Clearinghouse Rule 06-021

PROPOSED ORDER OF
DEPARTMENT OF HEALTH AND FAMILY SERVICES
TO ADOPT RULES

The Wisconsin Department of Health and Family Services proposes to **repeal** HFS 157.01 (16), HFS 157.02 (15), HFS 157.03 (2) Note, (235) Note, (424) and (425), HFS 157.09 (2) (c) 1. f. Note, 12., and 15., HFS 157.12 (3) (f) Note, (5), and (7) (c) Note, HFS 157.13 (10) (d), HFS 157.17 (16) and (17), HFS 157.44 (3) (b) 2. Note, and (c) Note, HFS 157.88 (3) (b), HFS 157.93 (5), HFS 157 Subchapter XV (title), HFS 157.97 and HFS 157.98; **to renumber** HFS 157.80 (1) (a) and (c), HFS 157.88 (3) (c), (d), (e) and (f); **to renumber and amend** HFS 157.09 (2) (c) 13. (intro.), a. to c., and 14., HFS 157.13 (5) (c) 1., HFS 157.51 (1) (intro.) and (a) to (c), HFS 157.52 (10) (e) 1. and 2. and (f) 1. and 2., HFS 157.93 (6) and (7); **to amend** HFS 157.01 (6), 157.02 (4) to (7) and (10), 157.03 (1), (2), (13), (46), (98), (140), (141), (198) (intro.) and (a) and (c), (199) (b), (200) (intro.) and (c), (201), (224), (225), (296), (326) (intro.) and (a) to (c), (327) (intro.) and (a) to (c), (334), (353), (376) (b), (390) and (398), (418), (419), and (428), HFS 157.05 (1) (a) and (3), HFS 157.09 (2) (c) (title), (intro.) and 1. a., HFS 157.10 (3), HFS 157.11 (1) (c) 6. Note, (2) (b) 5., (c) 4., (e) 2., and (f) 2. c. Note, 3. e., 6., (g) 1. a. 2. and 4., HFS 157.12 (3), HFS 157.13 (1) (a) Note, (4) (c) and (d) (title), 1. (intro.) and d., (4) (d) 5. i., and (i) 1., (8) (title) and (intro.), (11) (d) 2. (intro.) and (L) 1. Note, (12) (b) Note, and (17) (b) 1. (intro.), HFS 157.14 (2) (a) 2. Note, 5., and (b) (intro.), HFS 157.15 (1) (a) (title) and (intro.), (1) (b) 2. , (3) (b) 1., (4) (a) 1. to 3., (5) (a) 3., and (7) (a) 3. (intro.), HFS 157.22 (1) (a) 2. (intro.) and b., (5) (d) 1. Note, (f) Note and (8) (c) (intro.), HFS 157.28 (1) (title) and (a), HFS 157.29 (6) (e) 2. and Note, HFS 157.31 (1) (a) and (7) (c) Note, HFS 157.32 (1) (a) 3. Note and (5) (b) Note, HFS 157.33 (2), (3) (a) 3. (intro.), HFS 157.36 (1) (a), Note, 1. (intro.), 3. , (b) 9., (2) and Note, HFS 157.41 (2) (a), HFS 157.42 (1) (a), HFS 157.44 (6) (a), 2. to 4., (e), (f), and (g) 3., HFS 157.45 (11) (c), Subchapter V (title), HFS 157.52 (8) and (title), HFS 157.53 (1) (a) 1., HFS 157.54 (3) (b), HFS 157.55 (1) (d), HFS 157.56 (2) (b) Note, (4) (intro.) and (5), HFS 157.61 (1) (g), HFS 157.62 (2) (a), (3) (b) 2. a., (4) (title) and (intro.), and (8) (a) Note and (d), HFS 157.65 (1) (title) and (intro.), (6) (title) and (a) (intro.), HFS 157.67 (9) (b) 2., 3., 6., 8., 10., HFS 157.73 (15) (c) and (22) (k) and (m), HFS 157.74 (2) (b) (intro.), (g) 3. and 4., (3) (c) and (4) (b), Table HFS 157.75, HFS 157.79 (2) (c), HFS 157.80 (2), HFS 157.81 (3) (a), HFS 157.83 (2) (b), HFS 157.85 (15) (b) Note, HFS 157.86 (a) 1. to 5., HFS 157.88 (1) (a) 7. Note and (3) (a) 5., HFS 157.93 (4) (b) 3., 4. and (d), HFS 157.94 (2) (b), TABLE HFS 157.96A (title), HFS 157 Appendix B, HFS 157 Appendix F (title) and column titles on pages 370-112 to 370-118, 370-121, 370-122, HFS 157 Appendix G Section III. par. (a) (2), HFS 157 Appendix H Section I. par. (b) (4), HFS 157 Appendix P, the radioactive material Geranium that is listed in the Radioactive Material column, HFS 157 Appendix R section C. par. 9; **to repeal and recreate** HFS 157.03 (32), (68), (198) (d), (267), HFS 157.09 (2) (a) 2., HFS 157.13 (4) (i) 5., HFS 157.22 (1) (c) 1., HFS 157.25 (2) (a) 2., HFS 157.33 (3) (title) and (a), HFS 157.45 (14) (b) 6., HFS 157.52 (10) (title) and (a) to (d), HFS 157.61 (7), (8), (9) and (10), HFS 157.63 (1) (b), (2) (b), (4) and (5), HFS 157.64 (4), (5), and (6), HFS 157.65 (8) and (9), HFS 157.66 (2), HFS 157. 67 (17), HFS 157.72 (2), HFS 157.76, HFS 157.77 (5), HFS 157.92 (2) (b), (c), and (d), HFS 157 APPENDIX O; and to **create** HFS 157.03 (17m), (57g), (57r), (75m), (82m), (84m) and Note, (87m), (101m), (103m), (124m), (140) Note, (143m), (150m), 185m), (185r), (247m), (251m), (264m), (279m), and (295m), (371m), (402m), (419m), HFS 157.05 (5), 157.09 (2) (d) and (g), HFS 157.13 (1) (i), (4) (d) 1. f. and g., (5) (c) 1. a. to c., (13) Note, HFS 157.15 (1) (a) 3. and 4., HFS 157.28 (1) (a) (title) and (b) (title), HFS 157.33 (3) (a) 3. d., HFS 157.44 (3) (a) 5. Note, HFS 157.51 (1) (b) and (c), HFS

157.53 (1) (d), HFS 157.61 (12), HFS 157.63 (6), HFS 157.64 (7) and (8), HFS 157.65 (10), HFS 157.67 (18), HFS 157.68, HFS 157.74 (2) (d) 3., (g) 5. and Note, HFS 157.80 (1) (a) 2., 3., and (c) 2. and 3., HFS 157.93 (5) (d), (7), Tables HFS 157.93A and B, and (8), and HFS 157 APPENDIX L, relating to protecting public health by regulating the sources and use of ionizing radiation, and affecting small businesses.

SUMMARY OF PROPOSED RULE

Statute(s) 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), 254.35 (3) (g), 254.365 (4) and 254.37 (3), Stats.

Explanation of agency authority:
As specified under s. 254. 34 (1) (a), 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 2014.

In addition, s. 254.35 (3) (g), Stats., authorizes the Department to increase by rule the annual registration fees, established in s. 254.35 (3), Stats., for sites having ionizing radiation installations for x-ray tubes or for generally licensed devices that are not exempted by the Department.

Related statute (s) or rule (s):

Chapter NR 809 incorporates the radioactivity standards for community water systems and the analytical methods established in ss. HFS 157.95 and 157.96. The Department of Natural Resources applies these standards to community drinking water systems.

Chapter HFS 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 which is required to be licensed under ch. HFS 157. Section HFS 157.05 (4) requires that any person providing training for certified lead inspectors or risk assessors to meet the training requirements of s. HFS 163.24 (a) 1. and 3. and to complete an additional 8 hours of radiation safety training.

Plain language analysis:

Under s. 254.34 (1) (a) 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. The Department is also responsible for maintaining compliance with the Agreement signed by Governor Doyle in 2003 and the Nuclear Regulatory Commission (NRC) that 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. NRC staff periodically evaluates the state regulatory program.

One of the requirements of this Agreement is Wisconsin's assurance that it will revise the radioactive material portions of ch. HFS 157 within 3 years of any applicable changes in Title10 Code of Federal Regulations. Title 10 CFR has been revised since ch. HFS 157 was last revised in 2002. Therefore, the Department proposes to modify the radioactive material requirements in ch. HFS 157.

In addition, the Department proposes to revise the portions of ch. HFS 157 pertaining to x-rays to reflect new diagnostic and therapeutic technologies, experience with implementing the current rule, changes in comparable federal regulations in 21 CFR Part 1020, 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.

Finally, the Department proposes to increase the annual site fee and the x-ray tube fee established under s. 254.35 (3), Stats., to address a projected operating deficit in the x-ray and registration and inspection program for state fiscal year (SFY) 2006 and beyond. To maintain program revenue sufficient to operate the x-ray registration and inspection program, the Department under s. 254.35 (3) (g), Stats., proposes to increase annual registration fees by increasing both the annual site fee and x-ray tube fee for installations required to be registered as follows:

- Increase the annual site fee from $36 to $50 for all required registrants, including sites serving physicians and clinics, osteopaths and clinics, chiropractors, hospitals, podiatrists, veterinarian, industrial, educational facilities, research projects, and dental sites, and other sites required to be registered.
- Increase the annual x-ray tube fee from $44 to $50 for all sites, except dental, serving physicians and clinics, osteopaths and clinics, chiropractors, hospitals, podiatrists, veterinarian, industrial sites, educational facilities, research projects, and other sites.
- Increase the annual x-ray tube fee from $30 to $35 for dental sites.

The proposed revisions to chapter HFS 157 accomplish the following:

- Updates the radiation protection and regulatory requirements for radioactive materials to reflect changes in federal regulations in Title 10, Code of Federal Regulations Parts 19, 20, 31, 33-36, 39, 40, 70, 71 and 150 and applicable portions of Title 49 (transportation), Code of Federal Regulations.
- Updates the radiation safety requirements for x-ray producing devices to reflect new technologies, current federal regulation and the input of an ad hoc advisory group representing a cross-section of regulated users.
- Revises 7 of the 42 radioactive material license fee categories to reflect lessons learned after 1.5 years as an Agreement state. There is no fee increase associated with the materials fee category revision.
- Increases x-ray registration fees to ensure sufficient operating revenue for the x-ray registration and inspection program. The last fee increase occurred in 1996. The x-ray registration and inspection program helps to minimize unnecessary radiation exposure to the general public and device operators by verifying that devices are functioning according to radiation protection requirements in ch. HFS 157.

Pursuant to s. 227.21 Stats., the Department has requested permission from the Attorney General and the Revisor of Statues to incorporate by reference into ch. HFS 157, the ANSI N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma

Radiography", published by the American National Standards Institute. These standards are cited in the proposed rules.

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 3 years of the effective date of the federal regulations. The proposed changes to ch. HFS 157 ensure continued compatibility with new federal radioactive material regulations in 10 CFR Pts. 19, 20, 31, 33-36, 39, 40, 70, 71 and 150 and applicable parts of Title 49 CFR relating to transportation as required by s. 254.34 (1), Stats.

Comparison with rules in adjacent states:

Iowa – Iowa is an Agreement state with the Nuclear Regulatory Commission. As a result, Iowa law contains radiation protection and regulatory requirements very similar to those in ch. HFS 157 and compatible with equivalent federal regulations in Titles 10 and 49, Code of Federal Regulations. Under Iowa law, annual x-ray registration fees range from $20 to $1000 per tube depending on use. Medical/chiropractic annual registration fees are $51 per tube while dental/podiatry registration fees are $39 per tube.

Minnesota – Minnesota is in the process of becoming an Agreement state with the Nuclear Regulatory Commission. Minnesota adopted new radiation protection regulations for radioactive materials effective January 1, 2005. As a result, Minnesota law contains radiation protection and regulatory requirements very similar to those in ch. HFS 157 and compatible with equivalent federal regulations in Titles 10 and 49, Code of Federal Regulations. Under Minnesota law, annual x-ray registration fees consist of a base facility fee of $132 plus an additional tube fee ranging from $66 to $132 per tube depending on use. Medical/veterinary annual tube fees are $106 per tube while annual dental tube fees are $66 per tube.

Michigan – Michigan is not an Agreement state with the Nuclear Regulatory Commission. As a result, Michigan law does not contain regulations equivalent to most of ch. HFS 157. The Nuclear Regulatory Commission is responsible for regulating the majority of radioactive material use in Michigan under Titles 10 and 49, Code of Federal Regulations. Michigan law does contain a requirement to annually register radiation producing machines (i.e., x-ray devices). Under Michigan law, dental and veterinary annual x-ray registration fees are $62.49 for the first x-ray tube plus $34.68 for each additional tube. Medical and all other annual x-ray registration fees are $104.18 per tube.

Illinois – Illinois is an Agreement state with the Nuclear Regulatory Commission. As a result, Illinois law contains radiation protection and regulatory requirements very similar to those in ch. HFS 157 and compatible with equivalent federal regulations in Titles 10 and 49, Code of Federal Regulations. Under Illinois law, annual x-ray registration fees range from $35 to $170 per tube depending on use. Dental and veterinary annual x-ray registration fees are $35 per tube. Medical annual x-ray registration fees are $70 or $110 per tube depending on therapeutic or diagnostic use.

Summary of factual data and analytical methodologies:

The methods specified in s. 227.114, (2), Stats., for reducing a rule's impact on small business have not been incorporated in the proposed rules because incorporating any methods may be

contrary to the explicit state statutory requirements for radiation control; federal regulatory and statutory requirements for radiation control; Agreement state requirements; and the state's public policy on radiation control stated in s. 254.33, Stats. Because of the Department's limited use of discretion in developing the content of the proposed rules, the Department has limited its analysis of the proposed rules affect on the small businesses regulated by ch. HFS 157 to the affect that the proposed increase in annual registration fees will have on those businesses.

The Department referred to all of the following to draft the proposed rules and the small business fiscal impact analysis:

1. The proposed revisions were developed with the input of an ad hoc rules advisory group that included representatives of academic and medical facilities, radioactive materials users, x-ray users and large and small businesses and 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 Nuclear Regulatory Commission, the Food and Drug Administration and the Environmental Protection Agency. The SSRCR is also continually updated and used by most of the 33 existing Agreement states to help meet federal requirements.

2. Requirements of Titles 10, 21, and 49 of the Code of Federal Regulations; 42 USC; ss. 254.31 to 254.45, Stats., and the Agreement between Wisconsin and the Nuclear Regulatory Commission.

3. The 2002 Economic Census – Wisconsin Geographic Series, which is compiled by the U.S. census bureau every 5 years for each year ending in "2" and "7" and is the latest available economic data compiled on businesses located in Wisconsin. The Economic Census provides among other information, the North American Industry Classification Codes, information on industries, business revenues, sizes, and employment. The Department used this information to approximate business size and any possible percentage decrease in business revenues due to the proposed increase in annual registration fees.

4. Criteria adopted by the Department and approved by the Wisconsin Small Business Regulatory Review Board to determine whether the Department's proposed rules have a significant economic impact on a substantial number of small businesses. Pursuant to the Department's criteria, a proposed rule will have a significant economic impact on a substantial number of small businesses if at least 10% of the businesses affected by the proposed rules are small businesses and if operating expenditures, including annualized capital expenditures, increase by more than the prior year's consumer price index (CPI) or reduces revenues by more than the prior year's CPI. For the purposes of this rulemaking, we used 2005 as the index year; the 2005 CPI is estimated to be 3%. The consumer price index is compiled by the U.S. Department of Labor, Bureau of Labor Statistics and measures, among other things, the rate of inflation.

5. DHFS registration databases and operations data was used to determine fees paid by registered facilities, number of registered x-ray sites and number of x-ray tubes per sites and the revenues of the x-ray control program.

6. 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 employees 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 Department is the state’s 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. Sites of ionizing radiation (x-ray devices) are required under s. 254.35 (3), Stats., to register and pay annual registration fees, which consists of a site fee and a fee for each x-ray tube upon registration. The current registration fee is $66 for dental sites ($36 site fee; $30 for each x-ray tube) and $80 ($36 site fee; $44 for each x-ray tube) for all other required registrants, including sites serving physicians and clinics, osteopaths and clinics, chiropractors, hospitals, podiatrists, veterinarian, industrial sites, educational facilities, research projects, and other sites. These industries are represented in the North American Industry Classification System sectors 33-Manufacturing; 42- Wholesale Trade; 44-45 –Retail Trade; 54-Professional Scientific, and Technical Services; 61-Educational Services ; 62-Health Care and Social Assistance; 71- Arts, Entertainment, and Recreation; and 92-Correctional Facilities.

The Department’s x-ray registration and inspection program is 100% fee supported by the annual registration fees authorized under s. 254.35 (3), Stats. At current fee levels, the Department projects a program deficit of $27, 770 in SFY 06 that will increase to $135, 310 in SFY 07 and continue to increase each subsequent fiscal year if fees are not increased. To maintain program revenue sufficient to operate the x-ray registration and inspection program, the Department under s. 254.35 (3) (g), Stats., proposes to increase annual registration fees by increasing both the annual site fee and x-ray tube fee for installations required to be registered as follows:

- Increase the annual site fee from $36 to $50 for all required registrants, including sites serving physicians and clinics, osteopaths and clinics, chiropractors, hospitals, podiatrists, veterinarian, industrial, educational facilities, research projects, and dental sites, and other sites.
- Increase the annual x-ray tube fee from $44 to $50 for all sites, except dental, serving physicians and clinics, osteopaths and clinics, chiropractors, hospitals, podiatrists, veterinarian, industrial sites, educational facilities, research projects, and other sites.
- Increase the annual x-ray tube fee from $30 to $35 for dental sites.

An analysis of the Department’s facility registration data shows that the 2,152 registered dental facilities average 4 x-ray tubes per site at a current cost of $120 ($30 x 4) in annual x-ray tube fees and $36 in site fees for an approximate total of $156 per year (or $13 per month) in annual registration fees. Under the proposed fees increase, dental facilities with 4 x-ray tubes per site will pay $140 ($35 x 4) in annual x-ray tube fees and $50 in site fees for an approximate total of $190 per year (or $16 per month) in annual registration fees; an increase of $34 per year. Dental sites account for over 45% of the registered facilities and over 58% of the x-ray tubes, and at least 85% of these facilities may be considered small businesses.

Veterinary services (431 facilities); chiropractors (901 facilities), and podiatrists (119 facilities) average 1 x-ray tube per site at a current cost of $44 ($44 x 1) in annual x-ray tube fees and $36 in site fees for an approximate total of $80 per year (or $7 per month) in annual registration fees. Under the proposed fees increase, these facilities will pay $50 ($50 x 1) in annual x-ray tube fees and $50 site fee for an approximate total of $100 per year (or approximately $8 per month) in annual registration fees; an increase of approximately $20 per year. Veterinarians, chiropractors, and podiatrists account for 30% of the registered facilities and 10.5% of the x-ray tubes and at least 85% of these facilities may be considered small business.

Industrial applications; sites serving physicians and clinics and osteopaths and clinics; hospitals; educational facilities; research projects; and other sites including those with security installations, account for the remaining 25% of the registered facilities and 31% of the x-ray tubes. Some or all of these facilities are not small businesses as defined in s. 227.114 (1), Stats.

Based on an analysis of the average gross annual revenues (as given in the 2002 Economic Census) of dental facilities, chiropractic facilities, veterinary facilities, and podiatry facilities, the proposed increase in annual registration fees represents a less than 1% decrease in gross annual revenues of these small businesses.

Annual registration fees have not been increased since SFY1997. The proposed increase in fees will increase program revenues by approximately $140, 614 if implemented in SFY 07 and ensure adequate program funding thru at least SFY 10. Adequate funding of the x-ray registration and inspection program is important because this program helps to minimize unnecessary radiation exposure to the general public and device operators by verifying that devices are functioning according to the radiation protection requirements in ch. HFS 157, state statutes, federal statutes and regulations, and the radiation protection policy stated in s. 254.33, Stats. If the annual registration fees are not increased the Department would be forced to terminate staff and reduce the frequency in which x-ray inspection are conducted. Reduced inspection frequency is linked to higher rates of non-compliance with radiation safety requirements. Faulty x-ray equipment or x-ray equipment not used as required increases the risk of injuries to skin and organ tissue, and cancer.

Effect on small business:
Pursuant to the foregoing analysis, the proposed increase in annual site registration fees will affect a substantial number of the small businesses that have x-ray devices, but will not have a significant economic impact on those businesses.

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Place where written comments may be submitted and deadline for submission
The deadline for submitting comments to the Department is **4:30 p.m., on May 12, 2006**. Written comments may be submitted at the public hearing; submitted to the Department using the Wisconsin Administrative Rules Website at http://adminrules.wisconsin.gov ; or may be sent to:

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TEXT OF PROPOSED RULE

SECTION 1. HFS 157.01 (6) is amended to read:

HFS 157.01 (6) Subchapter V establishes radiation safety requirements for using sources of radiation for ~~wireline service operations~~well logging including mineral-logging, radioactive markers and subsurface tracer studies. The requirements of subch. V are in addition to the requirements of subchs. I, II, III, VIII and X.

SECTION 2. HFS 157.01 (16) is repealed.

SECTION 3. HFS 157.02 (4), (5), (6), (7) and (10) are amended to read:

HFS 157.02 (4) The requirements of subch. IV are for industrial radiography operations and are in addition to the requirements of subchs. I, II, III, VIII, X, XI, XII, and XIII ~~and XV~~.

(5) Subchapter V applies to all licensees or registrants who use sources of radiation for ~~wireline service operations~~well logging including mineral-logging, radioactive markers and subsurface tracer studies. The requirements of subch. V are in addition to the requirements of subchs. I, II, III, VIII, X, XI, XII~~,~~ and XIII ~~and XV~~.

(6) Subchapter VI applies to all persons using radioactive material in the healing arts. The requirements of subch. VI are in addition to the requirements of subchs. I, II, III, X, XI, XII~~,~~ and XIII ~~and XV~~.

(7) Subchapter VII applies to panoramic irradiators having either dry or wet storage of the radioactive sealed sources and to underwater irradiators in which both the source and the product being irradiated are submerged. Irradiators whose dose rates exceed 5 grays (500 rads) per hour at one meter from the radioactive sealed sources in air or in water, as applicable for the irradiator type, are covered by subch. VII. Nothing in subch. VII relieves a licensee from complying with other federal, state and local regulations governing the siting, zoning, land use and building code requirements for industrial facilities. Subchapter VII does not apply to self–contained dry–source–storage irradiators in which both the source and the area subject to irradiation are contained within a device and are not accessible by personnel, medical radiology or teletherapy, radiography for the irradiation of materials for nondestructive testing purposes, gauging or open–field, agricultural irradiations. The requirements of subch. VII are in addition to the requirements of subchs. I, II, III, X, XI, XII~~,~~ and XIII ~~and XV~~.

(10) The requirements of subch. X apply to all persons who receive, possess, use, own or transfer sources of radiation registered with or licensed by the department under subchs. II~~,~~ and VIII ~~and XV~~ of this chapter.

SECTION 4. HFS 157.02 (15) is repealed.

SECTION 5. HFS 157.03 (1) and (2) are amended to read:

HFS 157.03 (1) "A_1" means the maximum activity of special form radioactive material permitted in a ~~type~~Type A package. This value is either listed in Table A-1 and A-3 in Appendix O or may be derived under the procedures prescribed in Appendix O.

(2) "A_2" means the maximum activity of radioactive material, other than special form material, LSA and SCO material, permitted in a ~~type~~Type A package. This value is either listed in Table A-1 and Table A-3 in Appendix O or may be derived under the procedures prescribed in Appendix O.

SECTION 6. HFS 157.03 (2) Note is repealed.

SECTION 7. HFS 157.03 (13) is amended to read:

HFS 157.03 (13) "Agreement state" means any state with which the U.S. nuclear regulatory commission or the U.S. atomic energy commission has entered into an effective agreement under ~~42 USC 2201~~subsection 274b of the atomic energy act of 1954, as amended.

SECTION 8. HFS 157.03 (17m) is created to read:

HFS 157.03 (17m) “Air Kerma Rate” means the air kerma per unit time.

SECTION 9. HFS 157.03 (32) and (68) are repealed and recreated to read:

HFS 157.03 (32) “Attenuation block” means a block or stack of type 1100 aluminum alloy, or aluminum alloy having equivalent attenuation, with dimensions 20 centimeters by 20 centimeters or larger by 3.8 centimeters that is large enough to intercept the entire x-ray beam.

(68) “Coefficient of variation” means the ratio of the standard deviation to the mean value of a population of observations. It is estimated using the following equation:

$$C = \frac{s}{\overline{X}} = \frac{1}{\overline{X}}\left[\sum_{i=1}^{n}\frac{\left(X_i - \overline{X}\right)^2}{n-1}\right]^{1/2}$$

Where:

S=standard deviation of the observed values:

X=mean value of observations in sample:

Xi= ith observation in sample; and

n=number of observation in sample

SECTION 10. HFS 157.03 (46) is amended to read:

HFS 157.03 (46) "Brachytherapy" means a method of radiation therapy in which ~~sealed~~ sources are used to deliver a radiation dose at a distance of up to a few centimeters by surface, intracavitary or interstitial application.

SECTION 11. HFS 157.03 (57g), (57r), (75m), (82m), (84m) and Note, and (87m) are created to read:

HFS 157.03 (57g) “Certificate holder” means a person who has been issued a certificate of compliance or other package approval by the U.S. nuclear regulator commission.

(57r) “Certificate of Compliance” or “CoC” means the certificate issued by the U.S. nuclear regulatory commission under either subpart D or I of 10 CFR 71 which approves the design of a package for the transportation of radioactive material.

(75m) “Consignment” means each shipment of a package or groups of packages or load of radioactive material offered by a shipper for transport.

(82m) “Conveyance” means any one of the following:

(a) For transport by public highway or rail, any transport vehicle or large freight container.

(b) For transport by water, any vessel, or any hold, compartment or defined deck area of a vessel, including any transport vehicle on board the vessel.

(c) For transport by aircraft, any aircraft.

(84m) “Criticality safety index or “CSI” means the dimensionless number, rounded up to the next tenth, assigned to and placed on the label of a fissile material package, to designate the degree of control of accumulation of packages containing fissile material during transportation.

Note: Determination of the critically safe index is described in HFS 157.93 (7) and (8).

(87m) “Cumulative air kerma” means the total air kerma accrued from the beginning of an examination or procedure and includes all contributions from fluoroscopic and radiographic irradiation.

SECTION 12. HFS 157.03 (98) is amended to read:

HFS 157.03 (98) "Depleted uranium" means ~~the source material~~ uranium ~~in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material~~containing less uranium-235 than the naturally occurring distribution of uranium isotopes.

SECTION 13. HFS 157.03 (101m), (103m) and (124m) are created to read:

HFS 157.03 (101m) Deuterium” means deuterium and any deuterium compounds, including heavy water, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1:5000.

(103m) “DICOM” means digital imaging and communications in medicine.

(124m) “Exclusive use” means the sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier must ensure that any

loading or unloading is performed by personnel having radiological training and resources appropriate for the safe handling of the consignment. The consignor shall issue specific instructions, in writing, for maintenance of exclusive use shipment controls, and include them with the shipping paper information provided to the carrier by the consignor.

SECTION 14. HFS 157.03 (140) is amended to read:

HFS 157.03 (140) "Fissile material" means ~~plutonium-238~~the radionuclides uranium-233, uranium-235, plutonium-239~~,~~ and plutonium-241, ~~uranium-233, uranium-235~~ or any combination of these radionuclides. Fissile material means the fissile nuclides themselves, not material containing fissile nuclides. Unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that has been irradiated in thermal reactors only are not included in this definition.

SECTION 15. HFS 157.03 (140) Note is created to read:

HFS 157.03 (140) Note: Certain exclusions from fissile material controls are provided in 10 CFR 71.15.

SECTION 16. HFS 157.03 (141) is amended to read:

HFS 157.03 (141) "Fissile material package" or Type AF package, Type BF package, Type B(U)F package, or Type B(M)F package means a fissile material packaging together with its fissile material contents.

SECTION 17. HFS 157.03 (143m), (150m), 185m) and (185r) are created to read:

HFS 157.03 (143m) “Fluoroscopic air kerma display device” means a device, or subsystem, or component that provided the display of the air kerma rate and cumulative air kerma required by 21 CFR 1020.32 (k). It includes radiation detectors, if any, electronic and computer components, associated software, and display units.

(150m) “Graphite” means, for the purposes of 10 CFR 71.15 and 10 CFR 71.22, graphite with a boron equivalent content less than 5 parts per million and density greater than 1.5 grams per cubic centimeter.

(185m) “Last-image hold radiograph” means an image obtained either by retaining one or more fluoroscopic images, which may be temporally integrated, at the end of a fluoroscopic exposure or by initiating a separate and distinct radiographic exposure automatically and immediately in conjunction with termination of the fluoroscopic exposure.

(185r) “Lateral fluoroscope” means the x-ray tube and image receptor combination in a biplane system dedicated to the lateral projection. It consists of the lateral x-ray tube housing assembly and the lateral image receptor that are fixed in position relative to the table with the x-ray beam axis parallel to the plane of the table.

SECTION 18. HFS 157.03 (198) (intro.) and (a) and (c) are amended to read:

HFS 157.03 (198) (intro.) "Low specific activity - I" or "LSA-I material" means any of the following:

(a) ~~Ores~~Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing ~~only~~ naturally occurring ~~uranium or thorium decay series~~radioactive radionuclides ~~and uranium or thorium concentrates of such ores~~which are not intended to be processed for the use of radionuclides.

(c) Radioactive material~~, other than fissile material,~~ for which the A_2 value is unlimited.

SECTION 19. HFS 157.03 (198) (d) is repealed and recreated to read:

HFS 157.03 (198) (d) Other radioactive material in which the radioactive material is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentration determined under Appendix A.

SECTION 20. HFS 157.03 (199) (b), (200) (intro.) and (c), (201), (224), and (225) are amended to read:

HFS 157.03 (199) (b) ~~Material~~ Other material in which the radioactive material is distributed throughout, and the average specific activity does not exceed 10^{-4} A_2/g for solids and gases and 10^{-5} A_2/g for liquids.

(200) (intro.) "Low specific activity - III" or "LSA-III material" means solids, such as consolidated wastes or activated materials, excluding powders, for which all of the following apply:

(c) The estimated average specific activity of the solid does not exceed 2 x 10^{-3} A_2/g.

(201) "Low toxicity alpha emitters" means natural uranium, depleted uranium, natural thorium; uranium-235, uranium-238, thorium-232, thorium-228 or thorium-230 when contained in ores or physical or chemical concentrates or tailings; or alpha emitters with a half-life of less than 10 days.

(224) "Natural thorium" means thorium ~~isotopes~~ with ~~a~~the naturally occurring distribution of thorium isotopes, which is essentially 100 weight percent thorium-232.

(225) "Natural uranium" means uranium ~~isotopes~~ with the naturally occurring distribution of uranium isotopes, which is approximately 0.711 weight percent uranium-235, and the remainder by weight essentially uranium-238.

SECTION 21. HFS 157.03 (235) Note is repealed:

SECTION 22. HFS 157.03 (247m), (251m), (264m), (279m), and (295m) are created to read:

HFS 157.03 (247m) “PACS” means picture archiving communications system.

(251m) “Personnel dosimeter” means a dosimeter, assigned to an individual, that is processed and evaluated by an accredited national voluntary laboratory accreditation program (NVLAP) processor.

(264m) “Positron emission tomography/computed tomography” or “PET/CT” means a dual modality imaging assembly comprised of two distinct components, one using radioactive material for imaging and the other using an x-ray source.

(279m) “Pulsed mode” means operation of the x-ray system such that the x-ray tube current is pulsed by the x-ray control to produce one or more exposure intervals of duration less than one-half second.

(295m) “Radiation safety officer for medical use” means an individual that meets the requirements of ss. HFS 157.61 (7) (a) or (c) 1. and HFS 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 23. HFS 157.03 (296) is amended to read:

HFS 157.03 (296) “Radiation therapy simulation system” means a radiographic, CT or fluoroscopic x-ray system intended for localizing the volume to be exposed during radiation therapy and confirming the position and size of the therapeutic irradiation field.

SECTION 24. HFS 157.03 (267) is repealed and recreated to read:

HFS 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.

SECTION 25. HFS 157.03 (326) (intro.) and (a) to (c), (327) (intro.) and (a) to (c), (334), and 353 are amended to read:

HFS 157.03 (326) "SCO-I" means ~~an~~a surface contaminated object (SCO) for which all of the following apply:

(a) The non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 ~~becquerels~~ Bq/cm^2 (10^{-4} ~~□Ci~~ $microcurie/cm^2$) per cm^2 for beta and gamma and low toxicity alpha emitters, or 0.4 ~~becquerels~~ Bq/cm^2 (10^{-5} ~~□Ci~~ $microcurie/cm^2$) ~~per cm^2~~ for all other alpha emitters.

(b) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2~~,~~) does not exceed $4x10^4$ ~~becquerels~~ Bq/cm^2 (1.0 ~~□Ci~~ $microcurie/cm^2$) ~~per cm^2~~ for beta and gamma and low toxicity alpha emitters, or $4x10^3$ ~~becquerels~~ Bq/cm^2 (0.1 ~~□Ci~~ $microcurie/cm^2$) ~~per cm^2~~ for all other alpha emitters.

(c) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2~~,~~) does not exceed $4x10^4$ ~~becquerels~~ Bq/cm^2 (1.0 ~~□Ci~~ $microcurie/cm^2$) ~~per cm^2~~ for beta and gamma and low toxicity alpha emitters, or $4x10^3$ ~~becquerels~~ Bq/cm^2 (0.1 ~~□Ci~~ $microcurie/cm^2$) ~~per cm^2~~ for all other alpha emitters.

(327) "SCO-II" means ~~an~~a surface contaminated object (SCO) for which the limits for SCO-1 are exceeded and on which all of the following apply:

(a) The non-fixed contamination on the accessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2~~,~~) does not exceed 400 ~~becquerels~~ Bq/cm^2 (10^{-2} ~~□Ci~~

microcurie/cm^2) ~~per cm^2~~ for beta and gamma and low toxicity alpha emitters, or 40 ~~becquerels~~Bq/cm^2 (10^{-3} ~~μCi~~ microcurie/cm^2) ~~per cm^2~~ for all other alpha emitters.

(b) The fixed contamination on the accessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2~~,~~) does not exceed 8x10^5 ~~becquerels~~ Bq/cm^2 (20 ~~μCi~~ microcurie/cm^2) per cm^2 for beta and gamma and low toxicity alpha emitters, or 8x10^4 ~~becquerels~~ Bq/cm^2 (2 ~~μCi~~ microcurie/cm^2) ~~per cm^2~~ for all other alpha emitters.

(c) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2~~,~~ (or the area of the surface if less than 300 cm^2~~,~~) does not exceed 8x10^5 ~~becquerels~~ Bq/cm^2 (20 ~~μCi~~ microcurie/cm^2) ~~per cm^2~~ for beta and gamma and low toxicity alpha emitters, or 8x10^4 ~~becquerels~~ Bq/cm^2 (2 ~~μCi~~ microcurie/cm^2) ~~per cm^2~~ for all other alpha emitters.

(334) "Shallow dose equivalent~~,~~" or "H_s" ~~or "SDE"~~ means the dose equivalent at a tissue depth of 0.007 centimeter (7 mg/cm^2) ~~averaged over an area of one square centimeter~~. "Shallow dose equivalent" applies to the external exposure of the skin of the whole body or the skin of an extremity.

(353) "Specific activity" of a radionuclide means the radioactivity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the radioactivity per unit mass of the material.

SECTION 26. HFS 157.03 (371m) is created to read:

HFS 157.03 (371m) “Tailing” means the residual material resulting from the extraction of minerals from the earth.

SECTION 27. HFS 157.03 (376) (b), (390) and (398) are amended to read:

HFS 157.03 (376) (b) Radioactive materials are present for the purpose of performing ~~wireline service operations~~well logging or subsurface tracer studies.

(390) "Transport index" or “TI” means the dimensionless number, rounded up to the next tenth, placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is the number ~~expressing~~ is determined by multiplying the maximum radiation level in millisievert (mSv) per hour at one meter (3.3 feet) from the external surface of the package ~~in millisieverts per hour multiplied~~ by 100, which is equivalent to the maximum radiation level in millirem per hour at one meter (3.3 ft).

(398) "Type B package" means a packaging ~~and the radioactive contents of the packaging that meet the requirements of 49 CFR Part 173~~designed to transport greater than A^1 or A^2 quantity of radioactive material that, together with its radioactive contents, is designed to retain the integrity of containment and shielding required by 49 CFR 173 when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR 71.

SECTION 28. HFS 157.03 (402m) is created to read:

HFS 157.03 (402m) “Unirradiated uranium” means uranium containing not more than 2 X 10^3 Bq of plutonium per gram of uranium-235, not more than 9 X 10^6 Bq of fission products per gram of uranium-235, and not more than 5 X $^{-3}$ g of uranium-236 per gram of uranium-235.

SECTION 29. HFS 157.03 (418) and (419) are amended to read:

(418) "~~Well-bore~~Well" means a drilled hole in which ~~wireline service operations or subsurface tracer studies are~~well logging may be performed.

(419) "Well logging" means all operations involving the lowering and raising of measuring devices or tools which may contain sources of radiation into ~~well-bores~~wells or cavities for the purpose of obtaining information about the well or adjacent formations which may be used in oil, gas, mineral, groundwater or geological exploration.

SECTION 30. HFS 157.03 (419m) is created to read:

HFS 157.03 (419m) “Well-logging assistant” means any individual who, under the personal supervision of a well logging supervisor, handles sources of radiation that are not in logging tools or shipping containers or who performs surveys required by s. HFS 157.55.

SECTION 31. HFS 157.03 (424) and (425) are repealed.

SECTION 32. HFS 157.03 (428) is amended to read:

(428) "Working level month" or "WLM" means an exposure to one working level for 170 hours. ~~2,000~~ Two thousand working hours per year divided by 12 months per year is approximately equal to 170 hours per month.

SECTION 33. HFS 157.05 (1) (a) and (3) are amended to read:

HFS 157.05 (1) (a) A hand-held fluoroscopic screen ~~with x-ray equipment~~ unless it has been listed in the Registry of Sealed Source and Devices ~~or accepted for certification by the FDA, center for devices and radiological health~~.

(3) RADIATION SURVEY INSTRUMENTATION. No person may operate a portable device containing radioactive material designed to measure moisture content or density of materials unless calibrated and operable radiation survey instrumentation that meets the requirements of s. HFS 157.52 (4) (a), (b) and (c) is available for use at each site where the portable devices are used.

SECTION 34. HFS 157.05 (5) is created to read:

HFS 157.05 (5) No person may use a portable device containing radioactive material designed to measure moisture content or density of materials unless there is a minimum of 2 independent physical controls that form tangible barriers to secure the device from unauthorized removal, whenever the device is not under the control and constant surveillance of the licensee.

SECTION 35. HFS 157.09 (2) (a) 2. is repealed and recreated to read:

HFS 157.09 (2) (a) 2. A manufacturer, processor or producer of a product or material is exempt from the requirements of subch. II if they transfer radioactive material contained in a product or material in concentrations not in excess of those in Appendix A and introduced into the product or material by a licensee holding a specific license issued by the department, the NRC or another agreement state expressly authorizing such introduction.

SECTION 36. HFS 157.09 (2) (c) (title), (intro.) and 1. a. and 9. a. are amended to read:

HFS 157.09 (2) (c) ~~*Exempt*~~ *Certain items containing radioactive material.* Except for persons who apply radioactive material to the following products, or incorporate radioactive material into the following products, or initially transfers for sale or distribution the following products, a person is exempt from this subchapter if the person receives, possesses, uses, ~~initially~~ transfers ~~for sale or distribution~~, owns or acquires any of the following products:

HFS 157.09 (2) (c) 1. a. 925 MBq (25 ~~Millicuries~~millicuries) of tritium per timepiece.

9. a. 5.55 GBq (150 millicuries) of tritium per microwave receiver protector tube or 370 MBq (10 millicuries) of tritium per any other electron tube.

SECTION 37. HFS 157.09 (2) (c) 1. f. Note and 12. are repealed.

SECTION 38. HFS 157.09 (2) (d) is created to read:

HFS 157.09 (2) (d) *Self-luminous products containing tritium, krypton-85, promethium-147 or radium-226.* 1. Except for persons who manufacture, process, produce, or initially transfer for sale or distribution self-luminous products containing tritium, krypton-85 or promethium-147, and except as provided in subd. 3, any person is exempt from this subchapter to the extent that such person receives, possesses, uses, transfers, owns or acquires tritium, krypton-85 or promethium-147 in self-luminous products manufactured, processed, produced or initially transferred under a specific license issued by the NRC according to 10 CFR 32.22, which authorizes the initial transfer of the product for use under this subd.

2. Any person who desires to manufacture, process or produce self-luminous products containing tritium, krypton-85 or promethium-147, or to transfer such products for use according to subd. 1., shall apply for a license issued by the NRC according to 10 CFR 32.22, which states that the product may be transferred by the licensee to persons exempt from this subchapter according to subd. 1. or equivalent regulations of the NRC or an agreement state.

3. The exemption in subd. 1. does not apply to tritium, krypton-85 or promethium-147 used in products primarily for frivolous purposes or in toys or adornments.

4. Any person who receives, possesses, transfers, uses or owns self-luminous products containing less than 37 kBq (0.1 microcurie) of radium-226 is exempt from this subchapter.

SECTION 39. HFS 157.09 (2) (c) 13. (intro), a. to c., and 14. are renumbered HFS 157.09 (2) (e) (title) and 1. to 3., and HFS 157.09 (2) (f) and (title) and HFS 157.09 (2) (e) (title) and 1. and (f) and (title) as renumbered are amended to read:

(e) ~~Gas and aerosol detectors containing radioactive material provided that the following conditions are met:~~*Gas and aerosol detectors containing radioactive material.*

1. Except for persons who manufacture, process, ~~or~~ produce or initially transfer for sale or distribution gas and aerosol detectors containing radioactive material, a person is exempt from this ~~chapter~~subchapter if the person receives, possesses, uses, transfers, owns or acquires radioactive material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards provided that the detectors containing radioactive material have been manufactured, processed, produced or initially transferred for sale or distribution under a

specific license issued by the NRC under 10 CFR 32.26, a licensing state, other agreement state or the department under s. HFS 157.13 (4) (c), which authorizes the transfer of the detectors to persons who are exempt from regulatory requirements.

(f) ~~Resins containing scandium-46 and designed for sand consolidation in oil wells, to the extent that a person receives, possesses, uses, transfers, owns or acquires synthetic plastic resins containing scandium-46 which are designed for sand consolidation in oil wells.~~ *Resins containing scandium-46 and designed for sand-consolidation in oil wells.* Any person is exempt from this subchapter to the extent that a person receives, possesses, uses, transfers, owns or acquires synthetic plastic resins containing scandium-46 which are designed for sand consolidation in oil wells. These resins shall have been manufactured or initially transferred for sale or distribution under a specific license issued by the NRC, or shall have been manufactured under the specifications contained in a specific license issued by the department or any agreement state to the manufacturer of the resins under licensing requirements equivalent to those in 10 CFR 32.16 and 32.17. This exemption does not authorize the manufacture of any resins containing scandium-46.

SECTION 40. HFS 157.09 (2) (c) 15. is repealed.

SECTION 41. HFS 157.09 (2) (g) is created to read:

HFS 157.09 (2) (g) *Radioactive drug capsules containing no more than 37 kBq (1 µCi) carbon-14 urea each for in vivo diagnostic use for humans.* 1. Except as provided in subds. 2 and 3., any person is exempt from this subchapter provided that such person receives, possesses, uses, transfers, owns, or acquires capsules containing 37 kBq (1*µCi)* carbon-14 urea (allowing for nominal variation that may occur during the manufacturing process) each, for “in vivo” diagnostic use for humans.

2. Any person who desires to use the capsules for research involving human subjects shall apply for and receive specific license according to s. HFS 157.13.

3. Any person who desires to manufacture, prepare, process, produce, package, repackage, or transfer for commercial distribution such capsules shall apply for and receive a specific license according to s. HFS 157.13 (4) (i).

4. Nothing in this section relieves persons from complying with applicable FDA, other federal and state requirements governing receipt, administration and use of drugs.

SECTION 42. HFS 157.10 (3) is amended to read:

HFS 157.10 (3) FEE SCHEDULE. The following is the schedule of application, annual, amendment and reciprocity fees for specific radioactive material licenses.

Category	License Type	Application & Annual Fee
1.	Special Nuclear Material	
A.	License for possession and use of SNM in sealed sources	$1,000

	contained in devices used in measuring systems	
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	$3,000

	or redistribution of radiopharmaceuticals, generators, reagent kits and sources or devices	
	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 irradiation of materials where the source is exposed~~where the source is not exposed)~~ <u>for irradiation purposes. The category also includes underwater irradiators for irradiation of</u>	$3,000

	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 research and development that do not authorize commercial distribution	$1,800
	License for installation, repair, maintenance leak testing or other service of devices or items containing radioactive material, 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
4.	Waste Processing	
	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
	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~~, high dose rate afterloading~~ 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 development, excluding teletherapy, ~~high dose rate afterloading~~ or stereotactic radiosurgery devices	$20,000
C.	License for mobile nuclear medicine	$2,500
D.	Medical - all others, including SNM pacemakers and high does 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	$1,000

	distribution, excluding broad scope or human use licenses, with a combined possession limit of ~~6~~12 isotopes and 37 GBq (1 curie) total activity	
9.	Accelerator	
	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 without 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.

SECTION 43. HFS 157.11 (1) (c) 6. Note, (2) (b) 5., (c) 4., (e) 2., and (f) 2. c. Note, 3. e., 6., (g) 1. a. 2. and 4. are amended to read

HFS 157.11 (1) (c) Note: The "Certificate - Use of Depleted Uranium Under General License" form may be obtained by writing the Department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadioactiveMat/Index.htm. Completed forms may be mailed to the Department at the same address.

(2) (b) 5. The general license under this paragraph is exempt from the requirements of subch. X and subch. III, with the exception of ss. HFS 157.30 (1), 157.32 (1) and (2)~~, and subch. X~~.

(c) 4. The general license under this paragraph is exempt from the requirements of subch. X and subch. III, with the exception of ss. 157.30 (1), and 157.32 (1) and (2) ~~, and subch. X~~.

(e) 2. The general license under this paragraph is ~~exempt from~~subject to the requirements of subch. III, ~~with the exception of ss. HFS 157.30 (1), 157.32 (1) and (2),~~ and subch. X.

(f) 2. c. Note: The "Certificate - In Vitro Testing with Radioactive Material Under General License" form may be obtained by writing the Department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~ http://dhfs.wisconsin.gov/dph_beh/Radioactive Mat/Index.htm.

3. e. The general licensee shall dispose of the Mock Iodine-125 reference or calibration sources described in subd.1 e. as required by s. ~~HFS 157.23 (1)~~HFS 157.30 (1).

6. Any person using radioactive material under the general license under this paragraph is exempt from the requirements of subchs. III and X with respect to radioactive material covered by that general license, except that such persons using the Mock Iodine-125 described in subd. 1. e. shall comply with the provisions of ss. ~~HFS 157.23 (1)~~HFS 157.30 (1) and 157.32 (1) and (2).

(g) 1. a. Upon occurrence of visually observable damage, such as a bend or crack or discoloration from overheating to the device, discontinue use of the device until it has been inspected, tested for leakage and repaired by a person holding a specific license from the NRC or an agreement state to manufacture or service the devices; or shall dispose of the device under the provisions of s. ~~HFS 157.23 (1)~~HFS157.30 (1).

2. A person who owns, receives, acquires, possesses, uses or transfers strontium-90 contained in ice detection devices under the general license under this paragraph are exempt from the requirements of subchs. III and X except that the person shall comply with the provisions of ss. ~~HFS 157.23 (1)~~HFS 157.30 (1) and 157.32 (1) and (2)

4. The general license in this paragraph is exempt from the requirements of subch. X and subch. III with the exception of ss. HFS 157.30 (1), 157.32 (1) and (2)~~, and subch. X~~.

SECTION 44. HFS 157.12 (3) is amended to read:

HFS 157.12 (3) INFORMATION REQUIREMENTS. A general licensee shall ~~provide all the following information and any other information requested on the application form provided~~ furnish the following information and any other information specifically requested by the department:

SECTION 45. HFS 157.12 (3) (f) Note, (5), and (7) (c) Note are repealed.

SECTION 46. HFS 157.13 (1) (a) Note is amended to read:

HFS 157.13 (1) (a) Note: A specific license application form may be obtained by writing the Department, including a description of the proposed activity to be licensed. The Department's address is: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department's website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadioactiveMat/Index.htm.

SECTION 47. HFS 157.13 (1) (i) is created to read:

HFS 157.13 (1) (i) Each application for a specific license, other than a renewal, shall contain information describing how facility design procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning and minimize, to the extent practicable, the generation of radioactive waste.

SECTION 48. HFS 157.13 (4) (c) and (d) (title), 1. (intro.) and d. are amended to read:

HFS 157.13 (4) (c) *Licensing the incorporation of NARM into gas and aerosol detectors.* The department shall approve an application for a specific license authorizing the incorporation of NARM into gas and aerosol detectors to be distributed to persons exempt under s. ~~HFS 157.09 (2) (c) 13.~~ HFS 157.09 (2) (e) if the application satisfies requirements equivalent to those contained in 10 CFR 32.26. The maximum quantity of radium-226 in each device may not exceed 3.7 kBq (0.1 microcurie).

(d) (title) *Licensing the manufacture and initial distribution of devices to persons generally licensed under s. HFS 157.11 (2) (b).*

1. (intro.) The department shall approve an application for a specific license to manufacture or initially distribute devices containing radioactive material, excluding special nuclear material, to persons generally licensed under s. HFS 157.11 (2) (b) or equivalent regulations of the NRC, ~~an~~ another agreement state or a licensing state only under all the following conditions:

d. The applicant submits sufficient information, as specified in subd. 1. b., to provide reasonable assurance that under accident conditions such as fire and explosion associated with handling, storage, and use of the device, it is unlikely that any person would receive an external radiation dose or dose commitment in excess of the following organ doses:

Whole body; head and trunk; active blood-forming organs; gonads; or lens of eye.....150 mSv (15 rems)

Hands and forearms; feet and ankles; localized areas of skin averaged over areas no larger than one square centimeter..... .~~2 Sv~~ 2000 mSv (200 rems)

Other organs.....500 mSv (50 rems)

SECTION 49. HFS 157.13 (4) (d) 1. f. and g. are created to read:

HFS 157.13 (4) (d) 1. f. Each device having a separable source housing that provides the primary shielding for the source also bears, on the source housing, a durable label containing the device model number and serial number; the isotope and quantity; the words, “Caution-Radioactive Material”; the radiation symbol described in HFS 157.29 (1); and the name of the manufacturer or initial distributor.

g. Each device meeting the criteria of HFS 157.11 (2) (b), bears a permanent (e.g., embossed, etched, stamped, or engraved) label affixed to the source housing if separable, or the device if the source housing is not separable, that includes the words, “Caution-Radioactive Material “and if practicable, the radiation symbol described in s. HFS 157.29 (1).

SECTION 50. HFS 157.13 (4) (d) 5. i., and (i) 1. are amended to read:

HFS 157.13 (4) (d) 5. i. If a notification of bankruptcy has been made under s. HFS 157.13 (10) or the license is to be terminated, a person licensed under this paragraph shall provide, upon request, to the department and to the appropriate regulatory agency, NRC ~~and to any appropriate agreement state,~~ or other agreement state having jurisdiction at the devices location, records of final disposition required under subd. par. 5. h.

(i) 1. The applicant satisfies the general requirements specified in sub. (2) and ch. 450, Stats.

SECTION 51. HFS 157.13 (4) (i) 5. is repealed and recreated to read:

HFS 157.13 (4) (i) 5. The applicant submits information to demonstrate that individuals who will prepare the radioactive drugs for medical use meet the requirements of s. HFS 157.68.

SECTION 52. HFS 157.13 (5) (c) 1. is renumbered HFS 157.13 (5) (c) 1. (intro.) and as renumbered is amended to read:

HFS 157.13(5) (c)1. Provide to the department a copy of the board certification and the written attestation(s), signed by a preceptor, the NRC or agreement state license or the permit issued by a licensee of broad scope 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 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 the following:

SECTION 53. HFS 157.13 (5) (c) 1. a. to c. are created to read:

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

b. Training in device operation, safety procedures, and clinical use for the type(s) 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(s) of use for which the individual is seeking authorization as an authorized user under s. HFS 157.67 (1).

c. Training for the type(s) 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 completing either a training program provided by the vendor or by training supervised by an authorized medical physicist authorized for the type(s) of use for which the individual is seeking authorization as an authorized medical physicist.

SECTION 54. HFS 157.13 (8) (title) and (intro.) are amended to read:

HFS 157.13 (8) (title) and (intro.) SPECIAL REQUIREMENTS FOR A SPECIFIC LICENSE TO CONDUCT ~~WIRE-LINE OPERATIONS AND SUBSURFACE TRACER STUDIES~~WELL LOGGING. The department shall approve an application for a specific license for the use of radioactive material in ~~wire-line service operations and subsurface tracer studies~~well logging if all the following conditions are satisfied:

SECTION 55. HFS 157.13 (10) (d) is repealed.

SECTION 56. HFS 157.13 (11) (d) 2. (intro.) and (L) 1. Note, (12) (b) Note are amended to read:

HFS 157.13 (11) (d) 2. (intro.) If any separate building or outdoor area contains stored radioactive material or residual radioactivity so that the building or outdoor area is unsuitable for release, do one of the following:

(L) 1. Note: The form may be obtained by writing the Department at: Department of Health and Family Services, Radiation Protection Section, PO Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadiatioP/Index.htm.

(12) (b) Note: A license renewal form may be obtained by writing the Department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadiatioP/Index.htm.

SECTION 57. HFS 157.13 (13) Note is created to read:

HFS 157.13 (13) Note: A specific license application form is not required for an amendment request.

SECTION 58. HFS 157.13 (17) (b) 1. (intro.) is amended to read:

HFS 157.13 (17) (b) 1. (intro.) An unplanned contamination event that meets ~~any~~ all of the following criteria:

SECTION 59. HFS 157.14 (2) (a) 2. Note, 5., and (b) (intro.) are amended to read:

HFS 157.14 (2) (a) 2. Note: The form may be obtained by writing the department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadiatioPIndex.htm.

5. The out-of-state licensee does not transfer or dispose of radioactive material possessed or used under the general license granted under this paragraph except by transfer to a person who is either specifically licensed by the department ~~or by~~, the NRC or another agreement state to receive the material, or is exempt from the requirements for a license for the material under s. HFS 157.09 (2) (a).

(b) ~~Notwithstanding the provisions of par. (a), any~~ Any person who holds a specific license issued by the NRC or another agreement state authorizing the holder to manufacture, transfer, install or service a device described in s. HFS 157.11 (2) (b) within areas subject to the jurisdiction of the licensing body is granted a general license to install, transfer, demonstrate or service the device in this state provided that all of the following occur:

SECTION 60. HFS 157.15 (1) (a) (title) and (intro.) are amended to read:

HFS 157.15 (1) (a) (intro.) a) *Unsealed radioactive material, sealed sources or plated foils.* A person applying for a specific license authorizing the possession and use of unsealed radioactive material, sealed sources or plated foils shall submit a decommissioning funding plan as described in sub. (5) with the license application for any of the following types of materials:

SECTION 61. HFS 157.15 (1) (a) 3. and 4. are created to read:

HFS 157.15 (1) (a) 3. Sealed sources or plated foils with a half-life greater than 120 days and in quantities greater than 10^{12} times the applicable quantities listed in Appendix I.

4. Sealed sources or plated foils involving a combination of isotopes with R divided by 10^{12} being greater than one, where R is defined as the sum of the ratios of the quantity of each isotope to the applicable value in Appendix I.

SECTION 62. HFS 157.15 (1) (b) 2. , (3) (b) 1., (4) (a) 1. to 3., (5) (a) 3., and (7) (a) 3. (intro.) are amended to read:

HFS 157.15 (1) (b) 2. Submit a written certification, signed by the chief financial officer or other individual designated by management to represent the licensee, that financial assurance has been provided in the amount prescribed in sub. (4) using one of the methods described in sub. (5) and a signed original of the financial instrument obtained to satisfy the requirements of sub. (6). The written certification may state that the appropriate assurance will be obtained after the application has been approved and the license issued by the department but before receipt of radioactive material by the applicant. If the applicant defers execution of the financial instrument until after the license has been issued, the applicant shall submit to the department a signed original of the financial instrument obtained before receipt of licensed material. If the applicant does not defer execution of the financial instrument, the applicant shall submit to the department, as part of the certification, a signed original of the financial instrument obtained to satisfy the requirements of sub. (6).

(3) (b) 1. For a license authorizing the use of radioactive material meeting the criteria of sub. (1) (a), submit a decommissioning funding plan as described in sub. (5) and a certification of financial assurance for at least ~~$750,000~~1,125,000, under the criteria in sub. (4), with any application for license renewal.

(4) (a) 1. ~~Seven hundred fifty~~One million one hundred twenty-five thousand dollars if the quantity of material is greater than 10^4 but less than or equal to 10^5 times the applicable quantities of Appendix I in unsealed form. For a combination of isotopes, R divided by 10^4 is greater than one but R divided by 10^5 is less than or equal to one.

2. ~~One hundred fifty~~Two hundred twenty-five thousand dollars if the quantity of material is greater than 10^3 but less than or equal to 10^4 times the applicable quantities of Appendix I in unsealed form. For a combination of isotopes, R divided by 10^3 is greater than one but R divided by 10^4 is less than or equal to one.

3. ~~Seventy-five~~One hundred thirteen thousand dollars if the quantity of material is greater than 10^{10} but less than or equal to 10^{12} times the applicable quantities of Appendix I in sealed sources or plated foils. For a combination of isotopes, R divided by 10^{10} is greater than one but R divided by 10^{12} is less than or equal to one.

(5) (a) 3. A description of the method for adjusting cost estimates and associated funding levels periodically over the life of the facility. Cost estimates shall be adjusted at intervals not to exceed 3 years.

(7) (a) 3. Except for areas containing only sealed sources that have not leaked or where no contamination remains after a leak, or ~~byproduct~~ radioactive materials with half lives of less than 65 days, a list containing all the following:

SECTION 63. HFS 157.17 (16) and (17) are repealed.

SECTION 64. HFS 157.22 (1) (a) 2. (intro.) and b. is amended to read:

HFS 157.22 (1) (a) 2. The annual limits to the lens of the eye, to the skin of the whole body and to the skin of the extremities which are:

b. A shallow dose equivalent of 0.5 Sv (50 rem) to the skin of the whole body or to the skin of any extremity.

SECTION 65. HFS 157.22 (1) (c) 1. is repealed and recreated to read:

HFS 157.22 (1) (c) 1. The assigned deep-dose equivalent shall be for the part of the body receiving the highest exposure. The assigned shallow-dose equivalent shall be the dose averaged over the contiguous 10 square centimeters of skin receiving the highest exposure. The deep-dose equivalent, lens-dose equivalent and shallow-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure, or the results of individual monitoring are unavailable.

SECTION 66. HFS 157.22 (5) (d) 1. Note, (f) Note and (8) (c) (intro.) are amended to read:

(5) (d) 1. Note: An occupational radiation exposure history form may be obtained by writing to: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading the form from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadiatioP/Index.htm.

(f) Note: The Department's occupational radiation exposure history form may be obtained by writing to: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading the form from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~ http://dhfs.wisconsin.gov/dph_beh/RadiatioP/Index.htm.

(8) (c) The dose equivalent to an embryo or fetus is the sum of all of the following:

SECTION 67. HFS 157.25 (2) (a) 2. is repealed and recreated to read:

HFS 157.25 (2) (a) 2. Minors likely to receive in one year, from radiation sources external to the body, a deep-dose equivalent in excess of 1.0 mSv (0.1 rem), a lens-dose equivalent in excess of 1.5 mSv (0.15 rem), or a shallow-dose equivalent to the skin or to the extremities in excess of 5 mSv (0.5 rem).

SECTION 68. HFS 157.28 (1) (title) and (a) are amended to read:

HFS 157.28 (1) (title) SECURITY AND CONTROL OF LICENSED OR REGISTERED RADIOACTIVE ~~MATERIALS~~MATERIAL.

(a) A licensee or registrant shall secure licensed or registered radioactive material that is stored in an unrestricted area from unauthorized removal or access.

SECTION 69. HFS 157.28 (1) (a) (title) and (b) (title) are created to read:

HFS 157.28 (1) (a) (title) *Security of stored radioactive material.*

(b) (title) *Control of radioactive material not in storage.*

SECTION 70. HFS 157.29 (6) (e) 2. and Note are amended to read:

HFS 157.29 (6) (e) 2. External radiation levels exceed the limits of s. ~~HFS 157.94 (1) (i)~~ HFS157.94 (1) (j).

2. Note: The Department may be reached during normal business hours of 7:45 am to 4:30 pm, Monday through Friday, except state holidays, at 608-~~276-4797~~267-4797. The facsimile transmission number is 608-~~267-2744~~267-3695.

SECTION 71. HFS 157.31 (1) (a) and (7) (c) Note are amended to read:

HFS 157.31 (1) (a) A licensee or registrant shall use the SI units becquerel, gray, sievert and coulomb per kilogram followed by the special units curie, rad, rem and roentgen, or ~~the SI units and~~ the special units curie, rad, rem and roentgen, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by this subchapter.

(7) (c) Note: The form may be obtained by writing the Department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~http://dhfs.wisconsin.gov/dph_beh/RadiatioP/Index.htm.

SECTION 72. HFS 157.32 (1) (a) 3. Note and (5) (b) Note are amended to read:

HFS 157.32 (1) (a) 3. Note: The Department may be reached during normal business hours of 7:45 am to 4:30 pm, Monday through Friday, except state holidays, at 608-~~276-4797~~267-4797 or other times at 608-258-0099.

(5) (b) Note: The form may be obtained by writing the Department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659; or by downloading from the Department website at: ~~www.dhfs.state.wi.us/licensing/~~ http://dhfs.wisconsin.gov/dph_beh/RadiatioP/Index.htm.

SECTION 73. HFS 157.33 (2) is amended to read:

HFS 157.33 (2) RADIOLOGICAL CRITERIA FOR UNRESTRICTED USE. A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 0.25 mSv (25 mrem) per year, including exposure from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are ~~as low as reasonably achievable~~ALARA. Determination of the levels that are ALARA shall consider any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

SECTION 74. HFS 157.33 (3) (title) and (a) are repealed and recreated to read:

HFS 157.33 (3) ALTERNATE CRITERIA FOR A DECOMMISSIONING POSSESSION ONLY LICENSE. (a) A licensee may decommission a facility and maintain a decommissioning possession only license using alternate criteria greater than the dose criterion specified in sub. (2) of this rule, provided that the licensee does all of the following:

SECTION 75. HFS 157.33 (3) (a) 3. (intro.) is amended to read:

HFS 157.33 (3) (a) 3. (intro.) Has submitted a decommissioning plan to the department indicating the licensee's intent to decommission in accordance with provisions of ~~this chapter~~s. HFS 157.13 (11), and specifying that the licensee proposes to decommission by use of alternate criteria. The licensee shall document in the decommissioning plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and addressed, as appropriate, following analysis of that advice. In seeking such advice, the licensee shall provide for all the following:

SECTION 76. HFS 157.33 (3) (a) 3. d. is created to read:

HFS 157.33 (a) 3. d. Restrictions on site use, to the extent practical, to minimize exposures at the site.

SECTION 77. HFS 157.36 (1) (a), Note, 1. (intro.), 3. , (b) 9., (2) and Note are amended to read:

HFS 157.36 (1) (a) Except as provided in sub. (2), each radiographic exposure device, source assembly or sealed source and all associated equipment shall meet the requirements specified in ANSI ~~N43.9-1991"American National Standard for Gamma Radiography - Specifications for Design and Testing of Apparatus"~~ N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography".

Note: The publication ~~"American National Standard for Gamma Radiography - Specifications for Design and Testing of Apparatus, ANSI N43.9 – 1991~~, ANSI N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography" published by the ANSI, may be consulted at the Department of Health and Family Services, Radiation Protection Section, 1 West Wilson St, Room 150, Madison WI ~~53701~~53702-0007 or at the Secretary of State's Office or the Revisor of Statutes Bureau.

1. (intro.) A licensee shall ensure that each radiographic exposure device~~, source changer or source assembly~~ has attached to it a durable, legible, clearly visible label bearing all the following information:

3. Modification of radiographic exposure devices, source changers~~,~~ and source assemblies and associated equipment is prohibited, unless ~~approved by the department, the NRC or another agreement state~~the design of any replacement component, including source holder, source assembly, controls or guide tubes would not compromise the design safety features of the system.

(b) 9. The guide tube exposure head connection shall be able to withstand the tensile test for control units specified in ANSI ~~N43.9-1991~~N432 - 1980.

(2) EXCEPTION. Equipment used in industrial radiographic operations need not comply with 6.6.2 of the Endurance Test in ANSI ~~N43.9-1991" American National Standard for Gamma Radiography - Specifications for Design and Testing of Apparatus~~ N432 - 1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography" if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment may reasonably exert on the lever or crankshaft of the drive mechanism.

Note: The publication, ~~"American National Standard for Gamma Radiography - Specifications for Design and Testing of Apparatus N43.9 – 1991~~N432 -1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography"," ANSI, published by the ANSI, may be consulted at the Department of Health and Family Services, Radiation Protection Section, 1 West Wilson St, Room 150, Madison WI ~~53701~~ 53702-0007 or at the Secretary of State's Office or the Revisor of Statutes Bureau.

SECTION 78. HFS 157.41 (2) (a) is amended to read:

HFS 157.41 (2) (a) A licensee or registrant shall perform inspection and routine maintenance of radiation machines, radiographic exposure devices, source changers, associated equipment, transport and storage containers and survey instruments at intervals not to exceed 3 months or before the first use thereafter to ensure the proper functioning of components important to safety. Replacement components shall meet design specifications. A licensee or registrant shall utilize written inspection and maintenance procedures. If equipment problems are found, the equipment shall be removed from service until repaired.

SECTION 79. HFS 157.42 (1) (a) is amended to read:

HFS 157.42 (1) (a) An entrance control of the type described in s. ~~HFS 157.26 (1)~~ HFS 157.26 (1) (a) 1. that causes the radiation level upon entry into the area to be reduced.

SECTION 80. HFS 157.44 (3) (a) 5. Note is created to read:

HFS 157.44 (3) (a) 5. Note: A current list of state and national organizations administering the certification examination may be obtained by writing the ~~department~~Department at: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison, WI 53701-2659 or from the following website http://dhfs.wisconsin.gov/dph_beh/RadiatioP/IRCerts.htm

(b) 2. Demonstrated an understanding of ~~items in subd. 1~~ the licensee's license and operating and emergency procedures by successful completion of a written or oral examination covering this material.

SECTION 81. HFS 157.44 (3) (b) 2. Note and (c) Note are repealed.

SECTION 82. HFS 157.44 (6) (a), 2. to 4., (e), (f), and (g) 3. are amended to read:

HFS 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 ~~either a film badge, TLD or similar approved device~~ a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) 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.

2. Each ~~film badge, TLD or similar approved device~~ personnel dosimeter shall be assigned to and worn by only one individual.

3. ~~Film badges, TLD's or similar approved device~~ Personnel dosimeters shall be exchanged at periods not to exceed one month.

4. After replacement, ~~each film badge, TLD or similar approved device~~ personnel dosimeter shall be returned to the supplier for processing within 14 calendar days of the end of the monitoring period or as soon as practicable. In circumstances that make it impossible to return each film badge, TLD or similar approved device in 14 calendar days, the circumstances shall be documented and available for review by the department.

(e) If a ~~film badge, TLD or similar approved device~~personnel dosimeter is lost or damaged, the worker shall cease work immediately until a replacement ~~film badge, TLD or similar approved device~~personnel dosimeter is provided and the exposure is calculated for the time period from issuance to loss or damage. The results of the calculated exposure and the time period for which the ~~film badge, TLD or similar approved device~~personnel dosimeter was lost or damaged shall be included in the records maintained as specified under s. HFS 157.45 (11).

(f) ~~Reports~~ Dosimetry reports received from the ~~film badge, TLD or similar approved device~~accredited NVLAP personnel dosimeter processor shall be retained as specified under s. HFS 157.45 (11).

(g) 3. Require special means ~~outside of user control~~ to change the preset alarm function.

SECTION 83. HFS 157.45 (11) (c) is amended to read:

HFS 157.45 (11) (c) ~~Reports received from the film badge, TLD or similar approved device~~ Personnel dosimeter results received from the accredited NVLAP processor until the department terminates the license or registration.

SECTION 84 HFS 157.45 (14) (b) 6. is repealed and recreated to read:

HFS 157.45 (14) (b) 6. Records of direct reading dosimeters such as pocket dosimeters or electronic personal dosimeters readings as required under sub. (11).

SECTION 85. Subchapter V (title) is amended to read:

SUBCHAPTER V RADIATION SAFETY REQUIREMENTS FOR ~~WIRELINE SERVICE OPERATIONS AND SUBSURFACE TRACER STUDIES~~WELL LOGGING

SECTION 86. HFS 157.51 (1) (intro.) and (a) to (c) are renumbered HFS 157.51 (1) (title), (a) (intro.) and 1. to 3. and as renumbered HFS 157.51 (1) (title), (a) intro., and 1. and 2. are amended to read:

HFS 157.51 (1) (title) ~~WIRELINE~~ WELL LOGGING. (a) A licensee may not perform ~~wireline service operations~~ well logging with a sealed source unless, prior to commencement of the operation, the licensee has a written agreement with the well operator, well owner or land owner that includes all the following provisions:

1. In the event a sealed source is lost in the ~~well-bore~~well, the licensee shall make a reasonable effort at recovery unless, in the licensee's opinion, the recovery effort could result in rupture of the sealed source.

2. If a decision is made to abandon the sealed source in the ~~well-bore~~well, the licensee shall meet the requirements of s. HFS 157.56 (3) and any requirements of the department of natural resources under chs. NR 140 and 500 to 590.

SECTION 87. HFS 157.51 (1) (b) and (c) are created to read:

HFS 157.51 (1) (b) The licensee shall retain a copy of the written agreement for three years after the completion of the well logging operation.

(c) The licensee shall notify the department of natural resources prior to commencement of any operation involving well logging in a fresh water aquifer.

SECTION 88. HFS 157.52 (8) and (title) are amended to read:

HFS 157.52 (8) ~~QUARTERLY~~ PHYSICAL INVENTORY. A licensee or registrant shall conduct a ~~quarterly~~ semi-annual physical inventory to account for all sources of radiation.

Records of inventories shall be maintained for 3 years from the date of the inventory for inspection by the department and shall include the quantities and kinds of sources of radiation, the location where sources of radiation are assigned, the date of the inventory and the name of the individual conducting the inventory.

SECTION 89. HFS 157.52 (10) (title) and (a) to (d) is repealed and recreated to read:

HFS 157.52 (10) DESIGN PERFORMANCE CRITERIA FOR SEALED SOURCES. (a) Each sealed source, except those containing radioactive material in gaseous form or in energy compensation sources (ECS), used in well logging applications, shall meet all the following criteria:

1. Doubly encapsulated construction.

2. Contains licensed material whose chemical and physical forms are as insoluble and non-dispersable as practical.

3. The requirements of par. (b).

(b) Each sealed source, except those used in energy compensation sources (ECS), shall meet one of the following requirements:

1. For a sealed source manufactured on or before July 14, 1989, the requirements from the United States of America Standards Institute (USASI) N5.10-1968, "Classification of Sealed Radioactive Sources."

2. For a sealed source manufactured after July 14, 1989, the oil-well logging requirements from the American National Standard Institute/Health Physics Society (ANSI/HPS) N43.6-1997, "Sealed Radioactive Sources-Classification."

3. For a sealed source manufactured after July 14, 1989, the sealed source's prototype has been tested and found to maintain its integrity after each of the following tests:

a. Temperature. The test source shall be held at -40 degrees Celsius for 20 minutes, 600 degrees Celsius for one hour, and then be subjected to a thermal shock test with a temperature drop from 600 degrees Celsius to 20 degrees Celsius within 15 seconds.

b. Impact. A 5 kilogram (kg) steel hammer, 2.5 centimeters in diameter, shall be dropped from a height of 1 meter (m) onto the test source.

c. Vibration. The test source shall be subjected to a vibration from 25 Hertz (Hz) to 500 Hz with a peak amplitude of five times the acceleration of gravity for 30 minutes.

d. Puncture. A 1 gram (gm) hammer and pin, 0.3 centimeter (cm) pin diameter, shall be dropped from a height of 1 meter (m) onto the test source.

e. Pressure. The test source shall be subjected to an external pressure of 24,600 pounds per square inch absolute (1.695×10^7 pascals) without leakage.

Note: The publication, "Sealed Radioactive Sources - Classification," ANSI/HPS N43.6-1997, published by the ANSI, may be consulted at the Department of Health and Family

Services, Radiation Protection Section, 1 West Wilson St, Room 150, Madison WI 53702-0007 or at the Secretary of State's Office or the Revisor of Statutes Bureau. The publication may be purchased from the Health Physics Society, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101.

SECTION 90. HFS 157.52 (10) (e) 1. and 2. and (f) 1. and 2. are renumbered HFS 157.52 (10) (c) 1. and 2. and (d) 1. and 2. and HFS 157.52 (10) (c) 2. and (d) 1. and 2. as renumbered are amended to read:

HFS 157.52 (10) (c) 2. A licensee using an ECS in a well without a surface casing for protecting fresh water aquifers shall meet the requirements of subs. (5) to (9), and ss. HFS 157.51 (1) (a), 157.53 (2) and 157.56.

(d) 1. A licensee using a tritium neutron generator target source, containing quantities no greater than ~~1,100 MBq~~1,110 GBq (30 curies), in a well with a surface casing to protect fresh water aquifers is exempt from the requirements of s. HFS 157.56 and this subsection for tritium neutron generator target source use only.

2. A licensee using a tritium neutron generator target source, containing quantities exceeding ~~1,100 MBq~~ 1, 110 GBq (30 curies), or in a well without a surface casing to protect fresh water aquifers is exempt from the requirements of this subsection except for pars. (a) and (b) for tritium neutron generator target source use only.

SECTION 91. HFS 157.53 (1) (a) 1. is amended to read:

HFS 157.53 (1) (a) 1. Completed a course recognized by the department, the NRC, ~~an~~another agreement state or a licensing state incorporating the subjects outlined in Appendix J and demonstrated an understanding of the subject matter by successful completion of ~~an oral or~~ written examination.

SECTION 92. HFS 157.53 (1) (d) is created to read:

HFS 157.53 (1) (d) A license or registrant shall provide safety reviews for well logging supervisors and well logging assistants at least once during each calendar year.

SECTION 93. HFS 157.54 (3) (b) is amended to read:

HFS 157.54 (3) (b) A licensee may not inject or cause the injection of radioactive material into potable fresh water aquifers without prior written authorization from the department.

SECTION 94. HFS 157.55 (1) (d) is amended to read:

HFS 157.55 (1) (d) Radiation surveys shall be made and recorded at the jobsite or well-head for each sub-surface tracer study~~, except those using hydrogen-3, carbon-14 and sulfur-35~~. Surveys shall include measurements of radiation levels before and after the operation.

SECTION 95. HFS 157.56 (2) (b) Note is amended to read:

HFS 157.56 (2) (b) Note: The ~~department's telephone contact telephone number is~~department may be contacted at: 608-267-4797 during normal business hours of 7:45 am to 4:30 pm, Monday through Friday, except state holidays, and other times at 608-258-0099.

SECTION 96. HFS 157.56 (4) (intro.) and (5) are amended to read:

HFS 157.56 (4) (intro.) POSTING. Whenever a sealed source containing radioactive material is abandoned in a ~~well-bore~~well a licensee shall post a permanent plaque, as described in Appendix K, at the surface of the well ~~or well-bore~~. The plaque shall be constructed of long-lasting material, such as stainless steel or monel, and contain all the following information engraved on its face:

(5) LOSS IN POTABLE FRESH WATER AQUIFER. A licensee shall immediately notify the department by telephone and within 24 hours by confirming letter if the licensee knows or has reason to believe that radioactive material has been lost in or to an underground potable fresh water aquifer. The notice shall designate the well location, describe the magnitude and extent of loss of radioactive material, assess the consequences of such loss and explain efforts planned or being taken to mitigate these consequences.

SECTION 97. HFS 157.61 (1) (g), are amended to read:

HFS 157.61 (1) (g) A licensee shall retain a record of actions taken under pars. (a), (b) and (d) ~~under~~ according to the record retention requirements of s. HFS 157.71 (1).

SECTION 98. HFS 157.61 (7), (8), (9) and (10) are repealed and recreated to read:

HFS 157.61 (7) TRAINING FOR RADIATION SAFETY OFFICER. Except as provided in sub. (10), a licensee shall ensure that an individual fulfilling the responsibilities of the radiation safety officer 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, authorized medical physicist, authorized nuclear pharmacist or authorized user, as appropriate, who is authorized for the type(s) of use for which the licensee is seeking approval. A licensee shall also require the radiation safety officer to be a person who has obtained written attestation under sub. (12) (a) and meets any of the following requirements:

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

1.a. A bachelor's or graduate degree from an accredited college or university in physical science or engineering or biological science with a minimum of 20 college credits in physical science.

b. Five or more years of professional experience in health physics (graduate training may be substituted for no more than 2 years of the required experience) including at least 3 years in applied health physics.

c. Passed an examination administered by diplomates of the specialty board, which evaluates knowledge and competence in radiation physics and instrumentation, radiation

protection, mathematics pertaining to the use and measurement of radioactivity, radiation biology, and radiation dosimetry.

2. a. Master's or doctor's degree in physics, medical physics, other physical science, engineering, or applied mathematics from an accredited college or university.

b. Two years of full-time practical training and/or supervised experience in medical physics either under the supervision of a medical physicist who is certified in medical physics by a specialty board recognized by the department, the NRC, or another agreement state or in clinical nuclear medicine facilities providing diagnostic and/or therapeutic services under the direction of physicians who meet the requirements for authorized users in s. HFS 157.63 (5) or s. HFS 157.64 (4).

c. Pass an examination, administered by diplomates of the specialty board, that assesses knowledge and competence in clinical diagnostic radiological or nuclear medicine physics and in radiation safety.

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) Completed a structured educational program consisting of all the following:

1. 200 hours of classroom and laboratory training in all the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Radiation biology.

e. Radiation dosimetry.

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 broad scope licensee that authorizes similar types of uses of radioactive material involving all the following:

a. Shipping, receiving, and performing related radiation surveys.

b. Using and performing checks for proper operation of instruments used to determine the activity of dosages, survey meters and instruments used to measure radionuclides.

c. Securing and controlling radioactive material.

d. Using administrative controls to avoid mistakes in the administration of radioactive material.

e. Using procedures to prevent or minimize radioactive contamination and using proper decontamination procedures.

f. Using emergency procedures to control radioactive material.

g. Disposing of radioactive material.

(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 s. HFS 157. 61 (8) (a) and has experience in radiation safety for similar types of use of radioactive material for which the licensee is seeking the approval of the individual as radiation safety officer.

2. An authorized user, authorized medical physicist or authorized nuclear pharmacist identified on the licensee's license 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.

(8) TRAINING FOR AN AUTHORIZED MEDICAL PHYSICIST. Except as provided in s. sub. (10), a licensee shall require the authorized medical physicist to have training for the type(s) 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 completing either a training program provided by the vendor or by training supervised by an authorized medical physicist authorized for the type(s) of use for which the individual is seeking authorization. A licensee shall also require the authorized medical physicist to be a individual who has obtained written attestation under sub. (12) (b) and meets either of the following requirements:

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

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

b. Attained two years full-time practical training and/or supervised experience in medical physics under the supervision of a medical physicist who is certified in medical physics by a specialty board recognized by the department, the NRC or an agreement state or 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. HFS 157.65 (8) or s. HFS 157.67 (17).

c. 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) 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 completion of 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(s) 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:

1. Performing sealed source leak tests and inventories.

2. Performing decay corrections.

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

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

(9) 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:

(a) 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 be recognized, a specialty board shall require all candidates for certification to have all of the following:

1. Graduated from a pharmacy program accredited by the American council on pharmaceutical education (ACPE) or have passed the foreign pharmacy graduate examination committee (FPGEC) examination.

2. Hold a current, active license to practice pharmacy.

3. Provide evidence of having acquired at least 4000 hours of training and experience in nuclear pharmacy practice. Academic training may be substituted for no more than 2000 hours of the required training and experience.

4. Pass an examination in nuclear pharmacy administered by diplomates of the specialty board, that assesses knowledge and competency in the procurement, compounding, quality assurance, dispensing, distribution, health and safety, radiation safety, provision of information and consultation, monitoring patient outcomes, research and development.

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) Completed 700 hours in a structured educational program including all of the following requirements:

1. Two hundred hours of classroom and laboratory training covering all of the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

2. Supervised practical experience in a nuclear pharmacy involving all the following:

a. Shipping, receiving and performing related radiation surveys.

b. Using and performing checks for proper operation of instruments used to determine the activity of dosages, survey meters, and if appropriate, instruments used to measure alpha-emitting or beta-emitting radionuclides.

c. Calculating, assaying and safely preparing dosages for patients or human research subjects.

d. Using administrative controls to avoid medical events in the administration of radioactive material.

e. Using procedures to prevent or minimize radioactive contamination and using proper decontamination procedures.

(10) TRAINING FOR EXPERIENCED RADIATION SAFETY OFFICER, TELETHERAPY OR MEDICAL PHYSICIST, AUTHORIZED USER AND NUCLEAR PHARMACIST. (a) An individual identified as a radiation safety officer, a teletherapy or medical physicist, an authorized medical physicist or a nuclear pharmacist on a department, NRC, another agreement state license, or the permit issued by a licensee of broad scope need not comply with the training requirements of subs. (7) to (9), respectively.

(b) A physician, dentist or podiatrist identified as an authorized user for the medical, dental or podiatric use of radioactive material on a department, NRC, another agreement state license, or the permit issued by a licensee of broad scope who perform only those medical uses for which they were authorized need not comply with the training requirements of ss. HFS 157.63 to 157.67.

SECTION 99. HFS 157.61 (12) is created to read:

HFS 157.61 (12) WRITTEN ATTESTATION. (a) *Radiation safety officer.* The licensee shall ensure that an individual fulfilling the responsibilities of the radiation safety officer has obtained written attestation, signed by a preceptor radiation safety officer, that the individual has satisfactorily completed the requirements in sub. (7) (a) 1.a. and b., 2. a. and b., (b), or (c). and has achieved a level of radiation safety knowledge sufficient to independently function as an radiation safety officer for a medical use of radioactive material.

(b) *Authorized medical physicist.* . A licensee shall ensure that the individual has obtained written attestation that the individual has satisfactorily completed the requirements in sub. (8) (a) 1. a. and b. or (b) 1. and 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 equivalent 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.

(c) *Authorized nuclear pharmacist.* A licensee shall ensure that the individual has obtained written attestation, signed by a preceptor authorized nuclear pharmacist, that the individual has satisfactorily completed the requirements in sub. (9) (a) or (b) and has achieved a level of competency sufficient to function independently as an authorized nuclear pharmacist.

SECTION 100. HFS 157.62 (2) (a), (3) (b) 2. a., (4) (title) and (intro.), and (8) (a) Note and (d) are amended to read:

HFS 157.62 (2) (a) A licensee shall calibrate the survey instruments used to show compliance with this subchapter and subch. III before first use, ~~annually~~ at a frequency not to exceed 13 months and following any repair that will affect the calibration.

(3) (b) 2. a. A manufacturer or preparer licensed under s. HFS 157.13 (4) (i) or by NRC or another agreement state.

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

(8) (a) Note: ~~NUREG~~WISREG 1556, Vol. 9, ~~A Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Medical Licenses,~~ Guidance for Medical Use of Radioactive Material describes methods for calculating doses to other individuals and contains tables of activities not likely to cause doses exceeding 5 mSv (0.5 Rem). It is available from the following website:
~~http://www.nrc.gov/NRC/NUREGS/indexnum.html#_1_3~~http://dhfs.wisconsin.gov/dph_beh/RadioactiveMat/Index.htm.

(d) A licensee shall maintain a record of instructions provided to breast-feeding women under par. (b) according to record retention requirements of s. HFS 157.71 (11) (b).

SECTION 101. HFS 157.63 (1) (b), (2) (b), (4) and (5) are repealed and recreated to read:

HFS 157.63 (1) (b) Is prepared by any of the following:

1. An authorized nuclear pharmacist.

2. A physician who is an authorized user and who meets the requirements in sub. (5), or sub. (5)(c) 2.g. and s. HFS 157.64 (4).

3. An individual under the supervision, as specified in s. HFS 157.61 (10), of the authorized nuclear pharmacist in subd.1. or the physician in subd. 2.

(2) (b) Is prepared by any of the following:

1. An authorized nuclear pharmacist.

2. A physician who is an authorized user and who meets the requirements in sub. (5), or s. HFS 157.64 (4) and sub. (5) (c) 2. g.

3. An individual under the supervision, as specified in s. HFS 157.61 (10), of the authorized nuclear pharmacist in subd.1., or the physician in subd. 2.

(4) TRAINING FOR UPTAKE, DILUTION AND EXCRETION STUDIES. Except as provided in s. HFS 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:

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

1. Complete 60 hours of training and experience in basic radionuclide handling techniques and radiation safety applicable to the medical use of unsealed radioactive material for uptake, dilution, and excretion studies that includes the topics listed in par. (c).

2. Pass an examination, administered by diplomates of the specialty board that assesses knowledge and competence in radiation safety, radionuclide handling, and quality control.

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) An authorized user under sub. (5), s. HFS 157.64 (4), or equivalent agreement state requirements.

(c) Completed 60 hours of training and experience, including a minimum of 8 hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material for uptake, dilution and excretion studies that includes all the following:

1. Classroom and laboratory training in all the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

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

a. Ordering, receiving and unpacking radioactive materials safely and performing the related radiation surveys.

b. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters.

c. Calculating, measuring and safely preparing patient or human research subject dosages.

d. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material.

e. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures.

f. Administering dosages of radioactive drugs to patients or human research subjects.

(5) TRAINING FOR IMAGING AND LOCALIZATION STUDIES. Except as provided in s. HFS 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:

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

1. Complete 700 hours of training and experience in basic radionuclide handling techniques and radiation safety applicable to the medical use of unsealed radioactive material for uptake, dilution, and excretion studies that includes the topics listed in par. (c) 1. and (c) 2.

2. Pass an examination, administered by diplomates of the specialty board, which assesses knowledge and competence in radiation safety, radionuclide handling, and quality control.

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) An authorized user under s. HFS 157.64 (4) and meets the requirements in s. HFS 157.63 (5) (c) 2. g., or equivalent agreement state requirements.

(c) Completed 700 hours of training and experience, including a minimum of 80 hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material for imaging and localization studies that includes, at a minimum, all the following:

1. Classroom and laboratory training in all the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

2. Work experience, under the supervision of an authorized user, who meets the requirements in this subsection or ss. HFS 157.63 (5) (c) 2. g. and HFS 157.64 (4) or equivalent agreement state requirements, involving all the following:

a. Ordering, receiving and unpacking radioactive materials safely and performing the related radiation surveys.

b. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters.

c. Calculating, measuring and safely preparing patient or human research subject dosages.

d. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material.

e. Using procedures to safely contain spilled radioactive material and using proper decontamination procedures.

f. Administering dosages of radioactive drugs to patients or human research subjects.

g. Eluting generator systems appropriate for preparation of radioactive drugs for imaging and localization studies, measuring and testing the eluate for radionuclidic purity, and processing the eluate with reagent kits to prepare labeled radioactive drugs.

Note: Eluting generator systems are a family of radioactive material devices used to extract useful radioactive materials by passing sterile fluid through a column of the parent material. The resulting mixture of fluid and radioactive material, known as the eluate, is used in the diagnostic procedures. These generators are used to produce Tc-99 and Ga-67.

SECTION 102. HFS 157.63 (6) is created to read:

HFS 157.63 (6) WRITTEN ATTESTATION (a) *Unsealed radioactive material for uptake, dilution, and excretion studies for which a written directive is not required.* A licensee shall require an authorized user of unsealed radioactive material for the uses authorized under sub. (1) to have obtained written attestation, signed by a preceptor authorized user who meets the requirements of subs. (4) and (5), s. HFS 157.64 (4), or equivalent agreement state requirements, that the individual has satisfactorily completed the requirements of sub. (4) (a) 1. or (c) and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under sub. (1).

(b) *Unsealed radioactive for imaging and localization studies for which a written directive is not required.* A licensee shall require an authorized user of unsealed radioactive material for uses under sub. (2) to have written attestation, signed by a preceptor authorized user who meets the requirements in sub. (5), or ss. HFS 157.63(5) (c) 2. g and HFS 157.64 (4), or equivalent agreement state requirements, that the individual has satisfactorily completed the requirements in sub. (5) (a) 1. or (c) and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under subs. (1) and (2).

SECTION 103. HFS 157.64 (4), (5) and (6) are repealed and recreated to read:

HFS 157.64 (4) TRAINING FOR USE OF UNSEALED RADIOACTIVE MATERIAL FOR WHICH A WRITTEN DIRECTIVE IS REQUIRED. Except as provided in s. HFS 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:

(a) Certified by a medical specialty board whose certification process is recognized by the department, the NRC or an agreement state and who meets the requirements of par. (b) 2. g. To be recognized, a specialty board shall require all candidates for certification to have all of the following:

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.

2. Pass an examination, administered by diplomates of the specialty board, which tests knowledge and competence in radiation safety, radionuclide handling, quality assurance, and clinical use of unsealed radioactive material for which a written directive is required.

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) Completed 700 hours of certified training and experience, including a minimum of 200 hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material requiring a written directive that includes all the following:

1. Classroom and laboratory training in all the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

2. Work experience, under the supervision of an authorized user who meets the requirements in this subsection or equivalent agreement state requirements. A supervising authorized user, who meets the requirements of this paragraph or prior to the effective date of this chapter [revisor to insert effective date], shall also have experience under subd. par. g. in administering dosages in the same dosage category or categories as the individual requesting authorized user status. The work experience shall involve all the following:

a. Ordering, receiving and unpacking radioactive materials safely and performing the related radiation surveys.

b. Performing quality control procedures on instruments used to determine the activity of dosages, and performing checks for proper operation of survey meters.

c. Calculating, measuring, and safely preparing patient or human research subject dosages.

d. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material.

e. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures.

f. Reserved

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.

Note: 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.

(5) 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. HFS 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:

(a) Certified by a medical specialty board whose certification process includes all of the requirements in par. (c) and whose certification process has been recognized by the department, the NRC or an agreement state.

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

(c) 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 of the following:

1. Eighty hours of classroom and laboratory training in all of the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

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

a. Ordering, receiving and unpacking radioactive materials safely and performing the related radiation surveys.

b. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters.

c. Calculating, measuring, and safely preparing patient or human research subject dosages.

d. Using administrative controls to prevent a medical event involving the use of radioactive material.

e. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures.

f. Administering dosages to patients or human research subjects, that includes at least 3 cases involving the oral administration of less than or equal to 1.22 Gigabecquerels (33 millicuries) of sodium iodide I-131.

(6) 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. HFS 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:

(a) Certified by a medical specialty board whose certification process includes all of the requirements in par. (c) and whose certification has been recognized by the department, the NRC or agreement state.

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) 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 agreement state requirements.

(c) 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 of the following:

1. Eighty hours of classroom and laboratory training in all of the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

2. Work experience, under the supervision of an authorized user who meets the requirements in sub. (4) (a) or (b), this subsection or equivalent agreement state requirements. A supervising authorized user, who meets the requirements in sub. (4) (b), 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:

a. Ordering, receiving and unpacking radioactive materials safely and performing the related radiation surveys.

b. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters.

c. Calculating, measuring and safely preparing patient or human research subject dosages.

d. Using administrative controls to prevent a medical event involving the use of radioactive material.

e. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures.

f. Administering dosages to patients or human research subjects, that includes at least 3 cases involving the oral administration of greater than 1.22 Gigabecquerels (33 millicuries) of sodium iodide I-131.

SECTION 104. HFS 157.64 (7) and (8) are created to read:

HFS 157.64 (7) TRAINING FOR THE PARENTERAL ADMINISTRATION OF UNSEALED RADIOACTIVE MATERIAL REQUIRING A WRITTEN DIRECTIVE. Except as provided in s. HFS 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:

(a) An authorized user under sub. (4) for the specific parenteral uses listed in sub. (4) (b) 2. g., or equivalent agreement state requirements.

(b) An authorized user under s. HFS 157.65 (8) or 157.67 (17), or equivalent agreement state requirements and who meets the requirements in par. (c) 1. and 2.

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

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 which a written directive is required. The training shall include all of the following:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Chemistry of radioactive material for medical use.

e. Radiation biology.

2. 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 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) or this subsection, or equivalent agreement state requirements. The work experience shall involve all the following:

a. Ordering, receiving, and unpacking radioactive materials safely, and performing the related radiation surveys.

b. Performing quality control procedures on instruments used to determine the activity of dosages, and performing checks for proper operation of survey meters.

c. Calculating, measuring, and safely preparing patient or human research subject dosages.

d. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material.

e. Using procedures to contain spilled radioactive material safely, and using proper decontamination procedures.

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.

(8) WRITTEN ATTESTATION (a) *Unsealed radioactive material for which a written directive is required.* A 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 satisfactorily completed the requirements in sub. (4) (a) 1. and (4) (b) 2. g., or sub. (4) (b) and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under sub. (1). The written attestation shall be signed by a preceptor authorized user who meets the requirements in this subsection or equivalent agreement state requirements. The preceptor authorized user, who meets the requirements in sub. (4) (b) shall have experience under sub. (4) (b) 2. g. in administering dosages in the same dosage category or categories as the individual requesting authorized user status.

(b) *Oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 1.22 Gigabecquerels (33 millicuries).* A licensee shall require an authorized user of sodium iodide I-131 for oral administration, to have obtained written attestation that the individual has satisfactorily completed the requirements in sub. (5) (c) and has achieved a level of competency sufficient to function independently as an authorized user for medical uses

authorized under sub. (1). The written attestation shall be signed by a preceptor authorized user who meets the requirements in sub. (4), (5) or (6), or equivalent agreement state requirements. A preceptor authorized user, who meets the requirements of sub. (4) (b), shall have experience in administering I -131 dosage(s) less than 1.22 Gigabecquerels (33 millicuries) under sub. (4) (b) 2. g.

(c) *Oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 1.22 Gigabecquerels (33 millicuries).* A licensee shall require an authorized user for the oral administration of sodium iodide I-131 requiring a written directive in quantities greater than Gigabecquerels (33 millicuries) to have obtained written attestation that the individual has satisfactorily completed the requirements in sub. (6) (c) and has achieved a level of competency sufficient to function independently as an authorized user under sub. (1). The written attestation shall be signed by a preceptor authorized user who meets the requirements in sub. (4) or (6) or equivalent agreement state requirements. A preceptor authorized user, who meets the requirements of sub. (4) (b), shall have experience in administering dosages of I-131 greater than 1.22 Gigabecquerels (33 millicuries) as specified in sub. (4) (b) 2. g.

(d) *Parenteral administration of unsealed radioactive material requiring a written directive.* A licensee shall require an authorized user for the parenteral administration requiring a written directive to have obtained written attestation that the individual has satisfactorily completed the requirements in sub. (7) (b) or (c) and has achieved a level of competency sufficient to function independently as an authorized user for the parenteral administration of unsealed radioactive material requiring a written directive. The written attestation shall be signed by a preceptor authorized user who meets the requirements in sub. (4), or equivalent agreement state requirements. A preceptor authorized user, who meets the requirements in sub. (4) shall have experience in administering parenteral dosages as specified in sub. (4) (b) 2. g.

SECTION 105. HFS 157.65 (1) (title) and (intro.), (6) (title) and (a) (intro.) are amended to read:

HFS 157.65 (1) (title) USE OF ~~SEALED~~ SOURCES FOR MANUAL BRACHYTHERAPY. A licensee shall use only brachytherapy ~~sealed~~ sources for therapeutic medical uses under either of the following criteria:

(6) (title) CALIBRATION MEASUREMENTS OF BRACHYTHERAPY ~~SEALED~~ SOURCES. (a) Prior to the first medical use of brachytherapy ~~sealed~~ sources, a licensee shall do all the following:

SECTION 106. HFS 157.65 (8) and (9) are repealed and recreated to read:

HFS157.65 (8) TRAINING FOR USE OF MANUAL BRACHYTHERAPY SOURCES. Except as provided in s. HFS 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 either of the following requirements:

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

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 committee on post-graduate training of the American osteopathic association.

2. Pass an examination, administered by diplomates of the specialty board, that tests knowledge and competence in radiation safety, radionuclide handling, treatment planning, quality assurance, and clinical use of manual brachytherapy.

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) Completed a structured educational program in basic radionuclide handling techniques applicable to the use of manual brachytherapy sources that includes all of the following:

1. Two hundred hours of classroom and laboratory training in all of the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Radiation biology.

2. Five hundred hours of work experience, under the supervision of an authorized user who meets the requirements in this subsection or equivalent agreement state requirements at a medical institution, involving all of the following:

a. Ordering, receiving and unpacking radioactive materials safely and performing the related radiation surveys.

b. Checking survey meters for proper operation.

c. Preparing, implanting and removing brachytherapy sources.

d. Maintaining running inventories of material on hand.

e. Using administrative controls to prevent a medical event involving the use of radioactive material.

f. Using emergency procedures to control radioactive material.

3. Three years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in this subsection or equivalent 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 committee on postdoctoral training of the

American osteopathic association. The experience may be obtained concurrently with the supervised work experience required by subd. 2.

(9) TRAINING FOR OPHTHALMIC USE OF STRONTIUM-90. Except as provided in s. HFS 157.61 (10), a licensee shall require an authorized user of strontium-90 for ophthalmic radiotherapy to have obtained written attestation under sub. (10) (b) and be a physician who 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 meets all of the following criteria:

(a) Twenty-four hours of classroom and laboratory training that includes all of the following:

1. Radiation physics and instrumentation.

2. Radiation protection.

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

4. Radiation biology.

(b) 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:

1. Examination of each person to be treated.

2. Calculation of the dose to be administered.

3. Administration of the dose.

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

SECTION 107. HFS 157.65 (10) is created to read:

HFS 157.65 (10) WRITTEN ATTESTATION (a) *Manual brachytherapy sources.* 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), or equivalent agreement state requirements, that the individual has satisfactorily completed the requirements in sub. (8) (a) 1. or (b) and has achieved a level of competency sufficient to function independently as an authorized user of manual brachytherapy sources for the medical uses authorized under sub. (8).

(b) *Ophthalmic use of strontium-90.* 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 this sub. (8) or (9), or equivalent agreement state requirements, that the individual has satisfactorily completed the requirements in sub. (9) (a) and (b) and has achieved a level of competency sufficient to function independently as an authorized user of strontium-90 for ophthalmic use.

SECTION 108. HFS 157.66 (2) is repealed and recreated to read:

HFS 157.66 (2) TRAINING FOR USE OF SEALED SOURCES FOR DIAGNOSIS. Except as provided in s. HFS 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 of the following requirements:

(a) Certified by a specialty board whose certification process includes all of the requirements in par. (b) and whose certification is recognized by the department, the NRC or an agreement state.

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) Completed 8 hours of classroom and laboratory training in basic radionuclide handling techniques specifically applicable to the use of the device that includes all of the following:

1. Radiation physics and instrumentation.

2. Radiation protection.

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

4. Radiation biology.

SECTION 109. HFS 157.67 (9) (b) 2., 3., 6., 8., 10. are amended to read:

2. Relative ~~alignment~~ helmet factors to verify that the helmet material provides the required shielding to the patient.

3. Isocenter coincidence to confirm the centering accuracy of the radiation beam relative to the ~~alignment~~ helmet openings.

6. Trunnion centricity to determine the rotational center of the source relative to the ~~alignment~~ helmet openings.

8. Helmet microswitches to determine if the switches terminate the radiation beam when tripped by unintended movement of the ~~alignment~~ helmet.

10 Stereotactic frames and localizing devices (trunnions).

SECTION 110. HFS 157. 67 (17) is repealed and recreated to read:

HFS 157.67 (17) 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(s) 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(s) of use for which the individual is seeking authorization. Except as provided in s. HFS 157.61 (10), a licensee shall require an authorized user of 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 of the following requirements:

(a) Certified by a medical specialty board whose certification process has been recognized by the department, the NRC or an Agreement State. To be recognized, a specialty board shall require all candidates for certification to have all of the following:

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 committee on post-graduate training of the American osteopathic association.

2. Pass an examination, administered by diplomates of the specialty board, which tests knowledge and competence in radiation safety, radionuclide handling, treatment planning, quality assurance, and clinical use of stereotactic radiosurgery, remote afterloaders and external beam therapy.

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) Completed a structured educational program in basic radionuclide techniques applicable to the use of a sealed source in a therapeutic medical unit that includes all of the following:

1. Two hundred hours of classroom and laboratory training in all the following areas:

a. Radiation physics and instrumentation.

b. Radiation protection.

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

d. Radiation biology.

2. Five hundred hours of work experience, under the supervision of an authorized user who meets the requirements in this subsection, or equivalent agreement state requirements at a medical institution, involving all of the following:

a. Reviewing full calibration measurements and periodic spot checks.

b. Preparing treatment plans and calculating treatment doses and times.

c. Using administrative controls to prevent a medical event involving the use of radioactive material.

d. Implementing emergency procedures to be followed in the event of the abnormal operation of the medical unit or console.

e. Checking and using survey meters.

f. Selecting the proper dose and how it is to be administered.

3. Three years of supervised clinical experience in radiation therapy under an authorized user who meets the requirements in this subsection, or equivalent 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 111. HFS 157.67 (18) is created to read:

HFS 157.67(18) 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 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), 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.

SECTION 112. HFS 157.68 is created to read:

HFS 157.68 Radioactive drugs for medical use. (1) PREPARATION. A licensee authorized to manufacture, prepare or transfer for commercial distribution radioactive drugs shall ensure that any individual preparing the drugs is or meets one of the following criteria:

(a) An authorized nuclear pharmacist.

(b) An individual under the supervision of an authorized nuclear pharmacist.

(c) A pharmacist that meets any of the following criteria:

1. Meets the requirements for an authorized nuclear pharmacist as specified in s. HFS 157.61 (9) and (11).

2. Identified as an authorized nuclear pharmacist on a license issued by the department, an agreement state or the NRC.

3. Identified as an authorized nuclear pharmacist by a licensee who is authorized by the department, an agreement state or the NRC to designate authorized nuclear pharmacists operating under their license.

(2) DOCUMENTATION. A licensee shall provide to the department a copy of all the following, as appropriate:

(a) Each individual's certification by the Board of Pharmaceutical Specialties.

(b) The department, NRC or agreement state license.

(c) The permit issued by a licensee of broad scope.

(d) A list of of authorized nuclear pharmacists designated by a licensee under sub. (1) (c) 3.

(e) The state pharmacist licensure, no later than 30 days after the date that the licensee allows the individual to work as an authorized nuclear pharmacist.

SECTION 113. HFS 157.72 (2) is repealed and recreated to read:

HFS 157.72 (2) REPORT OF A DOSE TO AN EMBRYO OR FETUS OR A NURSING CHILD. (a) A licensee shall report to the department any dose to an embryo or fetus that is greater than 50 mSv (5 rem) dose equivalent that is a result of an administration of radioactive material or radiation from radioactive material to a pregnant individual unless the dose to the embryo or fetus was specifically approved, in advance, by the authorized user.

(b) A licensee shall report to the department any dose to a nursing child that is a result of an administration of radioactive material to a breast-feeding individual that meets either of the following criteria:

1. Greater than 50 mSv (5 rem) total effective dose equivalent.

2. Resulted in unintended permanent functional damage to an organ or a physiological system of the child, as determined by a physician.

(c) A licensee shall notify the department by telephone no later than the next calendar day after discovery of a dose to the embryo, fetus or nursing child that requires a report in par. (a) or (b).

(d) A licensee shall submit a written report to the department within 15 days after discovery of a dose to the embryo, fetus or nursing child that requires a report in par. (a) or (b). The written report shall include all of the following information:

1. The licensee's name.

2. The name of the prescribing physician.

3. A brief description of the event.

4. Why the event occurred.

5. The effect, if any, on the embryo, fetus or the nursing child.

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

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

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

(e) A licensee shall provide notification of the event to the referring physician and also notify the pregnant individual or mother, both hereafter referred to as the mother, no later than 24 hours after discovery of an event that would require reporting under par. (a) or (b), unless the referring physician personally informs the licensee either that he or she will inform the mother or that, based on medical judgment, telling the mother would be harmful. A licensee is not required to notify the mother without first consulting with the referring physician. If the referring physician or mother cannot be reached within 24 hours, a licensee shall make the appropriate notifications as soon as possible thereafter. A licensee may not delay any appropriate medical care for the embryo, fetus or for the nursing child, including any necessary remedial care as a result of the event, because of any delay in notification. To meet the requirements of this paragraph, the notification may be made to the mother's or child's responsible relative or guardian instead of the mother. If a verbal notification is made, the licensee shall inform the mother, or the mother's or child's responsible relative or guardian, that a written description of the event can be obtained from the licensee upon request. A licensee shall provide such a written description if requested.

(f) A licensee shall do all the following:

1. Annotate a copy of the report provided to the department with all of the following information:

a. Name of the pregnant individual or the nursing child who is the subject of the event.

b. Social security number or other identification number, if one has been assigned, of the pregnant individual or the nursing child who is the subject of the event.

2. Provide a copy of the annotated report to the referring physician, if other than the licensee, no later than 15 days after the discovery of the event.

(g) A licensee shall retain a record of a dose to an embryo, fetus or a nursing child under s. HFS 157.71 (5).

SECTION 114. HFS 157.73 (15) (c) and (22) (k) and (m) are amended to read:

HFS 157.73 (15) (c) Portable radiation survey meters shall be calibrated at ~~least annually~~ at a frequency not to exceed 13 months to an accuracy of plus or minus 20% for the gamma energy of the sources in use. The calibration shall be performed at 2 points on each scale or, for digital instruments, at one point per decade over the range that will be used. Portable radiation survey meters shall be of a type that does not fail and read zero at high radiation dose rates.

(22) (k) Records of the receipt, transfer and disposal of all licensed sealed sources as required by ~~s~~ss. HFS ~~157.13 (12), 10 CFR 30.51 or the equivalent agreement state or licensing state regulations~~157.13 (15) and (18).

(m) Records related to decommissioning of the irradiator as required by ~~this chapter, 10 CFR 30.35(g) or the equivalent state regulation~~ s. HFS 157.15 (7).

SECTION 115. HFS 157.74 (2) (b) (intro.), (g) 3. and 4. are amended to read:

HFS 157.74 (2) (b) A chart shall be ~~provided~~ posted next to the control panel of a diagnostic x-ray system that specifies, for all examinations performed with that system, all of the following information:

(g) 3. Each facility shall have leaded ~~aprons and gloves~~ shielding garments and devices available in sufficient numbers to provide protection to all personnel who are involved with x-ray operations and who are otherwise not shielded.

4. Leaded ~~aprons and gloves~~ shielding garments and devices shall be fluoroscopically or radiographically inspected at least every ~~3~~2 years for defects and replaced if defective. If visual inspection reveals possible defects, radiographic inspections shall be performed.

SECTION 116. HFS 157.74 (2) (d) 3., and (g) 5. and Note are created to read:

HFS 157.74 (2) (d) 3. Operators of c-arm configuration units which do not operate at a tube current in excess of 0.2 mA are exempt from the requirement to wear a leaded apron, provided the operator wears a personnel dosimeter as required under s. HFS 157.25 (2).

(g) 5. If visual inspection reveals possible defects, radiographic or fluoroscopic inspections shall be performed.

Note: Leaded shielding garments and devices include aprons, gloves, vests, skirts, thyroid shields and gonadal shields.

SECTION 117. HFS 157.74 (3) (c) and (4) (b) are amended to read:

HFS 157.74 (3) (c) X-ray film processing control tests shall be performed and analyzed on days when human patient films are being processed and prior to the processing of the first films of the day, except dental and podiatry facilities.

(4) (b) The darkroom shall be light tight with proper safelights so that any film type in use exposed in a cassette to x-radiation sufficient to produce an optical density from one to 2 when processed may not suffer an increase in density greater than 0.1, or 0.05 for mammography, when exposed in the darkroom for 2 minutes with all safelights on. This test shall be performed at least once every 6 months. If used, daylight film handling boxes shall preclude fogging of the film. Darkrooms typically used by more than one person shall be provided a method to prevent accidental entry while undeveloped films are being handled or processed.

SECTION 118. Table HFS 157.75 is amended to read:

TABLE HFS 157.75
HALF-VALUE LAYER REQUIREMENTS

Design Operating Range	Measured Operating Potential	Half-Value Layer In mm Aluminum

	(kVp)	~~Dental Intra-Oral~~ Specified Dental Systems[1]	Specified Dental and Other Diagnostic X-ray Systems[2]	~~All~~ Other Diagnostic X-Ray Systems[3]
Below 51	30	N/A	0.3	0.3
	40	N/A	0.4	0.4
	50	1.5	0.5	0.5
51 to 70	51	1.5	1.2	~~1.2~~1.3
	60	1.5	1.3	~~1.3~~1.5
	70	1.5	1.5	~~1.5~~1.8
Above 70	71	2.1	2.1	~~2.1~~2.4
	80	2.3	2.3	~~2.3~~2.8
	90	2.5	2.5	~~2.5~~3.2
	100	2.7	2.7	~~2.7~~3.6
	110	3.0	3.0	~~3.0~~4.1
	120	3.2	3.2	~~3.2~~4.5
	130	3.5	3.5	~~3.5~~5.0
	140	3.8	3.8	~~3.8~~5.4
	150	4.1	4.1	~~4.1~~5.9

1. Dental intraoral systems manufactured after December 1, 1980.

2. Dental intraoral systems manufactured on or before December 1, 1980 and all other diagnostic x-ray systems.

3. All x-ray systems, except dental x-ray systems designed for use with intraoral image receptors, subject to this section and manufactured as specified in federal x-ray equipment performance standards, 21 CFR 1020.

SECTION 119. HFS 157.76 is repealed and recreated to read:

HFS 157.76 Fluoroscopic equipment. Equipment for fluoroscopic imaging or for recording images from the fluoroscopic image receptor shall meet all the following requirements, except computed tomography x-ray systems manufactured on or after November 29, 1984.

(1) LIMITATION OF USEFUL BEAM. (a) The fluoroscopic imaging assembly shall be provided with a primary protective barrier which intercepts the entire cross section of the useful beam at any SID. The x-ray tube used for fluoroscopy shall not produce x-rays unless the barrier is in position to intercept the entire useful beam. The Air Kerma Rate due to

transmission through the barrier with the attenuation block in the useful beam combined with radiation from the fluoroscopic image receptor shall not exceed 3.34×10^{-3} percent of the entrance Air Kerma Rate, at a distance of 10 cm from any accessible surface of the fluoroscopic imaging assembly beyond the plane of the image receptor.

(b) Compliance shall be determined as follows:

1. The Air Kerma Rate shall be measured as required under sub. (4). The Air Kerma Rate due to transmission through the primary barrier combined with radiation from the fluoroscopic image receptor shall be determined by measurements averaged over an area of 100 square cm with no linear dimension greater than 20 cm.

2. If the source is below the tabletop, the measurement shall be made with the input surface of the fluoroscopic imaging assembly positioned 30 cm above the tabletop. If the source is above the tabletop and the SID is variable, the measurement shall be made with the end of the beam-limiting device or spacer as close to the tabletop as it can be placed, provided that it shall not be closer than 30 cm.

3. Movable grids and compression devices shall be removed from the useful beam during the measurement.

4. For all measurements, the attenuation block shall be positioned in the useful beam 10 cm from the point of measurement of entrance Air Kerma Rate and between this point and the input surface of the fluoroscopic imaging assembly.

(c) Radiation therapy simulation systems shall be exempt from this requirement provided the systems are intended only for remote control operation and the manufacturer sets forth instructions for assemblers with respect to control location as part of the information required in 21 CFR 1020.30 (g).

(2) FIELD LIMITATION. (a) For fluoroscopic equipment manufactured after February 25, 1978, when the angle between the image receptor and the beam axis of the x-ray beam is variable, means shall be provided to indicate when the axis of the x-ray beam is perpendicular to the plane of the image receptor. Compliance with par. (e) 1. and 2. of this section shall be determined with the beam axis indicated to be perpendicular to the plane of the image receptor.

(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 SID and/or the capability of a visible area of greater than 300 square cm, shall be provided with means for stepless adjustment of the x-ray field. Equipment with a fixed SID 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 SID, 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.

(c) The x-ray field produced by non-image-intensified fluoroscopic equipment shall not extend beyond the entire visible area of the image receptor. Means shall be provided for stepless adjustment of field size. The minimum field size, at the greatest SID, shall be containable in a square of 5 cm by 5 cm.

(d) For fluoroscopic equipment with inherently circular image receptors manufactured before June 10, 2006, other than radiation therapy simulation systems, all the following applies:

1. Neither the length nor the width of the x-ray field in the plane of the image receptor shall exceed that of the visible area of the image receptor by more than 3 percent of the SID. The sum of the excess length and the excess width shall be no greater than 4 percent of the SID.

2. For rectangular x-ray fields used with circular image receptors, the error in alignment shall be determined along the length and width dimensions of the x-ray field which pass through the center of the visible area of the image receptor.

3. For fluoroscopic equipment manufactured on or after June 10, 2006, other than radiation therapy simulation systems, the maximum area of the x-ray field in the plane of the image receptor shall conform to one of the following requirements:

4. When any linear dimension of the visible area of the image receptor measured through the center of the visible area is less than or equal to 34 cm in any direction, at least 80 percent of the area of the x-ray field overlaps the visible area of the image receptor, or

5. When any linear dimension of the visible area of the image receptor measured through the center of the visible area is greater than 34 cm in any direction, the x-ray field measured along the direction of greatest misalignment with the visible area of the image receptor does not extend beyond the edge of the visible area of the image receptor by more than 2 cm.

(e) For x-ray systems with inherently rectangular image receptors manufactured on or after June 10, 2006, all the following applies:

1. Neither the length nor the width of the x-ray field in the plane of the image receptor shall exceed that of the visible area of the image receptor by more than 3 percent of the SID. The sum of the excess length and the excess width shall be no greater than 4 percent of the SID.

2. The error in alignment shall be determined along the length and width dimensions of the x-ray field which pass through the center of the visible area of the image receptor.

(f) If the fluoroscopic x-ray field size is adjusted automatically as the SID or image receptor size is changed, a capability may be provided for overriding the automatic adjustment in case of system failure. If it is so provided, a signal visible at the fluoroscopist's position shall indicate whenever the automatic field adjustment is overridden. Each such system failure override switch shall be clearly labeled as follows:

For X-ray Field Limitation System Failure

(3) ACTIVATION OF TUBE. X-ray production in the fluoroscopic mode shall be controlled by a device which requires continuous pressure by the operator for the entire time of any exposure. When recording serial radiographic images from the fluoroscopic image receptor, the operator shall be able to terminate the x-ray exposure(s) at any time, but means may be provided to permit completion of any single exposure of the series in process.

(4) AIR KERMA RATES. (a) Fluoroscopic equipment manufactured before May 19, 1995 shall meet all the following requirements:

1. Equipment provided with automatic exposure rate control shall not be operable at any combination of tube potential and current that will result in an Air Kerma Rate in excess of 88 mGy per minute (10 R/min) at the measurement point specified in par. (e), except as specified in par. (e) 6.

2. Equipment provided without automatic exposure rate control shall not be operable at any combination of tube potential and current that will result in an Air Kerma Rate in excess of 44 mGy per minute (5 R/min) at the measurement point specified in par. (e), except as specified in par. (e) 6.

3. Equipment provided with both an automatic exposure rate control mode and a manual mode shall not be operable at any combination of tube potential and current that will result in an Air Kerma Rate in excess of 88 mGy per minute (10 R/min) in either mode at the measurement point specified in par. (e), except as specified in par. (e) 6.

4. Equipment may be modified in accordance with 21 CFR 1020.30(q) to comply with par. (a). When the equipment is modified, it shall bear a label indicating the date of the modification and the statement:

Modified to comply with 21 CFR 1020.32 (h) (2).

(b) The requirements of par. (a) do not apply to all the following:

1. During recording of fluoroscopic images.

2. When a mode of operation has an optional high-level control, in which case that mode shall not be operable at any combination of tube potential and current that will result in an Air Kerma Rate in excess of the rates specified in this subsection at the measurement point specified in par. (e), unless the high-level control is activated. Special means of activation of high-level controls shall be required. The high-level control shall be operable only when continuous manual activation is provided by the operator. A continuous signal audible to the fluoroscopist shall indicate that the high-level control is being employed.

(c) Fluoroscopic equipment manufactured on or after May 19, 1995 shall meet all the following requirements:

1. Equipped with AERC if operable at any combination of tube potential and current that results in an Air Kerma Rate greater than 44 mGy per minute (5 R/min) at the measurement point specified in this subsection. Provision for manual selection of technique factors may be provided.

2. Not be operable at any combination of tube potential and current that will result in an Air Kerma Rate in excess of 88 mGy per minute (10 R/min) at the measurement point specified in par. (e)

(d) The requirements of par. (c) do not apply to all the following:

1. For equipment manufactured prior to June 10, 2006, during the recording of images from a fluoroscopic image receptor using photographic film or a video camera when the x-ray source is operated in a pulsed mode.

2. For equipment manufactured on or after June 10, 2006, during the recording of images from the fluoroscopic image receptor for the purpose of providing the user with a recorded image(s) after termination of exposure. Such recording does not include images resulting from a last image-hold feature that are not recorded.

3. When a mode of operation has an optional high-level control and the control is activated, in which case the equipment shall not be operable at any combination of tube potential and current that will result in an Air Kerma Rate in excess of 176 mGy per minute (20 R/min) at the measurement point specified par. (e). Special means of activation of high-level controls shall be required. The high-level control shall be operable only when continuous manual activation is provided by the operator. A continuous signal audible to the fluoroscopist shall indicate that the high-level control is being employed.

(e) Compliance with par. (c) shall be determined as follows:

1. If the source is below the x-ray table, the Air Kerma Rate shall be measured at 1 cm above the tabletop or cradle.

2. If the source is above the x-ray table, the Air Kerma Rate shall be measured at 30 cm above the tabletop with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement.

3. In a C-arm type of fluoroscope, the Air Kerma Rate shall be measured at 30 cm from the input surface of the fluoroscopic imaging assembly, with the source positioned at any available SID, provided that the end of the beam limiting device or spacer is no closer than 30 cm from the input surface of the fluoroscopic imaging assembly.

4. In a C-arm type of fluoroscope having an SID less than 45 cm, the Air Kerma Rate shall be measured at the minimum SSD.

5. In a lateral type of fluoroscope, the air kerma rate shall be measured at a point 15 cm from the centerline of the x-ray table and in the direction of the x-ray source with the end of the beam limiting device or spacer positioned as closely as possible to the point of measurement. If the tabletop is movable, it shall be positioned as closely as possible to the lateral x-ray source, with the end of the beam-limiting device or spacer no closer than 15 cm to the centerline of the x-ray table.

6. Fluoroscopic radiation therapy simulation systems are exempt from these requirements.

(5) INDICATION OF POTENTIAL AND CURRENT. During fluoroscopy and cinefluorography, x-ray tube potential and current shall be continuously indicated. Deviation of x-ray tube potential and current from the indicated values shall not exceed the maximum deviation as stated by the manufacturer in accordance with 21 CFR 1020.30 (h) (3).

(6) SOURCE TO SKIN DISTANCE. (a) Means shall be provided to limit the source to skin distance to not less than 38 cm on stationary fluoroscopes and to not less than 30 cm on

mobile and portable fluoroscopes. In addition, for fluoroscopes intended for specific surgical application that would be prohibited at the source-skin distances specified in this paragraph, provisions may be made for operation at shorter source-skin distances but in no case less than 20 cm.

(b) For stationary, mobile, or portable C-arm fluoroscopic systems manufactured on or after June 10, 2006, having a maximum source-image receptor distance of less than 45 cm, means shall be provided to limit the source-skin distance to not less than 19 cm. Such systems shall be labeled for extremity use only. In addition, for those systems intended for specific surgical application that would be prohibited at the source-skin distances specified in this paragraph, provisions may be made for operation at shorter source-skin distances but in no case less than 10 cm.

(7) FLUOROSCOPIC IRRADIATION TIME, DISPLAY, AND SIGNAL. (a) Fluoroscopic equipment manufactured before June 10, 2006, shall be provided with means to preset the cumulative irradiation time of the fluoroscopic tube. The maximum cumulative time of the timing device shall not exceed 5 minutes without resetting. A signal audible to the fluoroscopist shall indicate the completion of any preset cumulative Irradiation time. Such signal shall continue to sound while x-rays are produced until the timing device is reset.

(b) As an alternative to the requirements of this par. (a), radiation therapy simulation systems may be provided with a means to indicate the total cumulative exposure time during which x-rays were produced, and which is capable of being reset between x-ray examinations.

(c) For x-ray controls manufactured on or after June 10, 2006, the following shall be provided for each fluoroscopic tube:

1. A display of the fluoroscopic irradiation time at the fluoroscopist's working position.

2. The display required in subd. 1. shall function independently of the audible signal described in sub. (4) and meet all the following requirements:

a. When the x-ray tube is activated, the fluoroscopic irradiation time in minutes and tenths of minutes shall be continuously displayed and updated at least once every 6 seconds.

b. The fluoroscopic irradiation time shall also be displayed within 6 seconds of termination of an exposure and remain displayed until reset.

c. Means shall be provided to reset the display to zero prior to the beginning of a new examination or procedure.

d. A signal audible to the fluoroscopist shall sound for each passage of 5 minutes of fluoroscopic irradiation time during an examination or procedure. The signal shall sound until manually reset or, if automatically reset, for at least 2 second.

(8) MOBILE AND PORTABLE FLUOROSCOPES. Mobile and portable fluoroscopes shall incorporate an image intensifier.

(9) DISPLAY OF LAST-IMAGE-HOLD (LIH). (a) Fluoroscopic equipment manufactured on or after June 10, 2006, shall be equipped with means to display the last image following termination of the fluoroscopic exposure.

(b) For a LIH obtained by retaining pre-termination fluoroscopic images, if the number of images and method of combining images are selectable by the user, the selection shall be indicated prior to initiation of the fluoroscopic exposure.

(c) For an LIH image obtained by initiating a separate radiographic-like exposure at the termination of fluoroscopic imaging, the techniques factors for the LIH image shall be selectable prior to the fluoroscopic exposure, and the combination selected shall be indicated prior to initiation of the fluoroscopic exposure.

(d) Means shall be provided to clearly indicate to the user whether a displayed image is the LIH radiograph or fluoroscopy. Display of the LIH radiograph shall be replaced by the fluoroscopic image concurrently with re-initiation of fluoroscopic exposure, unless separate displays are provided for the LIH radiograph and fluoroscopic images.

(e) The predetermined or selectable options for producing the LIH radiograph shall be described in the information required by 21 CFR 1020.30 (h). The information shall include a description of any technique factors applicable for the selected option and the impact of the selectable options on image characteristics and the magnitude of radiation emissions.

(10) DISPLAYS OF VALUES OF AIR KERMA RATE AND CUMULATIVE AIR KERMA. Fluoroscopic equipment manufactured on or after June 10, 2006, shall display at the fluoroscopist's working position the Air Kerma Rate and cumulative air kerma. Each x-ray tube used during an examination or procedure shall meet all the following requirements:

(a) When the x-ray tube is activated and the number of images produced per unit time is greater than six images per second, the Air Kerma Rate in mGy/min shall be continuously displayed and updated at least once every second.

(b) The cumulative air kerma in units of mGy shall be displayed either within 5 seconds of termination of an exposure or displayed continuously and updatedat least once every 5 seconds.

(c) The display of the Air Kerma Rate shall be clearly distinguishable from the display of the cumulative air kerma.

(d) The Air Kerma Rate and cumulative air kerma shall represent the value for conditions of free-in-air irradiation at one of the following reference locations specified according to the type of fluoroscope. The reference location shall be identified and described specifically in the information provided to users according to 21 CFR 1020.30 (h) (6) (iii).

1. For fluoroscopes with x-ray source below the x-ray table, x-ray source above the table, or of lateral type, the reference locations shall be the respective locations specified in sub. (4) for measuring compliance with air kerma rate limits.

2. For C-arm fluoroscopes, the reference location shall be 15 cm from the isocenter toward the x-ray source along the beam axis. Alternatively, the reference location shall be at a point specified by the manufacturer to represent the location of the intersection of the x-ray beam with the patient's skin.

(e) Means shall be provided to reset to zero the display of cumulative air kerma prior to the commencement of a new examination or procedure.

(f) The displayed Air Kerma Rate and cumulative air kerma shall not deviate from the actual values by more than ±35 percent over the range of 6 mGy/min and 100 mGy to the maximum indication of Air Kerma Rate and cumulative air kerma, respectively. Compliance shall be determined with an irradiation time greater than 3 seconds.

SECTION 120. HFS 157.77 (5) is repealed and recreated to read:

HFS 157.77 (5) RADIATION FROM CAPACITOR ENERGY STORAGE EQUIPMENT IN STANDBY STATUS. Radiation emitted from the x-ray tube when the system is fully charged and the exposure switch or timer is not activated may not exceed any of the following:

(a) A rate of 0.26mGy (0.03mR exposure) in one minute at 5 centimeters from any accessible surface of the diagnostic source assembly with the beam-limiting device fully open.

(b) An air kerma of 0.88 mGy (100mr/exposure) in one hour at 100 centimeters from the x-ray source, wit the beam-limiting device fully open, when the system is discharged through the x-ray tube either manually or automatically by use of a discharge switch or deactivation of the input power. Compliance shall be determined by measurements of the maximum air kerma per discharge multiplied by the total number of discharges in one hour (duty cycle). The measurements shall be averaged over an area of 100 square centimeters with no linear dimension greater than 20 centimeters.

SECTION 121. HFS 157.79 (2) (c) is amended to read:

HFS 175.79 (2) (c) A deadman type of exposure switch shall be provided with an electrical cord of sufficient length so that the operator <u>or the assistant,</u> may stand out of the useful beam and at least 2 meters (6.5 feet) from the ~~animal~~ <u>table</u> during all x-ray exposures. A foot operated exposure switch may be <u>used and this switch may be integrated into the table base or the foot switch may be on a 2 meter (6.5 feet) cord</u>.

SECTION 122. HFS 157.80 (1) (a) and (c) are renumbered HFS 157.80 (1) (a) 1. and (c) 1.

SECTION 123. HFS 157.80 (1) (a) 2. and 3. and (c) 2. and 3. are created to read:

HFS 157.80 (1) (a) 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 (100mR) in 1 hour at any point 5 centimeters outside the external surface of the housing of the scanning mechanism when the shutter is closed.

3. Compliance shall be determined by measurements averaged over an area of 100 square centimeters with no linear dimension greater than 20 centimeters.

(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 mRem) in one hour at any point 5 cm outside the external surface of the housing of the scanning mechanism when the shutter is closed.

3. Compliance shall be determined by measurements average over an area of 100 square cm with no linear dimension greater than 20 cm.

SECTION 124. HFS 157.80 (2) is amended to read:

HFS 157.80 (2) (a) A CT x-ray system may only be operated for diagnostic procedures by an American registry of radiologic technologists certified person who has been specifically trained in its operation. Combination systems which are designated as PET/CT shall be operated by a person qualified by training in the safe use of radioactive materials and who meets the training requirements of Appendix L.

SECTION 125. HFS 157.81 (3) (a) is amended to read:

HFS 157.81 (3) (a) A shielding plan for a facility with two or more x-ray rooms shall include a medical physicist or person approved by a medical physicist recommendation for shielding.

SECTION 126. HFS 157.83 (2) (b) is amended to read:

HFS 157.83 (2) (b) Develop procedures for and conduct a review of the program including, since the last review, an evaluation of a representative sample of patient administrations and all ~~recordable~~medical events to verify compliance with all aspects of the operational procedures program.

SECTION 127. HFS 157.85 (15) (b) Note is amended to read:

HFS 157.85 (15) (b) Note: An acceptable reference is "Comprehensive QA for Radiation Oncology: Report of AAPM Radiation Therapy Committee Task Group 40," AAPM Report No. 46, American Association of Physicists in Medicine, April, 1994. The publication may be consulted at the Department of Health and Family Services, Radiation Protection Section, 1 West Wilson St, Room 150, Madison WI ~~53701~~53702-0007. AAPM reports may be obtained from Medical Physics Publishing, ~~4531~~ 4513 Vernon Blvd., Madison WI 53705-4964 or ordered from their website: www.medicalphysics.org.

SECTION 128. HFS 157.86 (a) 1. to 5. are amended to read:

1. For a site having an ionizing radiation installation serving physicians and clinics, osteopaths and clinics, chiropractors or hospitals, the fee shall be $~~36~~50 for each site and $~~44~~50for each x-ray tube.

2. For a podiatric or veterinary site having an ionizing radiation installation, the fee shall be $~~36~~50 for each site and $~~44~~50 or each x-ray tube.

3. For a dental site having an ionizing radiation installation, the fee shall be $~~36~~50 for each site and $~~30~~35 for each x-ray tube.

4. For an industrial, school, research project or other site having an ionizing radiation installation, the fee shall be $~~36~~50 for each site and $~~44~~50 for each x-ray tube.

5. An additional fee of ~~$25~~50, regardless of the number of devices, shall be required for each registration whenever the annual fee for renewal is not paid prior to the expiration of the registration.

SECTION 129. HFS 157.88 (1) (a) 7. Note and (3) (a) 5. is amended to read:

HFS 157.88 (1) (a) 7. Note: The "Notice to Employees" form may be obtained from the Department by writing: Department of Health and Family Services, Radiation Protection Section, P.O. Box 2659, Madison WI 53701-2659 or from the Department's website ~~www.dhfs.state.wi.us/licensing~~ http://dhfs. wisconsin.gov/dph_beh/RadiatioP/Index.htm

(3) (a) 5. Each calendar quarter in which the worker's activities involved exposure to sources of radiation and the dates and locations of work. If a report under this paragraph is being provided to employees under par. (b) ~~or (c)~~, the report shall include the calendar quarter within which the employee terminates employment or requests a report under this subsection.

SECTION 130. HFS 157.88 (3) (b) is repealed.

SECTION 131. HFS 157.88 (3) (c), (d), (e) and (f) is renumbered HFS 157.88 (3) (b), (c), (d), and (e).

SECTION 132. HFS 157.92 (2) (b), (c), and (d) are repealed and recreated to read:

HFS 157.92 (2) (b) A licensee is exempt from the requirements of this subchapter with respect to shipment or carriage of any of the following materials:

1. Naturally occurring radioactive material and ores containing naturally occurring radionuclides that are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values specified in Appendix O, Table VII.

2. Materials for which the activity concentration is not greater than the activity concentration values specified in Appendix O, Table VII, or for which the consignment activity is not greater than the limit for an exempt consignment found in Appendix O, Table VII.

(c) Fissile materials meeting one of the following requirements are exempt from classification as fissile material and from the fissile material package standards of 10 CFR 71.55 and 10 CFR 71.59, but are subject to all other requirements of 10 CFR 71, except as noted.

1. Individual package containing 2 grams or less of fissile material.

2. Individual or bulk packaging containing 15 grams or less of fissile material provided the package has at least 200 grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but may not be included in determining the required mass for solid nonfissile material.

3. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that there is at least 2000 grams of solid nonfissile material for every gram of fissile material and there is no more than 180 grams of fissile material distributed within 360 kg of

contiguous nonfissile material. Lead, beryllium, graphite and hydrogenous material enriched in deuterium may be present in the package, but may not be included in determining the required mass of solid nonfissile material.

4. Uranium enriched in uranium-235 to a maximum of one percent by weight, and with total plutonium and uranium-233 content of up to one percent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium present in the package is less than 5 percent of the uranium mass.

5. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of two percent by weight, provided that all the following conditions apply:

a. The total plutonium and uranium-233 content does not exceed 0.002 percent of the total mass of uranium.

b. The nitrogen to uranium atomic ratio (N/U) is greater than or equal to 2.0.

c. The material shall be contained in at least a DOT Type A package.

6. Plutonium with a total mass of less than 1000 grams, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 20 percent by mass of the total quantity of plutonium in the package.

Note: The U.S. postal service domestic mail manual (DMM), Section C-023.9.0, is available at http://pe.usps.gov/.

(d) Any physician licensed by the state of Wisconsin to dispense drugs in the practice of medicine is exempt from sub. (1) with respect to transport by the physician of radioactive material for use in the practice of medicine provided the physician is an authorized user under subch. II of this chapter.

SECTION 133. HFS 157.93 (4) (b) 3., 4. and (d) are amended to read:

HFS 157.93 (4) (b) 3. Prior to the licensee's first use of the package, ~~has registered with~~ submits in writing to the nuclear regulatory commission the licensee's name and license number and the package identification number specified in the package approval. A licensee shall submit this information in accordance with 10 CFR 71.1 (a).

4. Has a quality assurance program that complies with ~~s. HFS 157.94 (6)~~ subpart H of 10 CFR 71.

(d) For a Type B or fissile material package, the design of which was approved by the nuclear regulatory commission before April 1, 1996, the general license issued in par. (a) is subject to the additional restrictions of ~~sub. (5)~~ 10 CFR 71.19 .

SECTION 134. HFS 157.93 (5) is repealed.

SECTION 135. HFS 157.93 (6) and (7) are renumbered HFS 157.93 (5) and (6) and as renumbered HFS 157.93 (5) (b) 3. and HFS 157.93 (6) (b) 2. are amended to read:

HFS 157.93 (5) (b) 3. Has a quality assurance program that complies with ~~s. HFS 157.94 (6)~~ 10 CFR 71, Subpart H.

(6) (b) 2. Complies with the terms and conditions of the certificate and revalidation, and with the requirements of ~~this subchapter~~ 10 CFR 71 Subparts A, G and H.

SECTION 136. HFS 157.93 (5) (d) is created to read:

HFS 157.93 (5) (d) The general license issued in par. (a) is subject to the limitation specified in 10 CFR 71.20 (e).

SECTION 137. HFS 157.93 (7) and Tables HFS 157.93A and B, and (8) are created to read:

HFS 157.93 (7) FISSILE MATERIAL. (a) A general license is hereby issued to any licensee to transport fissile material, or to deliver fissile material to a carrier for transport, if the material is shipped under this subsection. The fissile material need not be contained in a package which meets the standards of subparts E and F of 10 CFR 71; however, the material shall be contained in a Type A package. The Type A package shall also meet the DOT requirements of 49 CFR 173.417(a).

(b) The general license applies only to a licensee who has a quality assurance program approved by the NRC as satisfying the provision of subpart H of 10 CFR 71.

(c) The general license applies only when a package's contents meet all the following criteria:

1. Contain less than a Type A quantity of fissile material.

2. Contain less than 500 total grams of beryllium, graphite, or hydrogenous material enriched in deuterium.

(d) The general license applies only to packages containing fissile material that are labeled with a CSI and meets all the following criteria:

1. Has been determined in accordance with par. (e).

2. Has a value less than or equal to 10.0.

3. For a shipment of multiple packages containing fissile material, the sum of the CSIs shall be less than or equal to 50 (for shipment on a nonexclusive use conveyance) and less than or equal to 100 (for shipment on an exclusive use conveyance).

(e) The value for the CSI shall be greater than or equal to the number calculated by the following equation:

$$CSI = 10\left[\frac{grams\,of\ ^{235}\mathrm{U}}{X} + \frac{gram\,of\ ^{233}U}{Y} + \frac{grams\,of\ Pu}{Z}\right]$$

1. The calculated CSI shall be rounded up to the first decimal place.

2. The values of X, Y, and Z used in the CSI equation shall be taken from Table HFS 157.93A or Table HFS 157.93B, as appropriate.

3. If Table HFS 157.93B is used to obtain the value of X, then the values for the terms in the equation for uranium-233 and plutonium shall be assumed to be zero.

4. Table HFS 157.93A values for X, Y, and Z shall be used to determine the CSI under any of the following conditions:

a. Uranium-233 is present in the package.

b. The mass of plutonium exceeds one percent of the mass of uranium-235.

c. The uranium is of unknown uranium-235 enrichment or greater than 24 weight percent enrichment.

d. Substances having a moderating effectiveness (i.e., an average hydrogen density greater than H_2O) (e.g., certain hydrocarbon oils or plastics) are present in any form, except as polyethylene used for packing or wrapping.

TABLE HFS 157.93A
MASS LIMITS FOR GENERAL LICENSE PACKAGES CONTAINING MIXED QUANTITIES OF FISSILE MATERIAL OR URANIUM-235 OF UNKNOWN ENRICHMENT PER HFS 157.93(7)(e).

Fissile Material	**Fissile material mass mixed with moderating substances having an average hydrogen density less than or equal to H_2O (grams)**	**Fissile material mass mixed with moderating substances having an average hydrogen density greater than H_2O[a] (grams)**
^{235}U (X)	60	38
^{235}U (Y)	43	27
^{239}Pu or ^{241}Pu (Z)	37	24

[a] When mixtures of moderating substances are present, the lower mass limits shall be used if more than 15 percent of the moderating substance has an average hydrogen density greater than H_2O

TABLE HFS 157.93B
MASS LIMITS FOR GENERAL LICENSE PACKAGES CONTAINING URANIUM-235 OF KNOWN ENRICHMENT PER s. HFS 157.93 (7) (e).

Uranium enrichment in weight percent of U-235 not exceeding	**Fissile material mass of U-235 (X) (grams)**
24	60
20	63
15	67
11	72
10	76
9.5	78
9	81
8.5	82
8	85
7.5	88

7	90
6.5	93
6	97
5.5	102
5	108
4.5	114
4	120
3.5	132
3	150
2.5	180
2	246
1.5	408
1.35	480
1	1020
0.92	1800

(8) PLUTONIUM-BERYLLIUM SPECIAL FORM MATERIAL. (a) A general license is issued to any licensee to transport fissile material in the form of plutonium-beryllium (Pu-Be) special form sealed sources, or to deliver Pu-Be sealed sources to a carrier for transport, if the material is shipped under this subsection. This material need not be contained in a package which meets the standards of subparts E and F of 10 CFR 71; however, the material must be contained in a Type A package. The Type A package must also meet the DOT requirements of 49 CFR 173.417(a).

(b) The general license applies only to a licensee who has a quality assurance program approved by the nuclear regulatory commission as satisfying the provision of subpart H of 10 CFR 71.

(c) The general license applies when a package's contents meets all the following criteria:

1. Contain less than a Type A quantity of material.

2. Contain less than 1000 grams of plutonium, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 240 grams of the total quantity of plutonium in the package.

(d) The general license applies only to packages labeled with a CSI which meets all the following criteria:

1. Has been determined in accordance with par. (e).

2. Has a value less than or equal to 100.

3. For a shipment of multiple packages containing Pu-Be sealed sources, the sum of the CSIs shall be less than or equal to 50 (for shipment on a nonexclusive use conveyance) and to less than or equal to 100 (for shipment on an exclusive use conveyance).

(e) The value for the CSI shall be greater than or equal to the number calculated by the following equation and the calculated CSI rounded up to the first decimal place:

$$CSI = 10\left[\frac{grams\ of\ Pu-239 + grams\ of\ Pu-241}{24}\right]$$

SECTION 138. HFS 157.94 (2) (b) is amended to read:

HFS 157.94 (2) (b) The plutonium is contained in a material in which the specific activity ~~is not greater than 70 becquerel per gram (0.002 Ci/g) of material~~ is less than or equal to the activity concentration values for plutonium specified in Appendix O, Table VII and in which the radioactivity is essentially uniformly distributed.

SECTION 139. TABLE HFS 157.96A (title) is amended to read:

TABLE HFS 157.96A AVERAGE ANNUAL CONCENTRATIONS ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF~~4~~ 0.04 MILLISIEVERT (4 MILLIREM)/YEAR

SECTION 140. HFS 157 Subchapter XV (title), HFS 157.97 and HFS 157.98 are repealed.

SECTION 141. HFS 157 Appendix B is amended to read:

At the end of column 3 on page 370-48 add:

Any alpha emitting radioactive not listed above other than transuranic radioactive material.

At the end of column 4 on page 370-48 add:

0.01

SECTION 142. HFS 157 Appendix F (title), and column titles on pages 370-112 to 370-118, 370-121, 370-122 are amended to read:

HFS 157 Appendix F (title):

QUANTITIES OF LICENSED ~~OR REGISTERED~~ MATERIAL REQUIRING LABELING
(In Atomic Number Order)

Column title on page 370-112 of current code:

Radionuclide	Quantity (uCi)[b/]	Radionuclide	Quantity (uCi)

Note: To convert uCi to kBq, multiply the uCi value by 37.

Column title on page 370-113 of current code:

Radionuclide	Quantity (uCi)[b/]	Radionuclide	Quantity (uCi)

Note: To convert uCi to kBq, multiply the uCi value by 37.

Column title on page 370-114 of current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the *u*Ci value by 37.

Column title on page 370-115 of current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the *u*Ci value by 37.

Column title on page 370-116 of current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the *u*Ci value by 37.

Column title on page 370-117 of the current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the uCi value by 37.

Column title on page 370-118 of the current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the uCi value by 37.

Column title on page 370-121 of the current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the uCi value by 37.

Column title on page 370-122 of the current code:

Radionuclide	Quantity (uCi)	Radionuclide	Quantity (uCi)[b/]

Note: To convert uCi to kBq, multiply the uCi value by 37.

SECTION 143. HFS 157 Appendix G Section III. par. (a) (2) is amended to read:

Section III. – Control and Tracking. (a) (2) Label each package of waste to identify whether it is Class A waste, Class B waste ~~or~~, Class C waste or greater than Class C waste under Section I of Appendix H;

SECTION 144. HFS 157 Appendix H Section I. par. (b) (4) is amended to read:

Section I. – Classification of Radioactive Waste for Land Disposal. (b) Classes of waste. (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 ~~repositiitory~~repository as defined in 10 CFR 60.

SECTION 145. HFS 157 APPENDIX L is created to read:

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 acquistion system and 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

Note: *Details of the curriculum may be found at the following web site:* *http://www.asrt.org/Media/Pdf/PETCTCurriculumAccepted021704.pdf*

SECTION 146. HFS 157 APPENDIX O is repealed and recreated to read:

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. 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 VII may be used without obtaining department approval.

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:

$$\sum_i \frac{B(i)}{A_1(i)} \leq 1$$

(b) For normal form radioactive material, the maximum quantity transported in a Type A package:

$$\sum_i \frac{B(i)}{A_2(i)} \leq 1$$

where B(i) is the activity of radionuclide i and $A_1(i)$ and $A_2(i)$ are the A_1 and A_2 values for radionuclide respectively.
Alternatively, an A_1 value for mixtures of special form material may be determined as follows:

$$A_1 = \frac{1}{\sum_i \frac{f(i)}{A_1(i)}}$$

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.

An A_2 value for mixtures of normal form material may be determined as follows:

$$A_2 = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where f(i) is the fraction of activity of nuclide I in the mixture and $A_2(i)$ is the appropriate A_2 value for nuclide i.

V. 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.

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (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		$2.0X10^{1}$	$5.4X10^{2}$	$4.0X10^{1}$	$1.1X10^{3}$	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)		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$5.4X10^{5}$	$1.5X10^{7}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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 (h)		$1.0X10^{-1}$	2.7	$1.0X10^{-3}$	$2.7X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
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		$2.0X10^{-2}$	$5.4X10^{-1}$	$3.0X10^{-4}$	$8.1X10^{-3}$	$1.6X10^{-5}$	$4.2X10^{-3}$
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		$2.0X10^{-2}$	$5.4X10^{-1}$	$3.0X10^{-4}$	$8.1X10^{-3}$	$1.6X10^{-5}$	$4.2X10^{-3}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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)		2.0	$5.4X10^{1}$	$7.0X10^{-1}$	$1.9X10^{1}$	$6.1X10^{4}$	$1.6X10^{6}$
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		$4.0X10^{-1}$	$1.1X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{5}$	$3.1X10^{6}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$3.4X10^{2}$	$9.2X10^{3}$
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		$7.0X10^{-1}$	$1.9X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
Kr-81	Krypton (36)	$4.0X10^{1}$	$1.1X10^{3}$	$4.0X10^{1}$	$1.1X10^{3}$	$7.8X10^{-4}$	$2.1X10^{-2}$
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	$2.7X10^{1}$	$7.4X10^{-1}$	$2.0X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$
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)		$2.0X10^{1}$	$5.4X10^{2}$	2.0	$5.4X10^{1}$	$4.7X10^{-4}$	$1.3X10^{-2}$
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	$2.7X10^{1}$	$5.8X10^{3}$	$1.6X10^{5}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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)		$6.0X10^{-1}$	$1.6X10^{1}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$1.0X10^{1}$	$2.7X10^{2}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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	$8.5X10^{-1}$	$2.3X10^{-8}$
Sm-151		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{1}$	$2.7X10^{2}$	$9.7X10^{-1}$	$2.6X10^{1}$
Sm-153		9.0	$2.4X10^{2}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.6X10^{4}$	$4.4X10^{5}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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)		$5.0X10^{-1}$	$1.4X10^{1}$	$4.0X10^{-1}$	$1.1X10^{1}$	$1.1X10^{4}$	$8.0X10^{5}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
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	Thorium (90)	$4.0X10^{1}$	$1.1X10^{3}$	$2.0X10^{-2}$	$5.4X10^{-1}$	$2.0X10^{4}$	$5.3X10^{5}$
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)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
U-230 (slow lung absorption) (a)(f)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-1}$	2.7	$1.0X10^{3}$	$2.7X10^{4}$
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)		$4.0X10^{1}$	$1.1X10^{3}$	$1.0X10^{-2}$	$2.7X10^{-1}$	$8.3X10^{-1}$	$2.2X10^{1}$
U-233 (fast lung absorption) (d)	Uranium (92)	$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (medium lung absorption) (e)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
U-233 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$3.6X10^{-4}$	$9.7X10^{-3}$
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)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$
U-234 (slow lung absorption) (f)		$4.0X10^{1}$	$1.1X10^{3}$	$9.0X10^{-2}$	2.4	$2.3X10^{-4}$	$6.2X10^{-3}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	Specific Activity (Ci/g)
U-235 (all lung absorption types) (a),(d),(e),(f)	Uranium (92)	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)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
U-236 (slow lung absorption) (f)		Unlimited	Unlimited	Unlimited	Unlimited	$2.4X10^{-6}$	$6.5X10^{-5}$
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 A-3)
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	$8.1X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.2X10^{5}$	$3.3X10^{6}$

TABLE VI
A_1 AND A_2 VALUES FOR RADIONUCLIDES (cont.)

Symbol of Radionuclide	Element and Atomic No.	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific Activity (TBq/g)	(Ci/g)
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

(b) 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
Cs-137	Ba-137m
Ce-134	La-134
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-220	Po-216
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-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (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-12 (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,
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242

Am-243 Np-239

(c) The quantity 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 UF6, UO2F2 and UO2(NO3)2 in both normal and accident conditions of transport.

(e) These values apply only to compounds of uranium that take the chemical form of UO3, UF4, UCl4, 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) These values apply to domestic transport only. For international transport, use the values in the table below.

TABLE VI (SUPPLEMENT)
A_1 AND A_2 VALUES FOR RADIONUCLIDES FOR INTERNATIONAL SHIPMENTS

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Specific activity (TBq/g)	Specific activity (Ci/g)
Cf-252	Californium (98)	$5.0X10^{-2}$	1.4	$3.0X10^{-3}$	$8.1X10^{-2}$	$2.0X10^{1}$	$5.4X10^{2}$
Mo-99 (a)	Molybdenum (42)	1.0	$2.7X10^{1}$	$6.0X10^{-1}$	$1.6X10^{1}$	$1.8X10^{4}$	$4.8X10^{5}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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 (a)	Actinium (89)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
Ac-227 (a)		$1.0X10^{-1}$	$2.7X10^{-12}$	$1.0X10^{3}$	$2.7X10^{-8}$
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 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)	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 (a)	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)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
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		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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 (a)		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 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Er-169	Erbium (68)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
Er-171		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)	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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
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 (a)	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 (a)	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 (a)	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 (a)	Mercury (80)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Hg-195m (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
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		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
In-115m		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Ir-189 (a)	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-81	Krypton (36)	$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$
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 (a)	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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Np-237		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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
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 (a)	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 (a)	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		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)	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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Pu-242		1.0	$2.7X10^{-11}$	$1.0X10^{4}$	$2.7X10^{-7}$
Pu-244 (a)		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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
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)		$1.0X10^{4}$	$2.7X10^{-7}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
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		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
Sn-113 (a)	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 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
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 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-82 (a)	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 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
Sr-92 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
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 (a)	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 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
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		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
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 (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Te-129		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-129m (a)		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-131m (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Te-132 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{7}$	$2.7X10^{-4}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
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		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)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
Ti-44 (a)	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)(d)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (medium lung absorption) (a)(e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-230 (slow lung absorption) (a)(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$
U-232 (fast lung absorption) (d)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (medium lung absorption) (e)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-232 (slow lung absorption) (f)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U-233 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (medium lung absorption) (e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-233 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
U-234 (fast lung absorption) (d)	Uranium (92)	$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (medium lung absorption) (e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-234 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-235 (all lung absorption types) (a),(d),(e),(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (fast lung absorption) (d)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (medium lung absorption) (e)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-236 (slow lung absorption) (f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U-238 (all lung absorption types) (d),(e),(f)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{4}$	$2.7X10^{-7}$
U (nat)		1.0	$2.7X10^{-11}$	$1.0X10^{3}$	$2.7X10^{-8}$
U (enriched to 20% or less)(g)		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 (a)	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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{5}$	$2.7X10^{-6}$
Xe-122 (a)	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		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{10}$	$2.7X10^{-1}$

TABLE VII: EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	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)
Y-87 (a)	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 (a)		$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-88	Zirconium (40)	$1.0X10^{2}$	$2.7X10^{-9}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-93		$1.0X10^{3}$	$2.7X10^{-8}$	$1.0X10^{7}$	$2.7X10^{-4}$
Zr-95 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{6}$	$2.7X10^{-5}$
Zr-97 (a)		$1.0X10^{1}$	$2.7X10^{-10}$	$1.0X10^{5}$	$2.7X10^{-6}$

NOTES

(a) A_1 and/or A_2 values include contributions from daughter nuclides w/half-lives less than 10 days.

(b) 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
Cs-137	Ba-137m
Ce-134	La-134
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-220	Po-216
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-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (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,
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

(c) The quantity 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 UF6, UO2F2, and UO2(NO3)2 in both normal and accident conditions of transport.

(e) These values apply only to compounds of uranium that take the chemical form of UO3, UF4, UCl4, 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.

TABLE VIII: GENERAL VALUES FOR A_1 AND A_2

Contents	A_1 (TBq)	A_1 (Ci)	A_2 (TBq)	A_2 (Ci)	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limits for exempt consignments (Bq)	Activity limits for exempt consignments (Ci)
Only beta or gamma emitting radionuclides are known to be present	1×10^{-1}	2.7×10^{0}	2×10^{-2}	5.4×10^{-1}	1×10^{1}	2.7×10^{-10}	1×10^{4}	2.7×10^{-7}
Only alpha emitting radionuclides are known to be present	2×10^{-1}	5.4×10^{0}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}
No relevant data are available	1×10^{-3}	2.7×10^{-2}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^{3}	2.7×10^{-8}

TABLE IX: ACTIVITY-MASS RELATIONSHIPS FOR URANIUM

Uranium Enrichment* wt % U-235 present	Specific Activity	
	TBq/g	Ci/g
0.45	1.8×10^{-8}	5.0×10^{-7}
0.72	2.6×10^{-8}	7.1×10^{-7}
1	2.8×10^{-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	2.2×10^{-6}	2.8×10^{-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 147. HFS 157 Appendix P, radioactive material Geranium in listed in the column titled Radioactive Material is amended to read:

~~Geranium~~Geranium-68

SECTION 148. HFS 157 Appendix R section C. par. 9 is amended to read:

C. **Severity Level 3 – Significant Violations.** 9. Cumulative worker exposure in excess of the regulatory limits in this chapter when such exposure reflects a programmatic rather than an isolated weakness in radiation protection.

SECTION 149. EFFECTIVE DATE: The rules contained in this order shall take effect on the first day of the month following publication in the Wisconsin administrative register, as provided in s. 227.22 (2), Stats.

Wisconsin Department of Health
and Family Services

Dated:

By: _____
Helene Nelson,
Secretary

SEAL: