)$ is the A_1 value for radionuclide i.

(b) For normal form radioactive material, the maximum quantity transported in a Type A package is as follows:

$$\sum_i \frac{B(i)}{A_2(i)} \leq 1$$

where $B(i)$ is the activity of radionuclide i in normal form, and $A_2(i)$ is the value for radionuclide i.

(c) If the package contains both special and normal form radioactive material, the activity that may be transported in a Type A package is as follows:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)} \leq 1$$

where B(i) is the activity of radionuclide i as special form radioactive material, $A_1(i)$ is the A_1 value for radionuclide i, C(j) is the activity of radionuclide j as normal form radioactive material, $A_2(j)$ is the A_2 value for radionuclide j.

(d) Alternatively, the A_1 value for mixtures of special form material may be determined as follows:

$$A_1 \text{ for mixture } s = \frac{1}{\sum_i \frac{f(i)}{A_1(i)}}$$

where f(i) is the fraction of activity of nuclide (i) in the mixture and A_1(i) is the appropriate A_1 value for nuclide i.

(e) Alternatively the A_2 value for mixtures of normal form material may be determined as follows:

$$A_2 \text{ for mixtures } = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where f(i) is the fraction of activity for radionuclide (i) in the mixture, and A_2 (i) is the appropriate A_2 value for radionuclide (i).

(f) The exempt activity concentration for mixtures of nuclides may be determined as follows:

$$\text{Exempt activity concentration for mixture } = \frac{1}{\sum_i \frac{f(i)}{[A](i)}}$$

where f(i) is the fraction of activity concentration of radionuclide (i) in the mixture, and [A] is the activity concentration for exempt material containing radionuclide (i).

(g) The activity limit for an exempt consignment for mixtures of radionuclides may be determined as follows:

$$\text{Exempt consignment activity for mixture } = \frac{1}{\sum_i \frac{f(i)}{A(i)}}$$

where f(i) is the fraction of activity of radionuclide (i) in the mixture, and A is the activity limit for exempt consignments for radionuclide (i).

V. (a) When the identity of each radionuclide is known, but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest A_1 or A_2 value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraph IV. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest A_1 or A_2 values for the alpha emitters and beta/gamma emitters.

(b) When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest [A] (activity concentration for exempt material) or A (activity limit for exempt consignment) value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraph IV. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest [A] or A values for the alpha emitters and beta/gamma emitters, respectively.

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of Radionuclide	Element and Atomic No.	A1 (TBq)	A1 (Ci)	A2 (TBq)	A2 (Ci)	Specific Activity (TBq/g)	(Ci/g)
Ac-225 (a)	Actinium (89)	$8.0X10^{-1}$	$2.2X10^{1}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$2.1X10^{3}$	$5.8X10^{4}$
Ac-227 (a)		$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-5}$	$2.4X10^{-3}$	2.7	$7.2X10^{1}$
Ac-228		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$8.4X10^{4}$	$2.2X10^{6}$
Ag-105	Silver (47)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.1X10^{3}$	$3.0X10^{4}$
Ag-108m (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.7X10^{-1}$	$2.6X10^{1}$
Ag-110m (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.8X10^{2}$	$4.7X10^{3}$
Ag-111		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Al-26	Aluminum (13)	$1.0X10^{-1}$	2.7	$1.0X10^{-1}$	2.7	$7.0X10^{-4}$	$1.9X10^{-2}$
Am-241	Americium (95)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.3X10^{-1}$	3.4
Am-242m (a)		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.6X10^{-1}$	$1.0X10^{1}$
Am-243 (a)		5.0	$1.4X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$7.4X10^{-3}$	$2.0X10^{-1}$
Ar-37	Argon (18)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.7X10^{3}$	$9.9X10^{4}$
Ar-39		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	1.3	$3.4X10^{1}$
Ar-41		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.5X10^{6}$	$4.2X10^{7}$
As-72	Arsenic (33)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$6.2X10^{4}$	$1.7X10^{6}$
As-73		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$8.2X10^{2}$	$2.2X10^{4}$
As-74		1.0	$2.7X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$3.7X10^{3}$	$9.9X10^{4}$
As-76		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$5.8X10^{4}$	$1.6X10^{6}$
As-77		$2.0X10^{1}$	$5.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.9X10^{4}$	$1.0X10^{6}$
At-211 (a)	Astatine (85)	$2.0X10^{1}$	$5.4X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$7.6X10^{4}$	$2.1X10^{6}$
Au-193	Gold (79)	7.0	$1.9X10^{2}$	2.0	$5.4X10^{1}$	$3.4X10^{4}$	$9.2X10^{5}$
Au-194		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.5X10^{4}$	$4.1X10^{5}$
Au-195		$1.0X10^{1}$	$2.7X10^{2}$	6.0	$1.6X10^{2}$	$1.4X10^{2}$	$3.7X10^{3}$
Au-198		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.0X10^{3}$	$2.4X10^{5}$
Au-199		$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$7.7X10^{3}$	$2.1X10^{5}$
Ba-131 (a)	Barium (56)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$3.1X10^{3}$	$8.4X10^{4}$
Ba-133		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	9.4	$2.6X10^{2}$
Ba-133m		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.2X10^{4}$	$6.1X10^{5}$
Ba-140 (a)		$5.0X10^{-1}$	$1.4X10^{1}$	$3.0X10^{-1}$	8.1	$2.7X10^{3}$	$7.3X10^{4}$
Be-7	Beryllium (4)	$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$1.3X10^{4}$	$3.5X10^{5}$
Be-10		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-1}$	$1.6X10^{1}$	$8.3X10^{-4}$	$2.2X10^{-2}$
Bi-205	Bismuth (83)	$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$1.5X10^{3}$	$4.2X10^{4}$
Bi-206		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$3.8X10^{3}$	$1.0X10^{5}$
Bi-207		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	1.9	$5.2X10^{1}$
Bi-210		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.6X10^{3}$	$1.2X10^{5}$
Bi-210m (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.1X10^{-5}$	$5.7X10^{-4}$
Bi-212 (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.4X10^{5}$	$1.5X10^{7}$
Bk-247	Berkelium (97)	8.0	$2.2X10^{2}$	$8.0X10^{-4}$	$2.2X10^{-2}$	$3.8X10^{-2}$	1.0
Bk-249 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{-1}$	8.1	$6.1X10^{1}$	$1.6X10^{3}$
Br-76	Bromine (35)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$9.4X10^{4}$	$2.5X10^{6}$
Br-77		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$2.6X10^{4}$	$7.1X10^{5}$
Br-82		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{4}$	$1.1X10^{6}$

C-11	Carbon (6)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.1X10^{7}$	$8.4X10^{8}$
C-14		$4.0X10^{1}$	$1.1X10^{3}$	3.0	$8.1X10^{1}$	$1.6X10^{-1}$	4.5
Ca-41	Calcium (20)	Unlimited	Unlimited	Unlimited	Unlimited	$3.1X10^{-3}$	$8.5X10^{-2}$
Ca-45		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$6.6X10^{2}$	$1.8X10^{4}$
Ca-47 (a)		3.0	$8.1X10^{1}$	$3.0X10^{-1}$	8.1	$2.3X10^{4}$	$6.1X10^{5}$
Cd-109	Cadmium (48)	$3.0X10^{1}$	$8.1X10^{2}$	2.0	$5.4X10^{1}$	$9.6X10^{1}$	$2.6X10^{3}$
Cd-113m		$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	8.3	$2.2X10^{2}$
Cd-115 (a)		3.0	$8.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.9X10^{4}$	$5.1X10^{5}$
Cd-115m		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$9.4X10^{2}$	$2.5X10^{4}$
Ce-139	Cerium (58)	7.0	$1.9X10^{2}$	2.0	$5.4X10^{1}$	$2.5X10^{2}$	$6.8X10^{3}$
Ce-141		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.1X10^{3}$	$2.8X10^{4}$
Ce-143		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{4}$	$6.6X10^{5}$
Ce-144 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.2X10^{2}$	$3.2X10^{3}$
Cf-248	Californium (98)	$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$5.8X10^{1}$	$1.6X10^{3}$
Cf-249		3.0	$8.1X10^{1}$	$8.0X10^{-4}$	$2.2X10^{-2}$	$1.5X10^{-1}$	4.1
Cf-250		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	4.0	$1.1X10^{2}$
Cf-251		7.0	$1.9X10^{2}$	$7.0X10^{-4}$	$1.9X10^{-2}$	$5.9X10^{-2}$	1.6
Cf-252		$1.0X10^{-1}$	2.7	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
Cf-253 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{-2}$	1.1	$1.1X10^{3}$	$2.9X10^{4}$
Cf-254		$1.0X10^{-3}$	$2.7X10^{-2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.1X10^{2}$	$8.5X10^{3}$
Cl-36	Chlorine (17)	$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{-3}$	$3.3X10^{-2}$
Cl-38		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$4.9X10^{6}$	$1.3X10^{8}$
Cm-240	Curium (96)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$7.5X10^{2}$	$2.0X10^{4}$
Cm-241		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$6.1X10^{2}$	$1.7X10^{4}$
Cm-242		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$1.2X10^{2}$	$3.3X10^{3}$
Cm-243		9.0	$2.4X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.9X10^{-3}$	$5.2X10^{1}$
Cm-244		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	3.0	$8.1X10^{1}$
Cm-245		9.0	$2.4X10^{2}$	$9.0X10^{-4}$	$2.4X10^{-2}$	$6.4X10^{-3}$	$1.7X10^{-1}$
Cm-246		9.0	$2.4X10^{2}$	$9.0X10^{-4}$	$2.4X10^{-2}$	$1.1X10^{-2}$	$3.1X10^{-1}$
Cm-247 (a)		3.0	$8.1X10^{1}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.4X10^{-6}$	$9.3X10^{-5}$
Cm-248		$2.0X10^{-2}$	$5.4X10^{-1}$	$3.0X10^{-4}$	$8.1X10^{-3}$	$1.6X10^{-4}$	$4.2X10^{-3}$
Co-55	Cobalt (27)	$5.0X10^{-1}$	$1.4\ X10^{1}$	$5.0X10^{-1}$	$1.4\ X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$
Co-56		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.1X10^{3}$	$3.0X10^{4}$
Co-57		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$3.1X10^{2}$	$8.4X10^{3}$
Co-58		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.2X10^{3}$	$3.2X10^{4}$
Co-58m		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$2.2X10^{5}$	$5.9X10^{6}$
Co-60		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.2X10^{1}$	$1.1X10^{3}$
Cr-51	Chromium (24)	$3.0x10^{1}$	$8.1X10^{2}$	$3.0x10^{1}$	$8.1X10^{2}$	$3.4X10^{3}$	$9.2X10^{4}$
Cs-129	Cesium (55)	4.0	$1.1X10^{2}$	4.0	$1.1X10^{2}$	$2.8X10^{4}$	$7.6X10^{5}$
Cs-131		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$3.8X10^{3}$	$1.0X10^{5}$
Cs-132		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$5.7X10^{3}$	$1.5X10^{5}$
Cs-134		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.8X10^{1}$	$1.3X10^{3}$
Cs-134m		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{5}$	$8.0X10^{6}$
Cs-135		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$4.3X10^{-5}$	$1.2X10^{-3}$
Cs-136		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.7X10^{3}$	$7.3X10^{4}$
Cs-137 (a)		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	3.2	$8.7X10^{1}$

Cu-64	Copper (29)	6.0	$1.6X10^{2}$	1.0	$2.7X10^{1}$	$1.4X10^{5}$	$3.9X10^{6}$
Cu-67		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.8X10^{4}$	$7.6X10^{5}$
Dy-159	Dysprosium (66)	$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$2.1X10^{2}$	$5.7X10^{3}$
Dy-165		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{5}$	$8.2X10^{6}$
Dy-166 (a)		$9.0X10^{-1}$	$2.4X10^{1}$	$3.0X10^{-1}$	8.1	$8.6X10^{3}$	$2.3X10^{5}$
Er-169	Erbium (68)	$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$3.1X10^{3}$	$8.3X10^{4}$
Er-171		$8.0X10^{-1}$	$2.2X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$9.0X10^{4}$	$2.4X10^{6}$
Eu-147	Europium (63)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.4X10^{3}$	$3.7X10^{4}$
Eu-148		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.0X10^{2}$	$1.6X10^{4}$
Eu-149		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$3.5X10^{2}$	$9.4X10^{3}$
Eu-150 (short lived)		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
Eu-150 (long lived)		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
Eu-152		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	6.5	$1.8X10^{2}$
Eu-152m		$8.0X10^{-1}$	$2.2X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$8.2X10^{4}$	$2.2X10^{6}$
Eu-154		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	9.8	$2.6X10^{2}$
Eu-155		$2.0X10^{1}$	$5.4X10^{2}$	3.0	$8.1X10^{1}$	$1.8X10^{1}$	$4.9X10^{2}$
Eu-156		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.0X10^{3}$	$5.5X10^{4}$
F-18	Fluorine (9)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.5X10^{6}$	$9.5X10^{7}$
Fe-52 (a)	Iron (26)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.7X10^{5}$	$7.3X10^{6}$
Fe-55		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$8.8X10^{1}$	$2.4X10^{3}$
Fe-59		$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$1.8X10^{3}$	$5.0X10^{4}$
Fe-60 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-1}$	5.4	$7.4X10^{-4}$	$2.0X10^{-2}$
Ga-67	Gallium (31)	7.0	$1.9X10^{2}$	3.0	$8.1X10^{1}$	$2.2X10^{4}$	$6.0X10^{5}$
Ga-68		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.5X10^{6}$	$4.1X10^{7}$
Ga-72		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$
Gd-146 (a)	Gadolinium (64)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.9X10^{2}$	$1.9X10^{4}$
Gd-148		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	1.2	$3.2X10^{1}$
Gd-153		$1.0X10^{1}$	$2.7X10^{2}$	9.0	$2.4X10^{2}$	$1.3X10^{2}$	$3.5X10^{3}$
Gd-159		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.9X10^{4}$	$1.1X10^{6}$
Ge-68 (a)	Germanium (32)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.6X10^{2}$	$7.1X10^{3}$
Ge-71		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$5.8X10^{3}$	$1.6X10^{5}$
Ge-77		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.3X10^{5}$	$3.6X10^{6}$
Hf-172 (a)	Hafnium (72)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.1X10^{1}$	$1.1X10^{3}$
Hf-175		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$3.9X10^{2}$	$1.1X10^{4}$
Hf-181		2.0	$5.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.3X10^{2}$	$1.7X10^{4}$
Hf-182		Unlimited	Unlimited	Unlimited	Unlimited	$8.1X10^{-6}$	$2.2X10^{-4}$
Hg-194 (a)	Mercury (80)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.3X10^{-1}$	3.5
Hg-195m (a)		3.0	$8.1X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$
Hg-197		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.2X10^{3}$	$2.5X10^{5}$
Hg-197m		$1.0X10^{1}$	$2.7X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$2.5X10^{4}$	$6.7X10^{5}$
Hg-203		5.0	$1.4X10^{2}$	1.0	$2.7X10^{1}$	$5.1X10^{2}$	$1.4X10^{4}$
Ho-166	Holmium (67)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$2.6X10^{4}$	$7.0X10^{5}$
Ho-166m		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.6X10^{-2}$	1.8

I-123	Iodine (53)	6.0	$1.6X10^{2}$	3.0	$8.1X10^{1}$	$7.1X10^{4}$	$1.9X10^{6}$
I-124		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$9.3X10^{3}$	$2.5X10^{5}$
I-125		$2.0X10^{1}$	$5.4X10^{2}$	3.0	$8.1X10^{1}$	$6.4X10^{2}$	$1.7X10^{4}$
I-126		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$2.9X10^{3}$	$8.0X10^{4}$
I-129		Unlimited	Unlimited	Unlimited	Unlimited	$6.5X10^{-6}$	$1.8X10^{-4}$
I-131		3.0	$8.1X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.6X10^{3}$	$1.2X10^{5}$
I-132		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.8X10^{5}$	$1.0X10^{7}$
I-133		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.2X10^{4}$	$1.1X10^{6}$
I-134		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$9.9X10^{5}$	$2.7X10^{7}$
I-135 (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.3X10^{5}$	$3.5X10^{6}$
In-111	Indium (49)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$1.5X10^{4}$	$4.2X10^{5}$
In-113m		4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$6.2X10^{5}$	$1.7X10^{7}$
In-114m (a)		$1.0X10^{1}$	$2.7X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$8.6X10^{2}$	$2.3X10^{4}$
In-115m		7.0	$1.9X10^{2}$	1.0	$2.7X10^{1}$	$2.2X10^{5}$	$6.1X10^{6}$
Ir-189 (a)	Iridium (77)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$1.9X10^{3}$	$5.2X10^{4}$
Ir-190		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$2.3X10^{3}$	$6.2X10^{4}$
Ir-192		1.0(c)	$2.7X10^{1}$(c)	$6.0X10^{-1}$	$1.6X10^{1}$	$3.4X10^{2}$	$9.2X10^{3}$
Ir-194		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$3.1X10^{4}$	$8.4X10^{5}$
K-40	Potassium (19)	$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$2.4X10^{-7}$	$6.4X10^{-6}$
K-42		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$2.2X10^{5}$	$6.0X10^{6}$
K-43		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$
K-79	Krypton (36)	4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$4.2X10^{4}$	$1.1X10^{6}$
Kr-81		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$7.8X10^{-4}$	$2.1X10^{-2}$
Kr-85		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$1.5X10^{1}$	$3.9X10^{2}$
Kr-85m		8.0	$2.2X10^{2}$	3.0	$8.1X10^{1}$	$3.0X10^{5}$	$8.2X10^{6}$
Kr-87		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.0X10^{6}$	$2.8X10^{7}$
La-137	Lanthanum (57)	$3.0X10^{1}$	$8.1X10^{2}$	6.0	$1.6X10^{2}$	$1.6X10^{-3}$	$4.4X10^{-2}$
La-140		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$2.1X10^{4}$	$5.6X10^{5}$
Lu-172	Lutetium (71)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.2X10^{3}$	$1.1X10^{5}$
Lu-173		8.0	$2.2X10^{2}$	8.0	$2.2X10^{2}$	$5.6X10^{1}$	$1.5X10^{3}$
Lu-174		9.0	$2.4X10^{2}$	9.0	$2.4X10^{2}$	$2.3X10^{1}$	$6.2X10^{2}$
Lu-174m		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$2.0X10^{2}$	$5.3X10^{3}$
Lu-177		$3.0X10^{1}$	$8.1X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.1X10^{3}$	$1.1X10^{5}$
Mg-28 (a)	Magnesium (12)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.0X10^{5}$	$5.4X10^{6}$
Mn-52	Manganese (25)	$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.6X10^{4}$	$4.4X10^{5}$
Mn-53		Unlimited	Unlimited	Unlimited	Unlimited	$6.8X10^{-5}$	$1.8X10^{-3}$
Mn-54		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$2.9X10^{2}$	$7.7X10^{3}$
Mn-56		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$8.0X10^{5}$	$2.2X10^{7}$
Mo-93	Molybdenum (42)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	$4.1X10^{-2}$	1.1
Mo-99 (a) (h)		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$
N-13	Nitrogen (7)	$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.4X10^{7}$	$1.5X10^{9}$

Na-22	Sodium (11)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.3X10^{2}$	$6.3X10^{3}$
Na-24		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$3.2X10^{5}$	$8.7X10^{6}$
Nb-93m	Niobium (41)	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	8.8	$2.4X10^{2}$
Nb-94		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.9X10^{-3}$	$1.9X10^{-1}$
Nb-95		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.5X10^{3}$	$3.9X10^{4}$
Nb-97		$9.0X10^{-1}$	$2.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.9X10^{5}$	$2.7X10^{7}$
Nd-147	Neodymium (60)	6.0	$1.6X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{3}$	$8.1X10^{4}$
Nd-149		$6.0X10^{-1}$	$1.6X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$4.5X10^{5}$	$1.2X10^{7}$
Ni-59	Nickel (28)	Unlimited	Unlimited	Unlimited	Unlimited	$3.0X10^{-3}$	$8.0X10^{-2}$
Ni-63		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	2.1	$5.7X10^{1}$
Ni-65		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$7.1X10^{5}$	$1.9X10^{7}$
Np-235	Neptunium (93)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$5.2X10^{1}$	$1.4X10^{3}$
Np-236 (short-lived)		$2.0X10^{1}$	$5.4X10^{2}$	2.0	$5.4X10^{1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
Np-236 (long-lived)		9.0	$2.4X10^{2}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
Np-237		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{-3}$	$5.4X10^{-2}$	$2.6X10^{-5}$	$7.1X10^{-4}$
Np-239		7.0	$1.9X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$8.6X10^{3}$	$2.3X10^{5}$
Os-185	Osmium (76)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$2.8X10^{2}$	$7.5X10^{3}$
Os-191		$1.0X10^{1}$	$2.7X10^{2}$	2.0	$5.4X10^{1}$	$1.6X10^{3}$	$4.4X10^{4}$
Os-191m		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	$4.6X10^{4}$	$1.3X10^{6}$
Os-193		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{4}$	$5.3X10^{5}$
Os-194 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.1X10^{1}$	$3.1X10^{2}$
P-32	Phosphorus (15)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.1X10^{4}$	$2.9X10^{5}$
P-33		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Pa-230 (a)	Protactinium (91)	2.0	$5.4X10^{1}$	$7.0X10^{-2}$	1.9	$1.2X10^{3}$	$3.3X10^{4}$
Pa-231		4.0	$1.1X10^{2}$	$4.0X10^{-4}$	$1.1X10^{-2}$	$1.7X10^{-3}$	$4.7X10^{-2}$
Pa-233		5.0	$1.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$7.7X10^{2}$	$2.1X10^{4}$
Pb-201	Lead (82)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$6.2X10^{4}$	$1.7X10^{6}$
Pb-202		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{1}$	$5.4X10^{2}$	$1.2X10^{-4}$	$3.4X10^{-3}$
Pb-203		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$1.1X10^{4}$	$3.0X10^{5}$
Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	$4.5X10^{-6}$	$1.2X10^{-4}$
Pb-210 (a)		1.0	$2.7X10^{1}$	$5.0X10^{-2}$	1.4	2.8	$7.6X10^{1}$
Pb-212 (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$2.0X10^{-1}$	5.4	$5.1X10^{4}$	$1.4X10^{6}$
Pd-103 (a)	Palladium (46)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$2.8X10^{3}$	$7.5X10^{4}$
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	$1.9X10^{-5}$	$5.1X10^{-4}$
Pd-109		2.0	$5.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$7.9X10^{4}$	$2.1X10^{6}$
Pm-143	Promethium (61)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$1.3X10^{2}$	$3.4X10^{3}$
Pm-144		$7.0X10^{-1}$	$1.9X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.2X10^{1}$	$2.5X10^{3}$
Pm-145		$3.0X10^{1}$	$8.1X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	5.2	$1.4X10^{2}$
Pm-147		$4.0X10^{1}$	$1.1X10^{3}$	2.0	$5.4X10^{1}$	$3.4X10^{1}$	$9.3X10^{2}$
Pm-148m (a)		$8.0X10^{-1}$	$2.2X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$7.9X10^{2}$	$2.1X10^{4}$

Pm-149		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$
Pm-151		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.7X10^{4}$	$7.3X10^{5}$
Po-210	Polonium (84)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.7X10^{2}$	$4.5X10^{3}$
Pr-142	Praseodymium (59)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.3X10^{4}$	$1.2X10^{6}$
Pr-143		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{3}$	$6.7X10^{4}$
Pt-188 (a)	Platinum (78)	1.0	$2.7X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$2.5X10^{3}$	$6.8X10^{4}$
Pt-191		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$8.7X10^{3}$	$2.4X10^{5}$
Pt-193		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	1.4	$3.7X10^{1}$
Pt-193m		$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$
Pt-195m		$1.0X10^{1}$	$2.7X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.2X10^{3}$	$1.7X10^{5}$
Pt-197		$2.0X10^{1}$	$5.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.2X10^{4}$	$8.7X10^{5}$
Pt-197m		$1.0X10^{1}$	$2.7X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.7X10^{5}$	$1.0X10^{7}$
Pu-236	Plutonium (94)	$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^{1}$	$5.3X10^{2}$
Pu-237		$2.0X10^{1}$	$5.4X10^{2}$	$2.0X10^{1}$	$5.4X10^{2}$	$4.5X10^{2}$	$1.2X10^{4}$
Pu-238		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$6.3X10^{-1}$	$1.7X10^{1}$
Pu-239		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$2.3X10^{-3}$	$6.2X10^{-2}$
Pu-240		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$8.4X10^{-3}$	$2.3X10^{-1}$
Pu-241 (a)		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-2}$	1.6	3.8	$1.0X10^{2}$
Pu-242		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$1.5X10^{-4}$	$3.9X10^{-3}$
Pu-244 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$6.7X10^{-7}$	$1.8X10^{-5}$
Ra-223 (a)	Radium (88)	$4.0X10^{-1}$	$1.1X10^{1}$	$7.0X10^{-3}$	$1.9X10^{-1}$	$1.9X10^{3}$	$5.1X10^{4}$
Ra-224 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$5.9X10^{3}$	$1.6X10^{5}$
Ra-225 (a)		$2.0X10^{-1}$	5.4	$4.0X10^{-3}$	$1.1X10^{-1}$	$1.5X10^{3}$	$3.9X10^{4}$
Ra-226 (a)		$2.0X10^{-1}$	5.4	$3.0X10^{-3}$	$8.1X10^{-2}$	$3.7X10^{-2}$	1.0
Ra-228 (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.0X10^{1}$	$2.7X10^{2}$
Rb-81	Rubidium (37)	2.0	$5.4X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.1X10^{5}$	$8.4X10^{6}$
Rb-83 (a)		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$6.8X10^{2}$	$1.8X10^{4}$
Rb-84		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.8X10^{3}$	$4.7X10^{4}$
Rb-86		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$3.0X10^{3}$	$8.1X10^{4}$
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	$3.2X10^{-9}$	$8.6X10^{-8}$
Rb(nat)		Unlimited	Unlimited	Unlimited	Unlimited	$6.7X10^{6}$	$1.8X10^{8}$
Re-184	Rhenium (75)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$6.9X10^{2}$	$1.9X10^{4}$
Re-184m		3.0	$8.1X10^{1}$	1.0	$2.7X10^{1}$	$1.6X10^{2}$	$4.3X10^{3}$
Re-186		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$6.9X10^{3}$	$1.9X10^{5}$
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	$1.4X10^{-9}$	$3.8X10^{-8}$
Re-188		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.6X10^{4}$	$9.8X10^{5}$
Re-189 (a)		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{4}$	$6.8X10^{5}$
Re(nat)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	$2.4X10^{-8}$
Rh-99	Rhodium (45)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$3.0X10^{3}$	$8.2X10^{4}$
Rh-101		4.0	$1.1X10^{2}$	3.0	$8.1X10^{1}$	$4.1X10^{1}$	$1.1X10^{3}$
Rh-102		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$4.5X10^{1}$	$1.2X10^{3}$
Rh-102m		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$2.3X10^{2}$	$6.2X10^{3}$
Rh-103m		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$1.2X10^{6}$	$3.3X10^{7}$
Rh-105		$1.0X10^{1}$	$2.7X10^{2}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.1X10^{4}$	$8.4X10^{5}$
Rn-222 (a)	Radon (86)	$3.0X10^{-1}$	8.1	$4.0X10^{-3}$	$1.1X10^{-1}$	$5.7X10^{3}$	$1.5X10^{5}$
Ru-97	Ruthenium (44)	5.0	$1.4X10^{2}$	5.0	$1.4X10^{2}$	$1.7X10^{4}$	$4.6X10^{5}$
Ru-103 (a)		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.2X10^{3}$	$3.2X10^{4}$
Ru-105		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.5X10^{5}$	$6.7X10^{6}$

Ru-106 (a)		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$1.2X10^{2}$	$3.3X10^{3}$
S-35	Sulphur (16)	$4.0X10^{1}$	$1.1X10^{3}$	3.0	$8.1X10^{1}$	$1.6X10^{3}$	$4.3X10^{4}$
Sb-122	Antimony (51)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.5X10^{4}$	$4.0X10^{5}$
Sb-124		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$6.5X10^{2}$	$1.7X10^{4}$
Sb-125		2.0	$5.4X10^{1}$	1.0	$2.7X10^{1}$	$3.9X10^{1}$	$1.0X10^{3}$
Sb-126		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.1X10^{3}$	$8.4X10^{4}$
Sc-44	Scandium (21)	$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$6.7X10^{5}$	$1.8X10^{7}$
Sc-46		$5.0X10^{-1}$	$1.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$1.3X10^{3}$	$3.4X10^{4}$
Sc-47		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.1X10^{4}$	$8.3X10^{5}$
Sc-48		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$5.5X10^{4}$	$1.5X10^{6}$
Se-75	Selenium (34)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$5.4X10^{2}$	$1.5X10^{4}$
Se-79		$4.0X10^{1}$	$1.1X10^{3}$	2.0	$5.4X10^{1}$	$2.6X10^{-3}$	$7.0X10^{-2}$
Si-31	Silicon (14)	$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.4X10^{6}$	$3.9X10^{7}$
Si-32		$4.0X10^{1}$	$1.1X10^{3}$	$5.0X10^{-1}$	$1.4X10^{1}$	3.9	$1.1X10^{2}$
Sm-145	Samarium (62)	$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.8X10^{1}$	$2.6X10^{3}$
Sm-147		Unlimited	Unlimited	Unlimited	Unlimited	$8.5X10^{-10}$	$2.3X10^{-8}$
Sm-151		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.7X10^{-1}$	$2.6X10^{1}$
Sm-153		9.0	$2.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.6X10^{4}$	$4.4X10^{5}$
Sn-113 (a)	Tin (50)	4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$3.7X10^{2}$	$1.0X10^{4}$
Sn-117m		7.0	$1.9X10^{2}$	$4.0X10^{-1}$	$1.1X10^{1}$	$3.0X10^{3}$	$8.2X10^{4}$
Sn-119m		$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{1}$	$8.1X10^{2}$	$1.4X10^{2}$	$3.7X10^{3}$
Sn-121m (a)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-1}$	$2.4X10^{1}$	2.0	$5.4X10^{1}$
Sn-123		$8.0X10^{-1}$	$2.2X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.0X10^{2}$	$8.2X10^{3}$
Sn-125		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{3}$	$1.1X10^{5}$
Sn-126 (a)		$6.0X10^{-1}$	$1.6X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.0X10^{-3}$	$2.8X10^{-2}$
Sr-82 (a)	Strontium (38)	$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$2.3X10^{3}$	$6.2X10^{4}$
Sr-85		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$8.8X10^{2}$	$2.4X10^{4}$
Sr-85m		5.0	$1.4X10^{2}$	5.0	$1.4X10^{2}$	$1.2X10^{6}$	$3.3X10^{7}$
Sr-87m		3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$4.8X10^{5}$	$1.3X10^{7}$
Sr-89		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.1X10^{3}$	$2.9X10^{4}$
Sr-90 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	5.1	$1.4X10^{2}$
Sr-91 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.3X10^{5}$	$3.6X10^{6}$
Sr-92 (a)		1.0	$2.7X10^{1}$	$3.0X10^{-1}$	8.1	$4.7X10^{5}$	$1.3X10^{7}$
T(H-3)	Tritium (1)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.6X10^{2}$	$9.7X10^{3}$
Ta-178 (long-lived)	Tantalum (73)	1.0	$2.7X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$4.2X10^{6}$	$1.1X10^{8}$
Ta-179		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$4.1X10^{1}$	$1.1X10^{3}$
Ta-182		$9.0X10^{-1}$	$2.4X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$2.3X10^{2}$	$6.2X10^{3}$
Tb-157	Terbium (65)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$5.6X10^{-1}$	$1.5X10^{1}$
Tb-158		1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$5.6X10^{-1}$	$1.5X10^{1}$
Tb-160		1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$4.2X10^{2}$	$1.1X10^{4}$
Tc-95m (a)	Technetium (43)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$8.3X10^{2}$	$2.2X10^{4}$
Tc-96		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.2X10^{4}$	$3.2X10^{5}$
Tc-96m (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.4X10^{6}$	$3.8X10^{7}$
Tc-97		Unlimited	Unlimited	Unlimited	Unlimited	$5.2X10^{-5}$	$1.4X10^{-3}$
Tc-97m		$4.0X10^{1}$	$1.1X10^{3}$	1.0	$2.7X10^{1}$	$5.6X10^{2}$	$1.5X10^{4}$
Tc-98		$8.0X10^{-1}$	$2.2X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$3.2X10^{-5}$	$8.7X10^{-4}$
Tc-99		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-1}$	$2.4X10^{1}$	$6.3X10^{-4}$	$1.7X10^{-2}$

Tc-99m		$1.0X10^{1}$	$2.7X10^{2}$	4.0	$1.1X10^{2}$	$1.9X10^{5}$	$5.3X10^{6}$
Te-121	Tellurium (52)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$2.4X10^{3}$	$6.4X10^{4}$
Te-121m		5.0	$1.4X10^{2}$	3.0	$8.1X10^{1}$	$2.6X10^{2}$	$7.0X10^{3}$
Te-123m		8.0	$2.2X10^{2}$	1.0	$2.7X10^{1}$	$3.3X10^{2}$	$8.9X10^{3}$
Te-125m		$2.0X10^{1}$	$5.4X10^{2}$	$9.0X10^{-1}$	$2.4X10^{1}$	$6.7X10^{2}$	$1.8X10^{4}$
Te-127		$2.0X10^{1}$	$5.4X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$9.8X10^{4}$	$2.6X10^{6}$
Te-127m (a)		$2.0X10^{1}$	$5.4X10^{2}$	$5.0X10^{-1}$	$1.4X10^{1}$	$3.5X10^{2}$	$9.4X10^{3}$
Te-129		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$7.7X10^{5}$	$2.1X10^{7}$
Te-129m (a)		$8.0X10^{-1}$	$2.2X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{3}$	$3.0X10^{4}$
Te-131m (a)		$7.0X10^{-1}$	$1.9X10^{1}$	$5.0X10^{-1}$	$1.4X10^{1}$	$3.0X10^{4}$	$8.0X10^{5}$
Te-132 (a)		$5.0X10^{-1}$	$1.4X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{4}$	$3.0X10^{5}$
Th-227	Thorium (90)	$1.0X10^{1}$	$2.7X10^{2}$	$5.0X10^{-3}$	$1.4X10^{-1}$	$1.1X10^{3}$	$3.1X10^{4}$
Th-228 (a)		$5.0X10^{-1}$	$1.4X10^{1}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$3.0X10^{1}$	$8.2X10^{2}$
Th-229		5.0	$1.4X10^{2}$	$5.0X10^{-4}$	$1.4X10^{-2}$	$7.9X10^{-3}$	$2.1X10^{-1}$
Th-230		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$7.6X10^{-4}$	$2.1X10^{-2}$
Th-231		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.0X10^{4}$	$5.3X10^{5}$
Th-232		Unlimited	Unlimited	Unlimited	Unlimited	$4.0X10^{-9}$	$1.1X10^{-7}$
Th-234 (a)		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$8.6X10^{2}$	$2.3X10^{4}$
Th(nat)		Unlimited	Unlimited	Unlimited	Unlimited	$8.1X10^{-9}$	$2.2X10^{-7}$
Ti-44 (a)	Titanium (22)	$5.0X10^{-1}$	$1.4X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	6.4	$1.7X10^{2}$
Tl-200	Thallium (81)	$9.0X10^{-1}$	$2.4X10^{1}$	$9.0X10^{-1}$	$2.4X10^{1}$	$2.2X10^{4}$	$6.0X10^{5}$
Tl-201		$1.0X10^{1}$	$2.7X10^{2}$	4.0	$1.1X10^{2}$	$7.9X10^{3}$	$2.1X10^{5}$
Tl-202		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$2.0X10^{3}$	$5.3X10^{4}$
Tl-204		$1.0X10^{1}$	$2.7X10^{2}$	$7.0X10^{-1}$	$1.9X10^{1}$	$1.7X10^{1}$	$4.6X10^{2}$
Tm-167	Thulium (69)	7.0	$1.9X10^{2}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.1X10^{3}$	$8.5X10^{4}$
Tm-170		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.2X10^{2}$	$6.0X10^{3}$
Tm-171		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$
U-230 (fast lung absorption) (a)(d)	Uranium (92)	$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (medium lung absorption) (a)(e)		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{-3}$	$1.1X10^{-1}$	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (slow lung absorption) (a)(f)		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{-3}$	$8.1X10^{-2}$	$1.0X10^{3}$	$2.7X10^{4}$
U-232 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-232 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$7.0X10^{-3}$	$1.9X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-232 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{2}$	$1.0X10^{-3}$	$2.7X10^{-2}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-233 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$3.6X10^{-4}$	$9.7X10^{-3}$

U-234 (fast lung absorption) (d)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
U-234 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.3X10^{-4}$	$6.2X10^{-3}$
U-234 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$2.3X10^{-4}$	$6.2X10^{-3}$
U-235 (all lung absorption types) (a),(d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	$8.0X10^{-8}$	$2.2X10^{-6}$
U-236 (fast lung absorption) (d)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$6.0X10^{-3}$	$1.6X10^{-1}$	$2.4X10^{-6}$	$6.5X10^{-5}$
U-238 (all lung absorption types) (d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	$1.2X10^{-8}$	$3.4X10^{-7}$
U (nat)		Unlimited	Unlimited	Unlimited	Unlimited	$2.6X10^{-8}$	$7.1X10^{-7}$
U (enriched to 20% or less)(g)		Unlimited	Unlimited	Unlimited	Unlimited	N/A	N/A
U (dep)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	(See Table IX)
V-48	Vanadium (23)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$6.3X10^{3}$	$1.7X10^{5}$
V-49		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.0X10^{2}$	$8.1X10^{3}$
W-178 (a)	Tungsten (74)	9.0	$2.4X10^{2}$	5.0	$1.4X10^{2}$	$1.3X10^{3}$	$3.4X10^{4}$
W-181		$3.0X10^{1}$	$8.1X10^{2}$	$3.0X10^{1}$	$8.1X10^{2}$	$2.2X10^{2}$	$6.0X10^{3}$
W-185		$4.0X10^{1}$	$1.1X10^{3}$	$8.0X10^{-1}$	$2.2X10^{1}$	$3.5X10^{2}$	$9.4X10^{3}$
W-187		2.0	$5.4X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$2.6X10^{4}$	$7.0X10^{5}$
W-188 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$3.0X10^{-1}$	8.1	$3.7X10^{2}$	$1.0X10^{4}$
Xe-122 (a)	Xenon (54)	$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$4.8X10^{4}$	$1.3X10^{6}$
Xe-123		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$4.4X10^{5}$	$1.2X10^{7}$
Xe-127		4.0	$1.1X10^{2}$	2.0	$5.4X10^{1}$	$1.0X10^{3}$	$2.8X10^{4}$
Xe-131m		$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$3.1X10^{3}$	$8.4X10^{4}$
Xe-133		$2.0X10^{1}$	$5.4X10^{2}$	$1.0X10^{1}$	$2.7X10^{2}$	$6.9X10^{3}$	$1.9X10^{5}$
Xe-135		3.0	$8.1X10^{1}$	2.0	$5.4X10^{1}$	$9.5X10^{4}$	$2.6X10^{6}$
Y-87 (a)	Yttrium (39)	1.0	$2.7X10^{1}$	1.0	$2.7X10^{1}$	$1.7X10^{4}$	$4.5X10^{5}$
Y-88		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$5.2X10^{2}$	$1.4X10^{4}$
Y-90		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$2.0X10^{4}$	$5.4X10^{5}$
Y-91		$6.0X10^{-1}$	$1.6X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$9.1X10^{2}$	$2.5X10^{4}$
Y-91m		2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$1.5X10^{6}$	$4.2X10^{7}$
Y-92		$2.0X10^{-1}$	5.4	$2.0X10^{-1}$	5.4	$3.6X10^{5}$	$9.6X10^{6}$
Y-93		$3.0X10^{-1}$	8.1	$3.0X10^{-1}$	8.1	$1.2X10^{5}$	$3.3X10^{6}$
Yb-169	Ytterbium (79)	4.0	$1.1X10^{2}$	1.0	$2.7X10^{1}$	$8.9X10^{2}$	$2.4X10^{4}$
Yb-175		$3.0X10^{1}$	$8.1X10^{2}$	$9.0X10^{-1}$	$2.4X10^{1}$	$6.6X10^{3}$	$1.8X10^{5}$
Zn-65	Zinc (30)	2.0	$5.4X10^{1}$	2.0	$5.4X10^{1}$	$3.0X10^{2}$	$8.2X10^{3}$
Zn-69		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.8X10^{6}$	$4.9X10^{7}$

Zn-69m (a)		3.0	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$
Zr-88	Zirconium (40)	3.0	$8.1X10^{1}$	3.0	$8.1X10^{1}$	$6.6X10^{2}$	$1.8X10^{4}$
Zr-93		Unlimited	Unlimited	Unlimited	Unlimited	$9.3X10^{-5}$	$2.5X10^{-3}$
Zr-95 (a)		2.0	$5.4X10^{1}$	$8.0X10^{-1}$	$2.2X10^{1}$	$7.9X10^{2}$	$2.1X10^{4}$
Zr-97 (a)		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$7.1X10^{4}$	$1.9X10^{6}$

NOTES

(a) A_1 and/or A_2 values include contributions from daughter nuclides with half-lives less than 10 days, as listed in the following:

Mg-28	Al-28
Ca-47	Sc-47
Ti-44	Sc-44
Fe-52	Mn-52m
Fe-60	Co-60m
Zn-69m	Zn-69
Ge-68	Ga-68
Rb-83	Kr-83m
Sr-82	Rb-82
Sr-90	Y-90
Sr-91	Y-91m
Sr-92	Y-92
Y-87	Sr-87m
Zr-95	Nb-95m
Zr-97	Nb-97m, Nb-97
Mo-99	Tc-99m
Tc-95m	Tc-95
Tc-96m	Tc-96
Ru-103	Rh-103m
Ru-106	Rh-106
Pd-103	Rh-103m
Ag-108m	Ag-108
Ag-110m	Ag-110
Cd-115	In-115m
In-114m	In-114
Sn-113	In-113m
Sn-121m	Sn-121
Sn-126	Sb-126m
Te-127m	Te-127
Te-129m	Te-129
Te-131m	Te-131
Te-132	I-132
I-135	Xe-135m
Xe-122	I-122
Cs-137	Ba-137m
Ba-131	Cs-131
Ba-140	La-140
Ce-144	Pr-144m, Pr-144
Pm-148m	Pm-148
Gd-146	Eu-146
Dy-166	Ho-166

Hf-172	Lu-172
W-178	Ta-178
W-188	Re-188
Re-189	Os-189m
Os-194	Ir-194
Ir-189	Os-189m
Pt-188	Ir-188
Hg-194	Au-194
Hg-195m	Hg-195
Pb-210	Bi-210
Pb-212	Bi-212, Tl-208, Po-212
Bi-210m	Tl-206
Bi-212	Tl-208, Po-212
At-211	Po-211
Rn-222	Po-218, Pb-214, At-218, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Po-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212
Ra-225	Ac-225, Fr-221, At-217, Bi-213, Tl-209, Po-213, Pb-209
Ra-226	Rn-222, Po-218, Pb-214, At-218, Bi-214, Po-214
Ra-228	Ac-228
Ac-225	Fr-221, At-217, Bi-213, Tl-209, Po-213, Pb-209
Ac-227	Fr-223
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212
Th-234	Pa-234m, Pa-234
Pa-230	Ac-226, Th-226, Fr-222, Ra-222, Rn-218, Po-214
U-230	Th-226, Ra-222, Rn-218, Po-214
U-235	Th-231
Pu-241	U-237
Pu-244	U-240, Np-240m
Am-242m	Am-242, Np-238
Am-243	Np-239
Cm-247	Pu-243
Bk-249	Am-245
Cf-253	Cm-249

(b) The values of A_1 and A_2 in curies (Ci) are approximate and for information only; the regulatory standard units are Terabecquerels (TBq).

(c) The activity of Ir-192 in special form may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.

(d) These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO_3)^2$ in both normal and accident conditions of transport.

(e) These values apply only to compounds of uranium that take the chemical form of UO_3, UF_4, UCl_4, and hexavalent compounds in both normal and accident conditions of transport.

(f) These values apply to all compounds of uranium other than those specified in (d) and (e), above.

(g) These values apply to unirradiated uranium only.

(h) $A_2 = 0.74$ TBq (20 Ci) for Mo-99 for domestic use.

TABLE VII
EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of Radionuclide	Element and Atomic No.	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Ac-225	Actinium (89)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ac-227		$1.0X10^{-1}$	$2.7X10^{-12}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ac-228		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-105	Silver (47)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-108m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-110m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ag-111		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Al-26	Aluminum (13)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Am-241	Americium (95)	1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Am-242m (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Am-243 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ar-37	Argon (18)	$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ar-39		$1.0X10^{7}$	$2.7X10^{-4}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ar-41		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
As-72	Arsenic (33)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
As-73		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
As-74		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
As-76		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
As-77		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
At-211	Astatine (85)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-193	Gold (79)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-194		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Au-195		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Au-198		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Au-199		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-131	Barium (56)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-133		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-133m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ba-140 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Be-7	Beryllium (4)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Be-10		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-205	Bismuth (83)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-206		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bi-207		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Bi-210		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$

Bi-210m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bi-212 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Bk-247	Berkelium (97)	1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Bk-249		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Br-76	Bromine (35)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Br-77		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Br-82		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
C-11	Carbon (6)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
C-14		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-41	Calcium (20)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-45		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ca-47		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-109	Cadmium (48)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-113m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-115		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cd-115m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-139	Cerium (58)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-141		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ce-143		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ce-144 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cf-248	Californium (98)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-249		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cf-250		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-251		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cf-252		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cf-253		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cf-254		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cl-36	Chlorine (17)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cl-38		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-240	Curium (96)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-241		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cm-242		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cm-243		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-244		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-245		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cm-246		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Cm-247		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cm-248		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Co-55	Cobalt (27)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-56		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Co-57		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-58		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Co-58m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Co-60		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cr-51	Chromium (24)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Cs-129	Cesium (55)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-131		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cs-132		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-134		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$

Cs-134m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-135		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Cs-136		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Cs-137 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Cu-64	Copper (29)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Cu-67		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Dy-159	Dysprosium (66)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Dy-165		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Dy-166		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Er-169	Erbium (68)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Er-171		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-147	Europium (63)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-148		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-149		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Eu-150 (short lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-150 (long lived)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-152		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-152 m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-154		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Eu-155		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Eu-156		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
F-18	Fluorine (9)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-52	Iron (26)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-55		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-59		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Fe-60		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ga-67	Gallium (31)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ga-68		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ga-72		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Gd-146	Gadolinium (64)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Gd-148		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Gd-153		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Gd-159		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ge-68	Germanium (32)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ge-71		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ge-77		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Hf-172	Hafnium (72)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-175		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-181		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hf-182		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-194	Mercury (80)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-195m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-197		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Hg-197m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-203		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ho-166	Holmium (67)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ho-166m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$

I-123	Iodine (53)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
I-124		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-125		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-126		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-129		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-131		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-132		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-133		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
I-134		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
I-135		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-111	Indium (49)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-113m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-114m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-115m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-189	Iridium (77)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ir-190		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-192		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ir-194		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
K-40	Potassium (19)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
K-42		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
K-43		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Kr-79	Krypton (36)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Kr-81		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Kr-85		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{4}$	$2.7X10^{-7}$
Kr-85m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$
Kr-87		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
La-137	Lanthanum (57)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
La-140		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Lu-172	Lutetium (71)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Lu-173		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-174		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-174m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Lu-177		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Mg-28	Magnesium (12)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mn-52	Manganese (25)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mn-53		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{9}$	$2.7X10^{-2}$
Mn-54		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Mn-56		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Mo-93	Molybdenum (42)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Mo-99		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
N-13	Nitrogen (7)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Na-22	Sodium (11)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Na-24		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Nb-93m	Niobium (41)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Nb-94		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nb-95		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nb-97		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nd-147	Neodymium (60)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Nd-149		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

Ni-59	Nickel (28)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ni-63		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ni-65		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Np-235	Neptunium (93)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-236 (short-lived)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-236 (long-lived)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Np-237 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Np-239		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-185	Osmium (76)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Os-191		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-191m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Os-193		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Os-194		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
P-32	Phosphorus (15)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
P-33		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pa-230	Protactinium (91)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pa-231		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Pa-233		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pb-201	Lead (82)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-202		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-203		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pb-205		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pb-210 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pb-212 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pd-103	Palladium (46)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pd-107		$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Pd-109		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-143	Promethium (61)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-144		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-145		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pm-147		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pm-148m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-149		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pm-151		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Po-210	Polonium (84)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pr-142	Praseodymium (59)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pr-143		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-188	Platinum (78)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-191		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-193		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pt-193m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Pt-195m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-197		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pt-197m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Pu-236	Plutonium (94)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-237		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

Pu-238		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-239		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-240		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Pu-241		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pu-242		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-244		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ra-223 (a)	Radium (88)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-224 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-225		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Ra-226 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ra-228 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Rb-81	Rubidium (37)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-83		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-84		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rb-86		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Rb-87		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rb(nat)		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Re-184	Rhenium (75)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-184m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-186		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re-187		$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Re-188		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Re-189		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Re(nat)		$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Rh-99	Rhodium (45)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-101		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rh-102		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-102m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Rh-103m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Rh-105		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Rn-222 (a)	Radon (86)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{8}$	$2.7X10^{-3}$
Ru-97	Ruthenium (44)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ru-103		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ru-105		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ru-106 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
S-35	Sulphur (16)	$1.0X10^{5}$	$2.7X10^{-6}$	$1.0X10^{8}$	$2.7X10^{-3}$
Sb-122	Antimony (51)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sb-124		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sb-125		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sb-126		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sc-44	Scandium (21)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sc-46		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sc-47		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sc-48		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Se-75	Selenium (34)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Se-79		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Si-31	Silicon (14)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Si-32		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sm-145	Samarium (62)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$

Sm-147		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sm-151		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
Sm-153		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-113	Tin (50)	$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-117m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-119m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-121m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sn-123		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sn-125		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sn-126		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-82	Strontium (38)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-85		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-85m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Sr-87m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-89		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Sr-90 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{4}$	$2.7X10^{-7}$
Sr-91		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-92		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
T(H-3)	Tritium (1)	$1.0X10^{6}$	$2.7X10^{-5}$	$1.0X10^{9}$	$2.7X10^{-2}$
Ta-178 (long-lived)	Tantalum (73)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ta-179		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Ta-182		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Tb-157	Terbium (65)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tb-158		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tb-160		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-95m	Technetium (43)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-96		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-96m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-97		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{8}$	$2.7X10^{-3}$
Tc-97m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-98		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tc-99		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Tc-99m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-121	Tellurium (52)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-121m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-123m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-125m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-127		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-127m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-129		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-129m		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-131m		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-132		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Th-227	Thorium (90)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-228 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-229 (a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Th-230		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-231		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$

Th-232		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Th-234 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Th (nat) (a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ti-44	Titanium (22)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Tl-200	Thallium (81)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-201		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-202		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tl-204		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{4}$	$2.7X10^{-7}$
Tm-167	Thulium (69)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tm-170		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Tm-171		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{8}$	$2.7X10^{-3}$
U-230 (fast lung absorption) (a), (b)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (medium lung absorption) (c)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-230 (slow lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-232 (fast lung absorption) (a), (b)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (medium lung absorption) (c)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-232 (slow lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (fast lung absorption) (b)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (medium lung absorption) (c)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-233 (slow lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

U-234 (fast lung absorption) (b)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (medium lung absorption) (c)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-234 (slow lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-235 (all lung absorption types) (a),(b),(c),(d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (fast lung absorption) (b)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (medium lung absorption) (c)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-236 (slow lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-238 (all lung absorption types) (a), (b),(c),(d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U (nat)(a)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (enriched to 20% or less)(e)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (dep)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
V-48	Vanadium (23)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
V-49		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-178	Tungsten (74)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
W-181		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-185		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
W-187		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
W-188		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-122	Xenon (54)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$
Xe-123		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{9}$	$2.7X10^{-2}$

Xe-127		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-131m		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{4}$	$2.7X10^{-7}$
Xe-133		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{4}$	$2.7X10^{-7}$
Xe-135		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$
Y-87	Yttrium (39)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-88		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-90		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{5}$	$2.7X10^{-6}$
Y-91		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-91m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Y-92		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Y-93		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Yb-169	Ytterbium (79)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$
Yb-175		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zn-65	Zinc (30)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zn-69		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zn-69m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-88	Zirconium (40)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-93(a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zr-95		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-97 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

NOTES

(a) Parent nuclides and their progeny included in secular equilibrium are listed in the following:

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Ag-108m	Ag-108
Cs-137	Ba-137m
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210

Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

(b) These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2, and $UO_2(NO_3)_2$ in both normal and accident conditions of transport.

(c) These values apply only to compounds of uranium that take the chemical form of UO_3, UF_4, UCl_4, and hexavalent compounds in both normal and accident conditions of transport.

(d) These values apply to all compounds of uranium other than those specified in (d) and (e), above.

(e) These values apply to unirradiated uranium only.

TABLE VIII GENERAL VALUES FOR A_1 AND A_2				
Contents		Only beta or gamma emitting radionuclides are known to be present	Alpha emitting nuclides, but no neutron emitters, are known to be present. (a)	Neutron emitting nuclides are known to be present or no relevant data are available
A_1	(TBq)	1×10^{-1}	2×10^{-1}	1×10^{-3}
	(Ci)	2.7×10^{0}	5.4×10^{0}	2.7×10^{-2}
A_2	(TBq)	2×10^{-2}	9×10^{-5}	9×10^{-5}
	(Ci)	5.4×10^{-1}	2.4×10^{-3}	2.4×10^{-3}
Activity concentration for exempt material (Bq/g)		1×10^{1}	1×10^{-1}	1×10^{-1}
Activity concentration for exempt material (Ci/g)		2.7×10^{-10}	2.7×10^{-12}	2.7×10^{-12}
Activity limits for exempt consignments (Bq)		1×10^{4}	1×10^{3}	1×10^{3}
Activity limits for exempt consignments (Ci)		2.7×10^{-7}	2.7×10^{-8}	2.7×10^{-8}

(a) If beta or gamma emitting nuclides are known to be present, the A_1 value of 0.1 TBq (2.7 Ci) should be used.

TABLE IX ACTIVITY-MASS RELATIONSHIPS FOR URANIUM		
Uranium Enrichment* wt % U-235 present	**Specific Activity**	
	TBq/g	**Ci/g**
0.45	1.9×10^{-8}	5.0×10^{-7}
0.72	2.6×10^{-8}	7.1×10^{-7}
1	8×10^{-8}	7.6×10^{-7}
1.5	3.7×10^{-8}	1.0×10^{-6}
5	1.0×10^{-7}	2.7×10^{-6}
10	1.8×10^{-7}	4.8×10^{-6}
20	3.7×10^{-7}	1.0×10^{-5}
35	7.4×10^{-7}	2.0×10^{-5}
50	9.3×10^{-7}	2.5×10^{-5}
90	2.1×10^{-6}	5.8×10^{-5}
93	2.6×10^{-6}	7.0×10^{-5}
95	3.4×10^{-6}	9.1×10^{-5}

Note: The figures for uranium include representative values for the activity of the uranium-234 that is concentrated during the enrichment process.

SECTION 145. DHS 157 Appendix T is repealed and recreated to read:

Chapter DHS 157

APPENDIX T

Nationally Tracked Source Thresholds

The Terabecquerel (TBq) values are the regulatory standard. The curie (Ci) values specified are obtained by converting from the TBq value. The curie values are provided for practical usefulness only and are rounded after conversion.

Radioactive material	Category 1 (TBq)	Category 1 (Ci)	Category 2 (TBq)	Category 2 (Ci)
Actinium-227	20	540	0.2	5.4
Americium-241	60	1,600	0.6	16
Americium-241/Be	60	1,600	0.6	16
Californium-252	20	540	0.2	5.4
Cobalt-60	30	810	0.3	8.1
Curium-244	50	1,400	0.5	14
Cesium-137	100	2,700	1	27
Gadolinium-153	1,000	27,000	10	270
Iridium-192	80	2,200	0.8	22
Plutonium-238	60	1,600	0.6	16
Plutonium-239/Be	60	1,600	0.6	16
Polonium-210	60	1,600	0.6	16
Promethium-147	40,000	1,100,000	400	11,000
Radium-226	40	1,100	0.4	11
Selenium-75	200	5,400	2	54
Strontium-90	1,000	27,000	10	270
Thorium-228	20	540	0.2	5.4
Thorium-229	20	540	0.2	5.4
Thulium-170	20,000	540,000	200	5,400
Ytterbium-169	300	8,100	3	81

SECTION 146. EFFECTIVE DATE. This rule shall take effect on the first day of the month following publication in the Wisconsin administrative register, as provided in s. 227.22,Stats.

Wisconsin Department of Health Services

Dated: _____

_____

Kirsten Johnson, Secretary-designee

SEAL: