

PART 30--RULES OF GENERAL APPLICABILITY TO DOMESTIC LICENSING OF BYPRODUCT MATERIAL

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Authority: Secs. 81, 82, 161, 182, 183, 186, 68 Stat. 935, 948, 953, 954, 955, as amended, sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2111, 2112, 2201, 2232, 2233, 2236, 2282); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846); sec. 1704, 112 Stat. 2750 (44 U.S.C. 3504 note); Energy Policy Act of 2005, Pub. L. No. 109–58, 119 Stat. 549 (2005). Section 30.7 also issued under Pub. L. 95–601, sec. 10, 92 Stat. 2951 as amended by Pub. L. 102–486, sec. 2902, 106 Stat. 3123, (42 U.S.C. 5851). Section 30.34(b) also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Section 30.61 also issued under sec. 187, 68 Stat. 955 (42 U.S.C. 2237).

[72 FR 55924, Oct. 1, 2007; 72 FR 58486, Oct. 16, 2007; 73 FR 63570, Oct. 24, 2008]

General Provisions

§ 30.1 Scope.

This part prescribes rules applicable to all persons in the United States governing domestic licensing of byproduct material under the Atomic Energy Act of 1954, as amended (68 Stat. 919), and under title II of the Energy Reorganization Act of 1974 (88 Stat. 1242), and exemptions from the domestic licensing requirements permitted by Section 81 of the Act. This part also gives notice to all persons who knowingly provide to any licensee, applicant, certificate of registration holder, contractor, or subcontractor, components, equipment, materials, or other goods or services, that relate to a licensee's, applicant's or certificate of registration holder's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of § 30.10.

[63 FR 1895, Jan. 13, 1998]

§ 30.2 Resolution of conflict.

The requirements of this part are in addition to, and not in substitution for, other requirements of this chapter. In any conflict between the requirements in this part and a specific requirement in another part of the regulations in this chapter, the specific requirement governs.

[30 FR 8185, June 26, 1965]

§ 30.3 Activities requiring license.

(a) Except as provided in paragraphs (b)(2), (b)(3), (c)(2), and (c)(3) of this section and for persons exempt as provided in this part and part 150 of this chapter, no person shall manufacture, produce, transfer, receive, acquire, own, possess, or use byproduct material except as authorized in a specific or general license issued in accordance with the regulations in this chapter.

(b)(1) The requirements, including provisions that are specific to licensees, in this part and parts 19, 20, 21, and 71 of this chapter, as well as the additional requirements for specific broad scope, industrial radiography, irradiator, or well logging uses in 10 CFR parts 33, 34, 36, or 39, respectively, shall apply to Government agencies or Federally recognized Indian Tribes on November 30, 2007, when conducting activities under the authority provided by paragraphs (b)(2) and (b)(3) of this section.

(2) A specifically licensed Government agency or Federally recognized Indian Tribe that possesses and uses accelerator-produced radioactive material or discrete sources of radium-226 for which a license amendment is required to authorize the activities in paragraph (a) of this section, may continue to use these materials for uses permitted under this part until the date of the NRC's final licensing determination, provided that the licensee submits an amendment application on or before June 2, 2008.

(3) A Government agency or Federally recognized Indian Tribe that possesses and uses accelerator-produced radioactive material or discrete sources of radium-226 for which a specific license is required in paragraph (a) of this section, may continue to use such material for uses permitted under this part until the date of the NRC's final licensing determination provided that the agency or Indian Tribe submits an application for a license authorizing activities involving these materials on or before December 1, 2008.

(c)(1) The requirements, including provisions that are specific to licensees in this part and parts 19, 20, 21, and 71 of this chapter, as well as the additional requirements for specific broad scope, industrial radiography, irradiator, or well logging uses in 10 CFR parts 33, 34, 36, or 39, respectively, shall apply to all persons, other than those included in paragraph (b)(1) of this section, on August 8, 2009, or earlier as noticed by the NRC, when conducting activities under the authority provided by paragraphs (c)(2) and (c)(3) of this section.

(2) Except as provided in paragraph (b)(2) of this section, all other licensees, who possess and use accelerator-produced radioactive material or discrete sources of radium-226 for which a license amendment is required to authorize the activities in paragraph (a) of this section, may continue to use these materials for uses permitted under this part until the date of the NRC's final licensing determination, provided that the person submits an amendment application within 6 months from the waiver expiration date of August 7, 2009 or within 6 months from the date of an earlier termination of the waiver as noticed by the NRC, whichever date is earlier.

(3) Except as provided in paragraph (b)(3) of this section, all other persons, who possess and use accelerator-produced radioactive material or discrete sources of radium-226 for which a specific license is required in paragraph (a) of this section, may continue to use such material for uses permitted under this part until the date of the NRC's final licensing determination, provided that the person submits a license application within 12 months from the waiver expiration date of August 7, 2009 or within 12 months from the date of an earlier termination of the waiver as noticed by the NRC, whichever date is earlier.

(d) If a person or licensee is required to file an application for a license or amendment in accordance with paragraphs (b)(2), (b)(3), (c)(2), and (c)(3) of this section, but does not file for the license or amendment within the required time, the authority provided by paragraphs (b)(2), (b)(3), (c)(2), and (c)(3) of this section to receive or use the accelerator-produced radioactive material or discrete sources of radium-226 shall expire with respect to the person's or licensee's authority to receive and use such byproduct material. This authority shall not expire with respect to the responsibility of the person or licensee regarding the

possession of such byproduct material, the decommissioning (including financial assurance) of facilities, or the disposal of such byproduct material.

[30 FR 8185, June 26, 1965, as amended at 43 FR 6921, Feb. 17, 1978; 72 FR 55924, Oct. 1, 2007]

§ 30.4 Definitions.

Accelerator-produced radioactive material means any material made radioactive by a particle accelerator.

Act means the Atomic Energy Act of 1954 (68 Stat. 919), including any amendments thereto;

Agreement State means any state with which the Atomic Energy Commission or the Nuclear Regulatory Commission has entered into an effective agreement under subsection 274b. of the Act. *Non-agreement State* means any other State;

Alert means events may occur, are in progress, or have occurred that could lead to a release of radioactive material but that the release is not expected to require a response by offsite response organizations to protect persons offsite.

Byproduct material means— (1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material;

(2)(i) Any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; or

(ii) Any material that—

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

(B) Is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; and

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

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

(ii) Before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

Commencement of construction means any clearing of land, excavation, or other substantial action that would adversely affect the natural environment of a site but does not include changes desirable for the temporary use of the land for public recreational uses, necessary borings to determine site characteristics or other preconstruction monitoring to establish background information related to the suitability of a site or to the protection of environmental values.

Commission means the Nuclear Regulatory Commission and its duly authorized representatives;

Consortium means an association of medical use licensees and a PET radionuclide production facility in the same geographical area that jointly own or share in the operation and maintenance cost of the PET radionuclide production facility that produces PET radionuclides for use in producing radioactive drugs within the consortium for noncommercial distributions among its associated members for medical use. The PET radionuclide production facility within the consortium must be located at an educational institution or a Federal facility or a medical facility.

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Curie means that amount of radioactive material which disintegrates at the rate of 37 billion atoms per second;

Cyclotron means a particle accelerator in which the charged particles travel in an outward spiral or circular path. A cyclotron accelerates charged particles at energies usually in excess of 10 megaelectron volts and is commonly used for production of short half-life radionuclides for medical use.

Decommission means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits--

- (1) Release of the property for unrestricted use and termination of the license; or
- (2) Release of the property under restricted conditions and termination of the license.

Dentist means an individual licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to practice dentistry.

Department and Department of Energy means the Department of Energy established by the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565, 42 U.S.C. 7101 et seq.) to the extent that the Department, or its duly authorized representatives, exercises functions formerly vested in the U.S. Atomic Energy Commission, its Chairman, members, officers and components and transferred to the U.S. Energy Research and Development Administration and to the Administrator thereof pursuant to sections 104 (b), (c) and (d) of the Energy Reorganization Act of 1974 (Pub. L. 93-438, 88 Stat. 1233 at 1237, 42 U.S.C. 5814) and retransferred to the Secretary of Energy pursuant to section 301(a) of the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565 at 577-578, 42 U.S.C. 7151).

Discrete source means a radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.

Effective dose equivalent means the sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated. Weighting factors are: 0.25 for gonads, 0.15 for breast, 0.12 for red bone marrow, 0.12 for lungs, 0.03 for thyroid, 0.03 for bone surface, and 0.06 for each of the other five organs receiving the highest dose equivalent.

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

License, except where otherwise specified means a license for by-product material issued pursuant to the regulations in this part and parts 31 through 36 and 39 of this chapter;

Medical use means the intentional internal or external administration of byproduct material or the radiation therefrom to patients or human research subjects under the supervision of an authorized user as defined in 10 CFR Part 35.

Microcurie means that amount of radioactive material which disintegrates at the rate of 37 thousand atoms per second;

Millicurie means that amount of radioactive material which disintegrates at the rate of 37 million atoms per second;

Particle accelerator means any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and of discharging the resultant particulate or other radiation into a medium at energies usually in excess of 1 megaelectron volt. For purposes of this definition, accelerator is an equivalent term.

Person means: (1) Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Department, except that the Department shall be considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing;

Physician means a medical doctor or doctor of osteopathy licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to prescribe drugs in the practice of medicine;

Podiatrist means an individual licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to practice podiatry.

Principal activities, as used in this part, means activities authorized by the license which are essential to achieving the purpose(s) for which the license was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

Production facility means production facility as defined in the regulations contained in part 50 of this chapter;

Quantities of Concern means the quantities of the radionuclides meeting or exceeding the threshold limits set forth in Table I-1 of Appendix I of part 73 of this chapter.

Research and development means: (1) Theoretical analysis, exploration, or experimentation; or (2) the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials and processes. "Research and development" as used in this part and parts 31 through 35 does not include the internal or external administration of byproduct material, or the radiation therefrom, to human beings;

Sealed source means any by product material that is encased in a capsule designed to prevent leakage or escape of the byproduct material;

Site area emergency means events may occur, are in progress, or have occurred that could lead to a significant release of radioactive material and that could require a response by offsite response organizations to protect persons offsite.

Source material means source material as defined in the regulations contained in part 40 of this chapter;

Special nuclear material means special nuclear material as defined in the regulations contained in part 70 of this chapter;

United States, when used in a geographical sense, includes Puerto Rico and all territories and possessions of the United States;

Utilization facility means a utilization facility as defined in the regulations contained in part 50 of this chapter;

[30 FR 8185, June 26, 1965, as amended at 36 FR 1466, Jan. 30, 1971; 37 FR 5746, Mar. 21, 1972; 38 FR 29314, Oct. 24, 1973; 40 FR 8784, Mar. 3, 1975; 43 FR 6921, Feb. 17, 1978; 45 FR 14200, Mar. 5, 1980; 45 FR 18905, Mar. 24, 1980; 48 FR 39037, Aug. 29, 1983; 51 FR 36967, Oct. 16, 1986; 52 FR 8241, Mar. 17, 1987; 53 FR 24044, June 27, 1988; 54 FR 14059, Apr. 7, 1989; 58 FR 7736, Feb. 9, 1993; 59 FR 36034, July 15, 1994; 59 FR 61780, Dec. 2, 1994; 62 FR 28963, May 28, 1997; 62 FR 39089, July 21, 1997; 65 FR 54950, Sept. 12, 2000; 72 FR 55924, Oct. 1, 2007; 73 FR 63570, Oct. 24, 2008]

§ 30.5 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part and parts 31 through 36 and 39 by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

[30 FR 8185, June 26, 1965, as amended at 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993]

§ 30.6 Communications.

(a) Unless otherwise specified or covered under the regional licensing program as provided in paragraph (b) of this section, any communication or report concerning the regulations in parts 30 through 36 and 39 of this chapter and any application filed under these regulations may be submitted to the Commission as follows:

(1) By mail addressed: ATTN: Document Control Desk, Director, Office of Federal and State Materials and Environmental Management Programs, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001.

(2) By hand delivery to the NRC's offices at 11555 Rockville Pike, Rockville, Maryland.

(3) Where practicable, by electronic submission, for example, via Electronic Information Exchange, or CD-ROM. Electronic submissions must be made in a manner that enables the NRC to receive, read, authenticate, distribute, and archive the submission, and process and retrieve it a single page at a time. Detailed guidance on making electronic submissions can be obtained by visiting the NRC's Web site at <http://www.nrc.gov/site-help/e-submittals.html>, by calling (301) 415-0439, by e-mail to EIE@nrc.gov, or by writing the Office of Information Services, U.S. Nuclear Regulatory Commission, Washington, DC

20555-0001. The guidance discusses, among other topics, the formats the NRC can accept, the use of electronic signatures, and the treatment of nonpublic information.

(b) The Commission has delegated to the four Regional Administrators licensing authority for selected parts of its decentralized licensing program for nuclear materials as described in paragraph (b)(1) of this section. Any communication, report, or application covered under this licensing program must be submitted to the appropriate Regional Administrator. The Administrators' jurisdictions and mailing addresses are listed in paragraph (b)(2) of this section.

(1) The delegated licensing program includes authority to issue, renew, amend, cancel, modify, suspend, or revoke licenses for nuclear materials issued pursuant to 10 CFR parts 30 through 36, 39, 40, and 70 to all persons for academic, medical, and industrial uses, with the following exceptions:

(i) Activities in the fuel cycle and special nuclear material in quantities sufficient to constitute a critical mass in any room or area. This exception does not apply to license modifications relating to termination of special nuclear material licenses that authorize possession of larger quantities when the case is referred for action from NRC's Headquarters to the Regional Administrators.

(ii) Health and safety design review of sealed sources and devices and approval, for licensing purposes, of sealed sources and devices.

(iii) Processing of source material for extracting of metallic compounds (including Zirconium, Hafnium, Tantalum, Titanium, Niobium, etc.).

(iv) Distribution of products containing radioactive material to persons exempt pursuant 10 CFR 32.11 through 32.26.

(v) New uses or techniques for use of byproducts, source, or special nuclear material.

(2) *Submissions--(i) Region I.* The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region I non-Agreement States and the District of Columbia: Connecticut, Delaware, Maine, Massachusetts, New Jersey, Pennsylvania, and Vermont. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment, renewal, or termination request of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region I, Nuclear Material Section B, 475 Allendale Road, King of Prussia, Pennsylvania 19406-1415; where e-mail is appropriate it should be addressed to RidsRgn1MailCenter@nrc.gov.

(ii) *Region II.* The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region II non-Agreement States and territories: Virginia, West Virginia, Puerto Rico, and the Virgin Islands. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment, renewal, or termination request of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region II, Material Licensing/Inspection Branch, Sam Nunn Atlanta Federal Center, Suite 23T85, 61 Forsyth Street, SW, Atlanta, GA 30303-8931; where e-mail is appropriate it should be addressed to RidsRgn2MailCenter@nrc.gov.

(iii) *Region III.* The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region III non-Agreement States: Indiana, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment, renewal, or termination, request of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region III, Material

Licensing Section, 2443 Warrenville Road, Suite 210, Lisle, IL 60532- 4352; where e-mail is appropriate it should be addressed to *RidsRgn3MailCenter@nrc.gov*.

(iv) *Region IV*. The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region IV non-Agreement States and a territory: Alaska, Hawaii, Montana, Oklahoma, South Dakota, Wyoming, and Guam. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment, renewal, or termination request of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region IV, Material Radiation Protection Section, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011-4005; where e-mail is appropriate it should be addressed to *RidsRgn4MailCenter@nrc.gov*.

[48 FR 16031, Apr. 14, 1983, as amended at 49 FR 19630, May 9, 1984; 49 FR 47824, Dec. 7, 1984; 50 FR 14693, Apr. 11, 1985; 51 FR 36000, Oct. 8, 1986; 52 FR 8241, Mar. 17, 1987; 52 FR 38392, Oct. 16, 1987; 52 FR 48093, Dec. 18, 1987; 53 FR 3862, Feb. 10, 1988; 53 FR 43420, Oct. 27, 1988; 58 FR 7736, Feb. 9, 1993; 58 FR 64111, Dec. 6, 1993; 59 FR 17465, Apr. 13, 1994; 60 FR 24551, May 9, 1995; 62 FR 22880, Apr. 28, 1997; 68 FR 58803, Oct. 10, 2003; 70 FR 69421, Nov. 16, 2005; 71 FR 15007, Mar. 27, 2006; 72 FR 33386, Jun. 18, 2007; 73 FR 5717, Jan. 31, 2008]

§ 30.7 Employee protection.

(a) Discrimination by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant against an employee for engaging in certain protected activities is prohibited. Discrimination includes discharge and other actions that relate to compensation, terms, conditions, or privileges of employment. The protected activities are established in section 211 of the Energy Reorganization Act of 1974, as amended, and in general are related to the administration or enforcement of a requirement imposed under the Atomic Energy Act or the Energy Reorganization Act.

(1) The protected activities include but are not limited to:

(i) Providing the Commission or his or her employer information about alleged violations of either of the statutes named in paragraph (a) introductory text of this section or possible violations of requirements imposed under either of those statutes;

(ii) Refusing to engage in any practice made unlawful under either of the statutes named in paragraph (a) introductory text or under these requirements if the employee has identified the alleged illegality to the employer;

(iii) Requesting the Commission to institute action against his or her employer for the administration or enforcement of these requirements;

(iv) Testifying in any Commission proceeding, or before Congress, or at any Federal or State proceeding regarding any provision (or proposed provision) of either of the statutes named in paragraph (a) introductory text.

(v) Assisting or participating in, or is about to assist or participate in, these activities.

(2) These activities are protected even if no formal proceeding is actually initiated as a result of the employee assistance or participation.

(3) This section has no application to any employee alleging discrimination prohibited by this section who, acting without direction from his or her employer (or the employer's agent), deliberately causes a violation

of any requirement of the Energy Reorganization Act of 1974, as amended, or the Atomic Energy Act of 1954, as amended.

(b) Any employee who believes that he or she has been discharged or otherwise discriminated against by any person for engaging in protected activities specified in paragraph (a)(1) of this section may seek a remedy for the discharge or discrimination through an administrative proceeding in the Department of Labor. The administrative proceeding must be initiated within 180 days after an alleged violation occurs. The employee may do this by filing a complaint alleging the violation with the Department of Labor, Employment Standards Administration, Wage and Hour Division. The Department of Labor may order reinstatement, back pay, and compensatory damages.

(c) A violation of paragraphs (a), (e), or (f) of this section by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant may be grounds for--

(1) Denial, revocation, or suspension of the license.

(2) Imposition of a civil penalty on the licensee, applicant, or a contractor or subcontractor of the licensee or applicant.

(3) Other enforcement action.

(d) Actions taken by an employer, or others, which adversely affect an employee may be predicated upon nondiscriminatory grounds. The prohibition applies when the adverse action occurs because the employee has engaged in protected activities. An employee's engagement in protected activities does not automatically render him or her immune from discharge or discipline for legitimate reasons or from adverse action dictated by nonprohibited considerations.

(e)(1) Each specific licensee, each applicant for a specific license, and each general licensee subject to part 19 shall prominently post the revision of NRC Form 3, "Notice to Employees," referenced in 10 CFR 19.11(c).

(2) The posting of NRC Form 3 must be at locations sufficient to permit employees protected by this section to observe a copy on the way to or from their place of work. Premises must be posted not later than 30 days after an application is docketed and remain posted while the application is pending before the Commission, during the term of the license, and for 30 days following license termination.

(3) Copies of NRC Form 3 may be obtained by writing to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D to part 20 of this chapter, by calling (301) 415-5877, via e-mail to forms@nrc.gov, or by visiting the NRC's Web site at <http://www.nrc.gov> and selecting forms from the index found on the home page.

(f) No agreement affecting the compensation, terms, conditions, or privileges of employment, including an agreement to settle a complaint filed by an employee with the Department of Labor pursuant to section 211 of the Energy Reorganization Act of 1974, as amended, may contain any provision which would prohibit, restrict, or otherwise discourage an employee from participating in protected activity as defined in paragraph (a)(1) of this section including, but not limited to, providing information to the NRC or to his or her employer on potential violations or other matters within NRC's regulatory responsibilities.

[58 FR 52408, Oct. 8, 1993, as amended at 60 FR 24551, May 9, 1995; 61 FR 6764, Feb. 22, 1996; 68 FR 58803, Oct. 10, 2003; 72 FR 63969, Nov. 14, 2007]

§ 30.8 Information collection requirements: OMB approval.

(a) The Nuclear Regulatory Commission has submitted the information collection requirements contained in this part to the Office of Management and Budget (OMB) for approval as required by the Paperwork Reduction Act (44 U.S.C. 3501 et seq.). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB has approved the information collection requirements contained in this part under control number 3150-0017.

(b) The approved information collection requirements contained in this part appear in §§ 30.9, 30.11, 30.15, 30.19, 30.20, 30.32, 30.34, 30.35, 30.36, 30.37, 30.38, 30.41, 30.50, 30.51, 30.55, and appendices A, C, D, and E to this part.

(c) This part contains information collection requirements in addition to those approved under the control number specified in paragraph (a) of this section. These information collection requirements and the control numbers under which they are approved are as follows:

(1) In §§ 30.32, 30.37, and 30.38, NRC Form 313 is approved under control number 3150-0120.

(2) In § 30.36, NRC Form 314 is approved under control number 3150-0028.

(3) In § 30.34, DOC/NRC Forms AP-1, AP-A, and associated forms are approved under control number 0694-0135.

[49 FR 19625, May 9, 1984, as amended at 59 FR 61780, Dec. 2, 1994; 62 FR 52186, Oct. 6, 1997; 62 FR 63639, Dec. 2, 1997; 63 FR 29541, June 1, 1998; 67 FR 67099, Nov. 4, 2002; 73 FR 78604, Dec. 23, 2008]

§ 30.9 Completeness and accuracy of information.

(a) Information provided to the Commission by an applicant for a license or by a licensee or information required by statute or by the Commission's regulations, orders, or license conditions to be maintained by the applicant or the licensee shall be complete and accurate in all material respects.

(b) Each applicant or licensee shall notify the Commission of information identified by the applicant or licensee as having for the regulated activity a significant implication for public health and safety or common defense and security. An applicant or licensee violates this paragraph only if the applicant or licensee fails to notify the Commission of information that the applicant or licensee has identified as having a significant implication for public health and safety or common defense and security. Notification shall be provided to the Administrator of the appropriate Regional Office within two working days of identifying the information. This requirement is not applicable to information which is already required to be provided to the Commission by other reporting or updating requirements.

[52 FR 49371, Dec. 31, 1987]

§ 30.10 Deliberate misconduct.

(a) Any licensee, certificate of registration holder, applicant for a license or certificate of registration, employee of a licensee, certificate of registration holder or applicant; or any contractor (including a supplier or consultant), subcontractor, employee of a contractor or subcontractor of any licensee or certificate of registration holder or applicant for a license or certificate of registration, who knowingly provides to any licensee, applicant, certificate holder, contractor, or subcontractor, any components,

equipment, materials, or other goods or services that relate to a licensee's, certificate holder's or applicant's activities in this part, may not:

(1) Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee, certificate of registration holder, or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license issued by the Commission; or

(2) Deliberately submit to the NRC, a licensee, certificate of registration holder, an applicant, or a licensee's, certificate holder's or applicant's, contractor or subcontractor, information that the person submitting the information knows to be incomplete or inaccurate in some respect material to the NRC.

(b) A person who violates paragraph (a)(1) or (a)(2) of this section may be subject to enforcement action in accordance with the procedures in 10 CFR part 2, subpart B.

(c) For the purposes of paragraph (a)(1) of this section, deliberate misconduct by a person means an intentional act or omission that the person knows:

(1) Would cause a licensee, certificate of registration holder or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation, of any license issued by the Commission; or

(2) Constitutes a violation of a requirement, procedure, instruction, contract, purchase order, or policy of a licensee, certificate of registration holder, applicant, contractor, or subcontractor.

[63 FR 1896, Jan. 13, 1998]

Exemptions

§ 30.11 Specific exemptions.

(a) The Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part and parts 31 through 36 and 39 of this chapter as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

(b) Any licensee's activities are exempt from the requirements of this part to the extent that its activities are licensed under the requirements of part 72 of this chapter.

(c) The Department of Energy is exempt from the requirements of this part to the extent that its activities are subject to the requirements of part 60 or 63 of this chapter.

(d) Except as specifically provided in part 61 of this chapter, any licensee is exempt from the requirements of this part to the extent that its activities are subject to the requirements of part 61 of this chapter.

[37 FR 5746, Mar. 21, 1972, as amended at 39 FR 26279, July 18, 1974; 40 FR 8784, Mar. 3, 1975; 43 FR 6921, Feb. 21, 1978; 45 FR 65530, Oct. 3, 1980; 46 FR 13979, Feb. 25, 1981; 47 FR 57480, Dec. 27, 1982; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 66 FR 51838, Oct. 11, 2001; 66 FR 55790, Nov. 2, 2001]

§ 30.12 Persons using byproduct material under certain Department of Energy and Nuclear Regulatory Commission contracts.

Except to the extent that Department facilities or activities of the types subject to licensing pursuant to section 202 of the Energy Reorganization Act of 1974 are involved, any prime contractor of the Department is exempt from the requirements for a license set forth in sections 81 and 82 of the Act and from the regulations in this part to the extent that such contractor, under his prime contract with the Department manufactures, produces, transfers, receives, acquires, owns, possesses, or uses byproduct material for:

- (a) The performance of work for the Department at a United States Government-owned or controlled site, including the transportation of byproduct material to or from such site and the performance of contract services during temporary interruptions of such transportation;
- (b) Research in, or development, manufacture, storage, testing or transportation of, atomic weapons or components thereof; or
- (c) The use or operation of nuclear reactors or other nuclear devices in a United States Government-owned vehicle or vessel.

In addition to the foregoing exemptions and subject to the requirement for licensing of Department facilities and activities pursuant to section 202 of the Energy Reorganization Act of 1974, any prime contractor or subcontractor of the Department or the Commission is exempt from the requirements for a license set forth in sections 81 and 82 of the Act and from the regulations in this part to the extent that such prime contractor or subcontractor manufactures, produces, transfers, receives, acquires, owns, possesses, or uses byproduct material under his prime contract or subcontract when the Commission determines that the exemption of the prime contractor or subcontractor is authorized by law; and that, under the terms of the contract or subcontract, there is adequate assurance that the work thereunder can be accomplished without undue risk to the public health and safety.

[40 FR 8784, Mar. 3, 1975, as amended at 43 FR 6921, Feb. 17, 1978]

§ 30.13 Carriers.

Common and contract carriers, freight forwarders, warehousemen, and the U.S. Postal Service are exempt from the regulations in this part and parts 31 through 36 and 39 of this chapter and the requirements for a license set forth in section 81 of the Act to the extent that they transport or store byproduct material in the regular course of carriage for another or storage incident thereto.

[37 FR 3985, Feb. 25, 1972, as amended at 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993]

§ 30.14 Exempt concentrations.

(a) Except as provided in paragraphs (c) and (d) of this section, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in this part and parts 31 through 36 and 39 of this chapter to the extent that such person receives, possesses, uses, transfers, owns or acquires products or materials containing byproduct material in concentrations not in excess of those listed in § 30.70.

(b) This section shall not be deemed to authorize the import of byproduct material or products containing byproduct material.

(c) A manufacturer, processor, or producer of a product or material is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in this part and parts 31 through 36 and

39 of this chapter to the extent that this person transfers byproduct material contained in a product or material in concentrations not in excess of those specified in § 30.70 and introduced into the product or material by a licensee holding a specific license issued by the Commission expressly authorizing such introduction. This exemption does not apply to the transfer of byproduct material contained in any food, beverage, cosmetic, drug, or other commodity or product designed for ingestion or inhalation by, or application to, a human being.

(d) No person may introduce byproduct material into a product or material knowing or having reason to believe that it will be transferred to persons exempt under this section or equivalent regulations of an Agreement State, except in accordance with a license issued under § 32.11 of this chapter.

[30 FR 8185, June 26, 1965, as amended at 40 FR 8785, Mar. 3, 1975; 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 72 FR 58486, Oct. 16, 2007]

§ 30.15 Certain items containing byproduct material.

(a) Except for persons who apply byproduct material to, or persons who incorporate byproduct material into, the following products, or persons who initially transfer for sale or distribution the following products containing byproduct material, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 20 and 30 through 36 and 39 of this chapter to the extent that such person receives, possesses, uses, transfers, owns, or acquires the following products:

(1) Timepieces or hands or dials containing not more than the following specified quantities of byproduct material and not exceeding the following specified levels of radiation:

(i) 25 millicuries of tritium per timepiece,

(ii) 5 millicuries of tritium per hand,

(iii) 15 millicuries of tritium per dial (bezels when used shall be considered as part of the dial),

(iv) 100 microcuries of promethium 147 per watch or 200 microcuries of promethium 147 per any other timepiece,

(v) 20 microcuries of promethium 147 per watch hand or 40 microcuries of promethium 147 per other timepiece hand,

(vi) 60 microcuries of promethium 147 per watch dial or 120 microcuries of promethium 147 per other timepiece dial (bezels when used shall be considered as part of the dial),

(vii) The levels of radiation from hands and dials containing promethium 147 will not exceed, when measured through 50 milligrams per square centimeter of absorber:

(A) For wrist watches, 0.1 millirad per hour at 10 centimeters from any surface,

(B) For pocket watches, 0.1 millirad per hour at 1 centimeter from any surface,

(C) For any other timepiece, 0.2 millirad per hour at 10 centimeters from any surface.

(viii) 0.037 megabecquerel (1 microcurie) of radium-226 per timepiece in intact timepieces manufactured prior to November 30, 2007.

(2) [Reserved]

(3) Balances of precision containing not more than 1 millicurie of tritium per balance or not more than 0.5 millicurie of tritium per balance part manufactured before December 17, 2007.

(4) [Reserved]

(5) Marine compasses containing not more than 750 millicuries of tritium gas and other marine navigational instruments containing not more than 250 millicuries of tritium gas manufactured before December 17, 2007.

(6) [Reserved]

(7) Ionization chamber smoke detectors containing not more than 1 microcurie (μCi) of americium-241 per detector in the form of a foil and designed to protect life and property from fires.

(8) Electron tubes: *Provided*, That each tube does not contain more than one of the following specified quantities of byproduct material:

(i) 150 millicuries of tritium per microwave receiver protector tube or 10 millicuries of tritium per any other electron tube;

(ii) 1 microcurie of cobalt-60;

(iii) 5 microcuries of nickel-63;

(iv) 30 microcuries of krypton-85;

(v) 5 microcuries of cesium-137;

(vi) 30 microcuries of promethium-147;

And provided further, That the levels of radiation from each electron tube containing byproduct material do not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber.¹

(9) Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of byproduct material: *Provided*, That;

(i) Each source contains no more than one exempt quantity set forth in § 30.71, Schedule B, and

(ii) Each instrument contains no more than 10 exempt quantities. For purposes of this paragraph (a)(9), an instrument's source(s) may contain either one type or different types of radionuclides and an individual exempt quantity may be composed of fractional parts of one or more of the exempt quantities in § 30.71, Schedule B, provided that the sum of such fractions shall not exceed unity.

(iii) For purposes of this paragraph (a)(9), 0.05 microcurie of americium-241 is considered an exempt quantity under § 30.71, Schedule B.

(10) [Reserved]

(b) Any person who desires to apply byproduct material to, or to incorporate byproduct material into, the products exempted in paragraph (a) of this section, or who desires to initially transfer for sale or distribution such products containing byproduct material, should apply for a specific license pursuant to § 32.14 of this chapter, which license states that the product may be distributed by the licensee to persons exempt from the regulations pursuant to paragraph (a) of this section.

[31 FR 5316, Apr. 2, 1966, as amended at 31 FR 14349, Nov. 8, 1966; 32 FR 785, Jan. 24, 1967; 32 FR 6434, Apr. 26, 1967; 32 FR 13921, Oct. 6, 1967; 34 FR 6651, Apr. 18, 1969; 34 FR 19546, Dec. 11, 1969; 35 FR 6427, Apr. 22, 1970; 35 FR 8820, June 6, 1970; 43 FR 2387, Jan. 17, 1978; 43 FR 6921, Feb. 17, 1978; 46 FR 26471, May 13, 1981; 46 FR 46876, Sept. 23, 1981; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 72 FR 55925, Oct. 1, 2007; 72 FR 58486, Oct. 16, 2007]

¹ For purposes of this paragraph "electron tubes" include spark gap tubes, power tubes, gas tubes including glow lamps, receiving tubes, microwave tubes, indicator tubes, pickup tubes, radiation detection tubes, and any other completely sealed tube that is designed to conduct or control electrical currents.

§ 30.16 [Removed].

[32 FR 4241, Mar. 18, 1967, as amended at 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 72 FR 58486, Oct. 16, 2007]

§ 30.18 Exempt quantities.

(a) Except as provided in paragraphs (c) through (e) of this section, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 30 through 34, 36, and 39 of this chapter to the extent that such person receives, possesses, uses, transfers, owns, or acquires byproduct material in individual quantities, each of which does not exceed the applicable quantity set forth in § 30.71, Schedule B.

(b) Any person, who possesses byproduct material received or acquired before September 25, 1971, under the general license then provided in § 31.4 of this chapter or similar general license of a State, is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 30 through 34, 36 and 39 of this chapter to the extent that this person possesses, uses, transfers, or owns byproduct material.

(c) This section does not authorize for purposes of commercial distribution the production, packaging, repackaging, or transfer of byproduct material or the incorporation of byproduct material into products intended for commercial distribution.

(d) No person may, for purposes of commercial distribution, transfer byproduct material in the individual quantities set forth in § 30.71 Schedule B, knowing or having reason to believe that such quantities of byproduct material will be transferred to persons exempt under this section or equivalent regulations of an Agreement State, except in accordance with a license issued under § 32.18 of this chapter, which license states that the byproduct material may be transferred by the licensee to persons exempt under this section or the equivalent regulations of an Agreement State.

(e) No person may, for purposes of producing an increased radiation level, combine quantities of byproduct material covered by this exemption so that the aggregate quantity exceeds the limits set forth in § 30.71, Schedule B, except for byproduct material combined within a device placed in use before May 3, 1999, or as otherwise permitted by the regulations in this part.

[35 FR 6427, Apr. 22, 1970, as amended at 36 FR 16898, Aug. 26, 1971; 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 72 FR 55925, Oct. 1, 2007; 72 FR 58486, Oct. 16, 2007]

§ 30.19 Self-luminous products containing tritium, krypton-85, or promethium-147.

(a) 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 paragraph (c) of this section, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 20 and 30 through 36 and 39 of this chapter 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 in accordance with a specific license issued pursuant to § 32.22 of this chapter, which license authorizes the initial transfer of the product for use under this section.

(b) 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 pursuant to paragraph (a) of this section, should apply for a license pursuant to § 32.22 of this chapter, which license states that the product may be transferred by the licensee to persons exempt from the regulations pursuant to paragraph (a) of this section or equivalent regulations of an Agreement State.

(c) The exemption in paragraph (a) of this section does not apply to tritium, krypton-85, or promethium-147 used in products primarily for frivolous purposes or in toys or adornments.

[34 FR 9026, June 6, 1969, as amended at 40 FR 8785, Mar. 3, 1975; 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993]

§ 30.20 Gas and aerosol detectors containing byproduct material.



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(a) Except for persons who manufacture, process, produce, or initially transfer for sale or distribution gas and aerosol detectors containing byproduct material, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 19, 20, and 30 through 36, and 39 of this chapter to the extent that the person receives, possesses, uses, transfers, owns, or acquires byproduct material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards, and manufactured, processed, produced, or initially transferred in accordance with a specific license issued under § 32.26 of this chapter, which license authorizes the initial transfer of the product for use under this section. This exemption also covers gas and aerosol detectors manufactured or distributed before November 30, 2007 in accordance with a specific license issued by a State under comparable provisions to § 32.26 of this chapter authorizing distribution to persons exempt from regulatory requirements.

(b) Any person who desires to manufacture, process, or produce gas and aerosol detectors containing byproduct material, or to initially transfer such products for use pursuant to paragraph (a) of this section, should apply for a license pursuant to § 32.26 of this chapter, which license states that the product may be initially transferred by the licensee to persons exempt from the regulations pursuant to paragraph (a) of this section or equivalent regulations of an Agreement State.

[34 FR 6653, Apr. 18, 1969, as amended at 40 FR 8785, Mar. 3, 1975; 43 FR 6921, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 72 FR 55925, Oct. 1, 2007]

§ 30.21 Radioactive drug: Capsules containing carbon-14 urea for "in vivo" diagnostic use for humans.

(a) Except as provided in paragraphs (b) and (c) of this section, any person is exempt from the requirements for a license set forth in Section 81 of the Act and from the regulations in this part and part 35 of this chapter provided that such person receives, possesses, uses, transfers, owns, or acquires capsules containing 37 kBq (1 μ Ci) carbon-14 urea (allowing for nominal variation that may occur during the manufacturing process) each, for "in vivo" diagnostic use for humans.

(b) Any person who desires to use the capsules for research involving human subjects shall apply for and receive a specific license pursuant to part 35 of this chapter.

(c) Any person who desires to manufacture, prepare, process, produce, package, repack, or transfer for commercial distribution such capsules shall apply for and receive a specific license pursuant to § 32.21 of this chapter.

(d) Nothing in this section relieves persons from complying with applicable FDA, other Federal, and State requirements governing receipt, administration, and use of drugs.

[62 FR 63640, Dec. 2, 1997]

Licenses

§ 30.31 Types of licenses.

Licenses for byproduct material are of two types: General and specific.

(a) The Commission issues a specific license to a named person who has filed an application for the license under the provisions of this part and parts 32 through 36, and 39.

(b) A general license is provided by regulation, grants authority to a person for certain activities involving byproduct material, and is effective without the filing of an application with the Commission or the issuance of a licensing document to a particular person. However, registration with the Commission may be required by the particular general license.

[65 FR 79187, Dec. 18, 2000]

§ 30.32 Application for specific licenses.

(a) A person may file an application on NRC Form 313, "Application for Material License," in accordance with the instructions in § 30.6 of this chapter. Information contained in previous applications, statements or reports filed with the Commission or the Atomic Energy Commission may be incorporated by reference, provided that the reference is clear and specific.

(b) The Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

(c) Each application shall be signed by the applicant or licensee or a person duly authorized to act for and on his behalf.

(d) An application for license filed pursuant to the regulations in this part and parts 32 through 35 of this chapter will be considered also as an application for licenses authorizing other activities for which licenses are required by the Act, provided that the application specifies the additional activities for which licenses are requested and complies with regulations of the Commission as to applications for such licenses.

(e) Each application for a byproduct material license, other than a license exempted from part 170 of this chapter, shall be accompanied by the fee prescribed in § 170.31 of this chapter. No fee will be required to accompany an application for renewal or amendment of a license, except as provided in § 170.31 of this chapter.

(f) An application for a license to receive and possess byproduct material for the conduct of any activity which the Commission has determined pursuant to subpart A of part 51 of this chapter will significantly affect the quality of the environment shall be filed at least 9 months prior to commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by any Environmental Report required pursuant to subpart A of part 51 of this chapter.

(g) An application for a specific license to use byproduct material in the form of a sealed source or in a device that contains the sealed source must either--

(1) Identify the source or device by manufacturer and model number as registered with the Commission under § 32.210 of this chapter, with an Agreement State, or for a source or a device containing radium-226 or accelerator-produced radioactive material with a State under provisions comparable to § 32.210 of this chapter; or

(2) Contain the information identified in § 32.210(c) of this chapter; or

(3) For sources or devices containing naturally occurring or accelerator-produced radioactive material manufactured prior to November 30, 2007 that are not registered with the Commission under § 32.210 of this chapter or with an Agreement State, and for which the applicant is unable to provide all categories of information specified in § 32.210(c) of this chapter, the applicant must provide:

(i) All available information identified in § 32.210(c) of this chapter concerning the source, and, if applicable, the device; and

(ii) Sufficient additional information to demonstrate that there is reasonable assurance that the radiation safety properties of the source or device are adequate to protect health and minimize danger to life and property. Such information must include a description of the source or device, a description of radiation safety features, the intended use and associated operating experience, and the results of a recent leak test.

(h) As provided by § 30.35, certain applications for specific licenses filed under this part and parts 32 through 35 of this chapter must contain a proposed decommissioning funding plan or a certification of financial assurance for decommissioning. In the case of renewal applications submitted before July 27, 1990, this submittal may follow the renewal application but must be submitted on or before July 27, 1990.

(i)(1) Each application to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in § 30.72, "Schedule C--Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release," must contain either:

(i) An evaluation showing that the maximum dose to a person offsite due to a release of radioactive materials would not exceed 1 rem effective dose equivalent or 5 rems to the thyroid; or

(ii) An emergency plan for responding to a release of radioactive material.

(2) One or more of the following factors may be used to support an evaluation submitted under paragraph (i)(1)(i) of this section:

(i) The radioactive material is physically separated so that only a portion could be involved in an accident;

(ii) All or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;

(iii) The release fraction in the respirable size range would be lower than the release fraction shown § 30.72 due to the chemical or physical form of the material;

(iv) The solubility of the radioactive material would reduce the dose received;

(v) Facility design or engineered safety features in the facility would cause the release fraction to be lower than shown in § 30.72;

(vi) Operating restrictions or procedures would prevent a release fraction as large as that shown in § 30.72; or

(vii) Other factors appropriate for the specific facility.

(3) An emergency plan for responding to a release of radioactive material submitted under paragraph (i)(1)(ii) of this section must include the following information:

(i) *Facility description.* A brief description of the licensee's facility and area near the site.

(ii) *Types of accidents.* An identification of each type of radio-active materials accident for which protective actions may be needed.

(iii) *Classification of accidents.* A classification system for classifying accidents as alerts or site area emergencies.

(iv) *Detection of accidents.* Identification of the means of detecting each type of accident in a timely manner.

(v) *Mitigation of consequences.* A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.

(vi) *Assessment of releases.* A brief description of the methods and equipment to assess releases of radioactive materials.

(vii) *Responsibilities.* A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying offsite response organizations and the NRC; also responsibilities for developing, maintaining, and updating the plan.

(viii) *Notification and coordination.* A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point must be established.

The notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the NRC operations center immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency.¹

(ix) *Information to be communicated.* A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to offsite response organizations and to the NRC.

(x) *Training.* A brief description of the frequency, performance objectives and plans for the training that the licensee will provide workers on how to respond to an emergency including any special instructions and orientation tours the licensee would offer to fire, police, medical and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

(xi) *Safe shutdown.* A brief description of the means of restoring the facility to a safe condition after an accident.

(xii) *Exercises.* Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with offsite response organizations must include the check and update of all necessary telephone numbers. The licensee shall invite offsite response organizations to participate in the biennial exercises. Participation of offsite response organizations in biennial exercises although recommended is not required. Exercises must use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises must evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques must be corrected.

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

(4) The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to NRC. The licensee shall provide any comments received within the 60 days to the NRC with the emergency plan.

(j) An application from a medical facility, educational institution, or Federal facility to produce Positron Emission Tomography (PET) radioactive drugs for noncommercial transfer to licensees in its consortium authorized for medical use under part 35 of this chapter or equivalent Agreement State requirements shall include:

(1) A request for authorization for the production of PET radionuclides or evidence of an existing license issued under part 30 of this chapter or Agreement State requirements for a PET radionuclide production facility within its consortium from which it receives PET radionuclides.

(2) Evidence that the applicant is qualified to produce radioactive drugs for medical use by meeting one of the criteria in § 32.72(a)(2) of this chapter.

(3) Identification of individual(s) authorized to prepare the PET radioactive drugs if the applicant is a pharmacy, and documentation that each individual meets the requirements of an authorized nuclear pharmacist as specified in § 32.72(b)(2) of this chapter.

(4) Information identified in § 32.72(a)(3) of this chapter on the PET drugs to be noncommercially transferred to members of its consortium.

(k) Each applicant for a license for byproduct material shall protect Safeguards Information against unauthorized disclosure in accordance with the requirements in §§ 73.21, 73.22 and/or 73.23 of this chapter, as applicable.

[30 FR 8185, June 26, 1965, as amended at 36 FR 145, Jan. 6, 1971; 37 FR 5747, Mar. 21, 1972; 43 FR 6922, Feb. 17, 1978; 49 FR 9403, Mar. 12, 1984; 49 FR 27924, July 9, 1984; 52 FR 27786, July 24, 1987; 53 FR 24044, June 27, 1988; 54 FR 14060, Apr. 7, 1989; 68 FR 58804, Oct. 10, 2003; 72 FR 55925, Oct. 1, 2007; 73 FR 63570, Oct. 24, 2008]

¹ These reporting requirements do not supercede or release licensees of complying with the requirements under the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Pub. L. 99-499 or other state or federal reporting requirements.

§ 30.33 General requirements for issuance of specific licenses.

(a) An application for a specific license will be approved if:

(1) The application is for a purpose authorized by the Act;

(2) The applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property;

(3) The applicant is qualified by training and experience to use the material for the purpose requested in such manner as to protect health and minimize danger to life or property;

(4) The applicant satisfies any special requirements contained in parts 32 through 36 and 39; and

(5) In the case of an application for a license to receive and possess byproduct material for the conduct of any activity which the Commission determines will significantly affect the quality of the environment, the Director, Office of Federal and State Materials and Environmental Management Program or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to subpart A of part 51 of this chapter, has concluded, after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such conclusion shall be grounds for denial of a license to receive and possess byproduct material in such plant or facility. As used in this paragraph the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, necessary roads for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.

(b) Upon a determination that an application meets the requirements of the Act, and the regulations of the Commission, the Commission will issue a specific license authorizing the possession and use of byproduct material (Form NRC 374, "Byproduct Material License").

[30 FR 8185, June 26, 1965, as amended at 36 FR 12731, July 7, 1971; 37 FR 5747, Mar. 21, 1972; 39 FR 26279, July 18, 1974; 43 FR 6922, Feb. 17, 1978; 49 FR 9403, Mar. 12, 1984; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993; 73 FR 5717, Jan. 31, 2008]

§ 30.34 Terms and conditions of licenses.

(a) Each license issued pursuant to the regulations in this part and the regulations in parts 31 through 36 and 39 of this chapter shall be subject to all the provisions of the Act, now or hereafter in effect, and to all valid rules, regulations and orders of the Commission.

(b)(1) No license issued or granted pursuant to the regulations in this part and parts 31 through 36, and 39 nor any right under a license shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Commission shall, after securing full information, find that the transfer is in accordance with the provisions of the Act and shall give its consent in writing.

(2) An application for transfer of license must include:

(i) The identity, technical and financial qualifications of the proposed transferee; and

(ii) Financial assurance for decommissioning information required by § 30.35.

(c) Each person licensed by the Commission pursuant to the regulations in this part and parts 31 through 36 and 39 shall confine his possession and use of the byproduct material to the locations and purposes authorized in the license. Except as otherwise provided in the license, a license issued pursuant to the regulations in this part and parts 31 through 36 and 39 of this chapter shall carry with it the right to receive, acquire, own, and possess byproduct material. Preparation for shipment and transport of byproduct material shall be in accordance with the provisions of part 71 of this chapter.

(d) Each license issued pursuant to the regulations in this part and parts 31 through 36 and 39 shall be deemed to contain the provisions set forth in section 183b.- d., inclusive, of the Act, whether or not these provisions are expressly set forth in the license.

(e) The Commission may incorporate, in any license issued pursuant to the regulations in this part and parts 31 through 36 and 39, at the time of issuance, or thereafter by appropriate rule, regulation or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use and transfer of byproduct material as it deems appropriate or necessary in order to:

(1) Promote the common defense and security;

(2) Protect health or to minimize danger to life or property;

(3) Protect restricted data;

(4) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

(f) Licensees required to submit emergency plans by § 30.32(i) shall follow the emergency plan approved by the Commission. The licensee may change the approved without Commission approval only if the changes do not decrease the effectiveness of the plan. The licensee shall furnish the change to the

appropriate NRC Regional Office specified in § 30.6 and to affected offsite response organizations within six months after the change is made. Proposed changes that decrease, or potentially decrease, the effectiveness of the approved emergency plan may not be implemented without prior application to and prior approval by the Commission.

(g) Each licensee preparing technetium-99m radiopharmaceuticals from molybdenum-99/technetium-99m generators or rubidium-82 from strontium-82/rubidium-82 generators shall test the generator eluates for molybdenum-99 breakthrough or strontium-82 and strontium-85 contamination, respectively, in accordance with § 35.204 of this chapter. The licensee shall record the results of each test and retain each record for 3 years after the record is made.

(h)(1) Each general licensee that is required to register by § 31.5(c)(13) of this chapter and each specific licensee shall notify the appropriate NRC Regional Administrator, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of title 11 (Bankruptcy) of the United States Code by or against:

(i) The licensee;

(ii) An entity (as that term is defined in 11 U.S.C. 101(14~~5~~)) controlling the licensee or listing the license or licensee as property of the estate; or

(iii) An affiliate (as that term is defined in 11 U.S.C. 101(2)) of the licensee.

(2) This notification must indicate:

(i) The bankruptcy court in which the petition for bankruptcy was filed; and

(ii) The date of the filing of the petition.

(i) Security requirements for portable gauges.

Each portable gauge licensee shall use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal, whenever portable gauges are not under the control and constant surveillance of the licensee.

(j)(1) Authorization under § 30.32(j) to produce Positron Emission Tomography (PET) radioactive drugs for noncommercial transfer to medical use licensees in its consortium does not relieve the licensee from complying with applicable FDA, other Federal, and State requirements governing radioactive drugs.

(2) Each licensee authorized under § 30.32(j) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall:

(i) Satisfy the labeling requirements in § 32.72(a)(4) of this chapter for each PET radioactive drug transport radiation shield and each syringe, vial, or other container used to hold a PET radioactive drug intended for noncommercial distribution to members of its consortium.

(ii) Possess and use instrumentation to measure the radioactivity of the PET radioactive drugs intended for noncommercial distribution to members of its consortium and meet the procedural, radioactivity measurement, instrument test, instrument check, and instrument adjustment requirements in § 32.72(c) of this chapter.

(3) A licensee that is a pharmacy authorized under § 30.32(j) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall require that any individual that prepares PET radioactive drugs shall be:

(i) an authorized nuclear pharmacist that meets the requirements in § 32.72(b)(2) of this chapter, or

(ii) an individual under the supervision of an authorized nuclear pharmacist as specified in § 35.27 of this chapter.

(4) A pharmacy, authorized under § 30.32(j) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium that allows an individual to work as an authorized nuclear pharmacist, shall meet the requirements of § 32.72(b)(5) of this chapter.

(k) As required by the Additional Protocol, each specific licensee authorized to possess and use byproduct material shall file with the Commission location information described in § 75.11 of this chapter on DOC/NRC Forms AP-1 and associated forms. The licensee shall also permit verification of this information by the International Atomic Energy Agency (IAEA) and shall take other action as may be necessary to implement the US/IAEA Safeguards Agreement, as described in part 75 of this chapter.

(l) Each licensee shall ensure that Safeguards Information is protected against unauthorized disclosure in accordance with the requirements in §§ 73.21 and 73.23 of this chapter, as applicable.

[30 FR 8185, June 26, 1965, as amended at 38 FR 33969, Dec. 10, 1973; 43 FR 6922, Feb. 17, 1978; 48 FR 32328, July 15, 1983; 52 FR 1295, Jan. 12, 1987; 52 FR 8241, Mar. 17, 1987; 53 FR 19245, May 27, 1988; 53 FR 23383, June 22, 1988; 54 FR 14061, Apr. 7, 1989; 58 FR 7736, Feb. 9, 1993; 59 FR 61780, Dec. 2, 1994; 65 FR 79187, Dec. 18, 2000; 70 FR 2009, Jan. 12, 2005; 72 FR 55926, Oct. 1, 2007; 73 FR 78604, Dec. 23, 2008; 74 FR 7785, Feb. 20, 2009]

§ 30.35 Financial assurance and recordkeeping for decommissioning.

(a)(1) Each applicant for a specific license authorizing the possession and use of unsealed byproduct material of half-life greater than 120 days and in quantities exceeding 10^5 times the applicable quantities set forth in appendix B to part 30 shall submit a decommissioning funding plan as described in paragraph (e) of this section. The decommissioning funding plan must also be submitted when a combination of isotopes is involved if R divided by 10^5 is greater than 1 (unity rule), where R is defined here as the sum of the ratios of the quantity of each isotope to the applicable value in appendix B to part 30.

(2) Each holder of, or applicant for, any specific license authorizing the possession and use of sealed sources or plated foils of half-life greater than 120 days and in quantities exceeding 10^{12} times the applicable quantities set forth in appendix B to part 30 (or when a combination of isotopes is involved if R , as defined in § 30.35(a)(1), divided by 10^{12} is greater than 1), shall submit a decommissioning funding plan as described in paragraph (e) of this section. The decommissioning funding plan must be submitted to NRC by December 2, 2005.

(b) Each applicant for a specific license authorizing possession and use of byproduct material of half-life greater than 120 days and in quantities specified in paragraph (d) of this section shall either--

(1) Submit a decommissioning funding plan as described in paragraph (e) of this section; or

(2) Submit a certification that financial assurance for decommissioning has been provided in the amount prescribed by paragraph (d) of this section using one of the methods described in paragraph (f) of this section. For an applicant, this certification may state that the appropriate assurance will be obtained after

the application has been approved and the license issued but before the receipt of licensed material. If the applicant defers execution of the financial instrument until after the license has been issued, a signed original of the financial instrument obtained to satisfy the requirements of paragraph (f) of this section must be submitted to NRC before receipt of licensed material. If the applicant does not defer execution of the financial instrument, the applicant shall submit to NRC, as part of the certification, a signed original of the financial instrument obtained to satisfy the requirements of paragraph (f) of this section.

(c)(1) Each holder of a specific license issued on or after July 27, 1990, which is of a type described in paragraph (a) or (b) of this section, shall provide financial assurance for decommissioning in accordance with the criteria set forth in this section.

(2) Each holder of a specific license issued before July 27, 1990, and of a type described in paragraph (a) of this section shall submit a decommissioning funding plan as described in paragraph (e) of this section or a certification of financial assurance for decommissioning in an amount at least equal to \$1,125,000 in accordance with the criteria set forth in this section. If the licensee submits the certification of financial assurance rather than a decommissioning funding plan, the licensee shall include a decommissioning funding plan in any application for license renewal.

(3) Each holder of a specific license issued before July 27, 1990, and of a type described in paragraph (b) of this section shall submit, on or before July 27, 1990, a decommissioning funding plan as described, in paragraph (e) of this section, or a certification of financial assurance for decommissioning in accordance with the criteria set forth in this section.

(4) Any licensee who has submitted an application before July 27, 1990, for renewal of license in accordance with § 30.37 shall provide financial assurance for decommissioning in accordance with paragraphs (a) and (b) of this section. This assurance must be submitted when this rule becomes effective November 24, 1995.

(5) Waste collectors and waste processors, as defined in 10 CFR part 20, Appendix G, must provide financial assurance in an amount based on a decommissioning funding plan as described in paragraph (e) of this section. The decommissioning funding plan must include the cost of disposal of the maximum amount (curies) of radioactive material permitted by license, and the cost of disposal of the maximum quantity, by volume, of radioactive material which could be present at the licensee's facility at any time, in addition to the cost to remediate the licensee's site to meet the license termination criteria of 10 CFR part 20. The decommissioning funding plan must be submitted by December 2, 2005.

(d) Table of required amounts of financial assurance for decommissioning by quantity of material. Licensees required to submit the \$1,125,000 amount must do so by December 2, 2004. Licensees required to submit the \$113,000 or \$225,000 amount must do so by June 2, 2005. Licensees having possession limits exceeding the upper bounds of this table must base financial assurance on a decommissioning funding plan.

Greater than 10^4 but less than or equal to 10^5 times the applicable quantities of appendix B to part 30 in unsealed form. (For a combination of isotopes, if R, as defined in § 30.35(a)(1), divided by 10^4 is greater than 1 but R divided by 10^5 is less than or equal to 1.)	\$1,125,000
Greater than 10^3 but less than or equal to 10^4 times the applicable quantities of appendix B to part 30 in unsealed form. (For a combination of isotopes, if R, as defined in § 30.35(a)(1), divided by 10^3 is greater than 1 but R divided by 10^4 is less than or equal to 1.)	225,000
Greater than 10^{10} but less than or equal to 10^{12} times the applicable quantities of appendix B to part 30 in sealed sources or plated foils. (For a combination of isotopes, if R, as defined in § 30.35(a)(1), divided by 10^{10} is greater than, 1, but R divided by 10^{12} is less than or equal to 1)	113,000

(e)(1) Each decommissioning funding plan must be submitted for review and approval and must contain –

(i) A detailed cost estimate for decommissioning, in the amount reflecting:

(A) The cost of an independent contractor to perform all decommissioning activities;

(B) The cost of meeting the 10 CFR 20.1402 criteria for unrestricted use, provided that, if the applicant or licensee can demonstrate its ability to meet the provisions of 10 CFR 20.1403, the cost estimate may be based on meeting the 10 CFR 20.1403 criteria;

(C) The volume of onsite subsurface material containing residual radioactivity that will require remediation to meet the criteria for license termination; and

(D) An adequate contingency factor.

(ii) Identification of and justification for using the key assumptions contained in the DCE;

(iii) A description of the method of assuring funds for decommissioning from paragraph (f) of this section, including means for adjusting cost estimates and associated funding levels periodically over the life of the facility;

(iv) A certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning; and

(v) A signed original of the financial instrument obtained to satisfy the requirements of paragraph (f) of this section (unless a previously submitted and accepted financial instrument continues to cover the cost estimate for decommissioning).

(2) At the time of license renewal and at intervals not to exceed 3 years, the decommissioning funding plan must be resubmitted with adjustments as necessary to account for changes in costs and the extent of contamination. If the amount of financial assurance will be adjusted downward, this can not be done until the updated decommissioning funding plan is approved. The decommissioning funding plan must update the information submitted with the original or prior approved plan, and must specifically consider the effect of the following events on decommissioning costs:

(i) Spills of radioactive material producing additional residual radioactivity in onsite subsurface material;

(ii) Waste inventory increasing above the amount previously estimated;

(iii) Waste disposal costs increasing above the amount previously estimated;

(iv) Facility modifications;

(v) Changes in authorized possession limits;

(vi) Actual remediation costs that exceed the previous cost estimate;

(vii) Onsite disposal; and

(viii) Use of a settling pond and a description of the method of assuring funds for decommissioning from paragraph (f) of this section, including means for adjusting cost estimates and associated funding levels

~~periodically over the life of the facility. Cost estimates must be adjusted at intervals not to exceed 3 years. The decommissioning funding plan must also contain a certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning and a signed original of the financial instrument obtained to satisfy the requirements of paragraph (f) of this section.~~

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

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

(2) A surety method, insurance, or other guarantee method. These methods guarantee that decommissioning costs will be paid. A surety method may be in the form of a surety bond, letter of credit, or line of credit. A parent company guarantee of funds for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in appendix A to this part. A parent company guarantee may not be used in combination with other financial methods to satisfy the requirements of this section. For commercial corporations that issue bonds, a guarantee of funds by the applicant or licensee for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in appendix C to this part. For commercial companies that do not issue bonds, a guarantee of funds by the applicant or licensee for decommissioning costs may be used if the guarantee and test are as contained in appendix D to this part. For nonprofit entities, such as colleges, universities, and nonprofit hospitals, a guarantee of funds by the applicant or licensee may be used if the guarantee and test are as contained in appendix E to this part. A guarantee by the applicant or licensee may not be used in combination with any other financial methods used to satisfy the requirements of this section or in any situation where the applicant or licensee has a parent company holding majority control of the voting stock of the company. Any surety method or insurance used to provide financial assurance for decommissioning must contain the following conditions:

(i) The surety method or insurance must be open-ended or, if written for a specified term, such as five years, must be renewed automatically unless 90 days or more prior to the renewal date, the issuer notifies the Commission, the beneficiary, and the licensee of its intention not to renew. The surety method or insurance must also provide that the full face amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Commission within 30 days after receipt of notification of cancellation.

(ii) The surety method or insurance must be payable to a trust established for decommissioning costs. The trustee and trust must be acceptable to the Commission. An acceptable trustee includes an appropriate State or Federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency.

(iii) The surety method or insurance must remain in effect until the Commission has terminated the license.

(3) An external sinking fund in which deposits are made at least annually, coupled with a surety method or insurance, the value of which may decrease by the amount being accumulated in the sinking fund. An external sinking fund is a fund established and maintained by setting aside funds periodically in an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities. The surety or insurance provisions must be as stated in paragraph (f)(2) of this section.

(4) In the case of Federal, State, or local government licensees, a statement of intent containing a cost estimate for decommissioning or an amount based on the Table in paragraph (d) of this section, and indicating that funds for decommissioning will be obtained when necessary.

(5) When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity.

(g) Each person licensed under this part or parts 32 through 36 and 39 of this chapter shall keep records of information important to the decommissioning of a facility in an identified location until the site is released for unrestricted use. Before licensed activities are transferred or assigned in accordance with § 30.34(b), licensees shall transfer all records described in this paragraph to the new licensee. In this case, the new licensee will be responsible for maintaining these records until the license is terminated. If records important to the decommissioning of a facility are kept for other purposes, reference to these records and their locations may be used. Information the Commission considers important to decommissioning consists of--

(1) Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site. These records may be limited to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records must include any known information on identification of involved nuclides, quantities, forms, and concentrations.

(2) As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored, and of locations of possible inaccessible contamination such as buried pipes which may be subject to contamination. If required drawings are referenced, each relevant document need not be indexed individually. If drawings are not available, the licensee shall substitute appropriate records of available information concerning these areas and locations.

(3) Except for areas containing only sealed sources (provided the sources have not leaked or no contamination remains after any leak) or byproduct materials having only half-lives of less than 65 days, a list contained in a single document and updated every 2 years, of the following:

(i) All areas designated and formerly designated restricted areas as defined in 10 CFR 20.1003 (For requirements prior to January 1, 1994, see 10 CFR 20.3 as contained in the CFR edition revised as of January 1, 1993.);

(ii) All areas outside of restricted areas that require documentation under § 30.35(g)(1).

(iii) All areas outside of restricted areas where current and previous wastes have been buried as documented under 10 CFR 20.2108; and

(iv) All areas outside of restricted areas that contain material such that, if the license expired, the licensee would be required to either decontaminate the area to meet the criteria for decommissioning in 10 CFR part 20, subpart E, or apply for approval for disposal under 10 CFR 20.2002.

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

[53 FR 24044, June 27, 1988, as amended at 56 FR 23471, May 21, 1991; 58 FR 39633, July 26, 1993; 58 FR 67659, Dec. 22, 1993; 58 FR 68730, Dec. 29, 1993; 59 FR 1618, Jan. 12, 1994; 60 FR 38238, July 26,

1995; 61 FR 24673, May 16, 1996; 62 FR 39090, July 21, 1997; 63 FR 29541, June 1, 1998; 68 FR 57335, Oct. 3, 2003]

§ 30.36 Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas.

(a) Each specific license expires at the end of the day on the expiration date stated in the license, unless the licensee has filed an application for renewal under § 30.37 not less than 30 days before the expiration date stated in the existing license. If an application for renewal has been filed at least 30 days before the expiration date stated in the existing license, the existing license expires at the end of the day on which the Commission makes a final determination to deny the renewal application or, if the determination states an expiration date, the expiration date stated in the determination.

(b) Each specific license revoked by the Commission expires at the end of the day on the date of the Commission's final determination to revoke the license, or on the expiration date stated in the determination, or as otherwise provided by Commission Order.

(c) Each specific license continues in effect, beyond the expiration date if necessary, with respect to possession of byproduct material until the Commission notifies the licensee in writing that the license is terminated. During this time, the licensee shall--

(1) Limit actions involving byproduct material to those related to decommissioning; and

(2) Continue to control entry to restricted areas until they are suitable for release in accordance with NRC requirements.

(d) Within 60 days of the occurrence of any of the following, consistent with the administrative directions in § 30.6, each licensee shall provide notification to the NRC in writing of such occurrence, and either begin decommissioning its site, or any separate building or outdoor area that contains residual radioactivity so that the building or outdoor area is suitable for release in accordance with NRC requirements, or submit within 12 months of notification a decommissioning plan, if required by paragraph (g)(1) of this section, and begin decommissioning upon approval of that plan if--

(1) The license has expired pursuant to paragraph (a) or (b) of this section; or

(2) The licensee has decided to permanently cease principal activities, as defined in this part, at the entire site or in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with NRC requirements; or

(3) No principal activities under the license have been conducted for a period of 24 months; or

(4) No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with NRC requirements.

(e) Coincident with the notification required by paragraph (d) of this section, the licensee shall maintain in effect all decommissioning financial assurances established by the licensee pursuant to § 30.35 in conjunction with a license issuance or renewal or as required by this section. The amount of the financial assurance must be increased, or may be decreased, as appropriate, to cover the detailed cost estimate for decommissioning established pursuant to paragraph (g)(4)(v) of this section.

(1) Any licensee who has not provided financial assurance to cover the detailed cost estimate submitted with the decommissioning plan shall do so when this rule becomes effective November 24, 1995.

(2) Following approval of the decommissioning plan, a licensee may reduce the amount of the financial assurance as decommissioning proceeds and radiological contamination is reduced at the site with the approval of the Commission.

(f) The Commission may grant a request to extend the time periods established in paragraph (d) if the Commission determines that this relief is not detrimental to the public health and safety and is otherwise in the public interest. The request must be submitted no later than 30 days before notification pursuant to paragraph (d) of this section. The schedule for decommissioning set forth in paragraph (d) of this section may not commence until the Commission has made a determination on the request.

(g)(1) A decommissioning plan must be submitted if required by license condition or if the procedures and activities necessary to carry out decommissioning of the site or separate building or outdoor area have not been previously approved by the Commission and these procedures could increase potential health and safety impacts to workers or to the public, such as in any of the following cases:

(i) Procedures would involve techniques not applied routinely during cleanup or maintenance operations;

(ii) Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation;

(iii) Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

(iv) Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

(2) The Commission may approve an alternate schedule for submittal of a decommissioning plan required pursuant to paragraph (d) of this section if the Commission determines that the alternative schedule is necessary to the effective conduct of decommissioning operations and presents no undue risk from radiation to the public health and safety and is otherwise in the public interest.

(3) Procedures such as those listed in paragraph (g)(1) of this section with potential health and safety impacts may not be carried out prior to approval of the decommissioning plan.

(4) The proposed decommissioning plan for the site or separate building or outdoor area must include:

(i) A description of the conditions of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan;

(ii) A description of planned decommissioning activities;

(iii) A description of methods used to ensure protection of workers and the environment against radiation hazards during decommissioning;

(iv) A description of the planned final radiation survey; and

(v) An updated detailed cost estimate for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and a plan for assuring the availability of adequate funds for completion of decommissioning.

(vi) For decommissioning plans calling for completion of decommissioning later than 24 months after plan approval, the plan shall include a justification for the delay based on the criteria in paragraph (i) of this section.

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

(h)(1) Except as provided in paragraph (i) of this section, licensees shall complete decommissioning of the site or separate building or outdoor area as soon as practicable but no later than 24 months following the initiation of decommissioning.

(2) Except as provided in paragraph (i) of this section, when decommissioning involves the entire site, the licensee shall request license termination as soon as practicable but no later than 24 months following the initiation of decommissioning.

(i) The Commission may approve a request for an alternative schedule for completion of decommissioning of the site or separate building or outdoor area, and license termination if appropriate, if the Commission determines that the alternative is warranted by consideration of the following:

(1) Whether it is technically feasible to complete decommissioning within the allotted 24-month period;

(2) Whether sufficient waste disposal capacity is available to allow completion of decommissioning within the allotted 24-month period;

(3) Whether a significant volume reduction in wastes requiring disposal will be achieved by allowing short-lived radionuclides to decay;

(4) Whether a significant reduction in radiation exposure to workers can be achieved by allowing short-lived radionuclides to decay; and

(5) Other site-specific factors which the Commission may consider appropriate on a case-by-case basis, such as the regulatory requirements of other government agencies, lawsuits, ground-water treatment activities, monitored natural ground-water restoration, actions that could result in more environmental harm than deferred cleanup, and other factors beyond the control of the licensee.

(j) As the final step in decommissioning, the licensee shall--

(1) Certify the disposition of all licensed material, including accumulated wastes, by submitting a completed NRC Form 314 or equivalent information; and

(2) Conduct a radiation survey of the premises where the licensed activities were carried out and submit a report of the results of this survey, unless the licensee demonstrates in some other manner that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E. The licensee shall, as appropriate--

(i) Report levels of gamma radiation in units of millisieverts (microroentgen) per hour at one meter from surfaces, and report levels of radioactivity, including alpha and beta, in units of megabecquerels (disintegrations per minute or microcuries) per 100 square centimeters--removable and fixed--for surfaces, megabecquerels (microcuries) per milliliter for water, and becquerels (picocuries) per gram for solids such as soils or concrete; and

(ii) Specify the survey instrument(s) used and certify that each instrument is properly calibrated and tested.

(k) Specific licenses, including expired licenses, will be terminated by written notice to the licensee when the Commission determines that:

(1) Byproduct material has been properly disposed;

(2) Reasonable effort has been made to eliminate residual radioactive contamination, if present; and

(3)(i) A radiation survey has been performed which demonstrates that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E; or

(ii) Other information submitted by the licensee is sufficient to demonstrate that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E.

(4) Records required by § 30.51 (d) and (f) have been received.

[59 FR 36034, July 15, 1994, as amended at 60 FR 38238, July 26, 1995; 61 FR 1114, Jan. 16, 1996; 61 FR 24673, May 16, 1996; 61 FR 29637, June 12, 1996; 62 FR 39090, July 21, 1997; 73 FR 42673, July 23, 2008]

§ 30.37 Application for renewal of licenses.

(a) Application for renewal of a specific license must be filed on NRC Form 313 and in accordance with § 30.32.

(b) If any licensee granted the extension described in 10 CFR 30.36(a)(2) has a currently pending renewal application for the extended license, that application will be considered withdrawn by the licensee and any renewal fees paid by the licensee for that application will be refunded.

[59 FR 36035, July 15, 1994, as amended at 61 FR 1114, Jan. 16, 1996; 66 FR 64738, Dec. 14, 2001]

§ 30.38 Application for amendment of licenses.

Applications for amendment of a license shall be filed on Form NRC-313 in accordance with § 30.32 and shall specify the respects in which the licensee desires its license to be amended and the grounds for the amendment.

[49 FR 19625, May 9, 1984]

§ 30.39 Commission action on applications to renew or amend.

In considering an application by a licensee to renew or amend his license the Commission will apply the applicable criteria set forth in § 30.33 and parts 32 through 36 and 39 of this chapter.

[30 FR 8185, June 26, 1965, as amended at 43 FR 6922, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993]

§ 30.41 Transfer of byproduct material.

(a) No licensee shall transfer byproduct material except as authorized pursuant to this section.

(b) Except as otherwise provided in his license and subject to the provisions of paragraphs (c) and (d) of this section, any licensee may transfer byproduct material:

(1) To the Department;

(2) To the agency in any Agreement State which regulates radioactive material pursuant to an agreement under section 274 of the Act;

(3) To any person exempt from the licensing requirements of the Act and regulations in this part, to the extent permitted under such exemption;

(4) To any person in an Agreement State, subject to the jurisdiction of that State, who has been exempted from the licensing requirements and regulations of that State, to the extent permitted under such exemption;

(5) To any person authorized to receive such byproduct material under terms of a specific license or a general license or their equivalents issued by the Atomic Energy Commission, the Commission, or an Agreement State;

(6) To a person abroad pursuant to an export license issued under part 110 of this chapter; or

(7) As otherwise authorized by the Commission in writing.

(c) Before transferring byproduct material to a specific licensee of the Commission or an Agreement State or to a general licensee who is required to register with the Commission or with an Agreement State prior to receipt of the byproduct material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of byproduct material to be transferred.

(d) The following methods for the verification required by paragraph (c) of this section are acceptable:

(1) The transferor may have in his possession, and read, a current copy of the transferee's specific license or registration certificate;

(2) The transferor may have in his possession a written certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of byproduct material to be transferred, specifying the license or registration certificate number, issuing agency and expiration date;

(3) For emergency shipments the transferor may accept oral certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of byproduct material to be transferred, specifying the license or registration certificate number, issuing agency and expiration date: Provided, That the oral certification is confirmed in writing within 10 days;

(4) The transferor may obtain other sources of information compiled by a reporting service from official records of the Commission or the licensing agency of an Agreement State as to the identity of licensees and the scope and expiration dates of licenses and registration; or

(5) When none of the methods of verification described in paragraphs (d)(1) to (4) of this section are readily available or when a transferor desires to verify that information received by one of such methods is correct or up-to-date, the transferor may obtain and record confirmation from the Commission or the licensing agency of an Agreement State that the transferee is licensed to receive the byproduct material.

[38 FR 33969, Dec. 10, 1973, as amended at 40 FR 8785, Mar. 3, 1975; 43 FR 6922, Feb. 17, 1978]

Records, Inspections, Tests, and Reports

§ 30.50 Reporting requirements.

(a) *Immediate report.* Each licensee shall notify the NRC as soon as possible but not later than 4 hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).

(b) *Twenty-four hour report.* Each licensee shall notify the NRC within 24 hours after the discovery of any of the following events involving licensed material:

(1) An unplanned contamination event that:

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

(ii) Involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of §§ 20.1001-20.2401 of 10 CFR part 20 for the material; and

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

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

(i) The equipment is required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;

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

(iii) No redundant equipment is available and operable to perform the required safety function.

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

(4) An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:

(i) The quantity of material involved is greater than five times the lowest annual limit on intake specified in appendix B of §§ 20.1001-20.2401 of 10 CFR part 20 for the material; and

(ii) The damage affects the integrity of the licensed material or its container.

(c) Preparation and submission of reports. Reports made by licensees in response to the requirements of this section must be made as follows:

(1) Licensees shall make reports required by paragraphs (a) and (b) of this section by telephone to the NRC Operations Center.¹ To the extent that the information is available at the time of notification, the information provided in these reports must include:

- (i) The caller's name and call back telephone number;
- (ii) A description of the event, including date and time;
- (iii) The exact location of the event;
- (iv) The isotopes, quantities, and chemical and physical form of the licensed material involved; and
- (v) Any personnel radiation exposure data available.

(2) Written report. Each licensee who makes a report required by paragraph (a) or (b) of this section shall submit a written follow-up report within 30 days of the initial report. Written reports prepared pursuant to other regulations may be submitted to fulfill this requirement if the reports contain all of the necessary information and the appropriate distribution is made. These written reports must be sent to the NRC using an appropriate method listed in § 30.6(a); and a copy must be sent to the appropriate NRC Regional office listed in appendix D to part 20 of this chapter. The reports must include the following:

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

(3) The provisions of § 30.50 do not apply to licensees subject to the notification requirements in § 50.72. They do apply to those part 50 licensees possessing material licensed under part 30, who are not subject to the notification requirements in § 50.72.

[56 FR 40767, Aug. 16, 1991, as amended at 59 FR 14086, Mar. 25, 1994; 68 FR 58804, Oct. 10, 2003]

¹ The commercial telephone number for the NRC Operations Center is (301) 816-5100.

§ 30.51 Records.

(a) Each person who receives byproduct material pursuant to a license issued pursuant to the regulations in this part and parts 31 through 36 of this chapter shall keep records showing the receipt, transfer, and disposal of the byproduct material as follows:

(1) The licensee shall retain each record of receipt of byproduct material as long as the material is possessed and for three years following transfer or disposal of the material.

(2) The licensee who transferred the material shall retain each record of transfer for three years after each transfer unless a specific requirement in another part of the regulations in this chapter dictates otherwise.

(3) The licensee who disposed of the material shall retain each record of disposal of byproduct material until the Commission terminates each license that authorizes disposal of the material.

(b) The licensee shall retain each record that is required by the regulations in this part and parts 31 through 36 of this chapter or by license condition for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, the record must be retained until the Commission terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(c)(1) Records which must be maintained pursuant to this part and parts 31 through 36 of this chapter may be the original or a reproduced copy or microform if such reproduced copy or microform is duly authenticated by authorized personnel and the microform is capable of producing a clear and legible copy after storage for the period specified by Commission regulations. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as letters, drawings, specifications, must include all pertinent information such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

(2) If there is a conflict between the Commission's regulations in this part and parts 31 through 36 and 39 of this chapter, license condition, or other written Commission approval or authorization pertaining to the retention period for the same type of record, the retention period specified in the regulations in this part and parts 31 through 36 and 39 of this chapter for such records shall apply unless the Commission, pursuant to § 30.11, has granted a specific exemption from the record retention requirements specified in the regulations in this part or parts 31 through 36 and 39 of this chapter.

(d) Prior to license termination, each licensee authorized to possess radioactive material with a half-life greater than 120 days, in an unsealed form, shall forward the following records to the appropriate NRC Regional Office:

(1) Records of disposal of licensed material made under §§ 20.2002 (including burials authorized before January 28, 1981¹), 20.2003, 20.2004, 20.2005; and

(2) Records required by § 20.2103(b)(4).

(e) If licensed activities are transferred or assigned in accordance with § 30.34(b), each licensee authorized to possess radioactive material, with a half-life greater than 120 days, in an unsealed form, shall transfer the following records to the new licensee and the new licensee will be responsible for maintaining these records until the license is terminated:

(1) Records of disposal of licensed material made under §§ 20.2002 (including burials authorized before January 28, 1981), 20.2003, 20.2004, 20.2005; and

(2) Records required by § 20.2103(b)(4).

(f) Prior to license termination, each licensee shall forward the records required by § 30.35(g) to the appropriate NRC Regional Office.

[41 FR 18301, May 5, 1976, as amended at 43 FR 6922, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 53 FR 19245, May 27, 1988; 58 FR 7736, Feb. 9, 1993; 61 FR 24673, May, 16, 1996]

¹ A previous § 20.304 permitted burial of small quantities of licensed materials in soil before January 28, 1981, without specific Commission authorization. See § 20.304 contained in the 10 CFR, parts 0 to 199, edition revised as of January 1, 1981.

§ 30.52 Inspections.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect byproduct material and the premises and facilities wherein byproduct material is used or stored.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by him pursuant to the regulations in this chapter.

[30 FR 8185, June 26, 1965]

§ 30.53 Tests.

Each licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part and parts 31 through 36 and 39 of this chapter, including tests of:

(a) Byproduct material;

(b) Facilities wherein byproduct material is utilized or stored;

(c) Radiation detection and monitoring instruments; and

(d) Other equipment and devices used in connection with the utilization or storage of byproduct material.

[30 FR 8185, June 26, 1965, as amended by 43 FR 6922, Feb. 17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993]

§ 30.55 Tritium reports.

(a)-(b) [Reserved]

(c) Except as specified in paragraph (d) of this section, each licensee who is authorized to possess tritium shall report promptly to the appropriate NRC Regional Office listed in appendix D of part 20 of this chapter by telephone and telegraph, mailgram, or facsimile any incident in which an attempt has been made or is believed to have been made to commit a theft or unlawful diversion of more than 10 curies of such material at any one time or more than 100 curies of such material in any one calendar year. The initial report shall be followed within a period of fifteen (15) days by a written report submitted to the appropriate NRC Regional Office which sets forth the details of the incident and its consequences. Copies of such written report shall be sent to the Director, Office of Federal and State Materials and Environmental Management Programs, using an appropriate method listed in § 30.6(a). Subsequent to the submission of the written report required by this paragraph, the licensee shall promptly inform the Office of Federal and State Materials and Environmental Management Programs by means of a written report of any substantive additional information, which becomes available to the licensee, concerning an attempted or apparent theft or unlawful diversion of tritium.

(d) The reports described in this section are not required for tritium possessed pursuant to a general license provided in part 31 of this chapter or for tritium contained in spent fuel.

[37 FR 9208, May 6, 1972, as amended at 38 FR 1271, Jan. 11, 1973; 38 FR 2330, Jan. 24, 1973; 41 FR 16446, Apr. 19, 1976; 43 FR 6922, Feb. 17, 1978; 46 FR 55085, Nov. 6, 1981; 49 FR 24707, June 15, 1984; 52 FR 31611, Aug. 21, 1987; 68 FR 58804, Oct. 10, 2003; 73 FR 5718, Jan. 31, 2008]

Enforcement

§ 30.61 Modification and revocation of licenses.

(a) The terms and conditions of each license issued pursuant to the regulations in this part and parts 31 through 35 of this chapter shall be subject to amendment, revision or modification by reason of amendments to the Act, or by reason of rules, regulations and orders issued in accordance with the terms of the Act.

(b) Any license may be revoked, suspended or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act, or because of conditions revealed by such application or statement of fact or any report, record or inspection or other means which would warrant the Commission to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and provisions of the Act or of any rule, regulation or order of the Commission.

(c) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

[30 FR 8185, June 26, 1965, as amended at 35 FR 11460, July 17, 1970; 43 FR 6922, Feb. 17, 1978]

§ 30.62 Right to cause the withholding or recall of byproduct material.

The Commission may cause the withholding or recall of byproduct material from any licensee who is not equipped to observe or fails to observe such safety standards to protect health as may be established by the Commission, or who uses such materials in violation of law or regulation of the Commission, or in a manner other than as disclosed in the application therefore or approved by the Commission.

[30 FR 8185, June 26, 1965, as amended at 40 FR 8785, Mar. 3, 1975]

§ 30.63 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of--

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or

(3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violations of--

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section;

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

[57 FR 55072, Nov. 24, 1992]

§ 30.64 Criminal penalties.

(a) Section 223 of the Atomic Energy Act of 1954, as amended, provides for criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any regulation issued under sections 161b, 161i, or 161o of the Act. For purposes of section 223, all the regulations in part 30 are issued under one or more of sections 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.

(b) The regulations in part 30 that are not issued under sections 161b, 161i, or 161o for the purposes of section 223 are as follows: §§ 30.1, 30.2, 30.4, 30.5, 30.6, 30.8, 30.11, 30.12, 30.13, 30.15, 30.31, 30.32, 30.33, 30.37, 30.38, 30.39, 30.61, 30.62, 30.63, 30.64, 30.70, 30.71, and 30.72.

[57 FR 55072, Nov. 24, 1992; 73 FR 42673, July 23, 2008]

Schedules

§ 30.70 Schedule A--Exempt concentrations.

[See [footnotes](#) at the end of this table]

Element (atomic number)	Isotope	Col. I	Col. II
		Gas Concentration μCi/ml ¹	Liquid and Solid Concentration μCi/ml ²
Antimony (51)	Sb 122		3 x 10 ⁻⁴
	Sb 124		2 x 10 ⁻⁴
	Sb 125		1 x 10 ⁻³
Argon (18)	A 37	1 x 10 ⁻³	
	A 41	4 x 10 ⁻⁷	

Arsenic (33)	As 73		5×10^{-3}
	As 74		5×10^{-4}
	As 76		2×10^{-4}
	As 77		8×10^{-4}
Barium (56)	Ba 131		2×10^{-3}
	Ba 140		3×10^{-4}
Beryllium (4)	Be 7		2×10^{-2}
Bismuth (83)	Bi 206		4×10^{-4}
Bromine (35)	Br 82	4×10^{-7}	3×10^{-3}
Cadmium (48)	Cd 109		2×10^{-3}
	Cd 115M		3×10^{-4}
	Cd 115		3×10^{-4}
Calcium (20)	Ca 45		9×10^{-5}
	Ca 47		5×10^{-4}
Carbon (6)	C 14	1×10^{-6}	8×10^{-3}
Cerium (58)	Ce 141		9×10^{-4}
	Ce 143		4×10^{-4}
	Ce 144		1×10^{-4}
Cesium (55)	Cs 131		2×10^{-2}
	Cs 134m		6×10^{-2}
	Cs 134		9×10^{-5}
Chlorine (17)	Cl 38	9×10^{-7}	4×10^{-3}
Chromium (24)	Cr 51		2×10^{-2}
Cobalt (27)	Co 57		5×10^{-3}
	Co 58		1×10^{-3}
	Co 60		5×10^{-4}
Copper (29)	Cu 64		3×10^{-3}
Dysprosium (66)	Dy 165		4×10^{-3}
	Dy 166		4×10^{-4}
Erbium (68)	Er 169		9×10^{-4}
	Er 171		1×10^{-3}
Europium (63)	Eu 152 (T/2=9.2 hrs)		6×10^{-4}
	Eu 155		2×10^{-3}
Fluorine (9)	F 18	2×10^{-6}	8×10^{-3}
Gadolinium (64)	Gd 153		2×10^{-3}

	Gd 159		8×10^{-4}
Gallium (31)	Ga 72		4×10^{-4}
Germanium (32)	Ge 71		2×10^{-2}
Gold (79)	Au 196		2×10^{-3}
	Au 198		5×10^{-4}
	Au 199		2×10^{-3}
Hafnium (72)	Hf 181		7×10^{-4}
Hydrogen (1)	H 3	5×10^{-6}	3×10^{-2}
Indium (49)	In 113M		1×10^{-2}
	In 114M		2×10^{-4}
Iodine (53)	I 126	3×10^{-9}	2×10^{-5}
	I 131	3×10^{-9}	2×10^{-5}
	I 132	8×10^{-8}	6×10^{-4}
	I 133	1×10^{-8}	7×10^{-5}
	I 134	2×10^{-7}	1×10^{-3}
Iridium (77)	Ir 190		2×10^{-3}
	Ir 192		4×10^{-4}
	Ir 194		3×10^{-4}
Iron (26)	Fe 55		8×10^{-3}
	Fe 59		6×10^{-4}
Krypton (36)	Kr 85M	1×10^{-6}	
	Kr 85	3×10^{-6}	
Lanthanum (57)	La 140		2×10^{-4}
Lead (82)	Pb 203		4×10^{-3}
Lutetium (71)	Lu 177		1×10^{-3}
Manganese (25)	Mn 52		3×10^{-4}
	Mn 54		1×10^{-3}
	Mn 56		1×10^{-3}
Mercury (80)	Hg 197M		2×10^{-3}
	Hg 197		3×10^{-3}
	Hg 203		2×10^{-4}
Molybdenum (42)	Mo 99		2×10^{-3}
Neodymium (60)	Nd 147		6×10^{-4}
	Nd 149		3×10^{-3}
Nickel (28)	Ni 65		1×10^{-3}
Niobium (Columbium) (41)	Nb 95		1×10^{-3}

	Nb 97		9×10^{-3}
Osmium (76)	Os 185		7×10^{-4}
	Os 191M		3×10^{-2}
	Os 191		2×10^{-3}
	Os 193		6×10^{-4}
Palladium (46)	Pd 103		3×10^{-3}
	Pd 109		9×10^{-4}
Phosphorus (15)	P 32		2×10^{-4}
Platinum (78)	Pt 191		1×10^{-3}
	Pt 193M		1×10^{-2}
	Pt 197M		1×10^{-2}
	Pt 197		1×10^{-3}
Potassium (19)	K 42		3×10^{-3}
Praseodymium (59)	Pr 142		3×10^{-4}
	Pr 143		5×10^{-4}
Promethium (61)	Pm 147		2×10^{-3}
	Pm 149		4×10^{-4}
Rhenium (75)	Re 183		6×10^{-3}
	Re 186		9×10^{-4}
	Re 188		6×10^{-4}
Rhodium (45)	Rh 103M		1×10^{-1}
	Rh 105		1×10^{-3}
Rubidium (37)	Rb 86		7×10^{-4}
Ruthenium (44)	Ru 97		4×10^{-4}
	Ru 103		8×10^{-4}
	Ru 105		1×10^{-3}
	Ru 106		1×10^{-4}
Samarium (62)	Sm 153		8×10^{-4}
Scandium (21)	Sc 46		4×10^{-4}
	Sc 47		9×10^{-4}
	Sc 48		3×10^{-4}
Selenium (34)	Se 75		3×10^{-3}
Silicon (14)	Si 31		9×10^{-3}
Silver (47)	Ag 105		1×10^{-3}
	Ag 110M		3×10^{-4}
	Ag 111		4×10^{-4}

Sodium (11)	Na 24		2×10^{-3}
Strontium (38)	Sr 85		1×10^{-4}
	Sr 89		1×10^{-4}
	Sr 91		7×10^{-4}
	Sr 92		7×10^{-4}
Sulfur (16)	S 35	9×10^{-8}	6×10^{-4}
Tantalum (73)	Ta 182		4×10^{-4}
Technetium (43)	Tc 96M		1×10^{-1}
	Tc 96		1×10^{-3}
Tellurium (52)	Te 125M		2×10^{-3}
	Te 125M		6×10^{-4}
	Te 127		3×10^{-3}
	Te 129M		3×10^{-4}
	Te 131M		6×10^{-4}
	Te 132		3×10^{-4}
Terbium (65)	Tb 160		4×10^{-4}
Thallium (81)	Tl 200		4×10^{-3}
	Tl 201		3×10^{-3}
	Tl 202		1×10^{-3}
	Tl 204		1×10^{-3}
Thulium (69)	Tm 170		5×10^{-4}
	Tm 171		5×10^{-3}
Tin (50)	Sn 113		9×10^{-4}
	Sn 125		2×10^{-4}
Tungsten (Wolfram) (74)	W 181		4×10^{-3}
	W 187		7×10^{-4}
Vanadium (23)	V 48		3×10^{-4}
Xenon (54)	Xe 131M	4×10^{-6}	
	Xe 133	3×10^{-6}	
	Xe 135	1×10^{-6}	
Ytterbium (70)	Yb 175		1×10^{-3}
Yttrium (39)	Y 90		2×10^{-4}
	Y 91M		3×10^{-2}
	Y 91		3×10^{-4}
	Y 92		6×10^{-4}
	Y 93		3×10^{-4}
Zinc (30)	Zn 65		1×10^{-3}
	Zn 69M		7×10^{-4}

	Zn 69		2×10^{-2}
Zirconium (40)	Zr 95		6×10^{-4}
	Zr 97		2×10^{-4}
Beta and/or gamma emitting byproduct not listed above with half-life less than three years		1×10^{-10}	1×10^{-6}

Footnotes to Schedule A

1. Values are given only for those materials normally used as gases.
2. $\mu\text{Ci/gm}$ for solids.

NOTE 1: Many radioisotopes disintegrate into isotopes which are also radioactive. In expressing the concentrations in Schedule A, the activity stated is that of the parent isotope and takes into account the daughters.

NOTE 2: For purposes of 30.14 where there is involved a combination of isotopes, the limit for the combination should be derived as follows: Determine for each isotope in the product the ratio between the concentration present in the product and the exempt concentration established in Schedule A for the specific isotope when not in combination. The sum of such ratios may not exceed "1" (i.e., unity).

Example:

$$\frac{\text{Concentration of Isotope A in product}}{\text{Exempt concentration of Isotope A}} + \frac{\text{Concentration of Isotope B in product}}{\text{Exempt concentration of Isotope B}} \leq 1$$

[30 FR 8185, June 26, 1965, as amended at 35 FR 3982, Mar. 3, 1970; 38 FR 29314, Oct. 24, 1973; 59 FR 5520, Feb. 7, 1994]

§ 30.71 Schedule B.

Byproduct material	Microcuries
Antimony 122 (Sb 122)	100
Antimony 124 (Sb 124)	10
Antimony 125 (Sb 125)	10
Arsenic 73 (As 73)	100
Arsenic 74 (As 74)	10
Arsenic 76 (As 76)	10
Arsenic 77 (as 77)	100
Barium 131 (Ba 131)	10
Barium 133 (Ba 133)	10
Barium 140 (Ba 140)	10
Bismuth 210 (Bi 210)	1

Bromine 82 (Br 82)	10
Cadmium 109 (Cd 109)	10
Cadmium 115m (Cd 115m)	10
Cadmium 115 (Cd 115)	100
Calcium 45 (Ca 45)	10
Calcium 47 (Ca 47)	10
Carbon 14 (C 14)	100
Cerium 141 (Ce 141)	100
Cerium 143 (Ce 143)	100
Cerium 144 (Ce 144)	1
Cesium 129 (Cs 129)	100
Cesium 131 (Cs 131)	1,000
Cesium 134m (Cs 134m)	100
Cesium 134 (Cs 134)	1
Cesium 135 (Cs 135)	10
Cesium 136 (Cs 136)	10
Cesium 137 (Cs 137)	10
Chlorine 36 (Cl 36)	10
Chlorine 38 (Cl 38)	10
Chromium 51 (Cr 51)	1,000
Cobalt 57 (Co 57)	100
Cobalt 58m (Co 58m)	10
Cobalt 58 (Co 58)	10
Cobalt 60 (Co 60)	1
Copper 64 (Cu 64)	100
Dysprosium 165 (Dy 165)	10
Dysprosium 166 (Dy 166)	100
Erbium 169 (Er 169)	100
Erbium 171 (Er 171)	100
Europium 152 9.2 h (Eu 152 9.2 h)	100
Europium 152 13 yr (Eu 152 13 yr)	1
Europium 154 (Eu 154)	1
Europium 155 (Eu 155)	10
Fluorine 18 (F 18)	1,000
Gadolinium 153 (Gd 153)	10
Gadolinium 159 (Gd 159)	100

Gallium 67 (Ga 67)	100
Gallium 72 (Ga 72)	10
Germanium 68 (Ge 68)	10
Germanium 71 (Ge 71)	100
Gold 195 (Au 195)	10
Gold 198 (Au 198)	100
Gold 199 (Au 199)	100
Hafnium 181 (Hf 181)	10
Holmium 166 (Ho 166)	100
Hydrogen 3 (H3)	1,000
Indium 111 (In 111)	100
Indium 113m (In 113m)	100
Indium 114m (In 114m)	10
Indium 115m (In 115m)	100
Indium 115 (In 115)	10
Iodine 123 (I 123)	100
Iodine 125 (I 125)	1
Iodine 126 (I 126)	1
Iodine 129 (I 129)	0,1
Iodine 131 (I 131)	1
Iodine 132 (I 132)	10
Iodine 133 (I 133)	1
Iodine 134 (I 134)	10
Iodine 135 (I 135)	10
Iridium 192 (Ir 192)	10
Iridium 194 (Ir 194)	100
Iron 52 (Fe 52)	10
Iron 55 (Fe 55)	100
Iron 59 (Fe 59)	10
Krypton 85 (Kr 85)	100
Krypton 87 (Kr 87)	10
Lanthanum 140 (La 140)	10
Lutetium 177 (Lu 177)	100
Manganese 52 (Mn 52)	10
Manganese 54 (Mn 54)	10
Manganese 56 (Mn 56)	10

Mercury 197m (Hg 197m)	100
Mercury 197 (Hg 197)	100
Mercury 203 (Hg 203)	10
Molybdenum 99 (Mo 99)	100
Neodymium 147 (Nd 147)	100
Neodymium 149 (Nd 149)	100
Nickel 59 (Ni 59)	100
Nickel 63 (Ni 63)	10
Nickel 65 (Ni 65)	100
Niobium 93m (Nb 93m)	10
Niobium 95 (Nb 95)	10
Niobium 97 (Nb 97)	10
Osmium 185 (Os 185)	10
Osmium 191m (Os 191)	100
Osmium 191 (Os 191)	100
Osmium 193 (Os 193)	100
Palladium 103 (Pd 103)	100
Palladium 109 (Pd 109)	100
Phosphorus 32 (P 32)	10
Platinum 191 (Pt 191)	100
Platinum 193m (Pt 193m)	100
Platinum 193 (Pt 193)	100
Platinum 197m (Pt 197m)	100
Platinum 197 (Pt 197)	100
Polonium 210 (Po 210)	0.1
Potassium 42 (K 42)	10
Potassium 43 (K 43)	10
Praseodymium 142 (Pr 142)	100
Praseodymium 143 (Pr 143)	100
Promethium 147 (Pm 147)	10
Promethium 149 (Pm 149)	10
Rhenium 186 (Re 186)	100
Rhenium 188 (Re 188)	100
Rhodium 103m (Rh 103m)	100
Rhodium 105 (Rh 105)	100
Rubidium 81 (Rb 81)	10

Rubidium 86 (Rb 86)	10
Rubidium 87 (Rb 87)	10
Ruthenium 97 (Ru 97)	100
Ruthenium 103 (Ru 103)	10
Ruthenium 105 (Ru 105)	10
Ruthenium 106 (Ru 106)	1
Samarium 151 (Sm 151)	10
Samarium 153 (Sm 153)	100
Scandium 46 (Sc 46)	10
Scandium 47 (Sc 47)	100
Scandium 48 (Sc 48)	10
Selenium 75 (Se 75)	10
Silicon 31 (Si 31)	100
Silver 105 (Ag 105)	10
Silver 110m (Ag 110m)	1
Silver 111 (Ag 111)	100
Sodium 22 (Na 22)	10
Sodium 24 (Na 24)	10
Strontium 85 (Sr 85)	10
Strontium 89 (Sr 89)	1
Strontium 90 (Sr 90)	0.1
Strontium 91 (Sr 91)	10
Strontium 92 (Sr 92)	10
Sulphur 35 (S 35)	100
Tantalum 182 (Ta 182)	10
Technetium 96 (Tc 96)	10
Technetium 97m (Tc 97m)	100
Technetium 97 (Tc 97)	100
Technetium 99m (Tc 99m)	100
Technetium 99 (Tc 99)	10
Tellurium 125 m (Te 125 m)	10
Tellurium 127m (Te 127m)	10
Tellurium 127 (Te 127)	100
Tellurium 129m (Te 129m)	10
Tellurium 129 (Te 129)	100
Tellurium 131m (Te 131m)	10

Tellurium 132 (Te 132)	10
Terbium 160 (Tb 160)	10
Thallium 200 (Tl 200)	100
Thallium 201 (Tl 201)	100
Thallium 202 (Tl 202)	100
Thallium 204 (Tl 204)	10
Thulium 170 (Tm 170)	10
Thulium 171 (Tm 171)	10
Tin 113 (Sn 113)	10
Tin 125 (Sn 125)	10
Tungsten 181 (W 181)	10
Tungsten 185 (W 185)	10
Tungsten 187 (W 187)	100
Vanadium 48 (V 48)	10
Xenon 131m (Xe 131m)	1,000
Xenon 133 (Xe 133)	100
Xenon 135 (Xe 135)	100
Ytterbium 175 (Yb 175)	100
Yttrium 87 (Y 87)	10
Yttrium 88 (Y 88)	10
Yttrium 90 (Y 90)	10
Yttrium 91 (Y91)	10
Yttrium 92 (Y92)	100
Yttrium 93 (Y93)	100
Zinc 65 (Zn 65)	10
Zinc 69m (Zn 69m)	100
Zinc 69 (Zn 69)	1,000
Zirconium 93 (Zr 93)	10
Zirconium 95 (Zr 95)	10
Zirconium 97 (Zr 97)	10
Any byproduct material not listed above other than alpha emitting byproduct materials	0.1

[35 FR 6427, Apr. 22, 1970, as amended at 36 FR 16898, Aug. 26, 1971; 59 FR 5519, Feb. 7, 1994; 72 FR 55926, Oct. 1, 2007]

§ 30.72 Schedule C--Quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release.

Radioactive material ¹	Release fraction	Quantity (curies)
Actinium-228	0.001	4,000
Americium-241	.001	2
Americium-242	.001	2
Americium-243	.001	2
Antimony-124	.01	4,000
Antimony-126	.01	6,000
Barium-133	.01	10,000
Barium-140	.01	30,000
Bismuth-207	.01	5,000
Bismuth-210	.01	600
Cadmium-109	.01	1,000
Cadmium-113	.01	80
Calcium-45	.01	20,000
Californium-252	.001	g (20 mg)
Carbon-14 (non-carbon dioxide)	.01	50,000
Cerium-141	.01	10,000
Cerium-144	.01	300
Cesium-134	.01	2,000
Cesium-137	.01	3,000
Chlorine-36	.5	100
Chromium-51	.01	300,000
Cobalt-60	.001	5,000
Copper-64	.01	200,000
Curium-242	.001	60
Curium-243	.001	3
Curium-244	.001	4
Curium-245	.001	2
Europium-152	.01	500
Europium-154	.01	400
Europium-155	.01	3,000
Germanium-68	.01	2,000
Gadolinium-153	.01	5,000
Gold-198	.01	30,000
Hafnium-172	.01	400
Hafnium-181	.01	7,000

Holmium-166m	.01	100
Hydrogen-3	.5	20,000
Iodine-125	.5	10
Iodine-131	.5	10
Indium-114m	.01	1,000
Iridium-192	.001	40,000
Iron-55	.01	40,000
Iron-59	.01	7,000
Krypton-85	1.0	6,000,000
Lead-210	.01	8
Manganese-56	.01	60,000
Mercury-203	.01	10,000
Molybdenum-99	.01	30,000
Neptunium-237	.001	2
Nickel-63	.01	20,000
Niobium-94	.01	300
Phosphorus-32	.5	100
Phosphorus-33	.5	1,000
Polonium-210	.01	10
Potassium-42	.01	9,000
Promethium-145	.01	4,000
Promethium-147	.01	4,000
Radium-226	.001	100
Ruthenium-106	.01	200
Samarium-151	.01	4,000
Scandium-46	.01	3,000
Selenium-75	.01	10,000
Silver-110m	.01	1,000
Sodium-22	.01	9,000
Sodium-24	.01	10,000
Strontium-89	.01	3,000
Strontium-90	.01	90
Sulfur-35	.5	900
Technitium-99	.01	10,000
Technitium-99m	.01	400,000
Tellurium-127m	.01	5,000

Tellurium-129m	.01	5,000
Terbium-160	.01	4,000
Thulium-170	.01	4,000
Tin-113	.01	10,00
Tin-123	.01	3,000
Tin-126	.01	1,000
Titanium-44	.01	100
Vanadium-48	.01	7,000
Xenon-133	1.0	900,000
Yttrium-91	.01	2,000
Zinc-65	.01	5,000
Zirconium-93	.01	400
Zirconium-95	.01	5,000
Any other beta-gamma emitter	.01	10,000
Mixed fission products	.01	1,000
Mixed corrosion products	.01	10,000
Contaminated equipment beta-gamma	.001	10,000
Irradiated material, any form other than solid noncombustible	.01	1,000
Irradiated material, solid noncombustible	.001	10,000
Mixed radioactive waste, beta-gamma	.01	1,000
Packaged mixed waste, beta-gamma ⁴	.001	10,000
Any other alpha emitter	.001	2
Contaminated equipment, alpha	.0001	20
Packaged waste, alpha ⁴	.0001	20
Combinations of radioactive materials listed above ¹		

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

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

[54 FR 14061, Apr. 7, 1989, as amended at 61 FR 9902, Mar. 12, 1996; 72 FR 55926, Oct. 1, 2007]

Appendix A to Part 30--Criteria Relating to Use of Financial Tests and Parent Company Guarantees for Providing Reasonable Assurance of Funds for Decommissioning

I. Introduction

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on obtaining a parent company guarantee that funds will be available for

decommissioning costs and on a demonstration that the parent company passes a financial test. This appendix establishes criteria for passing the financial test and for obtaining the parent company guarantee.

II. Financial Test

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

1. The parent company must have:

(i) Two of the following three ratios: A ratio of total liabilities to net worth less than 2.0; a ratio of the sum of net income plus depreciation, depletion, and amortization to total liabilities greater than 0.1; and a ratio of current assets to current liabilities greater than 1.5; and

(ii) Net working capital and tangible net worth each at least six times the current decommissioning cost estimates for the total of all facilities or parts thereof (or prescribed amount if a certification is used), or, for a power reactor licensee, at least six times the amount of decommissioning funds being assured by a parent company guarantee for the total of all reactor units or parts thereof (Tangible net worth shall be calculated to exclude the net book value of the nuclear unit(s)); and

(iii) Tangible net worth of at least \$10 million; and

(iv) Assets located in the United States amounting to at least 90 percent of the total assets or at least six times the current decommissioning cost estimates for the total of all facilities or parts thereof (or prescribed amount if a certification is used), or, for a power reactor licensee, at least six times the amount of decommissioning funds being assured by a parent company guarantee for the total of all reactor units or parts thereof.

2. The parent company must have:

(i) A current rating for its most recent bond issuance of AAA, AA, A, or BBB as issued by Standard and Poor's or AAA, AA, A, or BAA as issued by Moody's; and

(ii) Tangible net worth each at least six times the current decommissioning cost estimates for the total of all facilities or parts thereof (or prescribed amount if a certification is used), or, for a power reactor licensee, at least six times the amount of decommissioning funds being assured by a parent company guarantee for the total of all reactor units or parts thereof (Tangible net worth shall be calculated to exclude the net book value of the nuclear unit(s)); and

(iii) Tangible net worth of at least \$10 million; and

(iv) Assets located in the United States amounting to at least 90 percent of the total assets or at least six times the current decommissioning cost estimates for the total of all facilities or parts thereof (or prescribed amount if a certification is used), or, for a power reactor licensee, at least six times the amount of decommissioning funds being assured by a parent company guarantee for the total of all reactor units or parts thereof.

B. The parent company's independent certified public accountant must have compared the data used by the parent company in the financial test, which is derived from the independently audited, year end financial statements for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure the licensee shall inform NRC within 90 days of any matters coming to the auditor's attention

which cause the auditor to believe that the data specified in the financial test should be adjusted and that the company no longer passes the test.

C. 1. After the initial financial test, the parent company must repeat the passage of the test within 90 days after the close of each succeeding fiscal year.

2. If the parent company no longer meets the requirements of paragraph A of this section, the licensee must send notice to the Commission of intent to establish alternate financial assurance as specified in the Commission's regulations. The notice must be sent by certified mail within 90 days after the end of the fiscal year for which the year end financial data show that the parent company no longer meets the financial test requirements. The licensee must provide alternate financial assurance within 120 days after the end of such fiscal year.

III. Parent Company Guarantee

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

A. The parent company guarantee will remain in force unless the guarantor sends notice of cancellation by certified mail to the licensee and the Commission. Cancellation may not occur, however, during the 120 days beginning on the date of receipt of the notice of cancellation by both the licensee and the Commission, as evidenced by the return receipts.

B. If the licensee fails to provide alternate financial assurance as specified in the Commission's regulations within 90 days after receipt by the licensee and Commission of a notice of cancellation of the parent company guarantee from the guarantor, the guarantor will provide such alternative financial assurance in the name of the licensee.

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

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

[53 FR 24046, June 27, 1988 as amended at 63 FR 50479, Sept. 22, 1998]

Appendix B to Part 30--Quantities¹ of Licensed Material Requiring Labeling

Materials	Microcuries
Americium-241	.01
Antimony-122	100
Antimony-124	10
Antimony-125	10
Arsenic-73	100
Arsenic-74	10
Arsenic-76	10

Arsenic-77	100
Barium-131	10
Barium-133	10
Barium-140	10
Bismuth-210	1
Bromine-82	10
Cadmium-109	10
Cadmium-115m	10
Cadmium-115	100
Calcium-45	10
Calcium-47	10
Carbon-14	100
Cerium-141	100
Cerium-143	100
Cerium-144	1
Cesium-131	1,000
Cesium-134m	100
Cesium-134	1
Cesium-135	10
Cesium-136	10
Cesium-137	10
Chlorine-36	10
Chlorine-38	10
Chromium-51	1,000
Cobalt-58m	10
Cobalt-58	10
Cobalt-60	1
Copper-64	100
Dysprosium-165	10
Dysprosium-166	100
Erbium-169	100
Erbium-171	100
Europium-152 9.2h	100
Europium-152 13 yr	1
Europium-154	1
Europium-155	10

Fluorine-18	1,000
Gadolinium-153	10
Gadolinium-159	100
Gallium-72	10
Germanium-71	100
Gold-198	100
Gold-199	100
Hafnium-181	10
Holmium-166	100
Hydrogen-3	1,000
Indium-113m	100
Indium-114m	10
Indium-115m	100
Indium-115	10
Iodine-125	1
Iodine-126	1
Iodine-129	0.1
Iodine-131	1
Iodine-132	10
Iodine-133	1
Iodine-134	10
Iodine-135	10
Iridium-192	10
Iridium-194	100
Iron-55	100
Iron-59	10
Krypton-85	100
Krypton-87	10
Lanthanum-140	10
Lutetium-177	100
Manganese-52	10
Manganese-54	10
Manganese-56	10
Mercury-197m	100
Mercury-197	100
Mercury-203	10

Molbdenum-99	100
Neodymium-147	100
Neodymium-149	100
Nickel-59	100
Nickel-63	10
Nickel-65	100
Niobium-93m	10
Niobium-95	10
Niobium-97	10
Osmium-185	10
Osmium-191m	100
Osmium-191	100
Osmium-193	100
Palladium-103	100
Palladium-109	100
Phosphorus-32	10
Platinum-191	100
Platinum-193m	100
Platinum-193	100
Platinum-197m	100
Platinum-197	100
Plutonium-239	.01
Polonium-210	0.1
Potassium-42	10
Praseodymium-142	100
Praseodymium-143	100
Promethium-147	10
Promethium-149	10
Radium-226	.01
Rhenium-186	100
Rhenium-188	100
Rhodium-103m	100
Rhodium-105	100
Rubidium-86	10
Rubidium-87	10
Ruthenium-97	100

Ruthenium-103	10
Ruthenium-105	10
Ruthenium-106	1
Samarium-151	10
Samarium-153	100
Scandium-46	10
Scandium-47	100
Scandium-48	10
Seleium-75	10
Silicon-31	100
Silver-105	10
Silver-110m	1
Silver-111	100
Sodium-24	10
Strontium-85	10
Strontium-89	1
Strontium-90	0.10
Strontium-91	10
Strontium-92	10
Sulphur-35	100
Tantalum-182	10
Technetium-96	10
Technetium-97m	100
Technetium-97	100
Technetium-99m	100
Technetium-99	10
Tellurium-125m	10
Tellurium127m	10
Tellurium-127	100
Tellurium129m	10
Tellurium-129	100
Tellurium-131m	10
Tellurium-132	10
Terbium-160	10
Thallium-200	100
Thallium-201	100

Thallium-202	100
Thallium-204	10
Thorium (natural) ¹	100
Thulium-170	10
Thulium-171	10
Tin-113	10
Tin-125	10
Tungsten-181	10
Tungsten-185	10
Tungsten-187	100
Uranium (natural) ²	100
Uranium-233	.01
Uranium-234--Uranium-235	.01
Vandium-48	10
Xenon-131m	1,000
Xenon-133	100
Xenon-135	100
Ytterbium-175	100
Yttrium-90	10
Yttrium-91	10
Yttrium-92	100
Yttrium-93	100
Zinc-65	10
Zinc-69m	100
Zinc-69	1,000
Zirconium-93	10
Zirconium-95	10
Zirconium-97	10
Any alpha emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition	.01
Any radionuclide other than alpha emitting radio-nuclides, not listed above or mixtures of beta emitters of unknown composition	.1

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

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

Note: For purposes of § 20.303, where there is involved a combination of isotopes in known amounts, the limit for the combination should be derived as follows: Determine, for each isotope in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific isotope when not in combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" (i.e., "unity").

[35 FR 6425, Apr. 22, 1970, as amended at 36 FR 16898, Aug. 26, 1971; 38 FR 29314, Oct. 24, 1973; 39 FR 23991, June 28, 1974; 45 FR 71763, Oct. 30, 1980. Redesignated at 56 FR 23391, May 21, 1991, and further redesignated at 58 FR 67659, Dec. 22, 1993]

Appendix C to Part 30--Criteria Relating to Use of Financial Tests and Self Guarantees for Providing Reasonable Assurance of Funds for Decommissioning

I. Introduction

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on furnishing its own guarantee that funds will be available for decommissioning costs and on a demonstration that the company passes the financial test of Section II of this appendix. The terms of the self-guarantee are in Section III of this appendix. This appendix establishes criteria for passing the financial test for the self guarantee and establishes the terms for a self-guarantee.

II. Financial Test

A. To pass the financial test, a company must meet all of the following criteria:

(1) Tangible net worth at least 10 times the total current decommissioning cost estimate for the total of all facilities or parts thereof (or the current amount required if certification is used), or, for a power reactor licensee, at least 10 times the amount of decommissioning funds being assured by a self guarantee, for all decommissioning activities for which the company is responsible as self-guaranteeing licensee and as parent-guarantor for the total of all reactor units or parts thereof (Tangible net worth shall be calculated to exclude the net book value of the nuclear unit(s)).

(2) Assets located in the United States amounting to at least 90 percent of total assets or at least 10 times the total current decommissioning cost estimate for the total of all facilities or parts thereof (or the current amount required if certification is used), or, for a power reactor licensee, at least 10 times the amount of decommissioning funds being assured by a self guarantee, for all decommissioning activities for which the company is responsible as self-guaranteeing licensee and as parent-guarantor for the total of all reactor units or parts thereof.

(3) A current rating for its most recent bond issuance of AAA, AA, or A as issued by Standard and Poors (S&P), or Aaa, Aa, or A as issued by Moodys.

B. To pass the financial test, a company must meet all of the following additional requirements:

(1) The company must have at least one class of equity securities registered under the Securities Exchange Act of 1934.

(2) The company's independent certified public accountant must have compared the data used by the company in the financial test which is derived from the independently audited, year-end financial statements for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure, the licensee shall inform NRC within 90 days of any matters coming to the attention of the auditor that

cause the auditor to believe that the data specified in the financial test should be adjusted and that the company no longer passes the test.

(3) After the initial financial test, the company must repeat passage of the test within 90 days after the close of each succeeding fiscal year.

C. If the licensee no longer meets the requirements of Section II.A. of this appendix, the licensee must send immediate notice to the Commission of its intent to establish alternate financial assurance as specified in the Commission's regulations within 120 days of such notice.

III. Company Self-Guarantee

The terms of a self-guarantee which an applicant or licensee furnishes must provide that:

A. The guarantee will remain in force unless the licensee sends notice of cancellation by certified mail to the Commission. Cancellation may not occur, however, during the 120 days beginning on the date of receipt of the notice of cancellation by the Commission, as evidenced by the return receipt.

B. The licensee shall provide alternative financial assurance as specified in the Commission's regulations within 90 days following receipt by the Commission of a notice of cancellation of the guarantee.

C. The guarantee and financial test provisions must remain in effect until the Commission has terminated the license or until another financial assurance method acceptable to the Commission has been put in effect by the licensee.

D. The licensee will promptly forward to the Commission and the licensee's independent auditor all reports covering the latest fiscal year filed by the licensee with the Securities and Exchange Commission pursuant to the requirements of section 13 of the Securities and Exchange Act of 1934.

E. If, at any time, the licensee's most recent bond issuance ceases to be rated in any category of "A" or above by either Standard and Poors or Moodys, the licensee will provide notice in writing of such fact to the Commission within 20 days after publication of the change by the rating service. If the licensee's most recent bond issuance ceases to be rated in any category of A or above by both Standard and Poors and Moodys, the licensee no longer meets the requirements of Section II.A. of this appendix.

F. The applicant or licensee must provide to the Commission a written guarantee (a written commitment by a corporate officer) which states that the licensee will fund and carry out the required decommissioning activities or, upon issuance of an order by the Commission, the licensee will set up and fund a trust in the amount of the current cost estimates for decommissioning.

[58 FR 68730, Dec. 29, 1993; 59 FR 1618, Jan. 12, 1994; 63 FR 50479, Sept. 22, 1998]

Appendix D to Part 30—Criteria Relating To Use of Financial Tests and Self-Guarantee for Providing Reasonable Assurance of Funds for Decommissioning by Commercial Companies That Have no Outstanding Rated Bonds

I. Introduction

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on furnishing its own guarantee that funds will be available for decommissioning costs and on a demonstration that the company passes the financial test of Section II of this appendix. The

terms of the self-guarantee are in Section III of this appendix. This appendix establishes criteria for passing the financial test for the self-guarantee and establishes the terms for a self-guarantee.

II. Financial Test

A. To pass the financial test a company must meet the following criteria:

- (1) Tangible net worth greater than \$10 million, or at least 10 times the total current decommissioning cost estimate (or the current amount required if certification is used), whichever is greater, for all decommissioning activities for which the company is responsible as self-guaranteeing licensee and as parent-guarantor.
- (2) Assets located in the United States amounting to at least 90 percent of total assets or at least 10 times the total current decommissioning cost estimate (or the current amount required if certification is used) for all decommissioning activities for which the company is responsible as self-guaranteeing licensee and as parent-guarantor.
- (3) A ratio of cash flow divided by total liabilities greater than 0.15 and a ratio of total liabilities divided by net worth less than 1.5.

B. In addition, to pass the financial test, a company must meet all of the following requirements:

- (1) The company's independent certified public accountant must have compared the data used by the company in the financial test, which is required to be derived from the independently audited yearend financial statement based on United States generally accepted accounting practices for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure, the licensee shall inform NRC within 90 days of any matters that may cause the auditor to believe that the data specified in the financial test should be adjusted and that the company no longer passes the test.
- (2) After the initial financial test, the company must repeat passage of the test within 90 days after the close of each succeeding fiscal year.
- (3) If the licensee no longer meets the requirements of paragraph II.A of this appendix, the licensee must send notice to the NRC of intent to establish alternative financial assurance as specified in NRC regulations. The notice must be sent by certified mail, return receipt requested, within 90 days after the end of the fiscal year for which the year end financial data show that the licensee no longer meets the financial test requirements. The licensee must provide alternative financial assurance within 120 days after the end of such fiscal year.

III. Company Self-Guarantee

The terms of a self-guarantee which an applicant or licensee furnishes must provide that:

- A. The guarantee shall remain in force unless the licensee sends notice of cancellation by certified mail, return receipt requested, to the NRC. Cancellation may not occur until an alternative financial assurance mechanism is in place.
- B. The licensee shall provide alternative financial assurance as specified in the regulations within 90 days following receipt by the NRC of a notice of cancellation of the guarantee.

C. The guarantee and financial test provisions must remain in effect until the Commission has terminated the license or until another financial assurance method acceptable to the Commission has been put in effect by the licensee.

D. The applicant or licensee must provide to the Commission a written guarantee (a written commitment by a corporate officer) which states that the licensee will fund and carry out the required decommissioning activities or, upon issuance of an order by the Commission, the licensee will set up and fund a trust in the amount of the current cost estimates for decommissioning.

[63 FR 29542, June 1, 1998]

Appendix E to Part 30--Criteria Relating to Use of Financial Tests and Self-Guarantee For Providing Reasonable Assurance of Funds For Decommissioning by Nonprofit Colleges, Universities, and Hospitals

I. Introduction

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on furnishing its own guarantee that funds will be available for decommissioning costs and on a demonstration that the applicant or licensee passes the financial test of Section II of this appendix. The terms of the self-guarantee are in Section III of this appendix. This appendix establishes criteria for passing the financial test for the self-guarantee and establishes the terms for a self-guarantee.

II. Financial Test

A. For colleges and universities, to pass the financial test a college or university must meet either the criteria in Paragraph II.A.(1) or the criteria in Paragraph II.A.(2) of this appendix.

(1) For applicants or licensees that issue bonds, a current rating for its most recent uninsured, uncollateralized, and unencumbered bond issuance of AAA, AA, or A as issued by Standard and Poors (S&P) or Aaa, Aa, or A as issued by Moodys.

(2) For applicants or licensees that do not issue bonds, unrestricted endowment consisting of assets located in the United States of at least \$50 million, or at least 30 times the total current decommissioning cost estimate (or the current amount required if certification is used), whichever is greater, for all decommissioning activities for which the college or university is responsible as a self-guaranteeing licensee.

B. For hospitals, to pass the financial test a hospital must meet either the criteria in Paragraph II.B.(1) or the criteria in Paragraph II.B.(2) of this appendix:

(1) For applicants or licensees that issue bonds, a current rating for its most recent uninsured, uncollateralized, and unencumbered bond issuance of AAA, AA, or A as issued by Standard and Poors (S&P) or Aaa, Aa, or A as issued by Moodys.

(2) For applicants or licensees that do not issue bonds, all the following tests must be met:

(a) (Total Revenues less total expenditures) divided by total revenues must be equal to or greater than 0.04.

(b) Long term debt divided by net fixed assets must be less than or equal to 0.67.

(c) (Current assets and depreciation fund) divided by current liabilities must be greater than or equal to 2.55.

(d) Operating revenues must be at least 100 times the total current decommissioning cost estimate (or the current amount required if certification is used) for all decommissioning activities for which the hospital is responsible as a self-guaranteeing license.

C. In addition, to pass the financial test, a licensee must meet all the following requirements:

(1) The licensee's independent certified public accountant must have compared the data used by the licensee in the financial test, which is required to be derived from the independently audited year end financial statements, based on United States generally accepted accounting practices, for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure, the licensee shall inform NRC within 90 days of any matters coming to the attention of the auditor that cause the auditor to believe that the data specified in the financial test should be adjusted and that the licensee no longer passes the test.

(2) After the initial financial test, the licensee must repeat passage of the test within 90 days after the close of each succeeding fiscal year.

(3) If the licensee no longer meets the requirements of Section I of this appendix, the licensee must send notice to the NRC of its intent to establish alternative financial assurance as specified in NRC regulations. The notice must be sent by certified mail, return receipt requested, within 90 days after the end of the fiscal year for which the year end financial data show that the licensee no longer meets the financial test requirements. The licensee must provide alternate financial assurance within 120 days after the end of such fiscal year.

III. Self-Guarantee

The terms of a self-guarantee which an applicant or licensee furnishes must provide that--

A. The guarantee shall remain in force unless the licensee sends notice of cancellation by certified mail, and/or return receipt requested, to the Commission. Cancellation may not occur unless an alternative financial assurance mechanism is in place.

B. The licensee shall provide alternative financial assurance as specified in the Commission's regulations within 90 days following receipt by the Commission of a notice of cancellation of the guarantee.

C. The guarantee and financial test provisions must remain in effect until the Commission has terminated the license or until another financial assurance method acceptable to the Commission has been put in effect by the licensee.

D. The applicant or licensee must provide to the Commission a written guarantee (a written commitment by a corporate officer or officer of the institution) which states that the licensee will fund and carry out the required decommissioning activities or, upon issuance of an order by the Commission, the licensee will set up and fund a trust in the amount of the current cost estimates for decommissioning.

E. If, at any time, the licensee's most recent bond issuance ceases to be rated in any category of "A" or above by either Standard and Poors or Moodys, the licensee shall provide notice in writing of such fact to the Commission within 20 days after publication of the change by the rating service.

[63 FR 29542, June 1, 1998]

PART 34--LICENSES FOR INDUSTRIAL RADIOGRAPHY AND RADIATION SAFETY REQUIREMENTS FOR INDUSTRIAL RADIOGRAPHIC OPERATIONS

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[Appendix A to 10 CFR Part 34--Radiographer Certification.](#)

Authority: Secs. 81, 161, 182, 183, 68 Stat. 935, 948, 953, 954, as amended (42 U.S.C. 2111, 2201, 2232, 2233); sec. 201, 88 Stat. 1242, as amended (42 U.S.C. 5841); sec. 1704, 112 Stat. 2750 (44 U.S.C. 3504 note). Section 34.45 also issued under sec. 206, 88 Stat. 1246 (42 U.S.C. 5846).

Source: 62 FR 28963, May 28, 1997, unless otherwise noted.

Subpart A--General Provisions

§ 34.1 Purpose and scope.

This part prescribes requirements for the issuance of licenses for the use of sealed sources containing byproduct material and radiation safety requirements for persons using these sealed sources in industrial radiography. The provisions and requirements of this part are in addition to, and not in substitution for, other requirements of this chapter. In particular, the requirements and provisions of 10 Parts 19, 20, 21, 30, 71, 150, 170, and 171 of this chapter apply to applications and licenses subject to this part. This rule does not apply to medical uses of byproduct material.

§ 34.3 Definitions.

ALARA (acronym for "as low as is reasonably achievable") means making every reasonable effort to maintain exposures to radiation as far below the dose limits specified in 10 CFR Part 20 as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Annual refresher safety training means a review conducted or provided by the licensee for its employees on radiation safety aspects of industrial radiography. The review may include, as appropriate, the results of internal inspections, new procedures or equipment, new or revised regulations, accidents or errors that have been observed, and should also provide opportunities for employees to ask safety questions.

Associated equipment means equipment that is used in conjunction with a radiographic exposure device to make radiographic exposures that drives, guides, or comes in contact with the source, (e.g., guide tube, control tube, control (drive) cable, removable source stop, "J" tube and collimator when it is used as an exposure head.

Becquerel (Bq) means one disintegration per second.

Certifying Entity means an independent certifying organization meeting the requirements in appendix A of this part or an Agreement State meeting the requirements in appendix A, Parts II and III of this part.

Collimator means a radiation shield that is placed on the end of the guide tube or directly onto a radiographic exposure device to restrict the size of the radiation beam when the sealed source is cranked into position to make a radiographic exposure.

Control (drive) cable means the cable that is connected to the source assembly and used to drive the source to and from the exposure location.

Control drive mechanism means a device that enables the source assembly to be moved to and from the exposure device.

Control tube means a protective sheath for guiding the control cable. The control tube connects the control drive mechanism to the radiographic exposure device.

Exposure head means a device that locates the gamma radiography sealed source in the selected working position. (An exposure head is also known as a source stop.)

Field station means a facility where licensed material may be stored or used and from which equipment is dispatched.

Gray means the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 Joule/kilogram. It is also equal to 100 rads.

Guide tube (Projection sheath) means a flexible or rigid tube (i.e., "J" tube) for guiding the source assembly and the attached control cable from the exposure device to the exposure head. The guide tube may also include the connections necessary for attachment to the exposure device and to the exposure head.

Hands-on experience means experience in all of those areas considered to be directly involved in the radiography process.

Independent certifying organization means an independent organization that meets all of the criteria of Appendix A to this part.

Industrial radiography (radiography) means an examination of the structure of materials by nondestructive methods, utilizing ionizing radiation to make radiographic images.

Lay-barge radiography means industrial radiography performed on any water vessel used for laying pipe.

Offshore platform radiography means industrial radiography conducted from a platform over a body of water.

Permanent radiographic installation means an enclosed shielded room, cell, or vault, not located at a temporary jobsite, in which radiography is performed.

Practical Examination means a demonstration through practical application of the safety rules and principles in industrial radiography including use of all appropriate equipment and procedures.

Radiation Safety Officer for industrial radiography means an individual with the responsibility for the overall radiation safety program on behalf of the licensee and who meets the requirements of § 34.42.

Radiographer means any individual who performs or who, in attendance at the site where the sealed source or sources are being used, personally supervises industrial radiographic operations and who is responsible to the licensee for assuring compliance with the requirements of the Commission's regulations and the conditions of the license.

Radiographer certification means written approval received from a certifying entity stating that an individual has satisfactorily met certain established radiation safety, testing, and experience criteria.

Radiographer's assistant means any individual who under the direct supervision of a radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instruments in industrial radiography.

Radiographic exposure device (also called a camera, or a projector) means any instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure.

Radiographic operations means all activities associated with the presence of radioactive sources in a radiographic exposure device during use of the device or transport (except when being transported by a common or contract transport), to include surveys to confirm the adequacy of boundaries, setting up equipment and any activity inside restricted area boundaries.

S-tube means a tube through which the radioactive source travels when inside a radiographic exposure device.

Sealed source means any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material.

Shielded position means the location within the radiographic exposure device or source changer where the sealed source is secured and restricted from movement.

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

Source assembly means an assembly that consists of the sealed source and a connector that attaches the source to the control cable. The source assembly may also include a stop ball used to secure the source in the shielded position.

Source changer means a device designed and used for replacement of sealed sources in radiographic exposure devices, including those also used for transporting and storage of sealed sources.

Storage area means any location, facility, or vehicle which is used to store or to secure a radiographic exposure device, a storage container, or a sealed source when it is not in use and which is locked or has a physical barrier to prevent accidental exposure, tampering with, or unauthorized removal of the device, container, or source.

Storage container means a container in which sealed sources are secured and stored.

Temporary jobsite means a location where radiographic operations are conducted and where licensed material may be stored other than those location(s) of use authorized on the license.

Underwater radiography means industrial radiography performed when the radiographic exposure device and/or related equipment are beneath the surface of the water.

§ 34.5 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission, other than a written interpretation by the General Counsel, will be recognized to be binding upon the Commission.

§ 34.8 Information collection requirements: OMB approval.

(a) The Nuclear Regulatory Commission has submitted the information collection requirements contained in this part to the Office of Management and Budget (OMB) for approval as required by the Paperwork Reduction Act (44 U.S.C. 3501 et seq.). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB has approved the information collection requirements contained in this part under control number 3150-0007.

(b) The approved information collection requirements contained in this part appear in §§ 34.13, 34.20, 34.25, 34.27, 34.29, 34.31, 34.33, 34.35, 34.41, 34.42, 34.43, 34.45, 34.47, 34.49, 34.53, 34.61, 34.63, 34.65, 34.67, 34.69, 34.71, 34.73, 34.75, 34.79, 34.81, 34.83, 34.85, 34.87, 34.89, 34.101 and appendix A.

(c) This part contains information collection requirements in addition to those approved under the control number specified in paragraph (a) of this section. These information collection requirements and the control numbers under which they are approved are as follows:

(1) In § 34.11, NRC Form 313 is approved under control number 3150-0120.

(2) [Reserved]

[62 FR 52186, Oct. 6, 1997]

Subpart B--Specific Licensing Provisions

§ 34.11 Application for a specific license.

A person may file an application for specific license for use of sealed sources in industrial radiography on NRC Form 313, "Application for Material License," in accordance with the provisions of § 30.32 of this chapter.

[68 FR 58805, Oct. 10, 2003]

§ 34.13 Specific license for industrial radiography.

An application for a specific license for the use of licensed material in industrial radiography will be approved if the applicant meets the following requirements:

(a) The applicant satisfies the general requirements specified in § 30.33 of this chapter for byproduct material, as appropriate, and any special requirements contained in this part.

(b) The applicant submits an adequate program for training radiographers and radiographers' assistants that meets the requirements of § 34.43.

(1) After May 28, 1999, a license applicant need not describe its initial training and examination program for radiographers in the subjects outlined in § 34.43(g).

(2) From June 27, 1997 to May 28, 1999 a license applicant may affirm that all individuals acting as industrial radiographers will be certified in radiation safety by a certifying entity before commencing duty as radiographers. This affirmation substitutes for a description of its initial training and examination program for radiographers in the subjects outlined in § 34.43(g).

(c) The applicant submits procedures for verifying and documenting the certification status of radiographers and for ensuring that the certification of individuals acting as radiographers remains valid.

(d) The applicant submits written operating and emergency procedures as described in § 34.45.

(e) The applicant submits a description of a program for inspections of the job performance of each radiographer and radiographers' assistant at intervals not to exceed 6 months as described in § 34.43(e).

(f) The applicant submits a description of the applicant's overall organizational structure as it applies to the radiation safety responsibilities in industrial radiography, including specified delegation of authority and responsibility.

(g) The applicant identifies and lists the qualifications of the individual(s) designated as the RSO (§ 34.42) and potential designees responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

(h) If an applicant intends to perform leak testing of sealed sources or exposure devices containing depleted uranium (DU) shielding, the applicant must describe the procedures for performing and the qualifications of the person(s) authorized to do the leak testing. If the applicant intends to analyze its own wipe samples, the application must include a description of the procedures to be followed. The description must include the--

(1) Instruments to be used;

(2) Methods of performing the analysis; and

(3) Pertinent experience of the person who will analyze the wipe samples.

(i) If the applicant intends to perform "in-house" calibrations of survey instruments the applicant must describe methods to be used and the relevant experience of the person(s) who will perform the calibrations. All calibrations must be performed according to the procedures described and at the intervals prescribed in § 34.25.

(j) The applicant identifies and describes the location(s) of all field stations and permanent radiographic installations.

(k) The applicant identifies the locations where all records required by this part and other parts of this chapter will be maintained.

Subpart C--Equipment

§ 34.20 Performance requirements for industrial radiography equipment.

Equipment used in industrial radiographic operations must meet the following minimum criteria:

(a)(1) Each radiographic exposure device, source assembly or sealed source, and all associated equipment must meet the requirements specified in American National Standards Institute, N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography," (published as NBS Handbook 136, issued January 1981). This publication has been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. This publication may be purchased from the American National Standards Institute, Inc., 25 West 43rd Street 1430

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~~Broadway~~, New York, New York 10018~~36~~. Telephone (212) 642-4900. Copies of the document are available for inspection at the Nuclear Regulatory Commission Library, 11545 Rockville Pike, Rockville, Maryland 20852. A copy of the document is also on file at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

(2) Engineering analysis may be submitted by an applicant or licensee to demonstrate the applicability of previously performed testing on similar individual radiography equipment components. Upon review, the Commission may find this an acceptable alternative to actual testing of the component pursuant to the above referenced standard.

(b) In addition to the requirements specified in paragraph (a) of this section, the following requirements apply to radiographic exposure devices, source changers, source assemblies and sealed sources.

(1) The licensee shall ensure that each radiographic exposure device has attached to it a durable, legible, clearly visible label bearing the--

(i) Chemical symbol and mass number of the radionuclide in the device;

(ii) Activity and the date on which this activity was last measured;

(iii) Model (or product code) and serial number of the sealed source;

(iv) Manufacturer's identity of the sealed source; and

(v) Licensee's name, address, and telephone number.

(2) Radiographic exposure devices intended for use as Type B transport containers must meet the applicable requirements of 10 CFR part 71.

(3) Modification of radiographic exposure devices, source changers, and source assemblies and associated equipment is prohibited, unless the design of any replacement component, including source holder, source assembly, controls or guide tubes would not compromise the design safety features of the system.

(c) In addition to the requirements specified in paragraphs (a) and (b) of this section, the following requirements apply to radiographic exposure devices, source assemblies, and associated equipment that allow the source to be moved out of the device for radiographic operations or to source changers.

(1) The coupling between the source assembly and the control cable must be designed in such a manner that the source assembly will not become disconnected if cranked outside the guide tube. The coupling must be such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions.

(2) The device must automatically secure the source assembly when it is cranked back into the fully shielded position within the device. This securing system may only be released by means of a deliberate operation on the exposure device.

(3) The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device must be equipped with safety plugs or covers which must be installed during storage and transportation to protect the source assembly from water, mud, sand or other foreign matter.

(4)(i) Each sealed source or source assembly must have attached to it or engraved on it, a durable, legible, visible label with the words: "DANGER--RADIOACTIVE."

(ii) The label may not interfere with the safe operation of the exposure device or associated equipment.

(5) The guide tube must be able to withstand a crushing test that closely approximates the crushing forces that are likely to be encountered during use, and be able to withstand a kinking resistance test that closely approximates the kinking forces that are likely to be encountered during use.

(6) Guide tubes must be used when moving the source out of the device.

(7) An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during industrial radiography operations.

(8) The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.

(9) Source changers must provide a system for ensuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting the drive cable to or from a source assembly.

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

(e) Notwithstanding paragraph (a)(1) of this section, equipment used in industrial radiographic operations need not comply with § 8.9.2(c) of the Endurance Test in American National Standards Institute N432-1980, if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment can realistically exert on the lever or crankshaft of the drive mechanism.

[62 FR 28963, May 28, 1997, as amended at 69 FR 18803, Apr. 9, 2004]

§ 34.21 Limits on external radiation levels from storage containers and source changers.

The maximum exposure rate limits for storage containers and source changers are 2 millisieverts (200 millirem) per hour at any exterior surface, and 0.1 millisieverts (10 millirem) per hour at 1 meter from any exterior surface with the sealed source in the shielded position.

§ 34.23 Locking of radiographic exposure devices, storage containers and source changers.

(a) Each radiographic exposure device must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The exposure device and/or its container must be kept locked (and if a keyed-lock, with the key removed at all times) when not under the direct surveillance of a radiographer or a radiographer's assistant except at permanent radiographic installations as stated in § 34.51. In addition, during radiographic operations the sealed source assembly must be secured in the shielded position each time the source is returned to that position.

(b) Each sealed source storage container and source changer must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers must be kept locked (and if a keyed-lock, with the key removed at

all times) when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.

§ 34.25 Radiation survey instruments.

(a) The licensee shall keep sufficient calibrated and operable radiation survey instruments at each location where radioactive material is present to make the radiation surveys required by this part and by 10 CFR part 20 of this chapter. Instrumentation required by this section must be capable of measuring a range from 0.02 millisieverts (2 millirems) per hour through 0.01 sievert (1 rem) per hour.

(b) The licensee shall have each radiation survey instrument required under paragraph (a) of this section calibrated--

(1) At intervals not to exceed 6 months and after instrument servicing, except for battery changes;

(2) For linear scale instruments, at two points located approximately one-third and two-thirds of full-scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at 3 points between 0.02 and 10 millisieverts (2 and 1000 millirems) per hour; and

(3) So that an accuracy within plus or minus 20 percent of the calibration source can be demonstrated at each point checked.

(c) The licensee shall maintain records of the results of the instrument calibrations in accordance with § 34.65.

§ 34.27 Leak testing and replacement of sealed sources.

(a) The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing of any sealed source must be performed by persons authorized to do so by the NRC or an Agreement State.

(b) The opening, repair, or modification of any sealed source must be performed by persons specifically authorized to do so by the Commission or an Agreement State.

(c) Testing and recordkeeping requirements.

(1) Each licensee who uses a sealed source shall have the source tested for leakage at intervals not to exceed 6 months. The leak testing of the source must be performed using a method approved by the Commission or by an Agreement State. The wipe sample should be taken from the nearest accessible point to the sealed source where contamination might accumulate. The wipe sample must be analyzed for radioactive contamination. The analysis must be capable of detecting the presence of 185 Bq (0.005 microcurie) of radioactive material on the test sample and must be performed by a person specifically authorized by the Commission or an Agreement State to perform the analysis.

(2) The licensee shall maintain records of the leak tests in accordance with § 34.67.

(3) Unless a sealed source is accompanied by a certificate from the transferor that shows that it has been leak tested within 6 months before the transfer, it may not be used by the licensee until tested for leakage. Sealed sources that are in storage and not in use do not require leak testing, but must be tested before use or transfer to another person if the interval of storage exceeds 6 months.

(d) Any test conducted pursuant to paragraph (c) of this section which reveals the presence of 185 Bq (0.005 microcurie) or more of removable radioactive material must be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall have it decontaminated and repaired or disposed of in accordance with Commission regulations. A report must be filed with the Director, Office of Federal and State Materials and Environmental Management Programs, by an appropriate method listed in § 30.6(a) of this chapter, the report to be filed within 5 days of any test with results that exceed the threshold in this paragraph (d), and to describe the equipment involved, the test results, and the corrective action taken. A copy of the report must be sent to the Administrator of the appropriate Nuclear Regulatory Commission's Regional Office listed in appendix D of 10 CFR part 20 of this chapter "Standards for Protection Against Radiation."

(e) Each exposure device using depleted uranium (DU) shielding and an "S" tube configuration must be tested for DU contamination at intervals not to exceed 12 months. The analysis must be capable of detecting the presence of 185 Bq (0.005 microcuries) of radioactive material on the test sample and must be performed by a person specifically authorized by the Commission or an Agreement State to perform the analysis. Should such testing reveal the presence of 185 Bq (0.005 microcuries) or more of removable DU contamination, the exposure device must be removed from use until an evaluation of the wear on the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. DU shielded devices do not have to be tested for DU contamination while in storage and not in use. Before using or transferring such a device however, the device must be tested for DU contamination if the interval of storage exceeded 12 months. A record of the DU leak-test must be made in accordance with § 34.67. Licensees will have until June 27, 1998, to comply with the DU leak-testing requirements of this paragraph.

[62 FR 28963, May 28, 1997, as amended at 63 FR 37061, July 9, 1998; 67 FR 77652, Dec. 19, 2002; 68 FR 58805, Oct. 10, 2003; 73 FR 5719, Jan. 31, 2008]

§ 34.29 Quarterly inventory.

(a) Each licensee shall conduct a quarterly physical inventory to account for all sealed sources and for devices containing depleted uranium received and possessed under this license.

(b) The licensee shall maintain records of the quarterly inventory in accordance with § 34.69.

§ 34.31 Inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments.

(a) The licensee shall perform visual and operability checks on survey meters, radiographic exposure devices, transport and storage containers, associated equipment and source changers before use on each day the equipment is to be used to ensure that the equipment is in good working condition, that the sources are adequately shielded, and that required labeling is present. Survey instrument operability must be performed using check sources or other appropriate means. If equipment problems are found, the equipment must be removed from service until repaired.

(b) Each licensee shall have written procedures for:

(1) Inspection and routine maintenance of 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. If equipment problems are found, the equipment must be removed from service until repaired.

(2) Inspection and maintenance necessary to maintain the Type B packaging used to transport radioactive materials. The inspection and maintenance program must include procedures to assure that Type B packages are shipped and maintained in accordance with the certificate of compliance or other approval.

(c) Records of equipment problems and of any maintenance performed under paragraphs (a) and (b) of this section must be made in accordance with § 34.73.

§ 34.33 Permanent radiographic installations.

(a) Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have either:

(1) An entrance control of the type described in § 20.1601(a)(1) of this chapter that reduces the radiation level upon entry into the area, or

(2) Both conspicuous visible and audible warning signals to warn of the presence of radiation. The visible signal must be actuated by radiation whenever the source is exposed. The audible signal must be actuated when an attempt is made to enter the installation while the source is exposed.

(b) The alarm system must be tested for proper operation with a radiation source each day before the installation is used for radiographic operations. The test must include a check of both the visible and audible signals. Entrance control devices that reduce the radiation level upon entry (designated in paragraph (a)(1) of this section) must be tested monthly. If an entrance control device or an alarm is operating improperly, it must be immediately labeled as defective and repaired within 7 calendar days. The facility may continue to be used during this 7-day period, provided the licensee implements the continuous surveillance requirements of § 34.51 and uses an alarming ratemeter. Test records for entrance controls and audible and visual alarm must be maintained in accordance with § 34.75.

§ 34.35 Labeling, storage, and transportation.

(a) The licensee may not use a source changer or a container to store licensed material unless the source changer or the storage container has securely attached to it a durable, legible, and clearly visible label bearing the standard trefoil radiation caution symbol conventional colors, i.e., magenta, purple or black on a yellow background, having a minimum diameter of 25 mm, and the wording

CAUTION*
RADIOACTIVE MATERIAL
NOTIFY CIVIL AUTHORITIES (or "NAME OF COMPANY")
* _____ or "DANGER"

(b) The licensee may not transport licensed material unless the material is packaged, and the package is labeled, marked, and accompanied with appropriate shipping papers in accordance with regulations set out in 10 CFR part 71.

(c) Locked radiographic exposure devices and storage containers must be physically secured to prevent tampering or removal by unauthorized personnel. The licensee shall store licensed material in a manner which will minimize danger from explosion or fire.

(d) The licensee shall lock and physically secure the transport package containing licensed material in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal of the licensed material from the vehicle.

Subpart D--Radiation Safety Requirements

§ 34.41 Conducting industrial radiographic operations.

(a) Whenever radiography is performed at a location other than a permanent radiographic installation, the radiographer must be accompanied by at least one other qualified radiographer or an individual who has at a minimum met the requirements of § 34.43(c). The additional qualified individual shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. Radiography may not be performed if only one qualified individual is present.

(b) All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized by the Commission.

(c) A licensee may conduct lay-barge, offshore platform, or underwater radiography only if procedures have been approved by the Commission or by an Agreement State.

(d) Licensees will have until June 27, 1998, to meet the requirements for having two qualified individuals present at locations other than a permanent radiographic installation as specified in paragraph (a) of this section.

[62 FR 28963, May 28, 1997, as amended at 63 FR 37061, July 9, 1998]

§ 34.42 Radiation Safety Officer for industrial radiography.

The RSO shall ensure that radiation safety activities are being performed in accordance with approved procedures and regulatory requirements in the daily operation of the licensee's program.

(a) The minimum qualifications, training, and experience for RSOs for industrial radiography are as follows:

- (1) Completion of the training and testing requirements of § 34.43(a);
- (2) 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and
- (3) Formal training in the establishment and maintenance of a radiation protection program.

(b) The Commission will consider alternatives when the RSO has appropriate training and/or experience in the field of ionizing radiation, and in addition, has adequate formal training with respect to the establishment and maintenance of a radiation safety protection program.

(c) The specific duties and authorities of the RSO include, but are not limited to:

- (1) Establishing and overseeing all operating, emergency, and ALARA procedures as required by 10 CFR part 20 of this chapter, and reviewing them regularly to ensure that the procedures in use conform to current 10 CFR part 20 procedures, conform to other NRC regulations and to the license conditions.
- (2) Overseeing and approving all phases of the training program for radiographic personnel, ensuring that appropriate and effective radiation protection practices are taught;
- (3) Ensuring that required radiation surveys and leak tests are performed and documented in accordance with the regulations, including any corrective measures when levels of radiation exceed established limits;

(4) Ensuring that personnel monitoring devices are calibrated and used properly by occupationally-exposed personnel, that records are kept of the monitoring results, and that timely notifications are made as required by § 20.2203 of this chapter; and

(5) Ensuring that operations are conducted safely and to assume control for instituting corrective actions including stopping of operations when necessary.

(d) Licensees will have until June 27, 1999, to meet the requirements of paragraph (a) or (b) of this section.

[62 FR 28963, May 28, 1997, as amended at 63 FR 37061, July 9, 1998]

§ 34.43 Training.

(a) The licensee may not permit any individual to act as a radiographer until the individual--

(1) Has received training in the subjects in paragraph (g) of this section, in addition to a minimum of 2 months of on-the-job training, and is certified through a radiographer certification program by a certifying entity in accordance with the criteria specified in appendix A of this part. (An independent organization that would like to be recognized as a certifying entity shall submit its request to the Director, Office of Federal and State Materials and Environmental Management Programs, by an appropriate method listed in § 30.6(a) of this chapter.); or

(2) The licensee may, until June 27, 1999, allow an individual who has not met the requirements of paragraph (a)(1) of this section, to act as a radiographer after the individual has received training in the subjects outlined in paragraph (g) of this section and demonstrated an understanding of these subjects by successful completion of a written examination that was previously submitted to and approved by the Commission.

(b) In addition, the licensee may not permit any individual to act as a radiographer until the individual--

(1) Has received copies of and instruction in the requirements described in NRC regulations contained in this part; in §§ 30.7, 30.9, and 30.10 of this chapter; in the applicable sections of 10 CFR parts 19 and 20, of this chapter, in applicable DOT regulations as referenced in 10 CFR part 71, in the NRC license(s) under which the radiographer will perform industrial radiography, and the licensee's operating and emergency procedures;

(2) Has demonstrated understanding of the licensee's license and operating and emergency procedures by successful completion of a written or oral examination covering this material.

(3) Has received training in the use of the licensee's radiographic exposure devices, sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments.

(4) Has demonstrated understanding of the use of radiographic exposure devices, sources, survey instruments and associated equipment described in paragraphs (b)(1) and (b)(3) of this section by successful completion of a practical examination covering this material.

(c) The licensee may not permit any individual to act as a radiographer's assistant until the individual--

(1) Has received copies of and instruction in the requirements described in NRC regulations contained in this part, in §§ 30.7, 30.9, and 30.10 of this chapter, in the applicable sections of 10 CFR parts 19 and 20 of this chapter, in applicable DOT regulations as referenced in 10 CFR part 71, in the NRC license(s) under

which the radiographer's assistant will perform industrial radiography, and the licensee's operating and emergency procedures;

(2) Has developed competence to use, under the personal supervision of the radiographer, the radiographic exposure devices, sealed sources, associated equipment, and radiation survey instruments that the assistant will use; and

(3) Has demonstrated understanding of the instructions provided under (c)(1) of this section by successfully completing a written test on the subjects covered and has demonstrated competence in the use of hardware described in (c)(2) of this section by successful completion of a practical examination on the use of such hardware.

(d) The licensee shall provide annual refresher safety training for each radiographer and radiographer's assistant at intervals not to exceed 12 months.

(e) Except as provided in paragraph (e)(4), the RSO or designee shall conduct an inspection program of the job performance of each radiographer and radiographer's assistant to ensure that the Commission's regulations, license requirements, and the applicant's operating and emergency procedures are followed. The inspection program must:

(1) Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals not to exceed 6 months; and

(2) Provide that, if a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months since the last inspection, the radiographer must demonstrate knowledge of the training requirements of § 34.43(b)(3) and the radiographer's assistant must re-demonstrate knowledge of the training requirements of § 34.43(c)(2) by a practical examination before these individuals can next participate in a radiographic operation.

(3) The Commission may consider alternatives in those situations where the individual serves as both radiographer and RSO.

(4) In those operations where a single individual serves as both radiographer and RSO, and performs all radiography operations, an inspection program is not required.

(f) The licensee shall maintain records of the above training to include certification documents, written and practical examinations, refresher safety training and inspections of job performance in accordance with § 34.79.

(g) The licensee shall include the following subjects required in paragraph (a) of this section:

(1) Fundamentals of radiation safety including--

(i) Characteristics of gamma radiation;

(ii) Units of radiation dose and quantity of radioactivity;

(iii) Hazards of exposure to radiation;

(iv) Levels of radiation from licensed material; and

- (v) Methods of controlling radiation dose (time, distance, and shielding);
- (2) Radiation detection instruments including--
 - (i) Use, operation, calibration, and limitations of radiation survey instruments;
 - (ii) Survey techniques; and
 - (iii) Use of personnel monitoring equipment;
- (3) Equipment to be used including--
 - (i) Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtailed).
 - (ii) Storage, control, and disposal of licensed material; and
 - (iii) Inspection and maintenance of equipment.
- (4) The requirements of pertinent Federal regulations; and
- (5) Case histories of accidents in radiography.
- (h) Licensees will have until June 27, 1998, to comply with the additional training requirements specified in paragraphs (b)(1) and (c)(1) of this section.
- (i) Licensees will have until June 27, 1999 to comply with the certification requirements specified in paragraph (a)(1) of this section. Records of radiographer certification maintained in accordance with § 34.79(a) provide appropriate affirmation of certification requirements specified in paragraph (a)(1) of this section.

[62 FR 28963, May 28, 1997, as amended at 63 FR 37061, July 9, 1998; 68 FR 58805, Oct. 10, 2003; 73 FR 5720, Jan. 31, 2008]

§ 34.45 Operating and emergency procedures.

- (a) Operating and emergency procedures must include, as a minimum, instructions in the following:
 - (1) Appropriate handling and use of licensed sealed sources and radiographic exposure devices so that no person is likely to be exposed to radiation doses in excess of the limits established in 10 CFR part 20 of this chapter "Standards for Protection Against Radiation";
 - (2) Methods and occasions for conducting radiation surveys;
 - (3) Methods for controlling access to radiographic areas;
 - (4) Methods and occasions for locking and securing radiographic exposure devices, transport and storage containers and sealed sources;

- (5) Personnel monitoring and the use of personnel monitoring equipment;
 - (6) Transporting sealed sources to field locations, including packing of radiographic exposure devices and storage containers in the vehicles, placarding of vehicles when needed, and control of the sealed sources during transportation (refer to 49 CFR parts 171-173);
 - (7) The inspection, maintenance, and operability checks of radiographic exposure devices, survey instruments, transport containers, and storage containers;
 - (8) Steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale or an alarm ratemeter alarms unexpectedly.
 - (9) The procedure(s) for identifying and reporting defects and noncompliance, as required by 10 CFR part 21 of this chapter;
 - (10) The procedure for notifying proper persons in the event of an accident;
 - (11) Minimizing exposure of persons in the event of an accident;
 - (12) Source recovery procedure if licensee will perform source recovery;
 - (13) Maintenance of records.
- (b) The licensee shall maintain copies of current operating and emergency procedures in accordance with §§ 34.81 and 34.89.

§ 34.46 Supervision of radiographers' assistants.

Whenever a radiographer's assistant uses radiographic exposure devices, associated equipment or sealed sources or conducts radiation surveys required by § 34.49(b) to determine that the sealed source has returned to the shielded position after an exposure, the assistant shall be under the personal supervision of a radiographer. The personal supervision must include:

- (a) The radiographer's physical presence at the site where the sealed sources are being used;
- (b) The availability of the radiographer to give immediate assistance if required; and
- (c) The radiographer's direct observation of the assistant's performance of the operations referred to in this section.

§ 34.47 Personnel monitoring.

(a) The licensee may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a direct reading dosimeter, an operating alarm ratemeter, and a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, the wearing of an alarming ratemeter is not required.

(1) Pocket dosimeters must have a range from zero to 2 millisieverts (200 millirems) and must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.

(2) Each personnel dosimeter must be assigned to and worn only by one individual.

(3) Film badges must be replaced at periods not to exceed one month and other personnel dosimeters processed and evaluated by an accredited NVLAP processor must be replaced at periods not to exceed three months.

(4) After replacement, each personnel dosimeter must be processed as soon as possible.

(b) Direct reading dosimeters such as pocket dosimeters or electronic personal dosimeters, must be read and the exposures recorded at the beginning and end of each shift, and records must be maintained in accordance with § 34.83.

(c) Pocket dosimeters, or electronic personal dosimeters, must be checked at periods not to exceed 12 months for correct response to radiation, and records must be maintained in accordance with § 34.83. Acceptable dosimeters must read within plus or minus 20 percent of the true radiation exposure.

(d) If an individual's pocket chamber is found to be off-scale, or if his or her electronic personal dosimeter reads greater than 2 millisieverts (200 millirems), and the possibility of radiation exposure cannot be ruled out as the cause, the individual's personnel dosimeter must be sent for processing within 24 hours. In addition, the individual may not resume work associated with licensed material use until a determination of the individual's radiation exposure has been made. This determination must be made by the RSO or the RSO's designee. The results of this determination must be included in the records maintained in accordance with § 34.83.

(e) If the personnel dosimeter that is required by paragraph (a) of this section is lost or damaged, the worker shall cease work immediately until a replacement personnel dosimeter meeting the requirements in paragraph (a) is provided and the exposure is calculated for the time period from issuance to loss or damage of the personnel dosimeter. The results of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged must be included in the records maintained in accordance with § 34.83.

(f) Dosimetry reports received from the accredited NVLAP personnel dosimeter processor must be retained in accordance with § 34.83.

(g) Each alarm ratemeter must--

(1) Be checked to ensure that the alarm functions properly (sounds) before using at the start of each shift;

(2) Be set to give an alarm signal at a preset dose rate of 5 mSv/hr (500 mrem/hr); with an accuracy of plus or minus 20 percent of the true radiation dose rate;

(3) Require special means to change the preset alarm function; and

(4) Be calibrated at periods not to exceed 12 months for correct response to radiation. The licensee shall maintain records of alarm ratemeter calibrations in accordance with § 34.83.

[62 FR 28963, May 28, 1997, as amended at 65 FR 63751, Oct. 24, 2000]

§ 34.49 Radiation surveys.

The licensee shall:

(a) Conduct surveys with a calibrated and operable radiation survey instrument that meets the requirements of § 34.25.

(b) Using a survey instrument meeting the requirements of paragraph (a) of this section, conduct a survey of the radiographic exposure device and the guide tube after each exposure when approaching the device or the guide tube. The survey must determine that the sealed source has returned to its shielded position before exchanging films, repositioning the exposure head, or dismantling equipment.

(c) Conduct a survey of the radiographic exposure device with a calibrated radiation survey instrument any time the source is exchanged and whenever a radiographic exposure device is placed in a storage area (as defined in § 34.3), to ensure that the sealed source is in its shielded position.

(d) Maintain records in accordance with § 34.85.

§ 34.51 Surveillance.

During each radiographic operation the radiographer, or the other individual present, as required by § 34.41, shall maintain continuous direct visual surveillance of the operation to protect against unauthorized entry into a high radiation area, as defined in 10 CFR part 20 of this chapter, except at permanent radiographic installations where all entryways are locked and the requirements of § 34.33 are met.

§ 34.53 Posting.

All areas in which industrial radiography is being performed must be conspicuously posted as required by § 20.1902 of this chapter. Exceptions listed in § 20.1903 of this chapter do not apply to industrial radiographic operations.

[62 FR 28963, May 28, 1997, as amended at 66 FR 64738, Dec. 14, 2001]

Subpart E--Recordkeeping Requirements

§ 34.61 Records of the specific license for industrial radiography.

Each licensee shall maintain a copy of its license, license conditions, documents incorporated by reference, and amendments to each of these items until superseded by new documents approved by the Commission, or until the Commission terminates the license.

§ 34.63 Records of receipt and transfer of sealed sources.

(a) Each licensee shall maintain records showing the receipts and transfers of sealed sources and devices using DU for shielding and retain each record for 3 years after it is made.

(b) These records must include the date, the name of the individual making the record, radionuclide, number of becquerels (curies) or mass (for DU), and manufacturer, model, and serial number of each sealed source and/or device, as appropriate.

§ 34.65 Records of radiation survey instruments.

Each licensee shall maintain records of the calibrations of its radiation survey instruments that are required under § 34.25 and retain each record for 3 years after it is made.

§ 34.67 Records of leak testing of sealed sources and devices containing depleted uranium.

Each licensee shall maintain records of leak test results for sealed sources and for devices containing DU. The results must be stated in units of becquerels (microcuries). The licensee shall retain each record for 3 years after it is made or until the source in storage is removed.

§ 34.69 Records of quarterly inventory.

(a) Each licensee shall maintain records of the quarterly inventory of sealed sources and of devices containing depleted uranium as required by § 34.29 and retain each record for 3 years after it is made.

(b) The record must include the date of the inventory, name of the individual conducting the inventory, radionuclide, number of becquerels (curies) or mass (for DU) in each device, location of sealed source and/or devices, and manufacturer, model, and serial number of each sealed source and/or device, as appropriate.

§ 34.71 Utilization logs.

(a) Each licensee shall maintain utilization logs showing for each sealed source the following information:

(1) A description, including the make, model, and serial number of the radiographic exposure device or transport or storage container in which the sealed source is located;

(2) The identity and signature of the radiographer to whom assigned; and

(3) The plant or site where used and dates of use, including the dates removed and returned to storage.

(b) The licensee shall retain the logs required by paragraph (a) of this section for 3 years after the log is made.

§ 34.73 Records of inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments.

(a) Each licensee shall maintain records specified in § 34.31 of equipment problems found in daily checks and quarterly inspections of radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments; and retain each record for 3 years after it is made.

(b) The record must include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/or maintenance, if any, was done.

§ 34.75 Records of alarm system and entrance control checks at permanent radiographic installations.

Each licensee shall maintain records of alarm system and entrance control device tests required under § 34.33 and retain each record for 3 years after it is made.

§ 34.79 Records of training and certification.

Each licensee shall maintain the following records (of training and certification) for 3 years after the record is made:

(a) Records of training of each radiographer and each radiographer's assistant. The record must include radiographer certification documents and verification of certification status, copies of written tests, dates of oral and practical examinations, and names of individuals conducting and receiving the oral and practical examinations; and

(b) Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant. The records must list the topics discussed during the refresher safety training, the dates the annual refresher safety training was conducted, and names of the instructors and attendees. For inspections of job performance, the records must also include a list showing the items checked and any non-compliances observed by the RSO.

§ 34.81 Copies of operating and emergency procedures.

Each licensee shall maintain a copy of current operating and emergency procedures until the Commission terminates the license. Superseded material must be retained for 3 years after the change is made.

§ 34.83 Records of personnel monitoring Procedures.

Each licensee shall maintain the following exposure records specified in § 34.47:

(a) Direct reading dosimeter readings and yearly operability checks required by § 34.47(b) and (c) for 3 years after the record is made.

(b) Records of alarm ratemeter calibrations for 3 years after the record is made.

(c) Personnel dosimeter results received from the accredited NVLAP processor until the Commission terminates the license.

(d) Records of estimates of exposures as a result of: off-scale personal direct reading dosimeters, or lost or damaged personnel dosimeters until the Commission terminates the license.

[62 FR 28963, May 28, 1997, as amended at 65 FR 63752, Oct. 24, 2000]

§ 34.85 Records of radiation surveys.

Each licensee shall maintain a record of each exposure device survey conducted before the device is placed in storage as specified in § 34.49(c), if that survey is the last one performed in the workday. Each record must be maintained for 3 years after it is made.

§ 34.87 Form of records.

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

§ 34.89 Location of documents and records.

- (a) Each licensee shall maintain copies of records required by this part and other applicable parts of this chapter at the location specified in § 34.13(k).
- (b) Each licensee shall also maintain copies of the following documents and records sufficient to demonstrate compliance at each applicable field station and each temporary jobsite;
- (1) The license authorizing the use of licensed material;
 - (2) A copy of 10 CFR parts 19, 20, and 34 of NRC regulations;
 - (3) Utilization records for each radiographic exposure device dispatched from that location as required by § 34.71.
 - (4) Records of equipment problems identified in daily checks of equipment as required by § 34.73(a);
 - (5) Records of alarm system and entrance control checks required by § 34.75, if applicable;
 - (6) Records of direct reading dosimeters such as pocket dosimeter and/or electronic personal dosimeters readings as required by § 34.83;
 - (7) Operating and emergency procedures required by § 34.81;
 - (8) Evidence of the latest calibration of the radiation survey instruments in use at the site, as required by § 34.65;
 - (9) Evidence of the latest calibrations of alarm ratemeters and operability checks of pocket dosimeters and/or electronic personal dosimeters as required by § 34.83;
 - (10) Latest survey records required by § 34.85;
 - (11) The shipping papers for the transportation of radioactive materials required by § 71.5 of this chapter; and
 - (12) When operating under reciprocity pursuant to § 150.20 of this chapter, a copy of the Agreement State license authorizing the use of licensed materials.

Subpart F--Notifications

§ 34.101 Notifications.

- (a) In addition to the reporting requirements specified in § 30.50 and under other sections of this chapter, such as § 21.21, each licensee shall send a written report to the NRC's Office of Federal and State Materials and Environmental Management Programs, by an appropriate method listed in § 30.6(a) of this chapter, within 30 days of the occurrence of any of the following incidents involving radiographic equipment:
- (1) Unintentional disconnection of the source assembly from the control cable;
 - (2) Inability to retract the source assembly to its fully shielded position and secure it in this position; or

(3) Failure of any component (critical to safe operation of the device) to properly perform its intended function;

(b) The licensee shall include the following information in each report submitted under paragraph (a) of this section, and in each report of overexposure submitted under 10 CFR 20.2203 which involves failure of safety components of radiography equipment:

- (1) A description of the equipment problem;
- (2) Cause of each incident, if known;
- (3) Name of the manufacturer and model number of equipment involved in the incident;
- (4) Place, date, and time of the incident;
- (5) Actions taken to establish normal operations;
- (6) Corrective actions taken or planned to prevent recurrence; and
- (7) Qualifications of personnel involved in the incident.

(c) Any licensee conducting radiographic operations or storing radioactive material at any location not listed on the license for a period in excess of 180 days in a calendar year, shall notify the appropriate NRC regional office listed in § 30.6(a)(2) of this chapter prior to exceeding the 180 days.

[62 FR 28963, May 28, 1997, as amended at 67 FR 3585, Jan. 25, 2002; 68 FR 58805, Oct. 10, 2003; 73 FR 5720, Jan. 31, 2008]

Subpart G--Exemptions

§ 34.111 Applications for exemptions.

The Commission may, upon application of any interested person or upon its own initiative, grant an exemption from the requirements of the regulations in this part if it determines the exemption is authorized by law and would not endanger life or property or the common defense and security and is otherwise in the public interest.

Subpart H--Violations

§ 34.121 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of--

- (1) The Atomic Energy Act of 1954, as amended;
- (2) Title II of the Energy Reorganization Act of 1974, as amended; or
- (3) A regulation or order issued pursuant to these Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under Section 234 of the Atomic Energy Act;

(1) For violations of--

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section.

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

§ 34.123 Criminal penalties.

(a) Section 223 of the Atomic Energy Act of 1952, as amended, provides for criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any regulation issued under one or more of §§ 161b, 161i, or 161o of the Act. For purposes of Section 223, all the regulations in 10 CFR part 34 are issued under one or more of §§ 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.

(b) The regulations in 10 CFR part 34 that are not issued under sections 161b, 161i, or 161o for the purposes of Section 223 are as follows: §§ 34.1, 34.3, 34.5, 34.8, 34.11, 34.13, 34.111, 34.121, 34.123.

Appendix A to 10 CFR Part 34--Radiographer Certification

 [TOP](#)

I. Requirements for an Independent Certifying Organization

An independent certifying organization shall:

1. Be an organization such as a society or association, whose members participate in, or have an interest in, the fields of industrial radiography;
2. Make its membership available to the general public nationwide that is not restricted because of race, color, religion, sex, age, national origin or disability;
3. Have a certification program open to nonmembers, as well as members;
4. Be an incorporated, nationally recognized organization, that is involved in setting national standards of practice within its fields of expertise;
5. Have an adequate staff, a viable system for financing its operations, and a policy-and decision-making review board;

6. Have a set of written organizational by-laws and policies that provide adequate assurance of lack of conflict of interest and a system for monitoring and enforcing those by-laws and policies;
7. Have a committee, whose members can carry out their responsibilities impartially, to review and approve the certification guidelines and procedures, and to advise the organization's staff in implementing the certification program;
8. Have a committee, whose members can carry out their responsibilities impartially, to review complaints against certified individuals and to determine appropriate sanctions;
9. Have written procedures describing all aspects of its certification program, maintain records of the current status of each individual's certification and the administration of its certification program;
10. Have procedures to ensure that certified individuals are provided due process with respect to the administration of its certification program, including the process of becoming certified and any sanctions imposed against certified individuals;
11. Have procedures for proctoring examinations, including qualifications for proctors. These procedures must ensure that the individuals proctoring each examination are not employed by the same company or corporation (or a wholly-owned subsidiary of such company or corporation) as any of the examinees;
12. Exchange information about certified individuals with the Commission and other independent certifying organizations and/or Agreement States and allow periodic review of its certification program and related records; and
13. Provide a description to the Commission of its procedures for choosing examination sites and for providing an appropriate examination environment.

II. Requirements for Certification Programs

All certification programs must:

1. Require applicants for certification to (a) receive training in the topics set forth in § 34.43(g) or equivalent Agreement State regulations, and (b) satisfactorily complete a written examination covering these topics;
2. Require applicants for certification to provide documentation that demonstrates that the applicant has: (a) received training in the topics set forth in § 34.43(g) or equivalent Agreement State regulations; (b) satisfactorily completed a minimum period of on-the-job training; and (c) has received verification by an Agreement State or a NRC licensee that the applicant has demonstrated the capability of independently working as a radiographer;
3. Include procedures to ensure that all examination questions are protected from disclosure;
4. Include procedures for denying an application, revoking, suspending, and reinstating a certificate;
5. Provide a certification period of not less than 3 years nor more than 5 years;
6. Include procedures for renewing certifications and, if the procedures allow renewals without examination, require evidence of recent full-time employment and annual refresher training.

7. Provide a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

III. Requirements for Written Examinations

All examinations must be:

1. Designed to test an individual's knowledge and understanding of the topics listed in § 34.43(g) or equivalent Agreement State requirements;
2. Written in a multiple-choice format;
3. Have test items drawn from a question bank containing psychometrically valid questions based on the material in § 34.43(g).

PART 40--DOMESTIC LICENSING OF SOURCE MATERIAL

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Authority: Secs. 62, 63, 64, 65, 81, 161, 182, 183, 186, 68 Stat. 932, 933, 935, 948, 953, 954, 955, as amended, secs. 11e(2), 83, 84, Pub. L. 95–604, 92 Stat. 3033, as amended, 3039, sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2014(e)(2), 2092, 2093, 2094, 2095, 2111, 2113, 2114, 2201, 2232, 2233, 2236, 2282); sec. 274, Pub. L. 86–373, 73 Stat. 688 (42 U.S.C. 2021); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846); sec. 275, 92 Stat. 3021, as amended by Pub. L. 97–415, 96 Stat. 2067 (42 U.S.C. 2022); sec. 193, 104 Stat. 2835, as amended by Pub. L. 104–134, 110 Stat. 1321, 1321–349 (42 U.S.C. 2243); sec. 1704, 112 Stat. 2750 (44 U.S.C. 3504 note); Energy Policy Act of 2005, Pub. L. No. 109–59, 119 Stat. 594 (2005). Section 40.7 also issued under Pub. L. 95–601, sec. 10, 92 Stat. 2951 (42 U.S.C. 5851). Section 40.31(g) also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Section 40.46 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Section 40.71 also issued under sec. 187, 68 Stat. 955 (42 U.S.C. 2237).

Source: 26 FR 284, Jan. 14, 1961, unless otherwise noted.

[72 FR 63973, Nov. 14, 2007; 73 FR 63570, Oct. 24, 2008]

General Provisions

§ 40.1 Purpose.

(a) The regulations in this part establish procedures and criteria for the issuance of licenses to receive title to, receive, possess, use, transfer, or deliver source and byproduct materials, as defined in this part, and establish and provide for the terms and conditions upon which the Commission will issue such licenses. (Additional requirements applicable to natural and depleted uranium at enrichment facilities are set forth in § 70.22 of this chapter.) These regulations also provide for the disposal of byproduct material and for the long-term care and custody of byproduct material and residual radioactive material. The regulations in this part also establish certain requirements for the physical protection of import, export, and transient

shipments of natural uranium. (Additional requirements applicable to the import and export of natural uranium are set forth in part 110 of this chapter.)

(b) The regulations contained in this part are issued under the Atomic Energy Act of 1954, as amended (68 Stat. 919), title II of the Energy Reorganization Act of 1974, as amended (88 Stat. 1242), and titles I and II of the Uranium Mill Tailings Radiation Control Act of 1978, as amended (42 U.S.C. 7901).

[55 FR 45597, Oct. 30, 1990, as amended at 56 FR 55997, Oct. 31, 1991]

§ 40.2 Scope.

Except as provided in §§ 40.11 to 40.14, inclusive, the regulations in this part apply to all persons in the United States. This part also gives notice to all persons who knowingly provide to any licensee, applicant, contractor, or subcontractor, components, equipment, materials, or other goods or services, that relate to a licensee's or applicant's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of § 40.10.

[56 FR 40689, Aug. 15, 1991]

§ 40.2a Coverage of inactive tailings sites.

(a) Prior to the completion of the remedial action, the Commission will not require a license pursuant to 10 CFR chapter I for possession of residual radioactive materials as defined in this part that are located at a site where milling operations are no longer active, if the site is covered by the remedial action program of title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended. The Commission will exert its regulatory role in remedial actions primarily through concurrence and consultation in the execution of the remedial action pursuant to title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended. After remedial actions are completed, the Commission will license the long-term care of sites, where residual radioactive materials are disposed, under the requirements set out in § 40.27.

(b) The Commission will regulate byproduct material as defined in this part that is located at a site where milling operations are no longer active, if such site is not covered by the remedial action program of title I of the Uranium Mill Tailings Radiation Control Act of 1978. The criteria in appendix A of this part will be applied to such sites.

[45 FR 65531, Oct. 3, 1980, as amended at 55 FR 45598, Oct. 30, 1990]

§ 40.3 License requirements.

A person subject to the regulations in this part may not receive title to, own, receive, possess, use, transfer, provide for long-term care, deliver or dispose of byproduct material or residual radioactive material as defined in this part or any source material after removal from its place of deposit in nature, unless authorized in a specific or general license issued by the Commission under the regulations in this part.

[55 FR 45598, Oct. 30, 1990]

§ 40.4 Definitions.

Act means the Atomic Energy Act of 1954 (68 Stat. 919), including any amendments thereto;

Agreement State means any State with which the Atomic Energy Commission or the Nuclear Regulatory Commission has entered into an effective agreement under subsection 274b. of the Atomic Energy Act of 1954, as amended.

Alert means events may occur, are in progress, or have occurred that could lead to a release of radioactive material but that the release is not expected to require a response by offsite response organizations to protect persons offsite.

Byproduct Material means the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

With the exception of "byproduct material" as defined in section 11e. of the Act, other terms defined in section 11 of the Act shall have the same meaning when used in the regulations in this part.

~~*Commencement of construction* means any clearing of land, excavation, or other substantial action that would adversely affect the natural environment of a site but does not include changes desirable for the temporary use of the land for public recreational uses, necessary borings to determine site characteristics or other preconstruction monitoring to establish background information related to the suitability of a site or to the protection of environmental values.~~

Commencement of construction means taking any action defined as "construction" or any other activity at the site of a facility subject to the regulations in this part that has a reasonable nexus to:

(1) Radiological health and safety.

Commission means the Nuclear Regulatory Commission or its duly authorized representatives.

Construction means the installation of wells associated with radiological operations (e.g., production, injection, or monitoring well networks associated with in-situ recovery or other facilities), the installation of foundations, or in-place assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to the regulations in this part that are related to radiological safety or security. The term "construction" does not include:

(1) Changes for temporary use of the land for public recreational purposes;

(2) Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;

(3) Preparation of the site for construction of the facility, including clearing of the site, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and borrow areas;

(4) Erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials subject to this part;

(5) Excavation;

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(6) Erection of support buildings (e.g., construction equipment storage sheds, warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and office buildings) for use in connection with the construction of the facility;

(7) Building of service facilities (e.g., paved roads, parking lots, railroad spurs, exterior utility and lighting systems, potable water systems, sanitary sewerage treatment facilities, and transmission lines);

(8) Procurement or fabrication of components or portions of the proposed facility occurring at other than the final, in-place location at the facility; or

(9) Taking any other action that has no reasonable nexus to:

(i) Radiological health and safety.

Corporation means the United States Enrichment Corporation (USEC), or its successor, a Corporation that is authorized by statute to lease the gaseous diffusion enrichment plants in Paducah, Kentucky, and Piketon, Ohio, from the Department of Energy, or any person authorized to operate one or both of the gaseous diffusion plants, or other facilities, pursuant to a plan for the privatization of USEC that is approved by the President.

Decommission means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits--

- (1) Release of the property for unrestricted use and termination of the license; or
- (2) Release of the property under restricted conditions and termination of the license.

Department and Department of Energy means the Department of Energy established by the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565, 42 U.S.C. 7101 et seq.) to the extent that the Department, or its duly authorized representatives, exercises functions formerly vested in the U.S. Atomic Energy Commission, its Chairman, members, officers and components and transferred to the U.S. Energy Research and Development Administration and to the Administrator thereof pursuant to sections 104 (b), (c) and (d) of the Energy Reorganization Act of 1974 (Pub. L. 93-438, 88 Stat. 1233 at 1237, 42 U.S.C. 5814) and retransferred to the Secretary of Energy pursuant to section 301(a) of the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565 at 577-578, 42 U.S.C. 7151).

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.

Effective kilogram means (1) for the source material uranium in which the uranium isotope uranium-235 is greater than 0.005 (0.5 weight percent) of the total uranium present: 10,000 kilograms, and (2) for any other source material: 20,000 kilograms.

Foreign obligations means the commitments entered into by the U.S. Government under Atomic Energy Act (AEA) section 123 agreements for cooperation in the peaceful uses of atomic energy. Imports and exports of material or equipment pursuant to such agreements are subject to these commitments, which in some cases involve an exchange of information on imports, exports, retransfers with foreign governments, peaceful end-use assurances, and other conditions placed on the transfer of the material or equipment. The U.S. Government informs the licensee of obligations attached to material.

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

License, except where otherwise specified, means a license issued pursuant to the regulations in this part.

Persons means: (1) Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Department of Energy except that the Department of Energy shall be considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244) and the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 3021), any State or any political subdivision of, or any political entity within a State, any foreign government or nation or any subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent or agency of the foregoing.

Pharmacist means an individual registered by a state or territory of the United States, the District of Columbia or the Commonwealth of Puerto Rico to compound and dispense drugs, prescriptions and poisons.

Physician means a medical doctor or doctor of osteopathy licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to prescribe drugs in the practice of medicine.

Principal activities, as used in this part, means activities authorized by the license which are essential to achieving the purpose(s) for which the license was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

Reconciliation means the process of evaluating and comparing licensee reports required under this part to the projected material balances generated by the Nuclear Materials Management and Safeguards System. This process is considered complete when the licensee resolves any differences between the reported and projected balances, including those listed for foreign obligated materials.

Residual radioactive material means: (1) Waste (which the Secretary of Energy determines to be radioactive) in the form of tailings resulting from the processing of ores for the extraction of uranium and other valuable constituents of the ores; and (2) other waste (which the Secretary of Energy determines to be radioactive) at a processing site which relates to such processing, including any residual stock of unprocessed ores or low-grade materials. This term is used only with respect to materials at sites subject to remediation under title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended.

Site area emergency means events may occur, are in progress, or have occurred that could lead to a significant release of radioactive material and that could require a response by offsite response organizations to protect persons offsite.

Source Material means: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material.

Special nuclear material means: (1) Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the

Act, determines to be special nuclear material; or (2) any material artificially enriched by any of the foregoing.

Transient shipment means a shipment of nuclear material, originating and terminating in foreign countries, on a vessel or aircraft that stops at a United States port.

United States, when used in a geographical sense, includes Puerto Rico and all territories and possessions of the United States.

Unrefined and unprocessed ore means ore in its natural form prior to any processing, such as grinding, roasting or beneficiating, or refining.

Uranium enrichment facility means:

- (1) Any facility used for separating the isotopes of uranium or enriching uranium in the isotope 235, except laboratory scale facilities designed or used for experimental or analytical purposes only; or
- (2) Any equipment or device, or important component part especially designed for such equipment or device, capable of separating the isotopes of uranium or enriching uranium in the isotope 235.

Uranium Milling means any activity that results in the production of byproduct material as defined in this part.

[26 FR 284, Jan. 14, 1961; 73 FR 32461, Jun. 9, 2008]

Editorial Note: For Federal Register citations affecting § 40.4, see the List of CFR Sections [Affected](#) in the Finding Aids section.

§ 40.5 Communications.

(a) Unless otherwise specified or covered under the regional licensing program as provided in paragraph (b) of this section, any communication or report concerning the regulations in this part and any application filed under these regulations may be submitted to the Commission as follows:

(1) By mail addressed: ATTN: Document Control Desk, Director, Office of Federal and State Materials and Environmental Management Programs, or Director, Office of Nuclear Security, or Director, Office of Nuclear Security and Incident Response, as appropriate, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

(2) By hand delivery to the NRC's offices at 11555 Rockville Pike, Rockville, Maryland.

(3) Where practicable, by electronic submission, for example, via Electronic Information Exchange, or CD-ROM. Electronic submissions must be made in a manner that enables the NRC to receive, read, authenticate, distribute, and archive the submission, and process and retrieve it a single page at a time. Detailed guidance on making electronic submissions can be obtained by visiting the NRC's Web site at <http://www.nrc.gov/site-help/e-submittals.html>, by calling (301) 415-0439, by e-mail to EIE@nrc.gov, or by writing the Office of Information Services, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. The guidance discusses, among other topics, the formats the NRC can accept, the use of electronic signatures, and the treatment of nonpublic information.

(b) The Commission has delegated to the four Regional Administrators licensing authority for selected parts of its decentralized licensing program for nuclear materials as described in paragraph (b)(1) of this section. Any communication, report, or application covered under this licensing program must be submitted to the appropriate Regional Administrator. The administrators' jurisdictions and mailing addresses are listed in paragraph (b)(2) of this section.

(1) The delegated licensing program includes authority to issue, renew, amend, cancel, modify, suspend, or revoke licenses for nuclear materials issued pursuant to 10 CFR parts 30 through 36, 39, 40, and 70 to all persons for academic, medical, and industrial uses, with the following exceptions:

(i) Activities in the fuel cycle and special nuclear material in quantities sufficient to constitute a critical mass in any room or area. This exception does not apply to license modifications relating to termination of special nuclear material licenses that authorize possession of larger quantities when the case is referred for action from NRC's Headquarters to the Regional Administrators.

(ii) Health and safety design review of sealed sources and devices and approval, for licensing purposes, of sealed sources and devices.

(iii) Processing of source material for extracting of metallic compounds (including Zirconium, Hafnium, Tantalum, Titanium, Niobium, etc.).

(iv) Distribution of products containing radioactive material to persons exempt pursuant to 10 CFR 32.11 through 32.26.

(v) New uses or techniques for use of byproduct, source, or special nuclear material.

(vi) Uranium enrichment facilities.

(2) *Submission--(i) Region I.* The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region I non-Agreement States and the District of Columbia: Connecticut, Delaware, Maine, Massachusetts, New Jersey, Pennsylvania, and Vermont. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment or renewal of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region I, 475 Allendale Road, King of Prussia, Pennsylvania 19406-1415; where e-mail is appropriate it should be addressed to *RidsRgn1MailCenter@nrc.gov*.

(ii) *Region II.* The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region II non-Agreement states and territories: Virginia, West Virginia, Puerto Rico, and the Virgin Islands. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment or renewal of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region II Material Licensing/Inspection Branch, Sam Nunn Atlanta Federal Center, Suite 23T85, 61 Forsyth Street, Atlanta, Georgia 30303-8931; where e-mail is appropriate it should be addressed to *RidsRgn2MailCenter@nrc.gov*.

(iii) *Region III.* The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region III non-Agreement States: Indiana, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment, or renewal of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region III, Material Licensing Section, 2443 Warrenville Road, Suite 210, Lisle, IL 60532-4352; where e-mail is appropriate it should be addressed to *RidsRgn3MailCenter@nrc.gov*.

(iv) *Region IV*. The regional licensing program involves all Federal facilities in the region and non-Federal licensees in the following Region IV non-Agreement States and a territory: Alaska, Hawaii, Montana, Oklahoma, South Dakota, Wyoming, and Guam. All mailed or hand-delivered inquiries, communications, and applications for a new license or an amendment or renewal of an existing license specified in paragraph (b)(1) of this section must use the following address: U.S. Nuclear Regulatory Commission, Region IV, Material Radiation Protection Section, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011-4005; where e-mail is appropriate it should be addressed to RidsRgn4MailCenter@nrc.gov.

[48 FR 16031, Apr. 14, 1983, as amended at 49 FR 19631, May 9, 1984; 49 FR 47824, Dec. 7, 1984; 50 FR 14694, Apr. 15, 1985; 51 FR 36001, Oct. 8, 1986; 52 FR 8241, Mar. 17, 1987; 52 FR 38392, Oct. 16, 1987; 52 FR 48093, Dec. 18, 1987; 53 FR 3862, Feb. 10, 1988; 53 FR 43420, Oct. 27, 1988; 57 FR 18390, Apr. 30, 1992; 58 FR 7736, Feb. 9, 1993; 58 FR 64111, Dec. 6, 1993; 59 FR 17466, Apr. 13, 1994; 60 FR 24551, May 9, 1995; 62 FR 22880, Apr. 28, 1997; 68 FR 58806, Oct. 10, 2003; 70 FR 69421, Nov. 16, 2005; 71 FR 15011, Mar. 27, 2006; 72 FR 33386, Jun. 18, 2007; 73 FR 5720, Jan. 31, 2008]

§ 40.6 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

§ 40.7 Employee protection.

(a) Discrimination by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant against an employee for engaging in certain protected activities is prohibited. Discrimination includes discharge and other actions that relate to compensation, terms, conditions, or privileges of employment. The protected activities are established in section 211 of the Energy Reorganization Act of 1974, as amended, and in general are related to the administration or enforcement of a requirement imposed under the Atomic Energy Act or the Energy Reorganization Act.

(1) The protected activities include but are not limited to:

(i) Providing the Commission or his or her employer information about alleged violations of either of the statutes named in paragraph (a) introductory text of this section or possible violations of requirements imposed under either of those statutes;

(ii) Refusing to engage in any practice made unlawful under either of the statutes named in paragraph (a) introductory text or under these requirements if the employee has identified the alleged illegality to the employer;

(iii) Requesting the Commission to institute action against his or her employer for the administration or enforcement of these requirements;

(iv) Testifying in any Commission proceeding, or before Congress, or at any Federal or State proceeding regarding any provision (or proposed provision) of either of the statutes named in paragraph (a) introductory text.

(v) Assisting or participating in, or is about to assist or participate in, these activities.

(2) These activities are protected even if no formal proceeding is actually initiated as a result of the employee assistance or participation.

(3) This section has no application to any employee alleging discrimination prohibited by this section who, acting without direction from his or her employer (or the employer's agent), deliberately causes a violation of any requirement of the Energy Reorganization Act of 1974, as amended, or the Atomic Energy Act of 1954, as amended.

(b) Any employee who believes that he or she has been discharged or otherwise discriminated against by any person for engaging in protected activities specified in paragraph (a)(1) of this section may seek a remedy for the discharge or discrimination through an administrative proceeding in the Department of Labor. The administrative proceeding must be initiated within 180 days after an alleged violation occurs. The employee may do this by filing a complaint alleging the violation with the Department of Labor, Employment Standards Administration, Wage and Hour Division. The Department of Labor may order reinstatement, back pay, and compensatory damages.

(c) A violation of paragraphs (a), (e), or (f) of this section by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant may be grounds for--

(1) Denial, revocation, or suspension of the license.

(2) Imposition of a civil penalty on the licensee, applicant, or a contractor or subcontractor of the licensee or applicant.

(3) Other enforcement action.

(d) Actions taken by an employer, or others, which adversely affect an employee may be predicated upon nondiscriminatory grounds. The prohibition applies when the adverse action occurs because the employee has engaged in protected activities. An employee's engagement in protected activities does not automatically render him or her immune from discharge or discipline for legitimate reasons or from adverse action dictated by nonprohibited considerations.

(e)(1) Each specific licensee, each applicant for a specific license, and each general licensee subject to part 19 shall prominently post the revision of NRC Form 3, "Notice to Employees", referenced in 10 CFR 19.11(c).

(2) The posting of NRC Form 3 must be at locations sufficient to permit employees protected by this section to observe a copy on the way to or from their place of work. Premises must be posted not later than 30 days after an application is docketed and remain posted while the application is pending before the Commission, during the term of the license, and for 30 days following license termination.

(3) Copies of NRC Form 3 may be obtained by writing to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D to part 20 of this chapter, by calling (301) 415-5877, via e-mail to forms@nrc.gov, or by visiting the NRC's Web site at <http://www.nrc.gov> and selecting forms from the index found on the home page.

(f) No agreement affecting the compensation, terms, conditions, or privileges of employment, including an agreement to settle a complaint filed by an employee with the Department of Labor pursuant to section 211 of the Energy Reorganization Act of 1974, may contain any provision which would prohibit, restrict, or otherwise discourage an employee from participating in protected activity as defined in paragraph (a)(1) of this section including, but not limited to, providing information to the NRC or to his or her employer on potential violations or other matters within NRC's regulatory responsibilities.

[58 FR 52409, Oct. 8, 1993, as amended at 60 FR 24551, May 9, 1995; 61 FR 6765, Feb. 22, 1996; 68 FR 58806, Oct. 10, 2003; 72 FR 63973, Nov. 14, 2007]

§ 40.8 Information collection requirements: OMB approval.

(a) The Nuclear Regulatory Commission has submitted the information collection requirements contained in this part to the Office of Management and Budget (OMB) for approval as required by the Paperwork Reduction Act (44 U.S.C. 3501 et seq.). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB has approved the information collection requirements contained in this part under control number 3150-0020.

(b) The approved information collection requirements contained in this part appear in §§ 40.9, 40.23, 40.25, 40.26, 40.27, 40.31, 40.35, 40.36, 40.41, 40.42, 40.43, 40.44, 40.51, 40.60, 40.61, 40.64, 40.65, 40.66, 40.67, and appendix A to this part.

(c) This Part contains information collection requirements in addition to those approved under the control number specified in paragraph (a) of this section. These information collection requirements and the control numbers under which they are approved are as follows:

(1) In §§ 40.31, 40.43, 40.44, and appendix A, NRC Form 313 is approved under control number 3150-0120.

(2) In § 40.31, DOC/NRC Forms AP-1, AP-A, and associated forms are approved under control numbers 0694-0135.

(3) In § 40.31, Forms N-71 and associated forms are approved under control number 3150-0056.

(4) In § 40.42, NRC Form 314 is approved under control number 3150-0028.

(5) In § 40.64, DOE/NRC Form 741 is approved under control number 3150-0003.

[49 FR 19626, May 9, 1984, as amended at 56 FR 40768, Aug. 16, 1991; 58 FR 68731, Dec. 29, 1993; 62 FR 52187, Oct. 6, 1997; 73 FR 78604, Dec. 23, 2008]

§ 40.9 Completeness and accuracy of information.

(a) Information provided to the Commission by an applicant for a license or by a licensee or information required by statute or by the Commission's regulations, orders, or license conditions to be maintained by the applicant or the licensee shall be complete and accurate in all material respects.

(b) Each applicant or licensee shall notify the Commission of information identified by the applicant or licensee as having for the regulated activity a significant implication for public health and safety or common defense and security. An applicant or licensee violates this paragraph only if the applicant or licensee fails to notify the Commission of information that the applicant or licensee has identified as having a significant implication for public health and safety or common defense and security. Notification shall be provided to the Administrator of the appropriate Regional Office within two working days of identifying the information. This requirement is not applicable to information which is already required to be provided to the Commission by other reporting or updating requirements.

[52 FR 49371, Dec. 31, 1987]

§ 40.10 Deliberate misconduct.

(a) Any licensee, applicant for a license, employee of a licensee or applicant; or any contractor (including a supplier or consultant), subcontractor, employee of a contractor or subcontractor of any licensee or applicant for a license, who knowingly provides to any licensee, applicant, contractor, or subcontractor, any components, equipment, materials, or other goods or services that relate to a licensee's or applicant's activities in this part, may not:

(1) Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license issued by the Commission; or

(2) Deliberately submit to the NRC, a licensee, an applicant, or a licensee's or applicant's contractor or subcontractor, information that the person submitting the information knows to be incomplete or inaccurate in some respect material to the NRC.

(b) A person who violates paragraph (a)(1) or (a)(2) of this section may be subject to enforcement action in accordance with the procedures in 10 CFR part 2, subpart B.

(c) For the purposes of paragraph (a)(1) of this section, deliberate misconduct by a person means an intentional act or omission that the person knows:

(1) Would cause a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation, of any license issued by the Commission; or

(2) Constitutes a violation of a requirement, procedure, instruction, contract, purchase order, or policy of a licensee, applicant, contractor, or subcontractor.

[63 FR 1896, Jan. 13, 1998]

Exemptions

§ 40.11 Persons using source material under certain Department of Energy and Nuclear Regulatory Commission contracts.

Except to the extent that Department facilities or activities of the types subject to licensing pursuant to section 202 of the Energy Reorganization Act of 1974 or the Uranium Mill Tailings Radiation Control Act of 1978 are involved, any prime contractor of the Department is exempt from the requirements for a license set forth in sections 62, 63, and 64 of the Act and from the regulations in this part to the extent that such contractor, under his prime contract with the Department, receives, possesses, uses, transfers or delivers source material for: (a) The performance of work for the Department at a United States Government-owned or controlled site, including the transportation of source material to or from such site and the performance of contract services during temporary interruptions of such transportation; (b) research in, or development, manufacture, storage, testing or transportation of, atomic weapons or components thereof; or (c) the use or operation of nuclear reactors or other nuclear devices in a United States Government-owned vehicle or vessel. In addition to the foregoing exemptions, and subject to the requirement for licensing of Department facilities and activities pursuant to section 202 of the Energy Reorganization Act of 1974 or the Uranium Mill Tailings Radiation Control Act of 1980, any prime contractor or subcontractor of the Department or the Commission is exempt from the requirements for a license set forth in sections 62, 63, and 64 of the Act and from the regulations in this part to the extent that such prime contractor or subcontractor receives, possesses, uses, transfers or delivers source material under his prime contract or subcontract when the Commission determines that the exemption of the prime contractor or subcontractor is authorized by law;

and that, under the terms of the contract or subcontract, there is adequate assurance that the work thereunder can be accomplished without undue risk to the public health and safety.

[40 FR 8787, Mar. 3, 1975, as amended at 43 FR 6923, Feb. 17, 1978; 45 FR 65531, Oct. 3, 1980]

§ 40.12 Carriers.

(a) Except as specified in paragraph (b) of this section, common and contract carriers, freight forwarders, warehousemen, and the U.S. Postal Service are exempt from the regulations in this part and the requirements for a license set forth in section 62 of the Act to the extent that they transport or store source material in the regular course of the carriage for another or storage incident thereto.

(b) The exemption in paragraph (a) of this section does not apply to a person who possesses a transient shipment (as defined in § 40.4(r)), an import shipment, or an export shipment of natural uranium in an amount exceeding 500 kilograms, unless the shipment is in the form of ore or ore residue.

[52 FR 9651, Mar. 26, 1987]

§ 40.13 Unimportant quantities of source material.

(a) Any person is exempt from the regulations in this part and from the requirements for a license set forth in section 62 of the Act to the extent that such person receives, possesses, uses, transfers or delivers source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than one-twentieth of 1 percent (0.05 percent) of the mixture, compound, solution or alloy. The exemption contained in this paragraph does not include byproduct material as defined in this part.

(b) Any person is exempt from the regulations in this part and from the requirements for a license set forth in section 62 of the act to the extent that such person receives, possesses, uses, or transfers unrefined and unprocessed ore containing source material; provided, that, except as authorized in a specific license, such person shall not refine or process such ore.

(c) Any person is exempt from the regulation in this part and from the requirements for a license set forth in section 62 of the Act to the extent that such person receives, possesses, uses, or transfers:

(1) Any quantities of thorium contained in (i) incandescent gas mantles, (ii) vacuum tubes, (iii) welding rods, (iv) electric lamps for illuminating purposes: *Provided*, That each lamp does not contain more than 50 milligrams of thorium, (v) germicidal lamps, sunlamps, and lamps for outdoor or industrial lighting: *Provided*, That each lamp does not contain more than 2 grams of thorium, (vi) rare earth metals and compounds, mixtures, and products containing not more than 0.25 percent by weight thorium, uranium, or any combination of these, or (vii) personnel neutron dosimeters: *Provided*, That each dosimeter does not contain more than 50 milligrams of thorium.

(2) Source material contained in the following products:

(i) Glazed ceramic tableware, provided that the glaze contains not more than 20 percent by weight source material;

(ii) Piezoelectric ceramic containing not more than 2 percent by weight source material;

(iii) Glassware containing not more than 10 percent by weight source material; but not including commercially manufactured glass brick, pane glass, ceramic tile, or other glass or ceramic used in construction;

(iv) Glass enamel or glass enamel frit containing not more than 10 percent by weight source material imported or ordered for importation into the United States, or initially distributed by manufacturers in the United States, before July 25, 1983.¹

(3) Photographic film, negatives, and prints containing uranium or thorium;

(4) Any finished product or part fabricated of, or containing tungsten or magnesium-thorium alloys, provided that the thorium content of the alloy does not exceed 4 percent by weight and that the exemption contained in this subparagraph shall not be deemed to authorize the chemical, physical or metallurgical treatment or processing of any such product or part; and

(5) Uranium contained in counterweights installed in aircraft, rockets, projectiles, and missiles, or stored or handled in connection with installation or removal of such counterweights: *Provided, That:*

(i) The counterweights are manufactured in accordance with a specific license issued by the Commission or the Atomic Energy Commission authorizing distribution by the licensee pursuant to this paragraph;

(ii) Each counterweight has been impressed with the following legend clearly legible through any plating or other covering: "Depleted Uranium";²

(iii) Each counterweight is durably and legibly labeled or marked with the identification of the manufacturer, and the statement: "Unauthorized Alterations Prohibited";² and

(iv) The exemption contained in this paragraph shall not be deemed to authorize the chemical, physical, or metallurgical treatment or processing of any such counterweights other than repair or restoration of any plating or other covering.

(6) Natural or depleted uranium metal used as shielding constituting part of any shipping container: *Provided, That:*

(i) The shipping container is conspicuously and legibly impressed with the legend "CAUTION--RADIOACTIVE SHIELDING--URANIUM"; and

(ii) The uranium metal is encased in mild steel or equally fire resistant metal of minimum wall thickness of one-eighth inch (3.2 mm).

(7) Thorium contained in finished optical lenses, provided that each lens does not contain more than 30 percent by weight of thorium; and that the exemption contained in this subparagraph shall not be deemed to authorize either:

(i) The shaping, grinding or polishing of such lens or manufacturing processes other than the assembly of such lens into optical systems and devices without any alteration of the lens; or

(ii) The receipt, possession, use, transfer, or of thorium contained in contact lenses, or in spectacles, or in eyepieces in binoculars or other optical instruments.

(8) Thorium contained in any finished aircraft engine part containing nickel-thoria alloy, *Provided, That:*

(i) The thorium is dispersed in the nickel-thoria alloy in the form of finely divided thoria (thorium dioxide); and

(ii) The thorium content in the nickel-thoria alloy does not exceed 4 percent by weight.

(9) The exemptions in this paragraph (c) do not authorize the manufacture of any of the products described.

(d) Any person is exempt from the regulations in this part and from the requirements for a license set forth in section 62 of the Act to the extent that such person receives, possesses, uses, or transfers uranium contained in detector heads for use in fire detection units, provided that each detector head contains not more than 0.005 microcurie of uranium. The exemption in this paragraph does not authorize the manufacture of any detector head containing uranium.

[26 FR 284, Jan. 14, 1961]

Editorial Note: For Federal Register citations affecting § 40.13, see the List of CFR Sections [Affected](#) in the Finding Aids section.

¹ On July 25, 1983, the exemption of glass enamel or glass enamel frit was suspended. The exemption was eliminated on September 11, 1984.

² The requirements specified in paragraphs (c)(5) (ii) and (iii) of this section need not be met by counterweights manufactured prior to Dec. 31, 1969: Provided, That such counterweights were manufactured under a specific license issued by the Atomic Energy Commission and were impressed with the legend required by § 40.13(c)(5)(ii) in effect on June 30, 1969.

§ 40.14 Specific exemptions.

(a) The Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulation in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

(b) [Reserved]

(c) The Department of Energy is exempt from the requirements of this part to the extent that its activities are subject to the requirements of part 60 or 63 of this chapter.

(d) Except as specifically provided in part 61 of this chapter any licensee is exempt from the requirements of this part to the extent that its activities are subject to the requirements of part 61 of this chapter.

[37 FR 5747, Mar. 21, 1972, as amended at 39 FR 26279, July 18, 1974; 40 FR 8787, Mar. 3, 1975; 45 FR 65531, Oct. 3, 1980; 46 FR 13979, Feb. 25, 1981; 47 FR 57481, Dec. 27, 1982; 66 FR 55790, Nov. 2, 2001]

General Licenses

§ 40.20 Types of licenses.

(a) Licenses for source material and byproduct material are of two types: general and specific. Licenses for long-term care and custody of residual radioactive material at disposal sites are general licenses. The

general licenses provided in this part are effective without the filing of applications with the Commission or the issuance of licensing documents to particular persons. Specific licenses are issued to named persons upon applications filed pursuant to the regulations in this part.

(b) Section 40.27 contains a general license applicable for custody and long-term care of residual radioactive material at uranium mill tailings disposal sites remediated under title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended.

(c) Section 40.28 contains a general license applicable for custody and long-term care of byproduct material at uranium or thorium mill tailings disposal sites under title II of the Uranium Mill Tailings Radiation Control Act of 1978, as amended.

[55 FR 45598, Oct. 30, 1990]

§ 40.21 General license to receive title to source or byproduct material.

A general license is hereby issued authorizing the receipt of title to source or byproduct material, as defined in this part, without regard to quantity. This general license does not authorize any person to receive, possess, deliver, use, or transfer source or byproduct material.

[45 FR 65531, Oct. 3, 1980]

§ 40.22 Small quantities of source material.

(a) A general license is hereby issued authorizing commercial and industrial firms, research, educational and medical institutions and Federal, State and local government agencies to use and transfer not more than fifteen (15) pounds of source material at any one time for research, development, educational, commercial or operational purposes. A person authorized to use or transfer source material, pursuant to this general license, may not receive more than a total of 150 pounds of source material in any one calendar year.

(b) Persons who receive, possess, use, or transfer source material pursuant to the general license issued in paragraph (a) of this section are exempt from the provisions of parts 19, 20, and 21, of this chapter to the extent that such receipt, possession, use or transfer are within the terms of such general license: *Provided, however,* That this exemption shall not be deemed to apply to any such person who is also in possession of source material under a specific license issued pursuant to this part.

(c) Persons who receive, possess, use or transfer source material pursuant to the general license in paragraph (a) of this section are prohibited from administering source material, or the radiation therefrom, either externally or internally, to human beings except as may be authorized by NRC in a specific license.

[26 FR 284, Jan. 14, 1961, as amended at 38 FR 22221, Aug. 17, 1973; 42 FR 28896, June 6, 1977; 45 FR 55420, Aug. 20, 1980]

§ 40.23 General license for carriers of transient shipments of natural uranium other than in the form of ore or ore residue.

(a) A general license is hereby issued to any person to possess a transient shipment of natural uranium, other than in the form of ore or ore residue, in amounts exceeding 500 kilograms.

(b)(1) Persons generally licensed under paragraph (a) of this section, who plan to carry a transient shipment with scheduled stops at a United States port, shall notify the Director, Division of Nuclear Security, Office

of Nuclear Security and Incident Response, using an appropriate method listed in § 40.5. The notification must be in writing and must be received at least 10 days before transport of the shipment commences at the shipping facility.

(2) The notification must include the following information:

- (i) Location of all scheduled stops in United States territory;
 - (ii) Arrival and departure times for all scheduled stops in United States territory;
 - (iii) The type of transport vehicle;
 - (iv) A physical description of the shipment;
 - (v) The numbers and types of containers;
 - (vi) The name and telephone number of the carrier's representatives at each stopover location in the United States territory;
 - (vii) A listing of the modes of shipments, transfer points, and routes to be used;
 - (viii) The estimated date and time that shipment will commence and that each nation (other than the United States) along the route is scheduled to be entered;
 - (ix) For shipment between countries that are not party to the Convention on the Physical Protection of Nuclear Material (i.e., not listed in appendix F to part 73 of this chapter), a certification that arrangements have been made to notify the Director, Division of Nuclear Security when the shipment is received at the destination facility.
- (c) Persons generally licensed under this section making unscheduled stops at United States ports, immediately after the decision to make an unscheduled stop, shall provide to the Director, Division of Nuclear Security the information required under paragraph (b) of this section.
- (d) A licensee who needs to amend a notification may do so by telephoning the Division of Nuclear Security at (301) 415-6828.

[52 FR 9651, Mar. 26, 1987, as amended at 53 FR 4110, Feb. 12, 1988; 60 FR 24551, May 9, 1995; 68 FR 58807, Oct. 10, 2003]

§ 40.24 [Reserved]

§ 40.25 General license for use of certain industrial products or devices.

(a) A general license is hereby issued to receive, acquire, possess, use, or transfer, in accordance with the provisions of paragraphs (b), (c), (d), and (e) of this section, depleted uranium contained in industrial products or devices for the purpose of providing a concentrated mass in a small volume of the product or device.

(b) The general license in paragraph (a) of this section applies only to industrial products or devices which have been manufactured or initially transferred in accordance with a specific license issued pursuant to § 40.34 (a) of this part or in accordance with a specific license issued by an Agreement State which

authorizes manufacture of the products or devices for distribution to persons generally licensed by the Agreement State.

(c)(1) Persons who receive, acquire, possess, or use depleted uranium pursuant to the general license established by paragraph (a) of this section shall file NRC Form 244, "Registration Certificate—Use of Depleted Uranium Under General License," with the Director, Office of Federal and State Materials and Environmental Management Programs, by an appropriate method listed in § 40.5, with a copy to the appropriate NRC Regional Administrator. The form shall be submitted within 30 days after the first receipt or acquisition of such depleted uranium. The registrant shall furnish on NRC Form 244 the following information and such other information as may be required by that form:

(i) Name and address of the registrant;

(ii) A statement that the registrant has developed and will maintain procedures designed to establish physical control over the depleted uranium described in paragraph (a) of this section and designed to prevent transfer of such depleted uranium in any form, including metal scrap, to persons not authorized to receive the depleted uranium; and

(iii) Name and/or title, address, and telephone number of the individual duly authorized to act for and on behalf of the registrant in supervising the procedures identified in paragraph (c)(1)(ii) of this section.

(2) The registrant possessing or using depleted uranium under the general license established by paragraph (a) of this section shall report in writing to the Director, Office of Federal and State Materials and Environmental Management Programs, with a copy to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D of part 20 of this chapter, any changes in information furnished by him in the NRC Form 244 "Registration Certificate—Use of Depleted Uranium Under General License." The report shall be submitted within 30 days after the effective date of such change.

(d) A person who receives, acquires, possesses, or uses depleted uranium pursuant to the general license established by paragraph (a) of this section:

(1) Shall not introduce such depleted uranium, in any form, into a chemical, physical, or metallurgical treatment or process, except a treatment or process for repair or restoration of any plating or other covering of the depleted uranium.

(2) Shall not abandon such depleted uranium.

(3) Shall transfer or dispose of such depleted uranium only by transfer in accordance with the provisions of § 40.51 of this part. In the case where the transferee receives the depleted uranium pursuant to the general license established by paragraph (a) of this section, the transferor shall furnish the transferee a copy of this section and a copy of Form NRC 244. In the case where the transferee receives the depleted uranium pursuant to a general license contained in an Agreement State's regulation equivalent to this section, the transferor shall furnish the transferee a copy of this section and a copy of Form NRC 244 accompanied by a note explaining that use of the product or device is regulated by the Agreement State under requirements substantially the same as those in this section.

(4) Within 30 days of any transfer, shall report in writing to the Director, Office of Federal and State Materials and Environmental Management Programs, with a copy to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D of part 20 of this chapter, the name and address of the person receiving the source material pursuant to such transfer.

(e) Any person receiving, acquiring, possessing, using, or transferring depleted uranium pursuant to the general license established by paragraph (a) of this section is exempt from the requirements of parts 19, 20 and 21 of this chapter with respect to the depleted uranium covered by that general license.

[41 FR 53331, Dec. 6, 1976, as amended at 42 FR 28896, June 6, 1977; 43 FR 6923, Feb. 17, 1978; 43 FR 52202, Nov. 9, 1978; 52 FR 31611, Aug. 21, 1987; 60 FR 24551, May 9, 1995; 68 FR 58807, Oct. 10, 2003; 73 FR 5720, Jan. 31, 2008]

§ 40.26 General license for possession and storage of byproduct material as defined in this part.

(a) A general license is hereby issued to receive title to, own, or possess byproduct material as defined in this part without regard to form or quantity.

(b) The general license in paragraph (a) of this section applies only: In the case of licensees of the Commission, where activities that result in the production of byproduct material are authorized under a specific license issued by the Commission pursuant to this part, to byproduct material possessed or stored at an authorized disposal containment area or transported incident to such authorized activity: Provided, That authority to receive title to, own, or possess byproduct material under this general license shall terminate when the specific license for source material expires, is renewed, or is amended to include a specific license for byproduct material as defined in this part.

(c) The general license in paragraph (a) of this section is subject to:

(1) The provisions of parts 19, 20, 21, and §§ 40.1, 40.2a, 40.3, 40.4, 40.5, 40.6, 40.41, 40.46, 40.60, 40.61, 40.62, 40.63, 40.65, 40.71, and 40.81 of part 40 of this chapter; and

(2) The documentation of daily inspections of tailings or waste retention systems and the immediate notification of the appropriate NRC regional office as indicated in appendix D to part 20 of this chapter, or the Director, Office of Federal and State Materials and Environmental Management Programs, U.S. Nuclear Regulatory Commission, Washington, DC 20555, of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or of any unusual conditions (conditions not contemplated in the design of the retention system) that if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas; and any additional requirements the Commission may by order deem necessary. The licensee shall retain this documentation of each daily inspection as a record for three years after each inspection is documented.

(d) The general license in paragraph (a) of this section shall expire nine months from the effective date of this subparagraph unless an applicable licensee has submitted, pursuant to the provisions of § 40.31 of this part, an application for license renewal or amendment which includes a detailed program for meeting the technical and financial criteria contained in appendix A of this part.

[44 FR 50014, Aug. 24, 1979, as amended at 45 FR 12377, Feb. 26, 1980; 45 FR 65531, Oct. 3, 1980; 53 FR 19248, May 27, 1988; 56 FR 40768, Aug. 16, 1991; 73 FR 5720, Jan. 31, 2008]

§ 40.27 General license for custody and long-term care of residual radioactive material disposal sites.

(a) A general license is issued for the custody of and long-term care, including monitoring, maintenance, and emergency measures necessary to protect public health and safety and other actions necessary to comply with the standards promulgated under section 275(a) of the Atomic Energy Act of 1954, as amended, for disposal sites under title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended. The license is available only to the Department of Energy, or another Federal agency designated by the President to provide long-term care. The purpose of this general license is to ensure that uranium

mill tailings disposal sites will be cared for in such a manner as to protect the public health, safety, and the environment after remedial action has been completed.

(b) The general license in paragraph (a) of this section becomes effective when the Commission accepts a site Long-Term Surveillance Plan (LTSP) that meets the requirements of this section, and when the Commission concurs with the Department of Energy's determination of completion of remedial action at each disposal site. There is no termination of this general license. The LTSP may incorporate by reference information contained in documents previously submitted to the Commission if the references to the individual incorporated documents are clear and specific. Each LTSP must include--

(1) A legal description of the disposal site to be licensed, including documentation on whether land and interests are owned by the United States or an Indian tribe. If the site is on Indian land, then, as specified in the Uranium Mill Tailings Radiation Control Act of 1978, as amended, the Indian tribe and any person holding any interest in the land shall execute a waiver releasing the United States of any liability or claim by the Tribe or person concerning or arising from the remedial action and holding the United States harmless against any claim arising out of the performance of the remedial action;

(2) A detailed description, which can be in the form of a reference, of the final disposal site conditions, including existing ground water characterization and any necessary ground water protection activities or strategies. This description must be detailed enough so that future inspectors will have a baseline to determine changes to the site and when these changes are serious enough to require maintenance or repairs. If the disposal site has continuing aquifer restoration requirements, then the licensing process will be completed in two steps. The first step includes all items other than ground water restoration. Ground water monitoring, which would be addressed in the LTSP, may still be required in this first step to assess performance of the tailings disposal units. When the Commission concurs with the completion of ground water restoration, the licensee shall assess the need to modify the LTSP and report results to the Commission. If the proposed modifications meet the requirements of this section, the LTSP will be considered suitable to accommodate the second step.

(3) A description of the long-term surveillance program, including proposed inspection frequency and reporting to the Commission (as specified in appendix A, criterion 12 of this part), frequency and extent of ground water monitoring if required, appropriate constituent concentration limits for ground water, inspection personnel qualifications, inspection procedures, recordkeeping and quality assurance procedures;

(4) The criteria for follow-up inspections in response to observations from routine inspections or extreme natural events; and

(5) The criteria for instituting maintenance or emergency measures.

(c) The long-term care agency under the general license established by paragraph (a) of this section shall--

(1) Implement the LTSP as described in paragraph (b) of this section;

(2) Care for the disposal site in accordance with the provisions of the LTSP;

(3) Notify the Commission of any changes to the LTSP; the changes may not conflict with the requirements of this section;

(4) Guarantee permanent right-of-entry to Commission representatives for the purpose of periodic site inspections; and

(5) Notify the Commission prior to undertaking any significant construction, actions, or repairs related to the disposal site, even if the action is required by a State or another Federal agency.

(d) As specified in the Uranium Mill Tailings Radiation Control Act of 1978, as amended, the Secretary of the Interior, with the concurrence of the Secretary of Energy and the Commission, may sell or lease any subsurface mineral rights associated with land on which residual radioactive materials are disposed. In such cases, the Commission shall grant a license permitting use of the land if it finds that the use will not disturb the residual radioactive materials or that the residual radioactive materials will be restored to a safe and environmentally sound condition if they are disturbed by the use.

(e) The general license in paragraph (a) of this section is exempt from parts 19, 20, and 21 of this chapter, unless significant construction, actions, or repairs are required. If these types of actions are to be undertaken, the licensee shall explain to the Commission which requirements from these parts apply for the actions and comply with the appropriate requirements.

[55 FR 45598, Oct. 30, 1990]

§ 40.28 General license for custody and long-term care of uranium or thorium byproduct materials disposal sites.

(a) A general license is issued for the custody of and long-term care, including monitoring, maintenance, and emergency measures necessary to protect the public health and safety and other actions necessary to comply with the standards in this part for uranium or thorium mill tailings sites closed under title II of the Uranium Mill Tailings Radiation Control Act of 1978, as amended. The licensee will be the Department of Energy, another Federal agency designated by the President, or a State where the disposal site is located. The purpose of this general license is to ensure that uranium and thorium mill tailings disposal sites will be cared for in such a manner as to protect the public health, safety, and the environment after closure.

(b) The general license in paragraph (a) of this section becomes effective when the Commission terminates, or concurs in an Agreement State's termination of, the current specific license and a site Long-Term Surveillance Plan (LTSP) meeting the requirements of this section has been accepted by the Commission. There is no termination of this general license. If the LTSP has not been formally received by the NRC prior to termination of the current specific license, the Commission may issue a specific order to the intended custodial agency to ensure continued control and surveillance of the disposal site to protect the public health, safety, and the environment. The Commission will not unnecessarily delay the termination of the specific license solely on the basis that an acceptable LTSP has not been received. The LTSP may incorporate by reference information contained in documents previously submitted to the Commission if the references to the individual incorporated documents are clear and specific. Each LTSP must include--

(1) A legal description of the disposal site to be transferred (unless transfer is exempted under provisions of the Atomic Energy Act, § 83(b)(1)(A)) and licensed;

(2) A detailed description, which can be in the form of a reference of the final disposal site conditions, including existing ground water characterization. This description must be detailed enough so that future inspectors will have a baseline to determine changes to the site and when these changes are serious enough to require maintenance or repairs;

(3) A description of the long-term surveillance program, including proposed inspection frequency and reporting to the Commission (as specified in appendix A, Criterion 12 of this part), frequency and extent of ground water monitoring if required, appropriate constituent concentration limits for ground water, inspection personnel qualifications, inspection procedures, recordkeeping and quality assurance procedures;

(4) The criteria for follow-up inspections in response to observations from routine inspections or extreme natural events; and

(5) The criteria for instituting maintenance or emergency measures.

(c) The long-term care agency who has a general license established by paragraph (a) of this section shall--

(1) Implement the LTSP as described in paragraph (b) of this section;

(2) Care for the disposal site in accordance with the provisions of the LTSP;

(3) Notify the Commission of any changes to the LTSP; the changes may not conflict with the requirements of this section;

(4) Guarantee permanent right-of-entry to Commission representatives for the purpose of periodic site inspections; and

(5) Notify the Commission prior to undertaking any significant construction, actions, or repairs related to the disposal site, even if the action is required by a State or another Federal agency.

(d) Upon application, the Commission may issue a specific license, as specified in the Uranium Mill Tailings Radiation Control Act of 1978, as amended, permitting the use of surface and/or subsurface estates transferred to the United States or a State. Although an application may be received from any person, if permission is granted, the person who transferred the land to DOE or the State shall receive the right of first refusal with respect to this use of the land. The application must demonstrate that--

(1) The proposed action does not endanger the public health, safety, welfare, or the environment;

(2) Whether the proposed action is of a temporary or permanent nature, the site would be maintained and/or restored to meet requirements in appendix A of this part for closed sites; and

(3) Adequate financial arrangements are in place to ensure that the byproduct materials will not be disturbed, or if disturbed that the applicant is able to restore the site to a safe and environmentally sound condition.

(e) The general license in paragraph (a) of this section is exempt from parts 19, 20, and 21 of this chapter, unless significant construction, actions, or repairs are required. If these types of actions are to be undertaken, the licensee shall explain to the Commission which requirements from these parts apply for the actions and comply with the appropriate requirements.

(f) In cases where the Commission determines that transfer of title of land used for disposal of any byproduct materials to the United States or any appropriate State is not necessary to protect the public health, safety or welfare or to minimize or eliminate danger to life or property (Atomic Energy Act, § 83(b)(1)(A)), the Commission will consider specific modifications of the custodial agency's LTSP provisions on a case-by-case basis.

[55 FR 45599, Oct. 30, 1990]

License Applications

§ 40.31 Application for specific licenses.

(a) A person may file an application for specific license on NRC Form 313, "Application for Material License," in accordance with the instructions in § 40.5 of this chapter. Information contained in previous applications, statements or reports filed with the Commission may be incorporated by reference provided that the reference is clear and specific.

(b) The Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked. All applications and statements shall be signed by the applicant or licensee or a person duly authorized to act for and on his behalf.

(c) Applications and documents submitted to the Commission in connection with applications will be made available for public inspection in accordance with the provisions of the regulations contained in parts 2 and 9 of this chapter.

(d) An application for a license filed pursuant to the regulations in this part will be considered also as an application for licenses authorizing other activities for which licenses are required by the Act: *Provided*, That the application specifies the additional activities for which licenses are requested and complies with regulations of the Commission as to applications for such licenses.

(e) Each application for a source material license, other than a license exempted from part 170 of this chapter, shall be accompanied by the fee prescribed in § 170.31 of this chapter. No fee will be required to accompany an application for renewal or amendment of a license, except as provided in § 170.31 of this chapter.

(f) An application for a license to possess and use source material for uranium milling, production of uranium hexafluoride, or for the conduct of any other activity which the Commission has determined pursuant to subpart A of part 51 of this chapter will significantly affect the quality of the environment shall be filed at least 9 months prior to commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by any Environmental Report required pursuant to subpart A of part 51 of this chapter.

(g) An applicant for a license to possess and use source material, or the recipient of such a license shall report information to the Commission as follows:

(1) In response to a written request by the Commission, a uranium or thorium processing plant, and any other applicant for a license to possess and use source material, shall submit facility information described in § 75.10 of this chapter on Form N-71 and associated forms and site information on DOC/NRC Form AP-A, and associated forms;

(2) As required by the Additional Protocol, a uranium or thorium processing plant, and any other applicant for a license to possess and use source material, shall submit location information described in § 75.11 of this chapter on DOC/NRC Form AP-1 and associated forms; shall permit verification of this information by the International Atomic Energy Agency (IAEA); and shall take other actions as may be necessary to implement the US/IAEA Safeguards Agreement, as described in Part 75 of this chapter; or

(3) As required by the Additional Protocol, an ore processing plant or a facility using or storing ore concentrates or other impure source materials shall submit the information described in § 75.11 of this chapter, as appropriate, on DOC/NRC Form AP-1 and associated forms; shall permit verification of this information by the International Atomic Energy Agency (IAEA); and shall take other actions as may be necessary to implement the US/IAEA Safeguards Agreement, as described in Part 75 of this chapter.

(h) An application for a license to receive, possess, and use source material for uranium or thorium milling or byproduct material, as defined in this part, at sites formerly associated with such milling shall contain proposed written specifications relating to milling operations and the disposition of the byproduct material to achieve the requirements and objectives set forth in appendix A of this part. Each application must clearly demonstrate how the requirements and objectives set forth in appendix A of this part have been addressed. Failure to clearly demonstrate how the requirements and objectives in appendix A have been addressed shall be grounds for refusing to accept an application.

(i) As provided by § 40.36, certain applications for specific licenses filed under this part must contain a proposed decommissioning funding plan or a certification of financial assurance for decommissioning. In the case of renewal applications submitted before July 27, 1990, this submittal may follow the renewal application but must be submitted on or before July 27, 1990.

(j)(1) Each application to possess uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total must contain either:

(i) An evaluation showing that the maximum intake of uranium by a member of the public due to a release would not exceed 2 milligrams; or

(ii) An emergency plan for responding to the radiological hazards of an accidental release of source material and to any associated chemical hazards directly incident thereto.

(2) One or more of the following factors may be used to support an evaluation submitted under paragraph (j)(1)(i) of this section:

(i) All or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;

(ii) Facility design or engineered safety features in the facility would reduce the amount of the release; or

(iii) Other factors appropriate for the specific facility.

(3) An emergency plan submitted under paragraph (j)(1)(ii) of this section must include the following:

(i) Facility description. A brief description of the licensee's facility and area near the site.

(ii) Types of accidents. An identification of each type of accident for which protective actions may be needed.

(iii) Classification of accidents. A classification system for classifying accidents as alerts or site area emergencies.

(iv) Detection of accidents. Identification of the means of detecting each type of radioactive materials accident in a timely manner.

(v) Mitigation of consequences. A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.

(vi) Assessment of releases. A brief description of the methods and equipment to assess releases of radioactive materials.

(vii) Responsibilities. A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying offsite response organizations and the NRC; also responsibilities for developing, maintaining, and updating the plan.

(viii) Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point must be established. The notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the NRC operations center immediately after notification of the offsite response organizations and not later than one hour after the licensee declares an emergency.¹

(ix) Information to be communicated. A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to offsite response organizations and to the NRC.

(x) Training. A brief description of the frequency, performance objectives and plans for the training that the licensee will provide workers on how to respond to an emergency including any special instructions and orientation tours the licensee would offer to fire, police, medical and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

(xi) Safe shutdown. A brief description of the means of restoring the facility to a safe condition after an accident.

(xii) Exercises. Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with offsite response organizations must include the check and update of all necessary telephone numbers. The licensee shall invite offsite response organizations to participate in the biennial exercises. Participation of offsite response organizations in biennial exercises although recommended is not required. Exercises must use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises must evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques must be corrected.

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

(4) The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to the NRC. The licensee shall provide any comments received within the 60 days to the NRC with the emergency plan.

(k) A license application for a uranium enrichment facility must be accompanied by an Environmental Report required under subpart A of part 51 of this chapter.

(l) A license application that involves the use of source material in a uranium enrichment facility must include the applicant's provisions for liability insurance.

(m) Each applicant for a license for the possession of source material at a facility for the production or conversion of uranium hexafluoride shall protect Safeguards Information against unauthorized disclosure in accordance with the requirements in §§ 73.21 and 73.22 of this chapter, as applicable. Each applicant for a license for source material shall protect Safeguards Information against unauthorized disclosure in accordance with the requirements in § 73.21 and the requirements of § 73.22 or § 73.23 of this chapter, as applicable.

[26 FR 284, Jan. 14, 1961, as amended at 31 FR 4669, Mar. 19, 1966; 34 FR 19546, Dec. 11, 1969; 36 FR 145, Jan. 6, 1971; 37 FR 5748, Mar. 21, 1972; 46 FR 13497, Feb. 23, 1981; 49 FR 9403, Mar. 12, 1984; 49 FR 19626, May 9, 1984; 49 FR 21699, May 23, 1984; 49 FR 27924, July 9, 1984; 53 FR 24047, June 27, 1988; 54 FR 14061, Apr. 7, 1989; 57 FR 18390, Apr. 30, 1992; 68 FR 58807, Oct. 10, 2003; 73 FR 78604, Dec. 23, 2008; 73 FR 63570, Oct. 24, 2008]

¹ These reporting requirements do not supersede or release licensees of complying with the requirements under the Emergency Planning and Community Right-to-Know Act of 1986, Title III. Pub. L. 99-499 or other state or federal reporting requirements.

§ 40.32 General requirements for issuance of specific licenses.

An application for a specific license will be approved if:

- (a) The application is for a purpose authorized by the Act; and
- (b) The applicant is qualified by reason of training and experience to use the source material for the purpose requested in such manner as to protect health and minimize danger to life or property; and
- (c) The applicant's proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property; and
- (d) The issuance of the license will not be inimical to the common defense and security or to the health and safety of the public; and

~~(e) In the case of an application for a license for a uranium enrichment facility, or for a license to possess and use source and byproduct material for uranium milling, production of uranium hexafluoride, or for the conduct of any other activity which the Commission determines will significantly affect the quality of the environment, the Director, Office of Federal and State Materials and Environmental Management Programs or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to subpart A of part 51 of this chapter, has concluded, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to this conclusion is grounds for denial of a license to possess and use source and byproduct material in the plant or facility. As used in this paragraph, the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, roads necessary for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.~~

(e) In the case of an application for a license for a uranium enrichment facility, or for a license to possess and use source and byproduct material for uranium milling, production of uranium hexafluoride, or for the

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conduct of any other activity which the NRC determines will significantly affect the quality of the environment, the Director, Office of Federal and State Materials and Environmental Management Programs or his/her designee, before commencement of construction, on the basis of information filed and evaluations made pursuant to subpart A of part 51 of this chapter, has concluded, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to this conclusion is grounds for denial of a license to possess and use source and byproduct material in the plant or facility. Commencement of construction as defined in § 40.4 may include non-construction activities if the activity has a reasonable nexus to radiological safety and security.

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(f) The applicant satisfies any applicable special requirements contained in § 40.34.

(g) If the proposed activity involves use of source material in a uranium enrichment facility, the applicant has satisfied the applicable provisions of part 140 of this chapter.

[26 FR 284, Jan. 14, 1961, as amended at 36 FR 12731, July 7, 1971; 40 FR 8787, Mar. 3, 1975; 41 FR 53332, Dec. 6, 1976; 43 FR 6924, Feb. 17, 1978; 49 FR 9403, Mar. 12, 1984; 57 FR 18390, Apr. 30, 1992; 73 FR 5721, Jan. 31, 2008]

§ 40.33 Issuance of a license for a uranium enrichment facility.

(a) The Commission will hold a hearing pursuant to 10 CFR part 2, subparts A, G, and I, on each application with regard to the licensing of the construction and operation of a uranium enrichment facility. The Commission will publish public notice of the hearing in the Federal Register at least 30 days before the hearing.

(b) A license for a uranium enrichment facility may not be issued before the hearing is completed and a decision issued on the application.

[57 FR 18391, Apr. 30, 1992]

§ 40.34 Special requirements for issuance of specific licenses.

(a) An application for a specific license to manufacture industrial products and devices containing depleted uranium, or to initially transfer such products or devices, for use pursuant to § 40.25 of this part or equivalent regulations of an Agreement State, will be approved if:

(1) The applicant satisfies the general requirements specified in § 40.32;

(2) The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control procedures, labeling or marking, proposed uses, and potential hazards of the industrial product or device to provide reasonable assurance that possession, use, or transfer of the depleted uranium in the product or device is not likely to cause any individual to receive in 1 year a radiation dose in excess of 10 percent of the annual limits specified in § 20.1201(a) of this chapter; and

(3) The applicant submits sufficient information regarding the industrial product or device and the presence of depleted uranium for a mass-volume application in the product or device to provide reasonable assurance that unique benefits will accrue to the public because of the usefulness of the product or device.

(b) In the case of an industrial product or device whose unique benefits are questionable, the Commission will approve an application for a specific license under this paragraph only if the product or device is found to combine a high degree of utility and low probability of uncontrolled disposal and dispersal of significant quantities of depleted uranium into the environment.

(c) The Commission may deny an applicant for a specific license under this paragraph if the end uses of the industrial product or device cannot be reasonably foreseen.

[41 FR 53332, Dec. 6, 1976, as amended at 43 FR 6924, Feb. 17, 1978; 58 FR 67661, Dec. 22, 1993; 59 FR 41643, Aug. 15, 1994]

§ 40.35 Conditions of specific licenses issued pursuant to § 40.34.

Each person licensed pursuant to § 40.34 shall:

(a) Maintain the level of quality control required by the license in the manufacture of the industrial product or device, and in the installation of the depleted uranium into the product or device;

(b) Label or mark each unit to: (1) Identify the manufacturer or initial transferor of the product or device and the number of the license under which the product or device was manufactured or initially transferred, the fact that the product or device contains depleted uranium, and the quantity of depleted uranium in each product or device; and (2) state that the receipt, possession, use, and transfer of the product or device are subject to a general license or the equivalent and the regulations of the U.S. NRC or of an Agreement State;

(c) Assure that the depleted uranium before being installed in each product or device has been impressed with the following legend clearly legible through any plating or other covering: "Depleted Uranium";

(d)(1) Furnish a copy of the general license contained in § 40.25 and a copy of Form NRC 244 to each person to whom he transfers source material in a product or device for use pursuant to the general license contained in § 40.25; or

(2) Furnish a copy of the general license contained in the Agreement State's regulation equivalent to § 40.25 and a copy of the Agreement State's certificate, or alternately, furnish a copy of the general license contained in § 40.25 and a copy of Form NRC 244 to each person to whom he transfers source material in a product or device for use pursuant to the general license of an Agreement State. If a copy of the general license in § 40.25 and a copy of Form NRC 244 are furnished to such person, they shall be accompanied by a note explaining that use of the product or device is regulated by the Agreement State under requirements substantially the same as those in § 40.25; and

(e)(1) Report to the Director, Office of Federal and State Materials and Environmental Management Programs, by an appropriate method listed in § 40.5, all transfers of industrial products or devices to persons for use under the general license in § 40.25. Such report shall identify each general licensee by name and address, an individual by name and/or position who may constitute a point of contact between the Commission and the general licensee, the type and model number of device transferred, and the quantity of depleted uranium contained in the product or device. The report shall be submitted within 30 days after the end of each calendar quarter in which such a product or device is transferred to the generally licensed person. If no transfers have been made to persons generally licensed under § 40.25 during the reporting period, the report shall so indicate;

(2) Report to the responsible Agreement State Agency all transfers of industrial products or devices to persons for use under the general license in the Agreement State's regulation equivalent to § 40.25. Such report shall identify each general licensee by name and address, an individual by name and/or position who

may constitute a point of contact between the Agency and the general licensee, the type and model number of device transferred, and the quantity of depleted uranium contained in the product or device. The report shall be submitted within 30 days after the end of each calendar quarter in which such product or device is transferred to the generally licensed person. If no transfers have been made to a particular Agreement State during the reporting period, this information shall be reported to the responsible Agreement State Agency;

(3) Keep records showing the name, address, and a point of contact for each general license to whom he or she transfers depleted uranium in industrial products or devices for use pursuant to the general license provided in § 40.25 or equivalent regulations of an Agreement State. The records must be retained for three years from the date of transfer and must show the date of each transfer, the quantity of depleted uranium in each product or device transferred, and compliance with the report requirements of this section.

(f) Licensees required to submit emergency plans by § 40.31(i) shall follow the emergency plan approved by the Commission. The licensee may change the plan without Commission approval if the changes do not decrease the effectiveness of the plan. The licensee shall furnish the change to the Director, Office of Federal and State Materials and Environmental Management Programs, by an appropriate method listed in § 40.5, and to affected offsite response organizations, within six months after the change is made. Proposed changes that decrease the effectiveness of the approved emergency plan may not be implemented without application to and prior approval by the Commission.

[41 FR 53332, Dec. 6, 1976, as amended at 43 FR 6924, Feb. 17, 1978; 52 FR 31611, Aug. 21, 1987; 53 FR 19248, May 27, 1988; 54 FR 14062, Apr. 7, 1989; 68 FR 58807, Oct. 10, 2003; 73 FR 5721, Jan. 31, 2008]

§ 40.36 Financial assurance and recordkeeping for decommissioning.

Except for licenses authorizing the receipt, possession, and use of source material for uranium or thorium milling, or byproduct material at sites formerly associated with such milling, for which financial assurance requirements are set forth in appendix A of this part, criteria for providing financial assurance for decommissioning are as follows:

(a) Each applicant for a specific license authorizing the possession and use of more than 100 mCi of source material in a readily dispersible form shall submit a decommissioning funding plan as described in paragraph (d) of this section.

(b) Each applicant for a specific license authorizing possession and use of quantities of source material greater than 10 mCi but less than or equal to 100 mCi in a readily dispersible form shall either--

(1) Submit a decommissioning funding plan as described in paragraph (d) of this section; or

(2) Submit a certification that financial assurance for decommissioning has been provided in the amount of \$225,000 by June 2, 2005 using one of the methods described in paragraph (e) of this section. For an applicant, this certification may state that the appropriate assurance will be obtained after the application has been approved and the license issued but before the receipt of licensed material. If the applicant defers execution of the financial instrument until after the license has been issued, a signed original of the financial instrument obtained to satisfy the requirements of paragraph (e) of this section must be submitted to NRC prior to receipt of licensed material. If the applicant does not defer execution of the financial instrument, the applicant shall submit to NRC, as part of the certification, a signed original of the financial instrument obtained to satisfy the requirements of paragraph (e) of this section.

(c)(1) Each holder of a specific license issued on or after July 27, 1990, which is covered by paragraph (a) or (b) of this section, shall provide financial assurance for decommissioning in accordance with the criteria set forth in this section.

(2) Each holder of a specific license issued before July 27, 1990, and of a type described in paragraph (a) of this section shall submit a decommissioning funding plan as described in paragraph (d) of this section or a certification of financial assurance for decommissioning in an amount at least equal to \$1,125,000 in accordance with the criteria set forth in this section. If the licensee submits the certification of financial assurance rather than a decommissioning funding plan, the licensee shall include a decommissioning funding plan in any application for license renewal. Licensees required to submit the \$1,125,000 amount must do so by December 2, 2004.

(3) Each holder of a specific license issued before July 27, 1990, and of a type described in paragraph (b) of this section shall submit, on or before July 27, 1990, a decommissioning funding plan, as described in paragraph (d) of this section, or a certification of financial assurance for decommissioning in accordance with the criteria set forth in this section.

(4) Any licensee who has submitted an application before July 27, 1990, for renewal of license in accordance with § 40.43 shall provide financial assurance for decommissioning in accordance with paragraphs (a) and (b) of this section. This assurance must be submitted when this rule becomes effective November 24, 1995.

(d)(1) Each decommissioning funding plan must be submitted for review and approval and must contain –

(i) A detailed cost estimate for decommissioning, in the amount reflecting:

(A) The cost of an independent contractor to perform all decommissioning activities;

(B) The cost of meeting the 10 CFR 20.1402 criteria for unrestricted use, provided that, if the applicant or licensee can demonstrate its ability to meet the provisions of 10 CFR 20.1403, the cost estimate may be based on meeting the 10 CFR 20.1403 criteria;

(C) The volume of onsite subsurface material containing residual radioactivity that will require remediation; and

(D) An adequate contingency factor.

(ii) Identification of and justification for using the key assumptions contained in the DCE;

(iii) A description of the method of assuring funds for decommissioning from paragraph (e) of this section, including means for adjusting cost estimates and associated funding levels periodically over the life of the facility;

(iv) A certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning; and

(v) A signed original, or if permitted, a copy, of the financial instrument obtained to satisfy the requirements of paragraph (e) of this section (unless a previously submitted and accepted financial instrument continues to cover the cost estimate for decommissioning).

(2) At the time of license renewal and at intervals not to exceed 3 years, the decommissioning funding plan must be resubmitted with adjustments as necessary to account for changes in costs and the extent of contamination. If the amount of financial assurance will be adjusted downward, this can not be done until the updated decommissioning funding plan is approved. The decommissioning funding plan must update the information submitted with the original or prior approved plan, and must specifically consider the effect of the following events on decommissioning costs:

(i) Spills of radioactive material producing additional residual radioactivity in onsite subsurface material;

(ii) Waste inventory increasing above the amount previously estimated;

(iii) Waste disposal costs increasing above the amount previously estimated;

(iv) Facility modifications;

(v) Changes in authorized possession limits;

(vi) Actual remediation costs that exceed the previous cost estimate;

(vii) Onsite disposal; and

(viii) Use of a settling pond.

(d) Each decommissioning funding plan must contain a cost estimate for decommissioning and a description of the method of assuring funds for decommissioning from paragraph (e) of this section, including means for adjusting cost estimates and associated funding levels periodically over the life of the facility. Cost estimates must be adjusted at intervals not to exceed 3 years. The decommissioning funding plan must also contain a certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning and a signed original of the financial instrument obtained to satisfy the requirements of paragraph (e) of this section.

(e) Financial assurance for decommissioning must be provided by one or more of the following methods:

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

(2) A surety method, insurance, or other guarantee method. These methods guarantee that decommissioning costs will be paid. A surety method may be in the form of a surety bond, letter of credit, or line of credit. A parent company guarantee of funds for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in appendix A to part 30. A parent company guarantee may not be used in combination with other financial methods to satisfy the requirements of this section. For commercial corporations that issue bonds, a guarantee of funds by the applicant or licensee for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in appendix C to part 30. For commercial companies that do not issue bonds, a guarantee of funds by the applicant or licensee for decommissioning costs may be used if the guarantee and test are as contained in appendix D to part 30. For nonprofit entities, such as colleges, universities, and nonprofit hospitals, a guarantee of funds by the applicant or licensee may be used if the guarantee and test are as contained in appendix E to part 30. A guarantee by the applicant or licensee may not be used in combination with any other financial methods used to satisfy the requirements of this section or in any situation where the applicant or licensee has a

parent company holding majority control of the voting stock of the company. Any surety method or insurance used to provide financial assurance for decommissioning must contain the following conditions:

- (i) The surety method or insurance must be open-ended or, if written for a specified term, such as five years, must be renewed automatically unless 90 days or more prior to the renewal date, the issuer notifies the Commission, the beneficiary, and the licensee of its intention not to renew. The surety method or insurance must also provide that the full face amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Commission within 30 days after receipt of notification of cancellation.
 - (ii) The surety method or insurance must be payable to a trust established for decommissioning costs. The trustee and trust must be acceptable to the Commission. An acceptable trustee includes an appropriate State or Federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency.
 - (iii) The surety method or insurance must remain in effect until the Commission has terminated the license.
- (3) An external sinking fund in which deposits are made at least annually, coupled with a surety method or insurance, the value of which may decrease by the amount being accumulated in the sinking fund. An external sinking fund is a fund established and maintained by setting aside funds periodically in an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities. The surety or insurance provision must be as stated in paragraph (e)(2) of this section.
- (4) In the case of Federal, State, or local government licensees, a statement of intent containing a cost estimate for decommissioning or an amount based on paragraph (b) of this section, and indicating that funds for decommissioning will be obtained when necessary.
- (5) When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity.
- (f) Each person licensed under this part shall keep records of information important to the decommissioning of a facility in an identified location until the site is released for unrestricted use. Before licensed activities are transferred or assigned in accordance with § 40.41(b) licensees shall transfer all records described in this paragraph to the new licensee. In this case, the new licensee will be responsible for maintaining these records until the license is terminated. If records important to the decommissioning of a facility are kept for other purposes, reference to these records and their locations may be used. Information the Commission considers important to decommissioning consists of--
- (1) Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site. These records may be limited to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records must include any known information on identification of involved nuclides, quantities, forms, and concentrations.
 - (2) As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored, and of locations of possible inaccessible contamination such as buried pipes which may be subject to contamination. If required drawings are referenced, each relevant document

need not be indexed individually. If drawings are not available, the licensee shall substitute appropriate records of available information concerning these areas and locations.

(3) Except for areas containing depleted uranium used only for shielding or as penetrators in unused munitions, a list contained in a single document and updated every 2 years, of the following:

(i) All areas designated and formerly designated as restricted areas as defined under 10 CFR 20.1003;

(ii) All areas outside of restricted areas that require documentation under § 40.36(f)(1);

(iii) All areas outside of restricted areas where current and previous wastes have been buried as documented under 10 CFR 20.2108; and

(iv) All areas outside of restricted areas that contain material such that, if the license expired, the licensee would be required to either decontaminate the area to meet the criteria for decommissioning in 10 CFR part 20, subpart E, or apply for approval for disposal under 10 CFR 20.2002.

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

[53 FR 24047, June 27, 1988, as amended at 58 FR 39633, July 26, 1993; 58 FR 67661, Dec. 22, 1993; 58 FR 68731, Dec. 29, 1993; 59 FR 1618, Jan. 12, 1994; 60 FR 38238, July 26, 1995; 61 FR 24674, May 16, 1996; 62 FR 39090, July 21, 1997; 63 FR 29543, June 1, 1998; 68 FR 57336, Oct. 3, 2003]

§ 40.38 Ineligibility of certain applicants.

A license may not be issued to the Corporation if the Commission determines that:

(a) The Corporation is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government; or

(b) The issuance of such a license would be inimical to--

(1) The common defense and security of the United States; or

(2) The maintenance of a reliable and economical domestic source of enrichment services.

[62 FR 6669, Feb. 12, 1997]

Licenses

§ 40.41 Terms and conditions of licenses.

(a) Each license issued pursuant to the regulations in this part shall be subject to all the provisions of the act, now or hereafter in effect, and to all rules, regulations and orders of the Commission.

(b) Neither the license nor any right under the license shall be assigned or otherwise transferred in violation of the provisions of the Act.

(c) Each person licensed by the Commission pursuant to the regulations in this part shall confine his possession and use of source or byproduct material to the locations and purposes authorized in the license. Except as otherwise provided in the license, a license issued pursuant to the regulations in this part shall carry with it the right to receive, possess, and use source or byproduct material. Preparation for shipment and transport of source or byproduct material shall be in accordance with the provisions of part 71 of this chapter.

(d) Each license issued pursuant to the regulations in this part shall be deemed to contain the provisions set forth in sections 183b.-d., of the Act, whether or not said provisions are expressly set forth in the license.

(e) The Commission may incorporate in any license at the time of issuance, or thereafter, by appropriate rule, regulation or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of source or byproduct material as it deems appropriate or necessary in order to:

(1) Promote the common defense and security;

(2) Protect health or to minimize danger of life or property;

(3) Protect restricted data;

(4) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary or appropriate to effectuate the purposes of the act and regulations thereunder.

(f)(1) Each licensee shall notify the appropriate NRC Regional Administrator, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of title 11 (Bankruptcy) of the United States Code by or against:

(i) The licensee;

(ii) An entity (as that term is defined in 11 U.S.C. 101(14)) controlling the licensee or listing the license or licensee as property of the estate; or

(iii) An affiliate (as that term is defined in 11 U.S.C. 101(2)) of the licensee.

(2) This notification must indicate:

(i) The bankruptcy court in which the petition for bankruptcy was filed; and

(ii) The date of the filing of the petition.

(g) No person may commence operation of a uranium enrichment facility until the Commission verifies through inspection that the facility has been constructed in accordance with the requirements of the license. The Commission shall publish notice of the inspection results in the Federal Register.

(h) Each licensee shall ensure that Safeguards Information is protected against unauthorized disclosure in accordance with the requirements in § 73.21 and the requirements of § 73.22 or § 73.23 of this chapter, as applicable.

[26 FR 284, Jan. 14, 1961, as amended at 31 FR 15145, Dec. 2, 1966; 45 FR 65531, Oct. 3, 1980; 48 FR 32328, July 15, 1983; 52 FR 1295, Jan. 12, 1987; 57 FR 18391, Apr. 30, 1992; 73 FR 63571, Oct. 24, 2008]

§ 40.42 Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas.

(a) Each specific license expires at the end of the day on the expiration date stated in the license unless the licensee has filed an application for renewal under § 40.43 not less than 30 days before the expiration date stated in the existing license. If an application for renewal has been filed at least 30 days before the expiration date stated in the existing license, the existing license expires at the end of the day on which the Commission makes a final determination to deny the renewal application or, if the determination states an expiration date, the expiration date stated in the determination.

(b) Each specific license revoked by the Commission expires at the end of the day on the date of the Commission's final determination to revoke the license, or on the expiration date stated in the determination, or as otherwise provided by Commission Order.

(c) Each specific license continues in effect, beyond the expiration date if necessary, with respect to possession of source material until the Commission notifies the licensee in writing that the license is terminated. During this time, the licensee shall--

(1) Limit actions involving source material to those related to decommissioning; and

(2) Continue to control entry to restricted areas until they are suitable for release in accordance with NRC requirements;

(d) Within 60 days of the occurrence of any of the following, consistent with the administrative directions in § 40.5, each licensee shall provide notification to the NRC in writing and either begin decommissioning its site, or any separate building or outdoor area that contains residual radioactivity, so that the building or outdoor area is suitable for release in accordance with NRC requirements, or submit within 12 months of notification a decommissioning plan, if required by paragraph (g)(1) of this section, and begin decommissioning upon approval of that plan if--

(1) The license has expired pursuant to paragraph (a) or (b) of this section; or

(2) The licensee has decided to permanently cease principal activities, as defined in this part, at the entire site or in any separate building or outdoor area; or

(3) No principal activities under the license have been conducted for a period of 24 months; or

(4) No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with NRC requirements.

(e) Coincident with the notification required by paragraph (d) of this section, the licensee shall maintain in effect all decommissioning financial assurances established by the licensee pursuant to § 40.36 in conjunction with a license issuance or renewal or as required by this section. The amount of the financial assurance must be increased, or may be decreased, as appropriate, to cover the detailed cost estimate for decommissioning established pursuant to paragraph (g)(4)(v) of this section.

(1) Any licensee who has not provided financial assurance to cover the detailed cost estimate submitted with the decommissioning plan shall do so when this rule becomes effective November 24, 1995.

(2) Following approval of the decommissioning plan, a licensee may reduce the amount of the financial assurance as decommissioning proceeds and radiological contamination is reduced at the site with the approval of the Commission.

(f) The Commission may grant a request to delay or postpone initiation of the decommissioning process if the Commission determines that such relief is not detrimental to the public health and safety and is otherwise in the public interest. The request must be submitted no later than 30 days before notification pursuant to paragraph (d) of this section. The schedule for decommissioning set forth in paragraph (d) of this section may not commence until the Commission has made a determination on the request.

(g)(1) A decommissioning plan must be submitted if required by license condition or if the procedures and activities necessary to carry out decommissioning of the site or separate building or outdoor area have not been previously approved by the Commission and these procedures could increase potential health and safety impacts to workers or to the public, such as in any of the following cases:

(i) Procedures would involve techniques not applied routinely during cleanup or maintenance operations;

(ii) Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation;

(iii) Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

(iv) Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

(2) The Commission may approve an alternate schedule for submittal of a decommissioning plan required pursuant to paragraph (d) of this section if the Commission determines that the alternative schedule is necessary to the effective conduct of decommissioning operations and presents no undue risk from radiation to the public health and safety and is otherwise in the public interest.

(3) The procedures listed in paragraph (g)(1) of this section may not be carried out prior to approval of the decommissioning plan.

(4) The proposed decommissioning plan for the site or separate building or outdoor area must include:

(i) A description of the conditions of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan;

(ii) A description of planned decommissioning activities;

(iii) A description of methods used to ensure protection of workers and the environment against radiation hazards during decommissioning;

(iv) A description of the planned final radiation survey; and

(v) An updated detailed cost estimate for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and a plan for assuring the availability of adequate funds for completion of decommissioning.

(vi) For decommissioning plans calling for completion of decommissioning later than 24 months after plan approval, a justification for the delay based on the criteria in paragraph (i) of this section.

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

(h)(1) Except as provided in paragraph (i) of this section, licensees shall complete decommissioning of the site or separate building or outdoor area as soon as practicable but no later than 24 months following the initiation of decommissioning.

(2) Except as provided in paragraph (i) of this section, when decommissioning involves the entire site, the licensee shall request license termination as soon as practicable but no later than 24 months following the initiation of decommissioning.

(i) The Commission may approve a request for an alternate schedule for completion of decommissioning of the site or separate building or outdoor area, and license termination if appropriate, if the Commission determines that the alternative is warranted by consideration of the following:

(1) Whether it is technically feasible to complete decommissioning within the allotted 24-month period;

(2) Whether sufficient waste disposal capacity is available to allow completion of decommissioning within the allotted 24-month period;

(3) Whether a significant volume reduction in wastes requiring disposal will be achieved by allowing short-lived radionuclides to decay;

(4) Whether a significant reduction in radiation exposure to workers can be achieved by allowing short-lived radionuclides to decay; and

(5) Other site-specific factors which the Commission may consider appropriate on a case-by-case basis, such as the regulatory requirements of other government agencies, lawsuits, ground-water treatment activities, monitored natural ground-water restoration, actions that could result in more environmental harm than deferred cleanup, and other factors beyond the control of the licensee.

(j) As the final step in decommissioning, the licensee shall--

(1) Certify the disposition of all licensed material, including accumulated wastes, by submitting a completed NRC Form 314 or equivalent information; and

(2) Conduct a radiation survey of the premises where the licensed activities were carried out and submit a report of the results of this survey, unless the licensee demonstrates in some other manner that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E or, for uranium milling (uranium and thorium recovery) facilities, Criterion 6(6) of Appendix A to this part. The licensee shall, as appropriate--

(i) Report levels of gamma radiation in units of millisieverts (microroentgen) per hour at one meter from surfaces, and report levels of radioactivity, including alpha and beta, in units of megabecquerels (disintegrations per minute or microcuries) per 100 square centimeters removable and fixed for surfaces, megabecquerels (microcuries) per milliliter for water, and becquerels (picocuries) per gram for solids such as soils or concrete; and

(ii) Specify the survey instrument(s) used and certify that each instrument is properly calibrated and tested.

(k) Specific licenses, including expired licenses, will be terminated by written notice to the licensee when the Commission determines that:

(1) Source material has been properly disposed;

(2) Reasonable effort has been made to eliminate residual radioactive contamination, if present; and

(3)(i) A radiation survey has been performed which demonstrates that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E; or for uranium milling (uranium and thorium recovery) facilities, Criterion 6(6) of Appendix A to this part;

(ii) Other information submitted by the licensee is sufficient to demonstrate that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E.

(4) Records required by § 40.61(d) and (f) have been received.

(l) Specific licenses for uranium and thorium milling are exempt from paragraphs (d)(4), (g) and (h) of this section with respect to reclamation of tailings impoundments and/or waste disposal areas.

[59 FR 36035, July 15, 1994, as amended at 60 FR 38239, July 26, 1995; 61 FR 1114, Jan. 16, 1996; 61 FR 24674, May 16, 1996; 61 FR 29637, June 12, 1996; 62 FR 39090, July 21, 1997; 66 FR 64738, Dec. 14, 2001; 68 FR 75390, Dec. 31, 2003; 73 FR 42673, Jul. 23, 2008]

§ 40.43 Renewal of licenses.

(a) Application for renewal of a specific license must be filed on NRC Form 313 and in accordance with § 40.31.

(b) If any licensee granted the extension described in 10 CFR 40.42(a)(2) has a currently pending renewal application for the extended license, that application will be considered to be withdrawn by the licensee and any renewal fees paid by the licensee for that application will be refunded.

[59 FR 36037, July 15, 1994, as amended at 61 FR 1114, Jan. 16, 1996; 62 FR 52187, Oct. 6, 1997]

§ 40.44 Amendment of licenses at request of licensee.

Applications for amendment of a license shall be filed on NRC Form 313 in accordance with § 40.31 and shall specify the respects in which the licensee desires the license to be amended and the grounds for such amendment.

[49 FR 19627, May 9, 1984, as amended at 56 FR 40768, Aug. 16, 1991]

§ 40.45 Commission action on applications to renew or amend.

In considering an application by a licensee to renew or amend his license the Commission will apply the applicable criteria set forth in § 40.32.

[26 FR 284, Jan. 14, 1961, as amended at 43 FR 6924, Feb. 17, 1978]

§ 40.46 Inalienability of licenses.

(a) No license issued or granted pursuant to the regulations in this part shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Commission shall after securing full information, find that the transfer is in accordance with the provisions of this act, and shall give its consent in writing.

(b) An application for transfer of license must include:

(1) The identity, technical and financial qualifications of the proposed transferee; and

(2) Financial assurance for decommissioning information required by § 40.36 or Appendix A to this part, as applicable.

Transfer of Source Material

§ 40.51 Transfer of source or byproduct material.

(a) No licensee shall transfer source or byproduct material except as authorized pursuant to this section.

(b) Except as otherwise provided in his license and subject to the provisions of paragraphs (c) and (d) of this section, any licensee may transfer source or byproduct material:

(1) To the Department of Energy;

(2) To the agency in any Agreement State which regulates radioactive materials pursuant to an agreement with the Commission or the Atomic Energy Commission under section 274 of the Act;

(3) To any person exempt from the licensing requirements of the Act and regulations in this part, to the extent permitted under such exemption;

(4) To any person in an Agreement State subject to the jurisdiction of that State who has been exempted from the licensing requirements and regulations of that State, to the extent permitted under such exemptions;

(5) To any person authorized to receive such source or byproduct material under terms of a specific license or a general license or their equivalents issued by the Commission or an Agreement State;

(6) To any person abroad pursuant to an export license issued under part 110 of this chapter; or

(7) As otherwise authorized by the commission in writing.

(c) Before transferring source or byproduct material to a specific licensee of the Commission or an Agreement State or to a general licensee who is required to register with the Commission or with an Agreement State prior to receipt of the source or byproduct material, the licensee transferring the material

shall verify that the transferee's license authorizes receipt of the type, form, and quantity of source or byproduct material to be transferred.

(d) The following methods for the verification required by paragraph (c) of this section are acceptable:

(1) The transferor may have in his possession, and read, a current copy of the transferee's specific license or registration certificate;

(2) The transferor may have in his possession a written certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of source or byproduct material to be transferred, specifying the license or registration certification number, issuing agency and expiration date;

(3) For emergency shipments the transferor may accept oral certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of source or byproduct material to be transferred, specifying the license or registration certificate number, issuing agency and expiration date: *Provided*, That the oral certification is confirmed in writing within 10 days;

(4) The transferor may obtain other sources of information compiled by a reporting service from official records of the Commission or the licensing agency of an Agreement State as to the identity of licensees and the scope and expiration dates of licenses and registrations; or

(5) When none of the methods of verification described in paragraphs (d)(1) to (4) of this section are readily available or when a transferor desires to verify that information received by one of such methods is correct or up-to-date, the transferor may obtain and record confirmation from the Commission or the licensing agency of an Agreement State that the transferee is licensed to receive the source or byproduct material.

[45 FR 65532, Oct. 3, 1980]

Records, Reports, and Inspections

§ 40.60 Reporting requirements.

(a) *Immediate report.* Each licensee shall notify the NRC as soon as possible but not later than 4 hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).

(b) *Twenty-four hour report.* Each licensee shall notify the NRC within 24 hours after the discovery of any of the following events involving licensed material:

(1) An unplanned contamination event that:

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

(ii) Involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of §§ 20.1001-20.2401 of 10 CFR part 20 for the material; and

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

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

(i) The equipment is required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;

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

(iii) No redundant equipment is available and operable to perform the required safety function.

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

(4) An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:

(i) The quantity of material involved is greater than five times the lowest annual limit on intake specified in appendix B of §§ 20.1001-20.2401 of 10 CFR part 20 for the material; and

(ii) The damage affects the integrity of the licensed material or its container.

(c) *Preparation and submission of reports.* Reports made by licensees in response to the requirements of this section must be made as follows:

(1) Licensees shall make reports required by paragraphs (a) and (b) of this section by telephone to the NRC Operations Center.¹ To the extent that the information is available at the time of notification, the information provided in these reports must include:

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

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

(iii) The exact location of the event;

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

(v) Any personnel radiation exposure data available.

(2) *Written report.* Each licensee who makes a report required by paragraph (a) or (b) of this section shall submit a written follow-up report within 30 days of the initial report. Written reports prepared pursuant to other regulations may be submitted to fulfill this requirement if the reports contain all of the necessary information and the appropriate distribution is made. These written reports must be sent to the NRC's Document Control Desk by an appropriate method listed in § 40.5, with a copy to the appropriate NRC regional office listed in appendix D to part 20 of this chapter. The reports must include the following:

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

- (ii) The exact location of the event;
 - (iii) The isotopes, quantities, and chemical and physical form of the licensed material involved;
 - (iv) Date and time of the event;
 - (v) Corrective actions taken or planned and the results of any evaluations or assessments; and
 - (vi) The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.
- (3) The provisions of § 40.60 do not apply to licensees subject to the notification requirements in § 50.72. They do apply to those part 50 licensees possessing material licensed under part 40 who are not subject to the notification requirements in § 50.72.

[56 FR 40768, Aug. 16, 1991, as amended at 59 FR 14086, Mar. 25, 1994; 68 FR 58807, Oct. 10, 2003]

¹ The commercial telephone number for the NRC Operations Center is (301) 816-5100.

§ 40.61 Records.

(a) Each person who receives source or byproduct material pursuant to a license issued pursuant to the regulations in this part shall keep records showing the receipt, transfer, and disposal of this source or byproduct material as follows:

- (1) The licensee shall retain each record of receipt of source or byproduct material as long as the material is possessed and for three years following transfer or disposition of the source or byproduct material.
- (2) The licensee who transferred the material shall retain each record of transfer or source or byproduct material until the Commission terminates each license that authorizes the activity that is subject to the recordkeeping requirement.
- (3) The licensee shall retain each record of disposal of source or byproduct material until the Commission terminates each license that authorizes the activity that is subject to the recordkeeping requirement.
- (4) If source or byproduct material is combined or mixed with other licensed material and subsequently treated in a manner that makes direct correlation of a receipt record with a transfer, export, or disposition record impossible, the licensee may use evaluative techniques (such as first-in-first-out), to make the records that are required by this Part account for 100 percent of the material received.

(b) The licensee shall retain each record that is required by the regulations in this part or by license condition for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, each record must be maintained until the Commission terminates the license that authorizes the activity that is subject to the recordkeeping requirement.

(c)(1) Records which must be maintained pursuant to this part may be the original or reproduced copy or microform if the reproduced copy or microform is duly authenticated by authorized personnel and the microform is capable of producing a clear and legible copy after storage for the period specified by Commission regulations. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as

letters, drawings, specifications, must include all pertinent information such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

(2) If there is a conflict between the Commission's regulations in this part, license condition, or other written Commission approval or authorization pertaining to the retention period for the same type of record, the retention period specified in the regulations in this part for such records shall apply unless the Commission, pursuant to § 40.14 of this part, has granted a specific exemption from the record retention requirements specified in the regulations in this part.

(d) Prior to license termination, each licensee authorized to possess source material, in an unsealed form, shall forward the following records to the appropriate NRC Regional Office:

(1) Records of disposal of licensed material made under § 20.2002 (including burials authorized before January 28, 1981¹), 20.2003, 20.2004, 20.2005; and

(2) Records required by § 20.2103(b)(4).

(e) If licensed activities are transferred or assigned in accordance with § 40.41(b), each licensee authorized to possess source material, in an unsealed form, shall transfer the following records to the new licensee and the new licensee will be responsible for maintaining these records until the license is terminated:

(1) Records of disposal of licensed material made under § 20.2002 (including burials authorized before January 28, 1981¹), 20.2003, 20.2004, 20.2005; and

(2) Records required by § 20.2103(b)(4).

(f) Prior to license termination, each licensee shall forward the records required by § 40.36(f) to the appropriate NRC Regional Office.

[45 FR 65532, Oct. 3, 1980, as amended at 53 FR 19248, May 27, 1988; 61 FR 24674, May 16, 1996]

¹ A previous § 20.304 permitted burial of small quantities of licensed materials in soil before January 28, 1981, without specific Commission authorization. See § 20.304 contained in the 10 CFR, parts 0 to 199, edition revised as of January 1, 1981.

§ 40.62 Inspections.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect source or byproduct material and the premises and facilities wherein source or byproduct material is used or stored.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by him pursuant to the regulations in this chapter.

[45 FR 65532, Oct. 3, 1980]

§ 40.63 Tests.

Each licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part, including tests of:

(a) Source or byproduct material;

- (b) Facilities wherein source or byproduct material is utilized or stored;
- (c) Radiation detection and monitoring instruments; and
- (d) Other equipment and devices used in connection with the utilization and storage of source or byproduct material.

[45 FR 65533, Oct. 3, 1980]

§ 40.64 Reports.

(a) Except as specified in paragraphs (d) and (e) of this section, each specific licensee who transfers, receives, or adjusts the inventory in any manner, of uranium or thorium source material with foreign obligations by one kilogram or more; or who imports or exports one kilogram or more of uranium or thorium source material; or who uses one kilogram or more of any uranium or thorium source material in enrichment services, downblending uranium that has an initial enrichment of the U^{235} isotope of 10 percent or more, or in the fabrication of mixed-oxide fuels, shall complete a Nuclear Material Transaction Report in computer-readable format as specified in the instructions in NUREG/BR-0006 and NMMSS Report D-24, "Personal Computer Data Input for NRC Licensees." Each licensee who exports one kilogram or more of uranium or thorium source material shall complete in the format listed above the licensee's portion of the Nuclear Material Transaction Report unless there is indication of loss, theft, or diversion as discussed under paragraph (d) of this section, in which case both the licensee's and the foreign facility's information must be reported. Licensees who import one kilogram or more of uranium or thorium source material shall complete the supplier's and the licensee's portion of the Nuclear Material Transaction Report. Copies of the instructions may be obtained either by writing the U.S. Nuclear Regulatory Commission, Division of Fuel Cycle Safety and Safeguards, Washington, DC 20555-0001, or by e-mail to RidsNmssFcsl@nrc.gov. Each licensee who transfers the material shall submit a Nuclear Material Transaction Report in computer-readable format as specified in the instructions no later than the close of business the next working day. Each licensee who receives the material shall submit a Nuclear Material Transaction Report in computer-readable format in accordance with instructions within ten (10) days after the material is received. The Commission's copy of the report must be submitted to the address specified in the instructions. These prescribed computer-readable forms replace the DOE/NRC Form 741 previously submitted in paper form.

(b) Except as specified in paragraphs (d) and (e) of this section, each licensee who:

(1) Possesses, or had possessed in the previous reporting period, at any one time and location, one kilogram or more of uranium or thorium source material with foreign obligations as defined in this part, shall document holdings as of September 30 of each year and submit to the Commission within 30 days, a statement of its source material inventory with foreign obligations as defined in this part. Alternatively, this information may be submitted with the licensee's material status reports on special nuclear material filed under part 72 or 74 of this chapter, as a statement of its source material inventory with foreign obligations as defined in this part. This statement must be submitted to the address specified in the reporting instructions in NUREG/BR-0007, and include the Reporting Identification Symbol (RIS) assigned by the Commission to the licensee.

(2) Possesses, or had possessed in the previous reporting period, one kilogram or more of uranium or thorium source material pursuant to the operation of enrichment services, downblending uranium that has an initial enrichment of the U^{235} isotope of 10 percent or more, or in the fabrication of mixed-oxide fuels shall complete and submit, in computer-readable format, Material Balance and Physical Inventory Listing Reports concerning all source material that the licensee has received, produced, possessed, transferred, consumed, disposed of, or lost. Reports must be submitted for each Reporting Identification Symbol (RIS) account including all holding accounts. Each licensee shall prepare and submit these reports as specified in

the instructions in NUREG/BR-0007 and NMMSS Report D-24, "Personal Computer Data Input for NRC Licensees." These reports must document holdings as of September 30 of each year and must be submitted to the Commission within 30 days. Alternatively, these reports may be submitted with the licensee's material status reports on special nuclear material filed under parts 72 or 74 of this chapter. Copies of the reporting instructions may be obtained either by writing to the U.S. Nuclear Regulatory Commission, Division of Fuel Cycle Safety and Safeguards, Washington, DC 20555-0001, or by e-mail to *RidsNmssFcsc@nrc.gov*. Each licensee required to report material balance, inventory, and/or foreign obligation information, as detailed in this part, shall resolve any discrepancies identified during the report review and reconciliation process within 30 calendar days of notification of a discrepancy identified by the NRC.

(c)(1) Except as specified in paragraph (d) of this section, each licensee who is authorized to possess uranium or thorium pursuant to a specific license shall notify the NRC Headquarters Operations Center by telephone, at the numbers listed in appendix A of part 73 of this chapter, of any incident in which an attempt has been made or is believed to have been made to commit a theft or unlawful diversion of more than 6.8 kilograms (kg) [15 pounds] of such material at any one time or more than 68 kg [150 pounds] of such material in any one calendar year.

(2) The licensee shall notify the NRC as soon as possible, but within 4 hours, of discovery of any incident in which an attempt has been made or is believed to have been made to commit a theft or unlawful diversion of such material. A copy of the written follow-up notification should also be made to the Director, Division of Nuclear Security, Office of Nuclear Security and Incident Response, by an appropriate method listed in § 40.5.

(3) The initial notification shall be followed within a period of sixty (60) days by a written follow-up notification submitted in accordance with § 40.5. A copy of the written follow-up notification shall also be sent to: ATTN: Document Control Desk, Director, Division of Nuclear Security, Office of Nuclear Security and Incident Response, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

(4) Subsequent to the submission of the written follow-up notification required by this paragraph, the licensee shall promptly update the written follow-up notification, in accordance with this paragraph, with any substantive additional information, which becomes available to the licensee, concerning an attempted or apparent theft or unlawful diversion of source material.

(d) The reports described in paragraphs (a), (b), and (c) of this section are not required for:

(1) Processed ores containing less than five (5) percent of uranium or thorium, or any combination of uranium or thorium, by dry weight;

(2) Thorium contained in magnesium-thorium and tungsten-thorium alloys, if the thorium content in the alloys does not exceed 4 percent by weight;

(3) Chemical catalysts containing uranium depleted in the U-235 isotope to 0.4 percent or less, if the uranium content of the catalyst does not exceed 15 percent by weight; or

(4) Any source material contained in non-nuclear end use devices or components, including but not limited to permanently installed shielding, teletherapy, radiography, X-ray, accelerator devices, or munitions.

(e) Any licensee who is required to submit inventory change reports and material status reports pursuant to part 75 of this chapter (pertaining to implementation of the US/IAEA Safeguards Agreement) shall prepare and submit such reports only as provided in §§ 75.34 and 75.35 of this chapter (instead of as provided in paragraphs (a) and (b) of this section).

[35 FR 12195, July 30, 1970, as amended at 36 FR 10938, June 5, 1971; 38 FR 1272, Jan. 11, 1973; 38 FR 2330, Jan. 24, 1973; 40 FR 8787, Mar. 3, 1975; 41 FR 16446, Apr. 19, 1976; 45 FR 50710, July 31, 1980; 49 FR 24707, June 15, 1984; 51 FR 9766, Mar. 21, 1986; 52 FR 31611, Aug. 21, 1987; 59 FR 35620, July 13, 1994; 68 FR 10364, Mar. 5, 2003; 68 FR 58807, Oct. 10, 2003; 73 FR 32461, Jun. 9, 2008]

§ 40.65 Effluent monitoring reporting requirements.

(a) Each licensee authorized to possess and use source material in uranium milling, in production of uranium hexafluoride, or in a uranium enrichment facility shall:

(1) Within 60 days after January 1, 1976 and July 1, 1976, and within 60 days after January 1 and July 1 of each year thereafter, submit a report to the Director, Office of Federal and State Materials and Environmental Management Programs, using an appropriate method listed in § 40.5, with a copy to the appropriate NRC Regional Office shown in appendix D to part 20 of this chapter; the report must specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous six months of operation, and such other information as the Commission may require to estimate maximum potential annual radiation doses to the public resulting from effluent releases. If quantities of radioactive materials released during the reporting period are significantly above the licensee's design objectives previously reviewed as part of the licensing action, the report shall cover this specifically. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

(2) [Reserved]

(b) [Reserved]

[40 FR 53230, Nov. 17, 1975, as amended at 41 FR 21627, May 27, 1976; 42 FR 25721, May 19, 1977; 52 FR 31611, Aug. 21, 1987; 57 FR 18391, Apr. 30, 1992; 68 FR 58807, Oct. 10, 2003; 73 FR 5721, Jan. 31, 2008]

§ 40.66 Requirements for advance notice of export shipments of natural uranium.

(a) Each licensee authorized to export natural uranium, other than in the form of ore or ore residue, in amounts exceeding 500 kilograms, shall notify the Director, Division of Nuclear Security, Office of Nuclear Security and Incident Response, by an appropriate method listed in § 40.5.

The notification must be in writing and must be received at least 10 days before transport of the shipment commences at the shipping facility.

(b) The notification must include the following information:

(1) The name(s), address(es), and telephone number(s) of the shipper, receiver, and carrier(s);

(2) A physical description of the shipment;

(3) A listing of the mode(s) of shipment, transfer points, and routes to be used;

(4) The estimated date and time that shipment will commence and that each nation (other than the United States) along the route is scheduled to be entered; and

(5) A certification that arrangements have been made to notify the Division of Nuclear Safety, Office of Nuclear Security and Incident Response when the shipment is received at the receiving facility.

(c) A licensee who needs to amend a notification may do so by telephoning the Division of Nuclear Safety, Office of Nuclear Security and Incident Response at (301) 816-5100.

[52 FR 9651, Mar. 26, 1987, as amended at 53 FR 4110, Feb. 12, 1988; 60 FR 24551, May 9, 1995; 68 FR 58808, Oct. 10, 2003; 69 FR 76600, Dec. 22, 2004]

§ 40.67 Requirement for advance notice for importation of natural uranium from countries that are not party to the Convention on the Physical Protection of Nuclear Material.

(a) Each licensee authorized to import natural uranium, other than in the form of ore or ore residue, in amounts exceeding 500 kilograms, from countries not party to the Convention on the Physical Protection of Nuclear Material (see appendix F to Part 73 of this chapter) shall notify the Director, Division of Nuclear Security, Office of Nuclear Security and Incident Response, using an appropriate method listed in § 40.5. . The notification must be in writing and must be received at least 10 days before transport of the shipment commences at the shipping facility.

(b) The notification must include the following information:

(1) The name(s), address(es), and telephone number(s) of the shipper, receiver, and carrier(s);

(2) A physical description of the shipment;

(3) A listing of the mode(s) of shipment, transfer points, and routes to be used;

(4) The estimated date and time that shipment will commence and that each nation along the route is scheduled to be entered.

(c) The licensee shall notify the Division of Nuclear Security by telephone at (301) 816-5100 when the shipment is received in the receiving facility.

(d) A licensee who needs to amend a notification may do so by telephoning the Division of Nuclear Security at (301) 816-5100.

[52 FR 9652, Mar. 26, 1987, as amended at 53 FR 4110, Feb. 12, 1988; 60 FR 24551, May 9, 1995; 68 FR 58808, Oct. 10, 2003; 69 FR 76600, Dec. 22, 2004]

Modification and Revocation of Licenses

§ 40.71 Modification and revocation of licenses.

(a) The terms and conditions of each license shall be subject to amendment, revision, or modification by reason of amendments to the Act, or by reason of rules, regulations, or orders issued in accordance with the Act.

(b) Any license may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act, or because of conditions revealed by such application or statement of fact or any report, record, or inspection or other means which would warrant the Commission to refuse to grant a license on an original application, or for

violation of, or failure to observe any of, the terms and conditions of the Act, or the license, or of any rule, regulation or order of the Commission.

(c) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended, or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded opportunity to demonstrate or achieve compliance with all lawful requirements.

[26 FR 284, Jan. 14, 1961, as amended at 35 FR 11460, July 17, 1970; 48 FR 32328, July 15, 1983]

Enforcement

§ 40.81 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of--

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or

(3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violations of--

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section;

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

[57 FR 55074, Nov. 24, 1992]

§ 40.82 Criminal penalties.

(a) Section 223 of the Atomic Energy Act of 1954, as amended, provides for criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any regulation issued under sections 161b, 161i, or 161o of the Act. For purposes of section 223, all the regulations in part 40 are issued under one or more of sections 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.

(b) The regulations in part 40 that are not issued under sections 161b, 161i, or 161o for the purposes of section 223 are as follows: §§ 40.1, 40.2, 40.2a, 40.4, 40.5, 40.6, 40.8, 40.11, 40.12, 40.13, 40.14, 40.20, 40.21, 40.31, 40.32, 40.34, 40.43, 40.44, 40.45, 40.71, 40.81, and 40.82.

[57 FR 55075, Nov. 24, 1992]

Appendix A to Part 40--Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content

Introduction. Every applicant for a license to possess and use source material in conjunction with uranium or thorium milling, or byproduct material at sites formerly associated with such milling, is required by the provisions of § 40.31(h) to include in a license application proposed specifications relating to milling operations and the disposition of tailings or wastes resulting from such milling activities. This appendix establishes technical, financial, ownership, and long-term site surveillance criteria relating to the siting, operation, decontamination, decommissioning, and reclamation of mills and tailings or waste systems and sites at which such mills and systems are located. As used in this appendix, the term "as low as is reasonably achievable" has the same meaning as in § 20.1003 of this chapter.

In many cases, flexibility is provided in the criteria to allow achieving an optimum tailings disposal program on a site-specific basis. However, in such cases the objectives, technical alternatives and concerns which must be taken into account in developing a tailings program are identified. As provided by the provisions of § 40.31(h) applications for licenses must clearly demonstrate how the criteria have been addressed.

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

Licensees or applicants may propose alternatives to the specific requirements in this appendix. The alternative proposals may take into account local or regional conditions, including geology, topography, hydrology, and meteorology. The Commission may find that the proposed alternatives meet the Commission's requirements if the alternatives will achieve a level of stabilization and containment of the sites concerned, and a level of protection for public health, safety, and the environment from radiological and nonradiological hazards associated with the sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements of this Appendix and the standards promulgated by the Environmental Protection Agency in 40 CFR Part 192, Subparts D and E.

All site specific licensing decisions based on the criteria in this Appendix or alternatives proposed by licensees or applicants will take into account the risk to the public health and safety and the environment with due consideration to the economic costs involved and any other factors the Commission determines to be appropriate. In implementing this Appendix, the Commission will consider "practicable" and "reasonably achievable" as equivalent terms. Decisions involving these terms will take into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of atomic energy in the public interest.

The following definitions apply to the specified terms as used in this appendix:

Aquifer means a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs. Any saturated zone created by uranium or thorium recovery operations would not be considered an aquifer unless the zone is or potentially is (1) hydraulically interconnected to a natural aquifer, (2) capable of discharge to surface water, or (3) reasonably accessible because of migration beyond the vertical projection of the boundary of the land transferred for long-term government ownership and care in accordance with Criterion 11 of this appendix.

As expeditiously as practicable considering technological feasibility, for the purposes of Criterion 6A, means as quickly as possible considering: the physical characteristics of the tailings and the site; the limits of *available technology*; the need for consistency with mandatory requirements of other regulatory

programs; and *factors beyond the control of the licensee*. The phrase permits consideration of the cost of compliance only to the extent specifically provided for by use of the term *available technology*.

Available technology means technologies and methods for emplacing a final radon barrier on uranium mill tailings piles or impoundments. This term shall not be construed to include extraordinary measures or techniques that would impose costs that are grossly excessive as measured by practice within the industry (or one that is reasonably analogous), (such as, by way of illustration only, unreasonable overtime, staffing, or transportation requirements, etc., considering normal practice in the industry; laser fusion of soils, etc.), provided there is reasonable progress toward emplacement of the final radon barrier. To determine grossly excessive costs, the relevant baseline against which cost shall be compared is the cost estimate for tailings impoundment closure contained in the licensee's approved reclamation plan, but costs beyond these estimates shall not automatically be considered grossly excessive.

Closure means the activities following operations to decontaminate and decommission the buildings and site used to produce byproduct materials and reclaim the tailings and/or waste disposal area.

Closure plan means the Commission approved plan to accomplish closure.

Compliance period begins when the Commission sets secondary ground-water protection standards and ends when the owner or operator's license is terminated and the site is transferred to the State or Federal agency for long-term care.

Dike means an embankment or ridge of either natural or man-made materials used to prevent the movement of liquids, sludges, solids or other materials.

Disposal area means the area containing byproduct materials to which the requirements of Criterion 6 apply.

Existing portion means that land surface area of an existing surface impoundment on which significant quantities of uranium or thorium byproduct materials had been placed prior to September 30, 1983.

Factors beyond the control of the licensee means factors proximately causing delay in meeting the schedule in the applicable reclamation plan for the timely emplacement of the final radon barrier notwithstanding the good faith efforts of the licensee to complete the barrier in compliance with paragraph (1) of Criterion 6A. These factors may include, but are not limited to:

- (1) Physical conditions at the site;
- (2) Inclement weather or climatic conditions;
- (3) An act of God;
- (4) An act of war;
- (5) A judicial or administrative order or decision, or change to the statutory, regulatory, or other legal requirements applicable to the licensee's facility that would preclude or delay the performance of activities required for compliance;
- (6) Labor disturbances;
- (7) Any modifications, cessation or delay ordered by State, Federal, or local agencies;

(8) Delays beyond the time reasonably required in obtaining necessary government permits, licenses, approvals, or consent for activities described in the reclamation plan proposed by the licensee that result from agency failure to take final action after the licensee has made a good faith, timely effort to submit legally sufficient applications, responses to requests (including relevant data requested by the agencies), or other information, including approval of the reclamation plan; and

(9) An act or omission of any third party over whom the licensee has no control.

Final radon barrier means the earthen cover (or approved alternative cover) over tailings or waste constructed to comply with Criterion 6 of this appendix (excluding erosion protection features).

Ground water means water below the land surface in a zone of saturation. For purposes of this appendix, ground water is the water contained within an aquifer as defined above.

Leachate means any liquid, including any suspended or dissolved components in the liquid, that has percolated through or drained from the byproduct material.

Licensed site means the area contained within the boundary of a location under the control of persons generating or storing byproduct materials under a Commission license.

Liner means a continuous layer of natural or man-made materials, beneath or on the sides of a surface impoundment which restricts the downward or lateral escape of byproduct material, hazardous constituents, or leachate.

Milestone means an action or event that is required to occur by an enforceable date.

Operation means that a uranium or thorium mill tailings pile or impoundment is being used for the continued placement of byproduct material or is in standby status for such placement. A pile or impoundment is in operation from the day that byproduct material is first placed in the pile or impoundment until the day final closure begins.

Point of compliance is the site specific location in the uppermost aquifer where the ground-water protection standard must be met.

Reclamation plan, for the purposes of Criterion 6A, means the plan detailing activities to accomplish reclamation of the tailings or waste disposal area in accordance with the technical criteria of this appendix. The reclamation plan must include a schedule for reclamation milestones that are key to the completion of the final radon barrier including as appropriate, but not limited to, wind blown tailings retrieval and placement on the pile, interim stabilization (including dewatering or the removal of freestanding liquids and recontouring), and final radon barrier construction. (Reclamation of tailings must also be addressed in the closure plan; the detailed reclamation plan may be incorporated into the closure plan.)

Surface impoundment means a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well.

Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

I. Technical Criteria

Criterion 1--The general goal or broad objective in siting and design decisions is permanent isolation of tailings and associated contaminants by minimizing disturbance and dispersion by natural forces, and to do so without ongoing maintenance. For practical reasons, specific siting decisions and design standards must involve finite times (e.g., the longevity design standard in Criterion 6). The following site features which will contribute to such a goal or objective must be considered in selecting among alternative tailings disposal sites or judging the adequacy of existing tailings sites:

Remoteness from populated areas;

Hydrologic and other natural conditions as they contribute to continued immobilization and isolation of contaminants from ground-water sources; and

Potential for minimizing erosion, disturbance, and dispersion by natural forces over the long term.

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

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

Tailings should be disposed of in a manner that no active maintenance is required to preserve conditions of the site.

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

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

Criterion 4--The following site and design criteria must be adhered to whether tailings or wastes are disposed of above or below grade.

(a) Upstream rainfall catchment areas must be minimized to decrease erosion potential and the size of the floods which could erode or wash out sections of the tailings disposal area.

(b) Topographic features should provide good wind protection.

(c) Embankment and cover slopes must be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as possible to those which would be provided if tailings were disposed of below grade; this could, for example, lead to slopes of about 10 horizontal to 1 vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided, and compensating factors and conditions which make such slopes acceptable should be identified.

(d) A full self-sustaining vegetative cover must be established or rock cover employed to reduce wind and water erosion to negligible levels.

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

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

Shape, size, composition, and gradation of rock particles (excepting bedding material average particles size must be at least cobble size or greater);

Rock cover thickness and zoning of particles by size; and

Steepness of underlying slopes.

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

Rock covering of slopes may be unnecessary where top covers are very thick (~~on the order of 10 m or greater or less~~); ~~impoundment slopes are very gentle~~ (on the order of 10 h:1v or less); bulk cover materials have inherently favorable erosion resistance characteristics; and, there is negligible drainage catchment area upstream of the pile and good wind protection as described in points (a) and (b) of this Criterion.

Furthermore, all impoundment surfaces must be contoured to avoid areas of concentrated surface runoff or abrupt or sharp changes in slope gradient. In addition to rock cover on slopes, areas toward which surface runoff might be directed must be well protected with substantial rock cover (rip rap). In addition to providing for stability of the impoundment system itself, overall stability, erosion potential, and geomorphology of surrounding terrain must be evaluated to assure that there are not ongoing or potential processes, such as gully erosion, which would lead to impoundment instability.

(e) The impoundment may not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in this criterion, the term "capable fault" has the same meaning as defined in section III(g) of Appendix A of 10 CFR Part 100. The term "maximum credible earthquake" means that earthquake which would cause the

maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material.

(f) The impoundment, where feasible, should be designed to incorporate features which will promote deposition. For example, design features which promote deposition of sediment suspended in any runoff which flows into the impoundment area might be utilized; the object of such a design feature would be to enhance the thickness of cover over time.

Criterion 5--Criteria 5A-5D and new Criterion 13 incorporate the basic ground-water protection standards imposed by the Environmental Protection Agency in 40 CFR Part 192, Subparts D and E (48 FR 45926; October 7, 1983) which apply during operations and prior to the end of closure. Ground-water monitoring to comply with these standards is required by Criterion 7A.

5A(1)--The primary ground-water protection standard is a design standard for surface impoundments used to manage uranium and thorium byproduct material. Unless exempted under paragraph 5A(3) of this criterion, surface impoundments (except for an existing portion) must have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water, or surface water) during the active life of the facility, provided that impoundment closure includes removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate. For impoundments that will be closed with the liner material left in place, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility.

5A(2)--The liner required by paragraph 5A(1) above must be--

(a) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

(b) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and

(c) Installed to cover all surrounding earth likely to be in contact with the wastes or leachate.

5A(3)--The applicant or licensee will be exempted from the requirements of paragraph 5A(1) of this criterion if the Commission finds, based on a demonstration by the applicant or licensee, that alternate design and operating practices, including the closure plan, together with site characteristics will prevent the migration of any hazardous constituents into ground water or surface water at any future time. In deciding whether to grant an exemption, the Commission will consider--

(a) The nature and quantity of the wastes;

(b) The proposed alternate design and operation;

(c) The hydrogeologic setting of the facility, including the attenuative capacity and thickness of the liners and soils present between the impoundment and ground water or surface water; and

(d) All other factors which would influence the quality and mobility of the leachate produced and the potential for it to migrate to ground water or surface water.

5A(4)--A surface impoundment must be designed, constructed, maintained, and operated to prevent overtopping resulting from normal or abnormal operations, overfilling, wind and wave actions, rainfall, or run-on; from malfunctions of level controllers, alarms, and other equipment; and from human error.

5A(5)--When dikes are used to form the surface impoundment, the dikes must be designed, constructed, and maintained with sufficient structural integrity to prevent massive failure of the dikes. In ensuring structural integrity, it must not be presumed that the liner system will function without leakage during the active life of the impoundment.

5B(1)--Uranium and thorium byproduct materials must be managed to conform to the following secondary ground-water protection standard: Hazardous constituents entering the ground water from a licensed site must not exceed the specified concentration limits in the uppermost aquifer beyond the point of compliance during the compliance period. Hazardous constituents are those constituents identified by the Commission pursuant to paragraph 5B(2) of this criterion. Specified concentration limits are those limits established by the Commission as indicated in paragraph 5B(5) of this criterion. The Commission will also establish the point of compliance and compliance period on a site specific basis through license conditions and orders. The objective in selecting the point of compliance is to provide the earliest practicable warning that the impoundment is releasing hazardous constituents to the ground water. The point of compliance must be selected to provide prompt indication of ground-water contamination on the hydraulically downgradient edge of the disposal area. The Commission shall identify hazardous constituents, establish concentration limits, set the compliance period, and may adjust the point of compliance if needed to accord with developed data and site information as to the flow of ground water or contaminants, when the detection monitoring established under Criterion 7A indicates leakage of hazardous constituents from the disposal area.

5B(2)--A constituent becomes a hazardous constituent subject to paragraph 5B(5) only when the constituent meets all three of the following tests:

- (a) The constituent is reasonably expected to be in or derived from the byproduct material in the disposal area;
- (b) The constituent has been detected in the ground water in the uppermost aquifer; and
- (c) The constituent is listed in Criterion 13 of this appendix.

5B(3)--Even when constituents meet all three tests in paragraph 5B(2) of this criterion, the Commission may exclude a detected constituent from the set of hazardous constituents on a site specific basis if it finds that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment. In deciding whether to exclude constituents, the Commission will consider the following:

- (a) Potential adverse effects on ground-water quality, considering--
 - (i) The physical and chemical characteristics of the waste in the licensed site, including its potential for migration;
 - (ii) The hydrogeological characteristics of the facility and surrounding land;
 - (iii) The quantity of ground water and the direction of ground-water flow;

- (iv) The proximity and withdrawal rates of ground-water users;
 - (v) The current and future uses of ground water in the area;
 - (vi) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality;
 - (vii) The potential for health risks caused by human exposure to waste constituents;
 - (viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;
 - (ix) The persistence and permanence of the potential adverse effects.
- (b) Potential adverse effects on hydraulically-connected surface water quality, considering--
- (i) The volume and physical and chemical characteristics of the waste in the licensed site;
 - (ii) The hydrogeological characteristics of the facility and surrounding land;
 - (iii) The quantity and quality of ground water, and the direction of ground-water flow;
 - (iv) The patterns of rainfall in the region;
 - (v) The proximity of the licensed site to surface waters;
 - (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;
 - (vii) The existing quality of surface water, including other sources of contamination and the cumulative impact on surface-water quality;
 - (viii) The potential for health risks caused by human exposure to waste constituents;
 - (ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and
 - (x) The persistence and permanence of the potential adverse effects.
- 5B(4)--In making any determinations under paragraphs 5B(3) and 5B(6) of this criterion about the use of ground water in the area around the facility, the Commission will consider any identification of underground sources of drinking water and exempted aquifers made by the Environmental Protection Agency.
- 5B(5)--At the point of compliance, the concentration of a hazardous constituent must not exceed--
- (a) The Commission approved background concentration of that constituent in the ground water;
 - (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or

(c) An alternate concentration limit established by the Commission.

5B(6)--Conceptually, background concentrations pose no incremental hazards and the drinking water limits in paragraph 5C state acceptable hazards but these two options may not be practically achievable at a specific site. Alternate concentration limits that present no significant hazard may be proposed by licensees for Commission consideration. Licensees must provide the basis for any proposed limits including consideration of practicable corrective actions, that limits are as low as reasonably achievable, and information on the factors the Commission must consider. The Commission will establish a site specific alternate concentration limit for a hazardous constituent as provided in paragraph 5B(5) of this criterion if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded. In making the present and potential hazard finding, the Commission will consider the following factors:

(a) Potential adverse effects on ground-water quality, considering--

(i) The physical and chemical characteristics of the waste in the licensed site including its potential for migration;

(ii) The hydrogeological characteristics of the facility and surrounding land;

(iii) The quantity of ground water and the direction of ground-water flow;

(iv) The proximity and withdrawal rates of ground-water users;

(v) The current and future uses of ground water in the area;

(vi) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality;

(vii) The potential for health risks caused by human exposure to waste constituents;

(viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;

(ix) The persistence and permanence of the potential adverse effects.

(b) Potential adverse effects on hydraulically-connected surface water quality, considering--

(i) The volume and physical and chemical characteristics of the waste in the licensed site;

(ii) The hydrogeological characteristics of the facility and surrounding land;

(iii) The quantity and quality of ground water, and the direction of ground-water flow;

(iv) The patterns of rainfall in the region;

(v) The proximity of the licensed site to surface waters; (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;

(vii) The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality;

(viii) The potential for health risks caused by human exposure to waste constituents;

(ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and

(x) The persistence and permanence of the potential adverse effects.

5C-Maximum Values for Ground-Water Protection

Constituent or property	Maximum concentration
Milligrams per liter:	
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Endrin (1,2,3,4,10,10-hexachloro-1,7 -epoxy-1,4,4a,5,6,7,8,9a-octahydro-1, 4-endo, endo-5, 8-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxyphenylethane)	0.1
Toxaphene (C ₁₀ H ₁₀ Cl ₁₆ , Technical chlorinated camphene, 67-69 percent chlorine)	0.005
2, 4-D(2,4-Dichlorophenoxyacetic acid)	0.1
2, 4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	
Picocuries per liter:	
Combined radium-226 and radium-228	5
Gross alpha-particle activity (excluding radon and uranium when producing uranium byproduct material or radon and thorium when producing thorium byproduct material)	15

5D-If the ground-water protection standards established under paragraph 5B(1) of this criterion are exceeded at a licensed site, a corrective action program must be put into operation as soon as is practicable, and in no event later than eighteen (18) months after the Commission finds that the standards have been exceeded. The licensee shall submit the proposed corrective action program and supporting rationale for Commission approval prior to putting the program into operation, unless otherwise agreed to by the Commission. The objective of the program is to return hazardous constituent concentration levels in ground water to the concentration levels set as standards. The licensee's proposed program must address removing hazardous constituents that have entered the ground water at the point of compliance or treating them in

place. The program must also address removing or treating any hazardous constituents that exceed concentration limits in ground water between the point of compliance and the downgradient facility property boundary. The licensee shall continue corrective action measures to the extent necessary to achieve and maintain compliance with the groundwater standard. The Commission will determine when the licensee may terminate corrective action measures based on data from the ground-water monitoring program and other information that provide reasonable assurance that the ground-water protection standard will not be exceeded.

5E--In developing and conducting ground-water protection programs, applicants and licensees shall also consider the following:

- (1) Installation of bottom liners(Where synthetic liners are used, a leakage detection system must be installed immediately below the liner to ensure major failures are detected if they occur. This is in addition to the ground-water monitoring program conducted as provided in Criterion 7. Where clay liners are proposed or relatively thin, in-situ clay soils are to be relied upon for seepage control, tests must be conducted with representative tailings solutions and clay materials to confirm that no significant deterioration of permeability or stability properties will occur with continuous exposure of clay to tailings solutions. Tests must be run for a sufficient period of time to reveal any effects if they are going to occur (in some cases deterioration has been observed to occur rather rapidly after about nine months of exposure)).
- (2) Mill process designs which provide the maximum practicable recycle of solutions and conservation of water to reduce the net input of liquid to the tailings impoundment.
- (3) Dewatering of tailings by process devices and/or in-situ drainage systems (At new sites, tailings must be dewatered by a drainage system installed at the bottom of the impoundment to lower the phreatic surface and reduce the driving head of seepage, unless tests show tailings are not amenable to such a system. Where in-situ dewatering is to be conducted, the impoundment bottom must be graded to assure that the drains are at a low point. The drains must be protected by suitable filter materials to assure that drains remain free running. The drainage system must also be adequately sized to assure good drainage).
- (4) Neutralization to promote immobilization of hazardous constituents.

5F--Where ground-water impacts are occurring at an existing site due to seepage, action must be taken to alleviate conditions that lead to excessive seepage impacts and restore ground-water quality. The specific seepage control and ground-water protection method, or combination of methods, to be used must be worked out on a site-specific basis. Technical specifications must be prepared to control installation of seepage control systems. A quality assurance, testing, and inspection program, which includes supervision by a qualified engineer or scientist, must be established to assure the specifications are met.

5G--In support of a tailings disposal system proposal, the applicant/operator shall supply information concerning the following:

- (1) The chemical and radioactive characteristics of the waste solutions.
- (2) The characteristics of the underlying soil and geologic formations particularly as they will control transport of contaminants and solutions. This includes detailed information concerning extent, thickness, uniformity, shape, and orientation of underlying strata. Hydraulic gradients and conductivities of the various formations must be determined. This information must be gathered from borings and field survey methods taken within the proposed impoundment area and in surrounding areas where contaminants might migrate to ground water. The information gathered on boreholes must include both geologic and geophysical logs in sufficient number and degree of sophistication to allow determining significant

discontinuities, fractures, and channeled deposits of high hydraulic conductivity. If field survey methods are used, they should be in addition to and calibrated with borehole logging. Hydrologic parameters such as permeability may not be determined on the basis of laboratory analysis of samples alone; a sufficient amount of field testing (e.g., pump tests) must be conducted to assure actual field properties are adequately understood. Testing must be conducted to allow estimating chemi-sorption attenuation properties of underlying soil and rock.

(3) Location, extent, quality, capacity and current uses of any ground water at and near the site.

5H--Steps must be taken during stockpiling of ore to minimize penetration of radionuclides into underlying soils; suitable methods include lining and/or compaction of ore storage areas.

Criterion 6--(1) In disposing of waste byproduct material, licensees shall place an earthen cover (or approved alternative) over tailings or wastes at the end of milling operations and shall close the waste disposal area in accordance with a design¹ which provides reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct materials, and radon-220 from thorium byproduct materials, to the atmosphere so as not to exceed an average² release rate of 20 picocuries per square meter per second (pCi/m²s) to the extent practicable throughout the effective design life determined pursuant to (1)(i) of this Criterion. In computing required tailings cover thicknesses, moisture in soils in excess of amounts found normally in similar soils in similar circumstances may not be considered. Direct gamma exposure from the tailings or wastes should be reduced to background levels. The effects of any thin synthetic layer may not be taken into account in determining the calculated radon exhalation level. If non-soil materials are proposed as cover materials, it must be demonstrated that these materials will not crack or degrade by differential settlement, weathering, or other mechanism, over long-term intervals.

(2) As soon as reasonably achievable after emplacement of the final cover to limit releases of radon-222 from uranium byproduct material and prior to placement of erosion protection barriers or other features necessary for long-term control of the tailings, the licensee shall verify through appropriate testing and analysis that the design and construction of the final radon barrier is effective in limiting releases of radon-222 to a level not exceeding 20 pCi/m²s averaged over the entire pile or impoundment using the procedures described in 40 CFR part 61, appendix B, Method 115, or another method of verification approved by the Commission as being at least as effective in demonstrating the effectiveness of the final radon barrier.

(3) When phased emplacement of the final radon barrier is included in the applicable reclamation plan, the verification of radon-222 release rates required in paragraph (2) of this criterion must be conducted for each portion of the pile or impoundment as the final radon barrier for that portion is emplaced.

(4) Within ninety days of the completion of all testing and analysis relevant to the required verification in paragraphs (2) and (3) of this criterion, the uranium mill licensee shall report to the Commission the results detailing the actions taken to verify that levels of release of radon-222 do not exceed 20 pCi/m²s when averaged over the entire pile or impoundment. The licensee shall maintain records until termination of the license documenting the source of input parameters including the results of all measurements on which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine compliance. These records shall be kept in a form suitable for transfer to the custodial agency at the time of transfer of the site to DOE or a State for long-term care if requested.

(5) Near surface cover materials (i.e., within the top three meters) may not include waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to ensure that surface radon exhalation is not significantly above background because of the cover material itself.

(6) The design requirements in this criterion for longevity and control of radon releases apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land, averaged over areas of 100 square meters, which, as a result of byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15 cm below the surface.

Byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at levels which are as low as is reasonably achievable. If more than one residual radionuclide is present in the same 100-square-meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site must be submitted for approval. The use of decommissioning plans with benchmark doses which exceed 100 mrem/yr, before application of ALARA, requires the approval of the Commission after consideration of the recommendation of the NRC staff. This requirement for dose criteria does not apply to sites that have decommissioning plans for soil and structures approved before June 11, 1999.

(7) The licensee shall also address the nonradiological hazards associated with the wastes in planning and implementing closure. The licensee shall ensure that disposal areas are closed in a manner that minimizes the need for further maintenance. To the extent necessary to prevent threats to human health and the environment, the licensee shall control, minimize, or eliminate post-closure escape of nonradiological hazardous constituents, leachate, contaminated rainwater, or waste decomposition products to the ground or surface waters or to the atmosphere.

Criterion 6A--(1) For impoundments containing uranium byproduct materials, the final radon barrier must be completed *as expeditiously as practicable considering technological feasibility* after the pile or impoundment ceases operation in accordance with a written, Commission-approved reclamation plan. (The term *as expeditiously as practicable considering technological feasibility* as specifically defined in the Introduction of this appendix includes factors beyond the control of the licensee.) Deadlines for completion of the final radon barrier and, if applicable, the following interim milestones must be established as a condition of the individual license: windblown tailings retrieval and placement on the pile and interim stabilization (including dewatering or the removal of freestanding liquids and recontouring). The placement of erosion protection barriers or other features necessary for long-term control of the tailings must also be completed in a timely manner in accordance with a written, Commission-approved reclamation plan.

(2) The Commission may approve a licensee's request to extend the time for performance of milestones related to emplacement of the final radon barrier if, after providing an opportunity for public participation, the Commission finds that the licensee has adequately demonstrated in the manner required in paragraph (2) of Criterion 6 that releases of radon-222 do not exceed an average of 20 pCi/m²s. If the delay is approved on the basis that the radon releases do not exceed 20 pCi/m²s, a verification of radon levels, as required by paragraph (2) of Criterion 6, must be made annually during the period of delay. In addition, once the Commission has established the date in the reclamation plan for the milestone for completion of the final radon barrier, the Commission may extend that date based on cost if, after providing an opportunity for public participation, the Commission finds that the licensee is making good faith efforts to emplace the final radon barrier, the delay is consistent with the definition of available technology, and the radon releases caused by the delay will not result in a significant incremental risk to the public health.

(3) The Commission may authorize by license amendment, upon licensee request, a portion of the impoundment to accept uranium byproduct material or such materials that are similar in physical, chemical, and radiological characteristics to the uranium mill tailings and associated wastes already in the pile or impoundment, from other sources, during the closure process. No such authorization will be made if it results in a delay or impediment to emplacement of the final radon barrier over the remainder of the impoundment in a manner that will achieve levels of radon-222 releases not exceeding 20 pCi/m²s averaged over the entire impoundment. The verification required in paragraph (2) of Criterion 6 may be completed with a portion of the impoundment being used for further disposal if the Commission makes a final finding that the impoundment will continue to achieve a level of radon-222 releases not exceeding 20 pCi/m²s averaged over the entire impoundment. In this case, after the final radon barrier is complete except for the continuing disposal area, (a) only byproduct material will be authorized for disposal, (b) the disposal will be limited to the specified existing disposal area, and (c) this authorization will only be made after providing opportunity for public participation. Reclamation of the disposal area, as appropriate, must be completed in a timely manner after disposal operations cease in accordance with paragraph (1) of Criterion 6; however, these actions are not required to be complete as part of meeting the deadline for final radon barrier construction.

*Criterion 7--*At least one full year prior to any major site construction, a preoperational monitoring program must be conducted to provide complete baseline data on a milling site and its environs. Throughout the construction and operating phases of the mill, an operational monitoring program must be conducted to measure or evaluate compliance with applicable standards and regulations; to evaluate performance of control systems and procedures; to evaluate environmental impacts of operation; and to detect potential long-term effects.

7A--The licensee shall establish a detection monitoring program needed for the Commission to set the site-specific ground-water protection standards in paragraph 5B(1) of this appendix. For all monitoring under this paragraph the licensee or applicant will propose for Commission approval as license conditions which constituents are to be monitored on a site specific basis. A detection monitoring program has two purposes. The initial purpose of the program is to detect leakage of hazardous constituents from the disposal area so that the need to set ground-water protection standards is monitored. If leakage is detected, the second purpose of the program is to generate data and information needed for the Commission to establish the standards under Criterion 5B. The data and information must provide a sufficient basis to identify those hazardous constituents which require concentration limit standards and to enable the Commission to set the limits for those constituents and the compliance period. They may also need to provide the basis for adjustments to the point of compliance. For licenses in effect September 30, 1983, the detection monitoring programs must have been in place by October 1, 1984. For licenses issued after September 30, 1983, the detection monitoring programs must be in place when specified by the Commission in orders or license conditions. Once ground-water protection standards have been established pursuant to paragraph 5B(1), the licensee shall establish and implement a compliance monitoring program. The purpose of the compliance monitoring program is to determine that the hazardous constituent concentrations in ground water continue to comply with the standards set by the Commission. In conjunction with a corrective action program, the licensee shall establish and implement a corrective action monitoring program. The purpose of the corrective action monitoring program is to demonstrate the effectiveness of the corrective actions. Any monitoring program required by this paragraph may be based on existing monitoring programs to the extent the existing programs can meet the stated objective for the program.

*Criterion 8--*Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable. The primary means of accomplishing this must be by means of emission controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to control emissions at the source. Notwithstanding the existence of individual dose standards, strict control of emissions is necessary to assure that population exposures are reduced to the maximum extent

reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not covered by tailings solution and emissions from yellowcake drying and packaging operations. During operations and prior to closure, radiation doses from radon emissions from surface impoundments of uranium or thorium byproduct materials must be kept as low as is reasonably achievable.

Checks must be made and logged hourly of all parameters (e.g., differential pressures and scrubber water flow rates) that determine the efficiency of yellowcake stack emission control equipment operation. The licensee shall retain each log as a record for three years after the last entry in the log is made. It must be determined whether or not conditions are within a range prescribed to ensure that the equipment is operating consistently near peak efficiency; corrective action must be taken when performance is outside of prescribed ranges. Effluent control devices must be operative at all times during drying and packaging operations and whenever air is exhausting from the yellowcake stack. Drying and packaging operations must terminate when controls are inoperative. When checks indicate the equipment is not operating within the range prescribed for peak efficiency, actions must be taken to restore parameters to the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging operations must cease as soon as practicable. Operations may not be restarted after cessation due to off-normal performance until needed corrective actions have been identified and implemented. All these cessations, corrective actions, and restarts must be reported to the appropriate NRC regional office as indicated in Criterion 8A, in writing, within ten days of the subsequent restart.

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

Milling operations producing or involving thorium byproduct material must be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as a result of exposures to the planned discharge of radioactive materials, radon-220 and its daughters excepted, to the general environment.

Uranium and thorium byproduct materials must be managed so as to conform to the applicable provisions of Title 40 of the Code of Federal Regulations, Part 440, "Ore Mining and Dressing Point Source Category: Effluent Limitations Guidelines and New Source Performance Standards, Subpart C, Uranium, Radium, and Vanadium Ores Subcategory," as codified on January 1, 1983.

Criterion 8A--Daily inspections of tailings or waste retention systems must be conducted by a qualified engineer or scientist and documented. The licensee shall retain the documentation for each daily inspection as a record for three years after the documentation is made. The appropriate NRC regional office as indicated in Appendix D to 10 CFR Part 20 of this chapter, or the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC, 20555-0001, must be immediately notified of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or of any unusual conditions (conditions not contemplated in the design of the retention system) that ~~is~~ not corrected could indicate the potential or lead to failure of the system and result in a release of tailings or waste into unrestricted areas.

II. Financial Criteria

Criterion 9—~~(a)~~ Financial surety arrangements must be established by each mill operator ~~prior to~~before the commencement of operations to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas. The amount of funds to be ensured by such surety arrangements must be based on Commission-approved cost estimates in a Commission-approved plan, or a proposed revision to the plan submitted to the Commission for approval, if the proposed revision contains a higher cost estimate, for

- (1) ~~D~~econtamination and decommissioning of mill buildings and the milling site to levels which allow unrestricted use of these areas upon decommissioning, and
- (2) ~~T~~he reclamation of tailings and/or waste areas in accordance with technical criteria delineated in Section I of this ~~a~~Appendix.

(b) Each cost estimate must contain –

(1) A detailed cost estimate for decontamination, decommissioning, and reclamation, in the amount reflecting:

(i) The cost of an independent contractor to perform the decontamination, decommissioning and reclamation activities; and

(ii) An adequate contingency factor;

(2) An estimate of the amount of radioactive contamination in onsite subsurface material;

(3) Identification of and justification for using the key assumptions contained in the DCE; and

(4) A description of the method of assuring funds for decontamination, decommissioning, and reclamation.

(c) The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and evaluates alternatives for mitigating these impacts. ~~The plan must include a signed original of the financial instrument obtained to satisfy the surety arrangement requirements of this criterion (unless a previously submitted and approved financial instrument continues to cover the cost estimate and the payment of the charge for long-term surveillance and control required by Criterion 10 of this section. In establishing specific surety arrangements, the licensee's cost estimates must take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work.~~

(d) ~~T~~~~In order to~~ avoid unnecessary duplication and expense, the Commission may accept financial sureties that have been consolidated with financial or surety arrangements established to meet requirements of other Federal or state agencies and/or local governing bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance and control, provided such arrangements are considered adequate to satisfy these requirements and that the portion of the surety which covers the decommissioning and reclamation of the mill, mill tailings site and associated areas, and the long-term funding charge is clearly identified and committed for use in accomplishing these activities.

(e) The licensees' surety mechanism will be reviewed annually by the Commission to assure, that sufficient funds would be available for completion of the reclamation plan if the work had to be performed by an independent contractor.

(f) The amount of surety liability should be adjusted to recognize any increases or decreases resulting from

(1) ~~I~~inflation;

(2) ~~C~~changes in engineering plans;

(3) ~~A~~activities performed;

(4) Spills, leakage or migration of radioactive material producing additional contamination in onsite subsurface material that must be remediated to meet applicable remediation criteria;

(5) Waste inventory increasing above the amount previously estimated;

(6) Waste disposal costs increasing above the amount previously estimated;

(7) Facility modifications;

(8) Changes in authorized possession limits;

(9) Actual remediation costs that exceed the previous cost estimate;

(10) Onsite disposal; -and

(11) ~~A~~ny other conditions affecting costs.

(g) Regardless of whether reclamation is phased through the life of the operation or takes place at the end of operations, an appropriate portion of surety liability must be retained until final compliance with the reclamation plan is determined.

(h) The appropriate portion of surety liability retained until final compliance with the reclamation plan is determined will be ~~This will yield a surety that is~~ at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance would be provided with a surety instrument which is written for a specified period of time (e.g., 5 years) ~~and yet~~ which must be automatically renewed unless the surety notifies the beneficiary (the Commission or the State regulatory agency) and the principal (the licensee) ~~with some~~ reasonable time (e.g., 90 days) ~~before prior to~~ the renewal date of their intention not to renew. In such a situation the surety requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief ~~period of~~ time to allow at least 60 days for the regulatory agency to collect.

(i) Proof of forfeiture must not be necessary to collect the surety. ~~Is that in~~ the event that the licensee ~~can~~not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The surety instrument must provide for collection of the full face amount immediately on demand without reduction for any reason, except for trustee fees and expenses provided for in a trust agreement, and that the surety will not refuse to make full payment. -The conditions described ~~previously above~~ would have to be clearly stated on any surety instrument which is not open-

ended, and must be agreed to by all parties. Financial surety arrangements generally acceptable to the Commission are:

(1) Trust funds;

(a2) Surety bonds;

(b) Cash deposits;

(c) Certificates of deposits;

(d) Deposits of government securities;

(3)(e) Irrevocable letters or lines of credit; and

(4) Combinations of the ~~financial surety~~ above or such other types of arrangements or other types of arrangements as may be approved by the Commission. ~~If a trust is not used, then a standby trust must be set up to receive funds in the event the Commission of State regulatory agency exercises its right to collect the surety. The surety arrangement and the surety or trustee, as applicable, must be acceptable to the Commission. However,~~ Self insurance, or any arrangement which essentially constitutes self insurance (e.g., a contract with a State or Federal agency), will not satisfy the surety requirement ~~because~~ ^{since} this provides no additional assurance other than that which already exists through license requirements.

Criterion 10--A minimum charge of \$250,000 (1978 dollars) to cover the costs of long-term surveillance must be paid by each mill operator to the general treasury of the United States or to an appropriate State agency prior to the termination of a uranium or thorium mill license.

If site surveillance or control requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in Criterion 12 (e.g., if fencing is determined to be necessary), variance in funding requirements may be specified by the Commission. In any case, the total charge to cover the costs of long-term surveillance must be such that, with an assumed 1 percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The total charge will be adjusted annually prior to actual payment to recognize inflation. The inflation rate to be used is that indicated by the change in the Consumer Price Index published by the U.S. Department of Labor, Bureau of Labor Statistics.

III. Site and Byproduct Material Ownership

Criterion 11--A. These criteria relating to ownership of tailings and their disposal sites become effective on November 8, 1981, and apply to all licenses terminated, issued, or renewed after that date.

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

C. Title to the byproduct material licensed under this Part and land, including any interests therein (other than land owned by the United States or by a State) which is used for the disposal of any such byproduct material, or is essential to ensure the long term stability of such disposal site, must be transferred to the United States or the State in which such land is located, at the option of such State. In view of the fact that physical isolation must be the primary means of long-term control, and Government land ownership is a desirable supplementary measure, ownership of certain severable subsurface interests (for example, mineral

rights) may be determined to be unnecessary to protect the public health and safety and the environment. In any case, however, the applicant/operator must demonstrate a serious effort to obtain such subsurface rights, and must, in the event that certain rights cannot be obtained, provide notification in local public land records of the fact that the land is being used for the disposal of radioactive material and is subject to either an NRC general or specific license prohibiting the disruption and disturbance of the tailings. In some rare cases, such as may occur with deep burial where no ongoing site surveillance will be required, surface land ownership transfer requirements may be waived. For licenses issued before November 8, 1981, the Commission may take into account the status of the ownership of such land, and interests therein, and the ability of a licensee to transfer title and custody thereof to the United States or a State.

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

E. Material and land transferred to the United States or a State in accordance with this Criterion must be transferred without cost to the United States or a State other than administrative and legal costs incurred in carrying out such transfer.

F. The provisions of this part respecting transfer of title and custody to land and tailings and wastes do not apply in the case of lands held in trust by the United States for any Indian tribe or lands owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the case of such lands which are used for the disposal of byproduct material, as defined in this Part, the licensee shall enter into arrangements with the Commission as may be appropriate to assure the long-term surveillance of such lands by the United States.

IV. Long-Term Site Surveillance

Criterion 12--The final disposition of tailings, residual radioactive material, or wastes at milling sites should be such that ongoing active maintenance is not necessary to preserve isolation. As a minimum, annual site inspections must be conducted by the government agency responsible for long-term care of the disposal site to confirm its integrity and to determine the need, if any, for maintenance and/or monitoring. Results of the inspections for all the sites under the licensee's jurisdiction will be reported to the Commission annually within 90 days of the last site inspection in that calendar year. Any site where unusual damage or disruption is discovered during the inspection, however, will require a preliminary site inspection report to be submitted within 60 days. On the basis of a site specific evaluation, the Commission may require more frequent site inspections if necessary due to the features of a particular disposal site. In this case, a preliminary inspection report is required to be submitted within 60 days following each inspection.

V. Hazardous Constituents

Criterion 13--Secondary ground-water protection standards required by Criterion 5 of this appendix are concentration limits for individual hazardous constituents. The following list of constituents identifies the constituents for which standards must be set and complied with if the specific constituent is reasonably expected to be in or derived from the byproduct material and has been detected in ground water. For purposes of this appendix, the property of gross alpha activity will be treated as if it is a hazardous constituent. Thus, when setting standards under paragraph 5B(5) of Criterion 5, the Commission will also set a limit for gross alpha activity. The Commission does not consider the following list imposed by 40

CFR Part 192 to be exhaustive and may determine other constituents to be hazardous on a case-by-case basis, independent of those specified by the U.S. Environmental Protection Agency in Part 192.

Hazardous Constituents

Acetonitrile (Ethanenitrile)

Acetophenone (Ethanone, 1-phenyl)

3-(alpha-Acetylbenzyl)-4-hydroxycoumarin and salts (Warfarin)

2-Acetylaminofluorene (Acetamide, N-(9H-fluoren-2-yl)-)

Acetyl chloride (Ethanoyl chloride)

1-Acetyl-2-thiourea (Acetamide, N-(aminothioxomethyl)-)

Acrolein (2-Propenal)

Acrylamide (2-Propenamide)

Acrylonitrile (2-Propenenitrile)

Aflatoxins

Aldrin (1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a,8b-hexahydro-endo, exo-1,4:5,8-Dimethanonaphthalene)

Allyl alcohol (2-Propen-1-ol)

Aluminum phosphide

4-Aminobiphenyl ([1,1'-Biphenyl]-4-amine)

6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methyl-carbamate azirino[2',3'3,4]pyrrolo[1,2-a]indole-4,7-dione, (ester) (Mitomycin C) (Azirino[2'3'3,4]pyrrolo(1,2-a)indole-4,7-dione, 6-amino-8-[(amino-carbonyl)oxy)methyl]-1,1a,2,8,8a,8b-hexa-hydro-8a methoxy-5-methy-)

5-(Aminomethyl)-3-isoxazolol (3(2H)-Isoxazolone, 5-(aminomethyl)-) 4-Aminopyridine (4-Pyridinamine)

Amitrole (1H-1,2,4-Triazol-3-amine)

Aniline (Benzenamine)

Antimony and compounds, N.O.S. [\(3\)](#)

Aramite (Sulfurous acid, 2-chloroethyl-, 2-[4-(1,1-dimethylethyl) phenoxy]-1-methylethyl ester)

Arsenic and compounds, N.O.S. [3](#)

Arsenic acid (Orthoarsenic acid)

Arsenic pentoxide (Arsenic (V) oxide)

Arsenic trioxide (Arsenic (III) oxide)

Auramine (Benzenamine, 4,4'-carbonimidoylbis[N,N-Dimethyl-, monohydrochloride)

Azaserine (L-Serine, diazoacetate (ester))

Barium and compounds, N.O.S.³

Barium cyanide

Benz[c]acridine (3,4-Benzacridine)

Benz[a]anthracene (1,2-Benzanthracene)

Benzene (Cyclohexatriene)

Benzenearsonic acid (Arsonic acid, phenyl-)

Benzene, dichloromethyl- (Benzal chloride)

Benzenethiol (Thiophenol)

Benzidine ([1,1'-Biphenyl]-4,4'diamine)

Benzo[b]fluoranthene (2,3-Benzofluoranthene)

Benzo[j]fluoranthene (7,8-Benzofluoranthene)

Benzo[a]pyrene (3,4-Benzopyrene)

p-Benzoquinone (1,4-Cyclohexadienedione)

Benzotrichloride (Benzene, trichloromethyl)

Benzyl chloride (Benzene, (chloromethyl)-)

Beryllium and compounds, N.O.S.³

Bis(2-chloroethoxy)methane (Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-])

Bis(2-chloroethyl) ether (Ethane, 1,1'-oxybis[2-chloro-])

N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)

Bis(2-chloroisopropyl) ether (Propane, 2,2'-oxybis[2-chloro-])

Bis(chloromethyl) ether (Methane, oxybis[chloro-])

Bis(2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester)

Bromoacetone (2-Propanone, 1-bromo-)

Bromomethane (Methyl bromide)

4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)

Brucine (Strychnidin-10-one, 2,3-dimethoxy-)

2-Butanone peroxide (Methyl ethyl ketone, peroxide)

Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester)

2-sec-Butyl-4,6-dinitrophenol (DNBP) (Phenol, 2,4-dinitro-6-(1-methylpropyl)-)

Cadmium and compounds, N.O.S.³

Calcium chromate (Chromic acid, calcium salt)

Calcium cyanide

Carbon disulfide (Carbon bisulfide)

Carbon oxyfluoride (Carbonyl fluoride)

Chloral (Acetaldehyde, trichloro-)

Chlorambucil (Butanoic acid, 4-[bis(2-chloroethyl)amino]benzene-)

Chlordane (alpha and gamma isomers) (4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3,4,7,7a-tetrahydro-)
(alpha and gamma isomers)

Chlorinated benzenes, N.O.S.³

Chlorinated ethane, N.O.S.³

Chlorinated fluorocarbons, N.O.S.³

Chlorinated naphthalene, N.O.S.³

Chlorinated phenol, N.O.S.³

Chloroacetaldehyde (Acetaldehyde, chloro-)

Chloroalkyl ethers, N.O.S.³

p-Chloroaniline (Benzenamine, 4-chloro-)

Chlorobenzene (Benzene, chloro-)

Chlorobenzilate (Benzenecetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-,ethyl ester)

p-Chloro-m-cresol (Phenol, 4-chloro-3-methyl)

1-Chloro-2,3-epoxypropane (Oxirane, 2-(chloromethyl)-)

2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy)-)

Chloroform (Methane, trichloro-)

Chloromethane (Methyl chloride)

Chloromethyl methyl ether (Methane, chloromethoxy-)

2-Chloronaphthalene (Naphthalene, betachloro-)

2-Chlorophenol (Phenol, o-chloro-)

1-(o-Chlorophenyl)thiourea (Thiourea, (2-chlorophenyl)-)

3-Chloropropionitrile (Propanenitrile, 3-chloro-)

Chromium and compounds, N.O.S.³

Chrysene (1,2-Benzphenanthrene)

Citrus red No. 2 (2-Naphthol, 1-[(2,5-dimethoxyphenyl)azo]-)

Coal tars

Copper cyanide

Creosote (Creosote, wood)

Cresols (Cresylic acid) (Phenol, methyl-)

Crotonaldehyde (2-Butenal)

Cyanides (soluble salts and complexes), N.O.S.³

Cyanogen (Ethanedinitrile)

Cyanogen bromide (Bromine cyanide)

Cyanogen chloride (Chlorine cyanide)

Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl-)

2-Cyclohexyl-4,6-dinitrophenol (Phenol, 2-cyclohexyl-4,6-dinitro-)

Cyclophosphamide (2H-1,3,2,-Oxazaphosphorine, [bis(2-chloroethyl) amino]-tetrahydro-,2-oxide)

Daunomycin (5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)

DDD (Dichlorodiphenyldichloroethane) (Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)

DDE (Ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)

DDT (Dichlorodiphenyltrichloroethane) (Ethane, 1,1,1-trichloro-2,2-bis (p-chlorophenyl)-)

Diallate (S-(2,3-dichloroallyl) diisopropylthiocarbamate)

Dibenz[a,h]acridine (1,2,5,6-Dibenzacridine)

Dibenz[a,j]acridine (1,2,7,8-Dibenzacridine)

Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene)

7H-Dibenzo[c,g]carbazole (3,4,5,6-Dibenzcarbazole)

Dibenzo[a,e]pyrene (1,2,4,5-Dibenzpyrene)

Dibenzo[a,h]pyrene (1,2,5,6-Dibenzpyrene)

Dibenzo[a,i]pyrene (1,2,7,8-Dibenzpyrene)

1,2-Dibromo-3-chloropropane (Propane, 1,2-dibromo-3-chloro-)

1,2-Dibromoethane (Ethylene dibromide)

Dibromomethane (Methylene bromide)

Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)

o-Dichlorobenzene (Benzene, 1,2-dichloro-)

m-Dichlorobenzene (Benzene, 1,3-dichloro-)

p-Dichlorobenzene (Benzene, 1,4-dichloro-)

Dichlorobenzene, N.O.S.³ (Benzene, dichloro-, N.O.S.³)

3,3'-Dichlorobenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-)

1,4-Dichloro-2-butene (2-Butene, 1,4-dichloro-)

Dichlorodifluoromethane (Methane, dichlorodifluoro-)

1,1-Dichloroethane (Ethylidene dichloride)

1,2-Dichloroethane (Ethylene dichloride)

trans-1,2-Dichloroethene (1,2-Dichloroethylene)

Dichloroethylene, N.O.S.³ (Ethene, dichloro-, N.O.S.³)

1,1-Dichloroethylene (Ethene, 1,1-dichloro-)

Dichloromethane (Methylene chloride)

2,4-Dichlorophenol (Phenol, 2,4-dichloro-)

2,6-Dichlorophenol (Phenol, 2,6-dichloro-)

2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)

Dichlorophenylarsine (Phenyl dichloroarsine)

Dichloropropane, N.O.S.³ (Propane, dichloro-, N.O.S.³)

1,2-Dichloropropane (Propylene dichloride)

Dichloropropanol, N.O.S.³ (Propanol, dichloro-, N.O.S.³)

Dichloropropene, N.O.S.³ (Propene, dichloro-, N.O.S.³)

1,3-Dichloropropene (1-Propene, 1,3-dichloro-)

Dieldin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octa-hydro-endo, exo- 1,4:5,8-Dimethanonaphthalene)

1,2:3,4-Diepoxybutane (2,2'-Bioxirane)

Diethylarsine (Arsine, diethyl-)

N,N-Diethylhydrazine (Hydrazine, 1,2-diethyl)

O,O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O,O-diethyl S-methyl ester)

O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)

Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)

O,O-Diethyl O-2-pyrazinyl phosphorothioate (Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)

Diethylstilbesterol (4,4'-Stilbenediol, alpha, alpha-diethyl, bis(dihydrogen phosphate, (E)-)

Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)

3,4-Dihydroxy-alpha-(methylamino)methyl benzyl alcohol (1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-)

Dilsopropylfluorophosphate (DFP) (Phosphorofluoridic acid, bis(1-methylethyl) ester)

Dimethoate (Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester)

3,3'-Dimethoxybenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-)

p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)

7,12-Dimethylbenz[a]anthracene (1,2-Benzanthracene, 7,12-dimethyl-)

3,3'-Dimethylbenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-)

Dimethylcarbamoyl chloride (Carbamoyl chloride, dimethyl-)

1,1-Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)

1,2-Dimethylhydrazine (Hydrazine, 1,2-dimethyl-)

3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl] oxime (Thiofanox)

alpha,alpha-Dimethylphenethylamine (Ethanamine, 1,1-dimethyl-2-phenyl-)

2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)

Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)

Dimethyl sulfate (Sulfuric acid, dimethyl ester)

Dinitrobenzene, N.O.S.³ (Benzene, dinitro-, N.O.S.³)

4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)

2,4-Dinitrophenol (Phenol, 2,4-dinitro-)

2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)

2,6-Dinitrotoluene (Benzene, 1-methyl-2,6-dinitro-)

Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)

1,4-Dioxane (1,4-Diethylene oxide)

Diphenylamine (Benzenamine, N-phenyl-)

1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)

Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)

Disulfoton (O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate)

2,4-Dithiobiuret (Thioimidodicarbonic diamide)

Endosulfan (5-Norbornene, 2,3-dimethanol, 1,4,5,6,7,7-hexachloro-, cyclic sulfite)

Endrin and metabolites (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,endo-1,4:5,8-dimethanonaphthalene, and metabolites)

Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)

Ethyl cyanide (propanenitrile)

Ethylenebisdithiocarbamic acid, salts and esters (1,2-Ethanediy-biscarbamodithioic acid, salts and esters)

Ethyleneimine (Aziridine)

Ethylene oxide (Oxirane)

Ethylenethiourea (2-Imidazolidinethione)

Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)

Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)

Fluoranthene (Benzo[j,k]fluorene)

Fluorine

2-Fluoroacetamide (Acetamide, 2-fluoro-)

Fluoroacetic acid, sodium salt (Acetic acid, fluoro-, sodium salt)

Formaldehyde (Methylene oxide)

Formic acid (Methanoic acid)

Glycidylaldehyde (1-Propanol-2,3-epoxy)

Halomethane, N.O.S.³

Heptachlor (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)

Heptachlor epoxide (alpha, beta, and gamma isomers) (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-, alpha, beta, and gamma isomers)

Hexachlorobenzene (Benzene, hexachloro-)

Hexachlorobutadiene (1,3-Butadiene, 1,1,2,3,4,4-hexachloro-)

Hexachlorocyclohexane (all isomers) (Lindane and isomers)

Hexachlorocyclopentadiene (1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-)

Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)

1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,endo-dimethanonaphthalene
(Hexachlorohexa-hydro-endo,endo-dimethanonaphthalene)

Hexachlorophene (2,2'-Methylenebis(3,4,6-trichlorophenol))

Hexachloropropene (1-Propene, 1,1,2,3,3,3-hexachloro-)

Hexaethyl tetraphosphate (Tetraphosphoric acid, hexaethyl ester)

Hydrazine (Diamine)

Hydrocyanic acid (Hydrogen cyanide)

Hydrofluoric acid (Hydrogen fluoride)

Hydrogen sulfide (Sulfur hydride)

Hydroxydimethylarsine oxide (Cacodylic acid)

Indeno (1,2,3-cd)pyrene (1,10-(1,2-phenylene)pyrene)

Iodomethane (Methyl iodide)

Iron dextran (Ferric dextran)

Isocyanic acid, methyl ester (Methyl isocyanate)

Isobutyl alcohol (1-Propanol, 2-methyl-)

Isosafrole (Benzene, 1,2-methylenedioxy-4-allyl-)

Kepone (Decachlorooctahydro-1,3,4-Methano-2H-cyclobuta[cd]pentalen-2-one)

Lasiocarpine (2-Butenoic acid, 2-methyl-, 7-[(2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester)

Lead and compounds, N.O.S.³

Lead acetate (Acetic acid, lead salt)

Lead phosphate (Phosphoric acid, lead salt)

Lead subacetate (Lead, bis(acetato-0)tetrahydroxytri-)

Maleic anhydride (2,5-Furandione)

Maleic hydrazide (1,2-Dihydro-3,6-pyridazinedione)

Malononitrile (Propanedinitrile)

Melphalan (Alanine, 3-[p-bis(2-chloroethyl)amino]phenyl-,L-)

Mercury fulminate (Fulminic acid, mercury salt)

Mercury and compounds, N.O.S.³

Methacrylonitrile (2-Propenenitrile, 2-methyl-)

Methanethiol (Thiomethanol)

Methapyrilene (Pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)

Metholmyl (Acetimidic acid, N-[(methylcarbamoyl)oxy]thio-, methyl ester)

Methoxychlor (Ethane, 1,1,1-trichloro-2,2-bis(p-methoxyphenyl)-)

2-Methylaziridine (1,2-Propylenimine)

3-Methylcholanthrene (Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-)

Methyl chlorocarbonate (Carbonochloridic acid, methyl ester)

4,4-Methylenebis(2-chloroaniline) (Benzenamine, 4,4-methylenebis- (2-chloro-)

Methyl ethyl ketone (MEK) (2-Butanone)

Methyl hydrazine (Hydrazine, methyl-)

2-Methylactonitrile (Propanenitrile, 2-hydroxy-2-methyl-)

Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)

Methyl methanesulfonate (Methanesulfonic acid, methyl ester)

2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime (Propanal, 2-methyl-2-(methylthio)-, 0-[(methylamino)carbonyl]oxime)

N-Methyl-N-nitro-N-nitrosoguanidine (Guanidine, N-nitroso-N-methyl-N- nitro-)

Methyl parathion (0,0-dimethyl 0-(4-nitrophenyl) phosphorothioate)

Methylthiouracil (4-IH-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-)

Molybdenum and compounds, N.O.S.³

Mustard gas (Sulfide, bis(2-chloroethyl)-)

Naphthalene

1,4-Naphthoquinone (1,4-Naphthalenedione)

1-Naphthylamine (alpha-Naphthylamine)

2-Naphthylamine (beta-Naphthylamine)

1-Naphthyl-2-thiourea (Thiourea, 1-naphthalenyl-)

Nickel and compounds, N.O.S.³

Nickel carbonyl (Nickel tetracarbonyl)

Nickel cyanide (Nickel (II) cyanide)

Nicotine and salts (Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)

Nitric oxide (Nitrogen (II) oxide)

p-Nitroaniline (Benzenamine, 4-nitro-)

Nitrobenzene (Benzene, nitro-)

Nitrogen dioxide (Nitrogen (IV) oxide)

Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)- N-methyl-, and hydrochloride salt)

Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)

Nitroglycerine (1,2,3-Propanetriol, trinitrate)

4-Nitrophenol (Phenol, 4-nitro-)

4-Nitroquinoline-1-oxide (Quinoline, 4-nitro-1-oxide-)

Nitrosamine, N.O.S.³

N-Nitrosodi-n-butylamine (1-Butanamine, N-butyl-N-nitroso-)

N-Nitrosodiethanolamine (Ethanol, 2,2-(nitrosoimino)bis-)

N-Nitrosodiethylamine (Ethanamine, N-ethyl-N-nitroso-)

N-Nitrosodimethylamine (Dimethylnitrosamine)

N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)

N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)

N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)

N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)

N-Nitrosomethylvinylamine (Ethenamine, N-methyl-N-nitroso-)

N-Nitrosomorpholine (Morpholine, N-nitroso-)

N-Nitrosornicotine (Nornicotine, N-nitroso-)

N-Nitrosopiperidine (Pyridine, hexahydro-, N-nitroso-)

Nitrosopyrrolidine (Pyrrole, tetrahydro-, N-nitroso-)

N-Nitrososarcosine (Sarcosine, N-nitroso-)

5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)

Octamethylpyrophosphoramidate (Diphosphoramidate, octamethyl-)

Osmium tetroxide (Osmium (VIII) oxide)

7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid (Endothal)

Paraldehyde (1,3,5-Trioxane, 2,4,6-trimethyl-)

Parathion (Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl)ester)

Pentachlorobenzene (Benzene, pentachloro-)

Pentachloroethane (Ethane, pentachloro-)

Pentachloronitrobenzene (PCNB) (Benzene, pentachloronitro-)

Pentachlorophenol (Phenol, pentachloro-)

Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)

Phenol (Benzene, hydroxy-)

Phenylenediamine (Benzenediamine)

Phenylmercury acetate (Mercury, acetatophenyl-)

N-Phenylthiourea (Thiourea, phenyl-)

Phosgene (Carbonyl chloride)

Phosphine (Hydrogen phosphide)

Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester (Phorate)

Phosphorothioic acid, O,O-dimethyl O-[p-((dimethylamino)sulfonyl)phenyl] ester (Famphur)

Phthalic acid esters, N.O.S.³ (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.³)

Phthalic anhydride (1,2-Benzenedicarboxylic acid anhydride)

2-Picoline (Pyridine, 2-methyl-)

Polychlorinated biphenyl, N.O.S.³

Potassium cyanide

Potassium silver cyanide (Argentate(1-), dicyano-, potassium)

Pronamide (3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)

1,3-Propane sultone (1,2-Oxathiolane, 2,2-dioxide)

n-Propylamine (1-Propanamine)

Propylthiouracil (Undecamethylenediamine, N,N'-bis(2-chlorobenzyl-), dihydrochloride)

2-Propyn-1-ol (Propargyl alcohol)

Pyridine

Radium -226 and -228

Reserpine (Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[3,4,5- trimethoxybenzoyl)oxy]-, methyl ester)

Resorcinol (1,3-Benzenediol)

Saccharin and salts (1,2-Benzoisothiazolin-3-one, 1,1-dioxide, and salts)

Safrole (Benzene, 1,2-methylenedioxy-4-allyl-)

Selenious acid (Selenium dioxide)

Selenium and compounds, N.O.S.³

Selenium sulfide (Sulfur selenide)

Selenourea (Carbamimidoseleonic acid)

Silver and compounds, N.O.S.³

Silver cyanide

Sodium cyanide

Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)

Strontium sulfide

Strychnine and salts (Strychnidin-10-one, and salts)

1,2,4,5-Tetrachlorobenzene (Benzene, 1,2,4,5-tetrachloro-)

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)

Tetrachloroethane, N.O.S.³ (Ethane, tetrachloro-, N.O.S.³)

1,1,1,2-Tetrachlorethane (Ethane, 1,1,1,2-tetrachloro-)

1,1,2,2-Tetrachlorethane (Ethane, 1,1,2,2-tetrachloro-)

Tetrachloroethane (Ethene, 1,1,2,2-tetrachloro-)

Tetrachloromethane (Carbon tetrachloride)

2,3,4,6,-Tetrachlorophenol (Phenol, 2,3,4,6-tetrachloro-)

Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)

Tetraethyl lead (Plumbane, tetraethyl-)

Tetraethylpyrophosphate (Pyrophosphoric acid, tetraethyl ester)

Tetranitromethane (Methane, tetranitro-)

Thallium and compounds, N.O.S.³

Thallic oxide (Thallium (III) oxide)

Thallium (I) acetate (Acetic acid, thallium (I) salt)

Thallium (I) carbonate (Carbonic acid, dithallium (I) salt)

Thallium (I) chloride

Thallium (I) nitrate (Nitric acid, thallium (I) salt)

Thallium selenite

Thallium (I) sulfate (Sulfuric acid, thallium (I) salt)

Thioacetamide (Ethanethioamide)

Thiosemicarbazide (Hydrazinecarbothioamide)

Thiourea (Carbamide thio-)

Thiuram (Bis(dimethylthiocarbamoyl) disulfide)

Thorium and compounds, N.O.S.,³ when producing thorium byproduct material

Toluene (Benzene, methyl-)

Toluenediamine (Diaminotoluene)

o-Toluidine hydrochloride (Benzenamine, 2-methyl-, hydrochloride)

Tolylene diisocyanate (Benzene, 1,3-diisocyanatomethyl-)

Toxaphene (Camphene, octachloro-)

Tribromomethane (Bromoform)

1,2,4-Trichlorobenzene (Benzene, 1,2,4-trichloro-)

1,1,1-Trichloroethane (Methyl chloroform)

1,1,2-Trichloroethane (Ethane, 1,1,2-trichloro-)

Trichloroethene (Trichloroethylene)

Trichloromethanethiol (Methanethiol, trichloro-)

Trichloromonofluoromethane (Methane, trichlorofluoro-)

2,4,5-Trichlorophenol (Phenol, 2,4,5-trichloro-)

2,4,6-Trichlorophenol (Phenol, 2,4,6-trichloro-)

2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)

2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex) (Propionic acid, 2-(2,4,5-trichlorophenoxy)-)

Trichloropropane, N.O.S.³ (Propane, trichloro-, N.O.S.³)

1,2,3-Trichloropropane (Propane, 1,2,3-trichloro-)

O,O,O-Triethyl phosphorothioate (Phosphorothioic acid, O,O,O-triethyl ester)

sym-Trinitrobenzene (Benzene, 1,3,5-trinitro-)

Tris(1-aziridiny) phosphine sulfide (Phosphine sulfide, tris(1-aziridiny)-)

Tris(2,3-dibromopropyl) phosphate (1-Propanol, 2,3-dibromo-, phosphate)

Trypan blue (2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl (1,1'-biphenyl)- 4,4'-diyl)bis(azo)]bis(5-amino-4-hydroxy-, tetrasodium salt)

Uracil mustard (Uracil 5-[bis(2-chloroethyl)amino]-)

Uranium and compounds, N.O.S.³

Vanadic acid, ammonium salt (ammonium vanadate)

Vanadium pentoxide (Vanadium (V) oxide)

Vinyl chloride (Ethene, chloro-)

Zinc cyanide

Zinc phosphide

[50 FR 41862, Oct. 16, 1985, as amended at 52 FR 31611, Aug. 21, 1987; 52 FR 43562, Nov. 13, 1987; 53 FR 19248, May 27, 1988; 55 FR 45600, Oct. 30, 1990; 56 FR 23473, May 21, 1991; 58 FR 67661, Dec. 22, 1993; 59 FR 28229, June 1, 1994; 64 FR 17510, Apr. 12, 1999]

1. In the case of thorium byproduct materials, the standard applies only to design. Monitoring for radon emissions from thorium byproduct materials after installation of an appropriately designed cover is not required.

2. This average applies to the entire surface of each disposal area over a period of a least one year, but a period short compared to 100 years. Radon will come from both byproduct materials and from covering materials. Radon emissions from covering materials should be estimated as part of developing a closure plan for each site. The standard, however, applies only to emissions from byproduct materials to the atmosphere.

3. The abbreviation N.O.S. (not otherwise specified) signifies those members of the general class not specifically listed by name in this list.

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Authority: Secs. 53, 57, 62, 63, 81, 161, 182, 183, 68 Stat. 930, 932, 933, 935, 948, 953, 954, as amended, sec. 1701, 106 Stat. 2951, 2952, 2953 (42 U.S.C. 2073, 2077, 2092, 2093, 2111, 2201, 2232, 2233, 2297f); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846); sec. 1704, 112 Stat. 2750 (44 U.S.C. 3504 note); Energy Policy Act of 2005, Pub. L. No. 109–58, 119 Stat. 594 (2005). Section 71.97 also issued under sec. 301, Pub. L. 96–295, 94 Stat. 789–790.

Source: 60 FR 50264, Sept. 28, 1995, unless otherwise noted.

[72 FR 63974, Nov. 14, 2007; 73 FR 63572, Oct. 24, 2008]

Subpart A--General Provisions

Source: 69 FR 3786, Jan. 26, 2004, unless otherwise noted.

§ 71.0 Purpose and scope.

(a) This part establishes--

(1) Requirements for packaging, preparation for shipment, and transportation of licensed material; and

(2) Procedures and standards for NRC approval of packaging and shipping procedures for fissile material and for a quantity of other licensed material in excess of a Type A quantity.

(b) The packaging and transport of licensed material are also subject to other parts of this chapter (e.g., 10 CFR parts 20, 21, 30, 40, 70, and 73) and to the regulations of other agencies (e.g., the U.S. Department of Transportation (DOT) and the U.S. Postal Service)¹ having jurisdiction over means of transport. The requirements of this part are in addition to, and not in substitution for, other requirements.

(c) The regulations in this part apply to any licensee authorized by specific or general license issued by the Commission to receive, possess, use, or transfer licensed material, if the licensee delivers that material to a carrier for transport, transports the material outside the site of usage as specified in the NRC license, or transports that material on public highways. No provision of this part authorizes possession of licensed material.

(d)(1) Exemptions from the requirement for license in § 71.3 are specified in § 71.14. General licenses for which no NRC package approval is required are issued in §§ 71.20 through 71.23. The general license in § 71.17 requires that an NRC certificate of compliance or other package approval be issued for the package to be used under this general license.

(2) Application for package approval must be completed in accordance with subpart D of this part, demonstrating that the design of the package to be used satisfies the package approval standards contained in subpart E of this part, as related to the tests of subpart F of this part.

(3) A licensee transporting licensed material, or delivering licensed material to a carrier for transport, shall comply with the operating control requirements of subpart G of this part; the quality assurance requirements of subpart H of this part; and the general provisions of subpart A of this part, including DOT regulations referenced in § 71.5.

(e) The regulations of this part apply to any person holding, or applying for, a certificate of compliance, issued pursuant to this part, for a package intended for the transportation of radioactive material, outside the confines of a licensee's facility or authorized place of use.

(f) The regulations in this part apply to any person required to obtain a certificate of compliance, or an approved compliance plan, pursuant to part 76 of this chapter, if the person delivers radioactive material to a common or contract carrier for transport or transports the material outside the confines of the person's plant or other authorized place of use.

(g) This part also gives notice to all persons who knowingly provide to any licensee, certificate holder, quality assurance program approval holder, applicant for a license, certificate, or quality assurance program approval, or to a contractor, or subcontractor of any of them, components, equipment, materials, or other goods or services, that relate to a licensee's, certificate holder's, quality assurance program approval holder's, or applicant's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of § 71.8.

¹ Postal Service Manual (Domestic Mail Manual), section 124, which is incorporated by reference at 39 CFR 111.1.

§ 71.1 Communications and records.

(a) Except where otherwise specified, all communications and reports concerning the regulations in this part and applications filed under them should be sent by mail addressed: ATTN: Document Control Desk, Director, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, by hand delivery to the NRC's offices at 11555 Rockville Pike, Rockville, Maryland; or, where practicable, by electronic submission, for example, via Electronic Information Exchange, or CD-ROM. Electronic submissions must be made in a manner that enables the NRC to receive, read, authenticate, distribute, and archive the submission, and process and retrieve it a single page at a time. Detailed guidance on making electronic submissions can be obtained by visiting the NRC's website at www.nrc.gov/site-help/e-submittals.html, by calling (301) 415-0439, by e-mail to EIE@nrc.gov, or by writing the Office of Information Services, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. The guidance discusses, among other topics, the formats the

NRC can accept, the use of electronic signatures, and the treatment of nonpublic information. If the submission date falls on a Saturday, Sunday, or a Federal holiday, the next Federal working day becomes the official due date.

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

[69 FR 3786, Jan. 26, 2004; 69 FR 58038, Sept. 29, 2004; 70 FR 69421, Nov. 16, 2005; 72 FR 33386, Jun. 18, 2007]

§ 71.2 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission, other than a written interpretation by the General Counsel, will be recognized to be binding upon the Commission.

§ 71.3 Requirement for license.

Except as authorized in a general license or a specific license issued by the Commission, or as exempted in this part, no licensee may--

- (a) Deliver licensed material to a carrier for transport; or
- (b) Transport licensed material.

§ 71.4 Definitions.

The following terms are as defined here for the purpose of this part. To ensure compatibility with international transportation standards, all limits in this part are given in terms of dual units: The International System of Units (SI) followed or preceded by U.S. standard or customary units. The U.S. customary units are not exact equivalents but are rounded to a convenient value, providing a functionally equivalent unit. For the purpose of this part, either unit may be used.

A₁ means the maximum activity of special form radioactive material permitted in a Type A package. This value is either listed in Appendix A, Table A-1, of this part, or may be derived in accordance with the procedures prescribed in Appendix A of this part.

A₂ means the maximum activity of radioactive material, other than special form material, LSA, and SCO material, permitted in a Type A package. This value is either listed in Appendix A, Table A-1, of this part, or may be derived in accordance with the procedures prescribed in Appendix A of this part.

Carrier means a person engaged in the transportation of passengers or property by land or water as a common, contract, or private carrier, or by civil aircraft.

Certificate holder means a person who has been issued a certificate of compliance or other package approval by the Commission.

Certificate of Compliance (CoC) means the certificate issued by the Commission under subpart D of this part which approves the design of a package for the transportation of radioactive material.

Close reflection by water means immediate contact by water of sufficient thickness for maximum reflection of neutrons.

Consignment means each shipment of a package or groups of packages or load of radioactive material offered by a shipper for transport.

Containment system means the assembly of components of the packaging intended to retain the radioactive material during transport.

Conveyance means:

- (1) For transport by public highway or rail any transport vehicle or large freight container;
- (2) 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; and
- (3) For transport by any aircraft.

Criticality Safety Index (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. Determination of the criticality safety index is described in §§ 71.22, 71.23, and 71.59.

Deuterium means, for the purposes of §§ 71.15 and 71.22, deuterium and any deuterium compounds, including heavy water, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1:5000.

DOT means the U.S. Department of Transportation.

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 safe handling of the consignment. The consignor must 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.

Fissile material means the radionuclides uranium-233, uranium-235, plutonium-239, and plutonium-241, 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. Certain exclusions from fissile material controls are provided in §71.15.

Graphite means, for the purposes of §§ 71.15 and 71.22, graphite with a boron equivalent content less than 5 parts per million and density greater than 1.5 grams per cubic centimeter.

Indian tribe means and Indian of Alaska native tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe pursuant to the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a.

Licensed material means byproduct, source, or special nuclear material received, possessed, used, or transferred under a general or specific license issued by the Commission pursuant to the regulations in this chapter.

Low Specific Activity (LSA) material means radioactive material with limited specific activity which is nonfissile or is excepted under §71.15, and which satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of three groups:

(1) LSA--I.

- (i) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radioactive radionuclides which are not intended to be processed for the use of these radionuclides;
- (ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures;
- (iii) Radioactive material for which the A_2 value is unlimited; or
- (iv) Other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentration determined in accordance with Appendix A.

(2) LSA--II.

- (i) Water with tritium concentration up to 0.8 TBq/liter (20.0 Ci/liter); or
- (ii) Other material in which the activity 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.

(3) LSA--III. Solids (e.g., consolidated wastes, activated materials), excluding powders, that satisfy the requirements of § 71.77, in which:

- (i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);
- (ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that even under loss of packaging, the loss of radioactive material per package by leaching, when placed in water for 7 days, would not exceed $0.1 A_2$; and
- (iii) The estimated average specific activity of the solid does not exceed $2 \times 10^{-3}A_2/g$.

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.

Maximum normal operating pressure means the maximum gauge pressure that would develop in the containment system in a period of 1 year under the heat condition specified in §71.71(c)(1), in the absence of venting, external cooling by an ancillary system, or operational controls during transport.

Natural thorium means thorium with the naturally occurring distribution of thorium isotopes (essentially 100 weight percent thorium-232).

Normal form radioactive material means radioactive material that has not been demonstrated to qualify as "special form radioactive material."

Optimum interspersed hydrogenous moderation means the presence of hydrogenous material between packages to such an extent that the maximum nuclear reactivity results.

Package means the packaging together with its radioactive contents as presented for transport.

(1) 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.

(2) Type A package means a Type A packaging together with its radioactive contents. A Type A package is defined and must comply with the DOT regulations in 49 CFR part 173.

(3) Type B package means a Type B packaging together with its radioactive contents. On approval, a Type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lbs/in²) gauge or a pressure relief device that would allow the release of radioactive material to the environment under the tests specified in §71.73 (hypothetical accident conditions), in which case it will receive a designation B(M). B(U) refers to the need for unilateral approval of international shipments; B(M) refers to the need for multilateral approval of international shipments. There is no distinction made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, see DOT regulations in 49 CFR Part 173. A Type B package approved before September 6, 1983, was designated only as Type B. Limitations on its use are specified in §71.19.

Packaging means the assembly of components necessary to ensure compliance with the packaging requirements of this part. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging.

Special form radioactive material means radioactive material that satisfies the following conditions:

(1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

(2) The piece or capsule has at least one dimension not less than 5 mm (0.2 in); and

(3) It satisfies the requirements of §71.75. A special form encapsulation designed in accordance with the requirements of §71.4 in effect on June 30, 1983 (see 10 CFR part 71, revised as of January 1, 1983), and constructed before July 1, 1985, and a special form encapsulation designed in accordance with the requirements of §71.4 in effect on March 31, 1996 (see 10 CFR part 71, revised as of January 1, 1983), and constructed before April 1, 1998, may continue to be used. Any other special form encapsulation must meet the specifications of this definition.

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.

Spent nuclear fuel or Spent fuel means fuel that has been withdrawn from a nuclear reactor following irradiation, has undergone at least 1 year's decay since being used as a source of energy in a power reactor, and has not been chemically separated into its constituent elements by reprocessing. Spent fuel includes the special nuclear material, byproduct material, source material, and other radioactive materials associated with fuel assemblies.

State means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands.

Surface Contaminated Object (SCO) means a solid object that is not itself classed as radioactive material, but which has radioactive material distributed on any of its surfaces. SCO must be in one of two groups with surface activity not exceeding the following limits:

(1) SCO-I: A solid object on which:

(i) The nonfixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4 Bq/cm² (10⁴ microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm² (10⁻⁵ microcurie/cm²) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4 x 10⁴ Bq/cm² (1.0 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 4 x 10³ Bq/cm² (0.1 microcurie/cm²) for all other alpha emitters; and

(iii) The nonfixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 4 x 10⁴ Bq/cm² (1 microcurie/cm²) for beta and gamma and low toxicity alpha emitters, or 4 x 10³ Bq/cm² (0.1 microcurie/cm²) for all other alpha emitters.

(2) SCO-II: A solid object on which the limits for SCO-I are exceeded and on which:

(i) The nonfixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 400 Bq/cm² (10² microcurie/cm²) for beta and gamma and low toxicity alpha emitters or 40 Bq/cm² (10³ microcurie/cm²) for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8 x 10⁵ Bq/cm² (20 microcuries/cm²) for beta and gamma and low toxicity alpha emitters, or 8 x 10⁴ Bq/cm² (2 microcuries/cm²) for all other alpha emitters; and

(iii) The nonfixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8 x 10⁵ Bq/cm² (20 microcuries/cm²) for beta and gamma and low toxicity alpha emitters, or 8 x 10⁴ Bq/cm² (2 microcuries/cm²) for all other alpha emitters.

Transport index (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 determined by multiplying the maximum radiation level in millisievert (mSv)

per hour at 1 meter (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at 1 meter (3.3 ft)).

Tribal official means the highest ranking individual that represents Tribal leadership, such as the Chief, President, or Tribal Council leadership.

Type A quantity means a quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material, or A_2 , for normal form radioactive material, where A_1 and A_2 are given in Table A-1 of this part, or may be determined by procedures described in Appendix A of this part.

Type B quantity means a quantity of radioactive material greater than a Type A quantity.

Unirradiated uranium means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235, and not more than 5×10^{-3} g of uranium-236 per gram of uranium-235.

Uranium--natural, depleted, enriched:

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

(2) Depleted uranium means uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.

(3) Enriched uranium means uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

§ 71.5 Transportation of licensed material.

(a) Each licensee who transports licensed material outside the site of usage, as specified in the NRC license, or where transport is on public highways, or who delivers licensed material to a carrier for transport, shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180, and 390 through 397, appropriate to the mode of transport.

(1) The licensee shall particularly note DOT regulations in the following areas:

(i) Packaging--49 CFR part 173: subparts A, B, and I.

(ii) Marking and labeling--49 CFR part 172: subpart D; and §§ 172.400 through 172.407 and §§ 172.436 through 172.441 of subpart E.

(iii) Placarding--49 CFR part 172: subpart F, especially §§ 172.500 through 172.519 and 172.556; and appendices B and C.

(iv) Accident reporting--49 CFR part 171: §§ 171.15 and 171.16.

(v) Shipping papers and emergency information--49 CFR part 172: subparts C and G.

(vi) Hazardous material employee training--49 CFR part 172: subpart H.

(vii) Security plans--49 CFR part 172: subpart I.

(viii) Hazardous material shipper/carrier registration--49 CFR part 107: subpart G.

(2) The licensee shall also note DOT regulations pertaining to the following modes of transportation:

(i) Rail--49 CFR part 174: subparts A through D and K.

(ii) Air--49 CFR part 175.

(iii) Vessel--49 CFR part 176: subparts A through F and M.

(iv) Public Highway--49 CFR part 177 and parts 390 through 397.

(b) If DOT regulations are not applicable to a shipment of licensed material, the licensee shall conform to the standards and requirements of the DOT specified in paragraph (a) of this section to the same extent as if the shipment or transportation were subject to DOT regulations. A request for modification, waiver, or exemption from those requirements, and any notification referred to in those requirements, must be filed with, or made to, the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555- 0001.

§ 71.6 Information collection requirements: OMB approval.

(a) The Nuclear Regulatory Commission has submitted the information collection requirements contained in this part to the Office of Management and Budget (OMB) for approval as required by the Paperwork Reduction Act (44 U.S.C. 3501 et seq.). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB has approved the information collection requirements contained in this part under control number 3150-0008.

(b) The approved information collection requirements contained in this part appear in §§ 71.5, 71.7, 71.9, 71.12, 71.17, 71.19, 71.20, 71.22, 71.23, 71.31, 71.33, 71.35, 71.37, 71.38, 71.39, 71.41, 71.47, 71.85, 71.87, 71.89, 71.91, 71.93, 71.95, 71.97, 71.101, 71.103, 71.105, 71.107, 71.109, 71.111, 71.113, 71.115, 71.117, 71.119, 71.121, 71.123, 71.125, 71.127, 71.129, 71.131, 71.133, 71.135, 71.137, and Appendix A, Paragraph II.

§ 71.7 Completeness and accuracy of information.

(a) Information provided to the Commission by a licensee, certificate holder, or an applicant for a license or CoC; or information required by statute or by the Commission's regulations, orders, license or CoC conditions, to be maintained by the licensee or certificate holder, must be complete and accurate in all material respects.

(b) Each licensee, certificate holder, or applicant for a license or CoC must notify the Commission of information identified by the licensee, certificate holder, or applicant for a license or CoC as having, for the regulated activity, a significant implication for public health and safety or common defense and security. A licensee, certificate holder, or an applicant for a license or CoC violates this paragraph only if the licensee, certificate holder, or applicant for a license or CoC fails to notify the Commission of information that the licensee, certificate holder, or applicant for a license or CoC has identified as having a significant implication for public health and safety or common defense and security. Notification must be provided to the Administrator of the appropriate Regional Office within 2 working days of identifying the information.

This requirement is not applicable to information which is already required to be provided to the Commission by other reporting or updating requirements.

§ 71.8 Deliberate misconduct.

(a) This section applies to any--

(1) Licensee;

(2) Certificate holder;

(3) Quality assurance program approval holder;

(4) Applicant for a license, certificate, or quality assurance program approval;

(5) Contractor (including a supplier or consultant) or subcontractor, to any person identified in paragraph (a)(4) of this section; or

(6) Employees of any person identified in paragraphs (a)(1) through (a)(5) of this section.

(b) A person identified in paragraph (a) of this section who knowingly provides to any entity, listed in paragraphs (a)(1) through (a)(5) of this section, any components, materials, or other goods or services that relate to a licensee's, certificate holder's, quality assurance program approval holder's, or applicant's activities subject to this part may not:

(1) Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee, certificate holder, quality assurance program approval holder, or any applicant to be in violation of any rule, regulation, or order; or any term, condition or limitation of any license, certificate, or approval issued by the Commission; or

(2) Deliberately submit to the NRC, a licensee, a certificate holder, quality assurance program approval holder, an applicant for a license, certificate or quality assurance program approval, or a licensee's, applicant's, certificate holder's, or quality assurance program approval holder's contractor or subcontractor, information that the person submitting the information knows to be incomplete or inaccurate in some respect material to the NRC.

(c) A person who violates paragraph (b)(1) or (b)(2) of this section may be subject to enforcement action in accordance with the procedures in 10 CFR part 2, subpart B.

(d) For the purposes of paragraph (b)(1) of this section, deliberate misconduct by a person means an intentional act or omission that the person knows:

(1) Would cause a licensee, certificate holder, quality assurance program approval holder, or applicant for a license, certificate, or quality assurance program approval to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license or certificate issued by the Commission; or

(2) Constitutes a violation of a requirement, procedure, instruction, contract, purchase order, or policy of a licensee, certificate holder, quality assurance program approval holder, applicant, or the contractor or subcontractor of any of them.

§ 71.9 Employee protection.

(a) Discrimination by a Commission licensee, certificate holder, an applicant for a Commission license or a CoC, or a contractor or subcontractor of any of these, against an employee for engaging in certain protected activities, is prohibited. Discrimination includes discharge and other actions that relate to compensation, terms, conditions, or privileges of employment. The protected activities are established in section 211 of the Energy Reorganization Act of 1974, as amended, and in general are related to the administration or enforcement of a requirement imposed under the Atomic Energy Act of 1954, as amended, or the Energy Reorganization Act of 1974, as amended.

(1) The protected activities include, but are not limited to:

(i) Providing the Commission or his or her employer information about alleged violations of either of the statutes named in paragraph (a) of this section or possible violations of requirements imposed under either of those statutes;

(ii) Refusing to engage in any practice made unlawful under either of the statutes named in paragraph (a) of this section or under these requirements if the employee has identified the alleged illegality to the employer;

(iii) Requesting the Commission to institute action against his or her employer for the administration or enforcement of these requirements;

(iv) Testifying in any Commission proceeding, or before Congress, or at any Federal or State proceeding regarding any provision (or proposed provision) of either of the statutes named in paragraph (a) of this section; and

(v) Assisting or participating in, or is about to assist or participate in, these activities.

(2) These activities are protected even if no formal proceeding is actually initiated as a result of the employee's assistance or participation.

(3) This section has no application to any employee alleging discrimination prohibited by this section who, acting without direction from his or her employer (or the employer's agent), deliberately causes a violation of any requirement of the Energy Reorganization Act of 1974, as amended, or the Atomic Energy Act of 1954, as amended.

(b) Any employee who believes that he or she has been discharged or otherwise discriminated against by any person for engaging in protected activities specified in paragraph (a)(1) of this section may seek a remedy for the discharge or discrimination through an administrative proceeding in the Department of Labor. The administrative proceeding must be initiated within 180 days after an alleged violation occurs. The employee may do this by filing a complaint alleging the violation with the Department of Labor, Employment Standards Administration, Wage and Hour Division. The Department of Labor may order reinstatement, back pay, and compensatory damages.

(c) A violation of paragraph (a), (e), or (f) of this section by a Commission licensee, certificate holder, applicant for a Commission license or a CoC, or a contractor or subcontractor of any of these may be grounds for:

(1) Denial, revocation, or suspension of the license or the CoC;

(2) Imposition of a civil penalty on the licensee, applicant, or a contractor or subcontractor of the licensee or applicant; or

(3) Other enforcement action.

(d) Actions taken by an employer, or others, which adversely affect an employee may be predicated upon nondiscriminatory grounds. The prohibition applies when the adverse action occurs because the employee has engaged in protected activities. An employee's engagement in protected activities does not automatically render him or her immune from discharge or discipline for legitimate reasons or from adverse action dictated by nonprohibited considerations.

(e)(1) Each licensee, certificate holder, and applicant for a license or CoC must prominently post the current revision of NRC Form 3, "Notice to Employees," referenced in §19.11(c) of this chapter. This form must be posted at locations sufficient to permit employees protected by this section to observe a copy on the way to or from their place of work. The premises must be posted not later than 30 days after an application is docketed and remain posted while the application is pending before the Commission, during the term of the license or CoC, and for 30 days following license or CoC termination.

(2) Copies of NRC Form 3 may be obtained by writing to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in Appendix D to part 20 of this chapter or by calling the NRC Publishing Services Branch at 301-415-5877.

(f) No agreement affecting the compensation, terms, conditions, or privileges of employment, including an agreement to settle a complaint filed by an employee with the Department of Labor pursuant to section 211 of the Energy Reorganization Act of 1974, as amended, may contain any provision which would prohibit, restrict, or otherwise discourage an employee from participating in a protected activity as defined in paragraph (a)(1) of this section including, but not limited to, providing information to the NRC or to his or her employer on potential violations or other matters within NRC's regulatory responsibilities.

[72 FR 63975, Nov. 14, 2007]

§ 71.10 Public inspection of application.

Applications for approval of a package design under this part, which are submitted to the Commission, may be made available for public inspection, in accordance with provisions of parts 2 and 9 of this chapter. This includes an application to amend or revise an existing package design, any associated documents and drawings submitted with the application, and any responses to NRC requests for additional information.

§ 71.11 Protection of Safeguards Information

Each licensee, certificate holder, or applicant for a Certificate of Compliance for a transportation package for transport of irradiated reactor fuel, strategic special nuclear material, a critical mass of special nuclear material, or byproduct material in quantities determined by the Commission through order or regulation to be significant to the public health and safety or the common defense and security, shall protect Safeguards Information against unauthorized disclosure in accordance with the requirements in § 73.21 and the requirements of § 73.22 or § 73.23 of this chapter, as applicable.

[73 FR 63572, Oct. 24, 2008]

Subpart B--Exemptions

Source: 69 FR 3786, Jan. 26, 2004, unless otherwise noted.

§ 71.12 Specific exemptions.

On application of any interested person or on its own initiative, the Commission may grant any exemption from the requirements of the regulations in this part that it determines is authorized by law and will not endanger life or property nor the common defense and security.

§ 71.13 Exemption of physicians.

Any physician licensed by a State to dispense drugs in the practice of medicine is exempt from § 71.5 with respect to transport by the physician of licensed material for use in the practice of medicine. However, any physician operating under this exemption must be licensed under 10 CFR part 35 or the equivalent Agreement State regulations.

§ 71.14 Exemption for low-level materials.

(a) A licensee is exempt from all the requirements of this part with respect to shipment or carriage of the following low-level materials:

(1) Natural 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 A, Table A-2, of this part.

(2) Materials for which the activity concentration is not greater than the activity concentration values specified in Appendix A, Table A-2 of this part, or for which the consignment activity is not greater than the limit for an exempt consignment found in Appendix A, Table A-2, of this part.

(b) A licensee is exempt from all the requirements of this part, other than §§ 71.5 and 71.88, with respect to shipment or carriage of the following packages, provided the packages do not contain any fissile material, or the material is exempt from classification as fissile material under § 71.15:

(1) A package that contains no more than a Type A quantity of radioactive material;

(2) A package transported within the United States that contains no more than 0.74 TBq (20 Ci) of special form plutonium-244; or

(3) The package contains only LSA or SCO radioactive material, provided--

(i) That the LSA or SCO material has an external radiation dose of less than or equal to 10 mSv/h (1 rem/h), at a distance of 3 m from the unshielded material; or

(ii) That the package contains only LSA-I or SCO-I material.

§ 71.15 Exemption from classification as fissile material.

Fissile material meeting the requirements of at least one of the paragraphs (a) through (f) of this section are exempt from classification as fissile material and from the fissile material package standards of §§ 71.55 and 71.59, but are subject to all other requirements of this part, except as noted.

(a) Individual package containing 2 grams or less fissile material.

(b) 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 must not be included in determining the required mass for solid nonfissile material.

(c)(1) Low concentrations of solid fissile material commingled with solid nonfissile material, provided that:

(i) There is at least 2000 grams of solid nonfissile material for every gram of fissile material, and

(ii) There is no more than 180 grams of fissile material distributed within 360 kg of contiguous nonfissile material.

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

(d) Uranium enriched in uranium-235 to a maximum of 1 percent by weight, and with total plutonium and uranium-233 content of up to 1 percent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium constitutes less than 5 percent of the uranium mass.

(e) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 percent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 percent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2. The material must be contained in at least a DOT Type A package.

(f) Packages containing, individually, a total plutonium mass of not more than 1000 grams, of which not more than 20 percent by mass may consist of plutonium-239, plutonium-241, or any combination of these radionuclides.

§ 71.16 [Reserved]

Subpart C--General Licenses

Source: 69 FR 3792, Jan. 26, 2004, unless otherwise noted.

§ 71.17 General license: NRC-approved package.

(a) A general license is issued to any licensee of the Commission to transport, or to deliver to a carrier for transport, licensed material in a package for which a license, certificate of compliance (CoC), or other approval has been issued by the NRC.

(b) This general license applies only to a licensee who has a quality assurance program approved by the Commission as satisfying the provisions of subpart H of this part.

(c) This general license applies only to a licensee who--

(1) Has a copy of the CoC, or other approval of the package, and has the drawings and other documents referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken before shipment;

(2) Complies with the terms and conditions of the license, certificate, or other approval, as applicable, and the applicable requirements of subparts A, G, and H of this part; and

(3) Before the licensee's first use of the package, submits in writing to: ATTN: Document Control Desk, Director, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards, using an appropriate method listed in § 71.1(a), the licensee's name and license number and the package identification number specified in the package approval.

(d) This general license applies only when the package approval authorizes use of the package under this general license.

(e) For a Type B or fissile material package, the design of which was approved by NRC before April 1, 1996, the general license is subject to the additional restrictions of § 71.19.

§ 71.18 [Reserved]

§ 71.19 Previously approved package.

(a) [Reserved]

(b) A Type B(U) package, a Type B(M) package, or a fissile material package, previously approved by the NRC but without the designation "- 85" in the identification number of the NRC CoC, may be used under the general license of § 71.17 with the following additional conditions:

(1) Fabrication of the package is satisfactorily completed by April 1, 1999, as demonstrated by application of its model number in accordance with § 71.85(c);

(2) A package used for a shipment to a location outside the United States is subject to multilateral approval as defined in DOT regulations at 49 CFR 173.403; and

(3) A serial number which uniquely identifies each packaging which conforms to the approved design is assigned to and legibly and durably marked on the outside of each packaging.

(c) A Type B(U) package, a Type B(M) package, or a fissile material package previously approved by the NRC with the designation "-85" in the identification number of the NRC CoC, may be used under the general license of § 71.17 with the following additional conditions:

(1) Fabrication of the package must be satisfactorily completed by December 31, 2006, as demonstrated by application of its model number in accordance with § 71.85(c); and

(2) After December 31, 2003, a package used for a shipment to a location outside the United States is subject to multilateral approval as defined in DOT regulations at 49 CFR 173.403.

(d) NRC will approve modifications to the design and authorized contents of a Type B package, or a fissile material package, previously approved by NRC, provided--

(1) The modifications of a Type B package are not significant with respect to the design, operating characteristics, or safe performance of the containment system, when the package is subjected to the tests specified in §§ 71.71 and 71.73;

(2) The modifications of a fissile material package are not significant, with respect to the prevention of criticality, when the package is subjected to the tests specified in §§ 71.71 and 71.73; and

(3) The modifications to the package satisfy the requirements of this part.

(e) NRC will revise the package identification number to designate previously approved package designs as B, BF, AF, B(U), B(M), B(U)F, B(M)F, B(U)-85, B(U)F-85, B(M)-85, B(M)F-85, or AF-85 as appropriate, and with the identification number suffix "-96" after receipt of an application demonstrating that the design meets the requirements of this part.

§ 71.21 General license: Use of foreign approved package.

(a) A general license is issued to any licensee of the Commission to transport, or to deliver to a carrier for transport, licensed material in a package, the design of which has been approved in a foreign national competent authority certificate, that has been revalidated by DOT as meeting the applicable requirements of 49 CFR 171.12.

(b) Except as otherwise provided in this section, the general license applies only to a licensee who has a quality assurance program approved by the Commission as satisfying the applicable provisions of subpart H of this part.

(c) This general license applies only to shipments made to or from locations outside the United States.

(d) This general license applies only to a licensee who--

(1) Has a copy of the applicable certificate, the revalidation, and the drawings and other documents referenced in the certificate, relating to the use and maintenance of the packaging and to the actions to be taken before shipment; and

(2) Complies with the terms and conditions of the certificate and revalidation, and with the applicable requirements of subparts A, G, and H of this part. With respect to the quality assurance provisions of subpart H of this part, the licensee is exempt from design, construction, and fabrication considerations.

§ 71.22 General license: Fissile material.

(a) A general license is issued to any licensee of the Commission to transport fissile material, or to deliver fissile material to a carrier for transport, if the material is shipped in accordance with this section. The fissile material need not be contained in a package which meets the standards of subparts E and F of this part; 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 Commission as satisfying the provisions of subpart H of this part.

(c) The general license applies only when a package's contents:

(1) Contain no more than a Type A quantity of radioactive material; and

(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 which:

(1) Has been determined in accordance with paragraph (e) of this section;

- (2) Has a value less than or equal to 10; and
- (3) For a shipment of multiple packages containing fissile material, the sum of the CSIs must 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)(1) The value for the CSI must be greater than or equal to the number calculated by the following equation:

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

- (2) The calculated CSI must be rounded up to the first decimal place;
- (3) The values of X, Y, and Z used in the CSI equation must be taken from Tables 71-1 or 71-2, as appropriate;
- (4) If Table 71-2 is used to obtain the value of X, then the values for the terms in the equation for uranium-233 and plutonium must be assumed to be zero; and
- (5) Table 71-1 values for X, Y, and Z must be used to determine the CSI if:
- (i) Uranium-233 is present in the package;
 - (ii) The mass of plutonium exceeds 1 percent of the mass of uranium-235;
 - (iii) The uranium is of unknown uranium-235 enrichment or greater than 24 weight percent enrichment; or
 - (iv) Substances having a moderating effectiveness (i.e., an average hydrogen density greater than H₂O) (e.g., certain hydrocarbon oils or plastics) are present in any form, except as polyethylene used for packing or wrapping.

Table 71-1. Mass Limits for General License Packages Containing Mixed Quantities of Fissile Material or Uranium-235 of Unknown Enrichment per § 71.22(e)

Fissile material	Fissile material mass mixed with moderating substances having an average hydrogen density less than or equal to H ₂ O (grams)	Fissile material mass mixed with moderating substances having an average hydrogen density greater than H ₂ O ^a (grams)
²³⁵ U (X)	60	38
²³³ 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 H₂O.

Table 71-2. Mass Limits for General License Packages Containing Uranium-235 of Known Enrichment per § 71.22(e)

Uranium enrichment in weight percent of ²³⁵ U not exceeding	Fissile material mass of ²³⁵ U (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	1,020
0.92	1,800

[69 FR 3786, Jan. 26, 2004; 69 FR 58038, Sept. 29, 2004]

§ 71.23 General license: Plutonium-beryllium special form material.

(a) A general license is issued to any licensee of the Commission 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 in accordance with this section. This material need not be contained in a package which meets the standards of subparts E and F of this part; 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 Commission as satisfying the provisions of subpart H of this part.

(c) The general license applies only when a package's contents:

(1) Contain no more than a Type A quantity of radioactive material; and

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

(d) The general license applies only to packages labeled with a CSI which:

(1) Has been determined in accordance with paragraph (e) of this section;

(2) Has a value less than or equal to 100; and

(3) For a shipment of multiple packages containing Pu-Be sealed sources, the sum of the CSIs must 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)(1) The value for the CSI must be greater than or equal to the number calculated by the following equation:

$$CSI = 10 \left[\frac{\text{grams of } ^{239}\text{Pu} + \text{grams of } ^{241}\text{Pu}}{24} \right]; \text{ and}$$

(2) The calculated CSI must be rounded up to the first decimal place.

§ 71.24 [Reserved]

§ 71.25 [Reserved]

Subpart D--Application for Package Approval

§ 71.31 Contents of application.

(a) An application for an approval under this part must include, for each proposed packaging design, the following information:

(1) A package description as required by § 71.33;

(2) A package evaluation as required by § 71.35; and

(3) A quality assurance program description, as required by § 71.37, or a reference to a previously approved quality assurance program.

(b) Except as provided in § 71.13, an application for modification of a package design, whether for modification of the packaging or authorized contents, must include sufficient information to demonstrate that the proposed design satisfies the package standards in effect at the time the application is filed.

(c) The applicant shall identify any established codes and standards proposed for use in package design, fabrication, assembly, testing, maintenance, and use. In the absence of any codes and standards, the applicant shall describe and justify the basis and rationale used to formulate the package quality assurance program.

§ 71.33 Package description.

The application must include a description of the proposed package in sufficient detail to identify the package accurately and provide a sufficient basis for evaluation of the package. The description must include --

(a) With respect to the packaging --

- (1) Classification as Type B(U), Type B(M), or fissile material packaging;
- (2) Gross weight;
- (3) Model number;
- (4) Identification of the containment system;
- (5) Specific materials of construction, weights, dimensions, and fabrication methods of --

- (i) Receptacles;
- (ii) Materials specifically used as nonfissile neutron absorbers or moderators;
- (iii) Internal and external structures supporting or protecting receptacles;
- (iv) Valves, sampling ports, lifting devices, and tie-down devices; and
- (v) Structural and mechanical means for the transfer and dissipation of heat; and
- (6) Identification and volumes of any receptacles containing coolant.

(b) With respect to the contents of the package --

- (1) Identification and maximum radioactivity of radioactive constituents;
- (2) Identification and maximum quantities of fissile constituents;
- (3) Chemical and physical form;
- (4) Extent of reflection, the amount and identity of nonfissile materials used as neutron absorbers or moderators, and the atomic ratio of moderator to fissile constituents;
- (5) Maximum normal operating pressure;
- (6) Maximum weight;
- (7) Maximum amount of decay heat; and

(8) Identification and volumes of any coolants.

§ 71.35 Package evaluation.

The application must include the following:

- (a) A demonstration that the package satisfies the standards specified in subparts E and F of this part;
- (b) For a fissile material package, the allowable number of packages that may be transported in the same vehicle in accordance with § 71.59; and
- (c) For a fissile material shipment, any proposed special controls and precautions for transport, loading, unloading, and handling and any proposed special controls in case of an accident or delay.

§ 71.37 Quality assurance.

- (a) The applicant shall describe the quality assurance program (see Subpart H of this part) for the design, fabrication, assembly, testing, maintenance, repair, modification, and use of the proposed package.
- (b) The applicant shall identify any specific provisions of the quality assurance program that are applicable to the particular package design under consideration, including a description of the leak testing procedures.

§ 71.38 Renewal of a certificate of compliance or quality assurance program approval.

- (a) Except as provided in paragraph (b) of this section, each Certificate of Compliance or Quality Assurance Program Approval expires at the end of the day, in the month and year stated in the approval.
- (b) In any case in which a person, not less than 30 days before the expiration of an existing Certificate of Compliance or Quality Assurance Program Approval issued pursuant to the part, has filed an application in proper form for renewal of either of those approvals, the existing Certificate of Compliance or Quality Assurance Program Approval for which the renewal application was filed shall not be deemed to have expired until final action on the application for renewal has been taken by the Commission.
- (c) In applying for renewal of an existing Certificate of Compliance or Quality Assurance Program Approval, an applicant may be required to submit a consolidated application that incorporates all changes to its program that, are incorporated by reference in the existing approval or certificate, into as few referenceable documents as reasonably achievable.

§ 71.39 Requirement for additional information.

The Commission may at any time require additional information in order to enable it to determine whether a license, certificate of compliance, or other approval should be granted, renewed, denied, modified, suspended, or revoked.

Subpart E--Package Approval Standards

§ 71.41 Demonstration of compliance.

- (a) The effects on a package of the tests specified in § 71.71 ("Normal conditions of transport"), and the tests specified in § 71.73 ("Hypothetical accident conditions"), and § 71.61 ("Special requirements for Type B packages containing more than 10^5 A₂"), must be evaluated by subjecting a specimen or scale model to a

specific test, or by another method of demonstration acceptable to the Commission, as appropriate for the particular feature being considered.

(b) Taking into account the type of vehicle, the method of securing or attaching the package, and the controls to be exercised by the shipper, the Commission may permit the shipment to be evaluated together with the transporting vehicle.

(c) Environmental and test conditions different from those specified in §§ 71.71 and 71.73 may be approved by the Commission if the controls proposed to be exercised by the shipper are demonstrated to be adequate to provide equivalent safety of the shipment.

(d) Packages for which compliance with the other provisions of these regulations is impracticable shall not be transported except under special package authorization. Provided the applicant demonstrates that compliance with the other provisions of the regulations is impracticable and that the requisite standards of safety established by these regulations have been demonstrated through means alternative to the other provisions, a special package authorization may be approved for one-time shipments. The applicant shall demonstrate that the overall level of safety in transport for these shipments is at least equivalent to that which would be provided if all the applicable requirements had been met.

[60 FR 50264, Sept. 28, 1995 as amended at 69 FR 3794, Jan. 26, 2004]

§ 71.43 General standards for all packages.

(a) The smallest overall dimension of a package may not be less than 10 cm (4 in).

(b) The outside of a package must incorporate a feature, such as a seal, that is not readily breakable and that, while intact, would be evidence that the package has not been opened by unauthorized persons.

(c) Each package must include a containment system securely closed by a positive fastening device that cannot be opened unintentionally or by a pressure that may arise within the package.

(d) A package must be made of materials and construction that assure that there will be no significant chemical, galvanic, or other reaction among the packaging components, among package contents, or between the packaging components and the package contents, including possible reaction resulting from leakage of water, to the maximum credible extent. Account must be taken of the behavior of materials under irradiation.

(e) A package valve or other device, the failure of which would allow radioactive contents to escape, must be protected against unauthorized operation and, except for a pressure relief device, must be provided with an enclosure to retain any leakage.

(f) A package must be designed, constructed, and prepared for shipment so that under the tests specified in § 71.71 ("Normal conditions of transport") there would be no loss or dispersal of radioactive contents, no significant increase in external surface radiation levels, and no substantial reduction in the effectiveness of the packaging.

(g) A package must be designed, constructed, and prepared for transport so that in still air at 38°C (100°F) and in the shade, no accessible surface of a package would have a temperature exceeding 50°C (122°F) in a nonexclusive use shipment, or 85°C (185°F) in an exclusive use shipment.

(h) A package may not incorporate a feature intended to allow continuous venting during transport.

§ 71.45 Lifting and tie-down standards for all packages.

(a) Any lifting attachment that is a structural part of a package must be designed with a minimum safety factor of three against yielding when used to lift the package in the intended manner, and it must be designed so that failure of any lifting device under excessive load would not impair the ability of the package to meet other requirements of this subpart. Any other structural part of the package that could be used to lift the package must be capable of being rendered inoperable for lifting the package during transport, or must be designed with strength equivalent to that required for lifting attachments.

(b) Tie-down devices:

(1) If there is a system of tie-down devices that is a structural part of the package, the system must be capable of withstanding, without generating stress in any material of the package in excess of its yield strength, a static force applied to the center of gravity of the package having a vertical component of 2 times the weight of the package with its contents, a horizontal component along the direction in which the vehicle travels of 10 times the weight of the package with its contents, and a horizontal component in the transverse direction of 5 times the weight of the package with its contents.

(2) Any other structural part of the package that could be used to tie down the package must be capable of being rendered inoperable for tying down the package during transport, or must be designed with strength equivalent to that required for tie-down devices.

(3) Each tie-down device that is a structural part of a package must be designed so that failure of the device under excessive load would not impair the ability of the package to meet other requirements of this part.

§ 71.47 External radiation standards for all packages.

(a) Except as provided in paragraph (b) of this section, each package of radioactive materials offered for transportation must be designed and prepared for shipment so that under conditions normally incident to transportation the radiation level does not exceed 2 mSv/h (200 mrem/h) at any point on the external surface of the package, and the transport index does not exceed 10.

(b) A package that exceeds the radiation level limits specified in paragraph (a) of this section must be transported by exclusive use shipment only, and the radiation levels for such shipment must not exceed the following during transportation:

(1) 2 mSv/h (200 mrem/h) on the external surface of the package, unless the following conditions are met, in which case the limit is 10 mSv/h (1000 mrem/h):

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

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

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

(2) 2 mSv/h (200 mrem/h) at any point on the outer surface of the vehicle, including the top and underside of the vehicle; or in the case of a flat-bed style vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load or enclosure, if used, and on the lower external surface of the vehicle; and

(3) 0.1 mSv/h (10 mrem/h) at any point 2 meters (80 in) from the outer lateral surfaces of the vehicle (excluding the top and underside of the vehicle); or in the case of a flat-bed style vehicle, at any point 2 meters (6.6 feet) from the vertical planes projected by the outer edges of the vehicle (excluding the top and underside of the vehicle); and

(4) 0.02 mSv/h (2 mrem/h) in any normally occupied space, except that this provision does not apply to private carriers, if exposed personnel under their control wear radiation dosimetry devices in conformance with 10 CFR 20.1502.

(c) For shipments made under the provisions of paragraph (b) of this section, the shipper shall provide specific written instructions to the carrier for maintenance of the exclusive use shipment controls. The instructions must be included with the shipping paper information.

(d) The written instructions required for exclusive use shipments must be sufficient so that, when followed, they will cause the carrier to avoid actions that will unnecessarily delay delivery or unnecessarily result in increased radiation levels or radiation exposures to transport workers or members of the general public.

§ 71.51 Additional requirements for Type B packages.

(a) A Type B package, in addition to satisfying the requirements of §§ 71.41 through 71.47, must be designed, constructed, and prepared for shipment so that under the tests specified in:

(1) Section 71.71 ("Normal conditions of transport"), there would be no loss or dispersal of radioactive contents--as demonstrated to a sensitivity of 10^{-6} A₂ per hour, no significant increase in external surface radiation levels, and no substantial reduction in the effectiveness of the packaging; and

(2) Section 71.73 ("Hypothetical accident conditions"), there would be no escape of krypton-85 exceeding 10 A₂ in 1 week, no escape of other radioactive material exceeding a total amount A₂ in 1 week, and no external radiation dose rate exceeding 10 mSv/h (1 rem/h) at 1 m (40 in) from the external surface of the package.

(b) Where mixtures of different radionuclides are present, the provisions of appendix A, paragraph IV of this part shall apply, except that for Krypton-85, an effective A₂ value equal to 10 A₂ may be used.

(c) Compliance with the permitted activity release limits of paragraph (a) of this section may not depend on filters or on a mechanical cooling system.

(d) For packages which contain radioactive contents with activity greater than 10⁵ A₂, the requirements of § 71.61 must be met.

[60 FR 50264, Sept. 28, 1995 as amended at 69 FR 3794, Jan. 26, 2004]

§ 71.53 [Reserved]

[62 FR 5913, Feb. 10, 1997; 69 FR 3794, January 26, 2004]

§ 71.55 General requirements for fissile material packages.

(a) A package used for the shipment of fissile material must be designed and constructed in accordance with §§ 71.41 through 71.47. When required by the total amount of radioactive material, a package used for the shipment of fissile material must also be designed and constructed in accordance with § 71.51.

(b) Except as provided in paragraph (c) or (g) of this section, a package used for the shipment of fissile material must be so designed and constructed and its contents so limited that it would be subcritical if water were to leak into the containment system, or liquid contents were to leak out of the containment system so that, under the following conditions, maximum reactivity of the fissile material would be attained:

(1) The most reactive credible configuration consistent with the chemical and physical form of the material;

(2) Moderation by water to the most reactive credible extent; and

(3) Close full reflection of the containment system by water on all sides, or such greater reflection of the containment system as may additionally be provided by the surrounding material of the packaging.

(c) The Commission may approve exceptions to the requirements of paragraph (b) of this section if the package incorporates special design features that ensure that no single packaging error would permit leakage, and if appropriate measures are taken before each shipment to ensure that the containment system does not leak.

(d) A package used for the shipment of fissile material must be so designed and constructed and its contents so limited that under the tests specified in § 71.71 ("Normal conditions of transport") --

(1) The contents would be subcritical;

(2) The geometric form of the package contents would not be substantially altered;

(3) There would be no leakage of water into the containment system unless, in the evaluation of undamaged packages under § 71.59(a)(1), it has been assumed that moderation is present to such an extent as to cause maximum reactivity consistent with the chemical and physical form of the material; and

(4) There will be no substantial reduction in the effectiveness of the packaging, including:

(i) No more than 5 percent reduction in the total effective volume of the packaging on which nuclear safety is assessed;

(ii) No more than 5 percent reduction in the effective spacing between the fissile contents and the outer surface of the packaging; and

(iii) No occurrence of an aperture in the outer surface of the packaging large enough to permit the entry of a 10 cm (4 in) cube.

(e) A package used for the shipment of fissile material must be so designed and constructed and its contents so limited that under the tests specified in § 71.73 ("Hypothetical accident conditions"), the package would be subcritical. For this determination, it must be assumed that:

(1) The fissile material is in the most reactive credible configuration consistent with the damaged condition of the package and the chemical and physical form of the contents;

(2) Water moderation occurs to the most reactive credible extent consistent with the damaged condition of the package and the chemical and physical form of the contents; and

(3) There is full reflection by water on all sides, as close as is consistent with the damaged condition of the package.

(f) For fissile material package designs to be transported by air:

(1) The package must be designed and constructed, and its contents limited so that it would be subcritical, assuming reflection by 20 cm (7.9 in) of water but no water inleakage, when subjected to sequential application of:

(i) The free drop test in § 71.73(c)(1);

(ii) The crush test in § 71.73(c)(2);

(iii) A puncture test, for packages of 250 kg or more, consisting of a free drop of the specimen through a distance of 3 m (120 in) in a position for which maximum damage is expected at the conclusion of the test sequence, onto the upper end of a solid, vertical, cylindrical, mild steel probe mounted on an essentially unyielding, horizontal surface. The probe must be 20 cm (7.9 in) in diameter, with the striking end forming the frustum of a right circular cone with the dimensions of 30 cm height, 2.5 cm top diameter, and a top edge rounded to a radius of not more than 6 mm (0.25 in). For packages less than 250 kg, the puncture test must be the same, except that a 250 kg probe must be dropped onto the specimen which must be placed on the surface; and

(iv) The thermal test in § 71.73(c)(4), except that the duration of the test must be 60 minutes.

(2) The package must be designed and constructed, and its contents limited, so that it would be subcritical, assuming reflection by 20 cm (7.9 in) of water but no water inleakage, when subjected to an impact on an unyielding surface at a velocity of 90 m/s normal to the surface, at such orientation so as to result in maximum damage. A separate, undamaged specimen can be used for this evaluation.

(3) Allowance may not be made for the special design features in paragraph (c) of this section, unless water leakage into or out of void spaces is prevented following application of the tests in paragraphs (f)(1) and (f)(2) of this section, and subsequent application of the immersion test in § 71.73(c)(5).

(g) Packages containing uranium hexafluoride only are excepted from the requirements of paragraph (b) of this section provided that:

(1) Following the tests specified in § 71.73 ("Hypothetical accident conditions"), there is no physical contact between the valve body and any other component of the packaging, other than at its original point of attachment, and the valve remains leak tight;

(2) There is an adequate quality control in the manufacture, maintenance, and repair of packagings;

(3) Each package is tested to demonstrate closure before each shipment; and

(4) The uranium is enriched to not more than 5 weight percent uranium-235.

[60 FR 50264, Sept. 28, 1995; 61 FR 28724, June 6, 1996; 69 FR 3794, Jan. 26, 2004]

§ 71.57 [Reserved]

§ 71.59 Standards for arrays of fissile material packages.

(a) A fissile material package must be controlled by either the shipper or the carrier during transport to assure that an array of such packages remains subcritical. To enable this control, the designer of a fissile

material package shall derive a number "N" based on all the following conditions being satisfied, assuming packages are stacked together in any arrangement and with close full reflection on all sides of the stack by water:

(1) Five times "N" undamaged packages with nothing between the packages would be subcritical;

(2) Two times "N" damaged packages, if each package were subjected to the tests specified in § 71.73 ("Hypothetical accident conditions") would be subcritical with optimum interspersed hydrogenous moderation; and

(3) The value of "N" cannot be less than 0.5.

(b) The CSI must be determined by dividing the number 50 by the value of "N" derived using the procedures specified in paragraph (a) of this section. The value of the CSI may be zero provided that an unlimited number of packages are subcritical, such that the value of "N" is effectively equal to infinity under the procedures specified in paragraph (a) of this section. Any CSI greater than zero must be rounded up to the first decimal place.

(c) For a fissile material package which is assigned a CSI value--

(1) Less than or equal to 50, that package may be shipped by a carrier in a nonexclusive use conveyance, provided the sum of the CSIs is limited to less than or equal to 50.

(2) Less than or equal to 50, that package may be shipped by a carrier in an exclusive use conveyance, provided the sum of the CSIs is limited to less than or equal to 100.

(3) Greater than 50, that package must be shipped by a carrier in an exclusive use conveyance, provided the sum of the CSIs is limited to less than or equal to 100.

[69 FR 3795, Jan. 26, 2004]

§ 71.61 Special requirements for Type B packages containing more than 10^5A_2 .

A Type B package containing more than 10^5A_2 must be designed so that its undamaged containment system can withstand an external water pressure of 2 MPa (290 psi) for a period of not less than 1 hour without collapse, buckling, or inleakage of water.

[69 FR 3795, Jan. 26, 2004]

§ 71.63 Special requirement for plutonium shipments.

Shipments containing plutonium must be made with the contents in solid form, if the contents contain greater than 0.74 TBq (20 Ci) of plutonium.

[69 FR 3795, Jan. 26, 2004]

§ 71.64 Special requirements for plutonium air shipments.

(a) A package for the shipment of plutonium by air subject to § 71.88(a)(4), in addition to satisfying the requirements of §§ 71.41 through 71.63, as applicable, must be designed, constructed, and prepared for shipment so that under the tests specified in --

(1) Section 71.74 ("Accident conditions for air transport of plutonium") --

(i) The containment vessel would not be ruptured in its post-tested condition, and the package must provide a sufficient degree of containment to restrict accumulated loss of plutonium contents to not more than an A₂ quantity in a period of 1 week;

(ii) The external radiation level would not exceed 10 mSv/h (1 rem/h) at a distance of 1 m (40 in) from the surface of the package in its post-tested condition in air; and

(iii) A single package and an array of packages are demonstrated to be subcritical in accordance with this part, except that the damaged condition of the package must be considered to be that which results from the plutonium accident tests in § 71.74, rather than the hypothetical accident tests in § 71.73; and

(2) Section 71.74(c), there would be no detectable leakage of water into the containment vessel of the package.

(b) With respect to the package requirements of paragraph (a), there must be a demonstration or analytical assessment showing that --

(1) The results of the physical testing for package qualification would not be adversely affected to a significant extent by --

(i) The presence, during the tests, of the actual contents that will be transported in the package; and

(ii) Ambient water temperatures ranging from 0.6°C (+33°F) to 38°C (+100°F) for those qualification tests involving water, and ambient atmospheric temperatures ranging from -40°C (-40°F) to +54°C (+130°F) for the other qualification tests.

(2) The ability of the package to meet the acceptance standards prescribed for the accident condition sequential tests would not be adversely affected if one or more tests in the sequence were deleted.

§ 71.65 Additional requirements.

The Commission may, by rule, regulation, or order, impose requirements on any licensee, in addition to those established in this part, as it deems necessary or appropriate to protect public health or to minimize danger to life or property.

Subpart F--Package, Special Form, and LSA-III Tests²

§ 71.71 Normal conditions of transport.

(a) *Evaluation.* Evaluation of each package design under normal conditions of transport must include a determination of the effect on that design of the conditions and tests specified in this section. Separate specimens may be used for the free drop test, the compression test, and the penetration test, if each specimen is subjected to the water spray test before being subjected to any of the other tests.

(b) *Initial conditions.* With respect to the initial conditions for the tests in this section, the demonstration of compliance with the requirements of this part must be based on the ambient temperature preceding and following the tests remaining constant at that value between -29°C (-20°F) and +38°C (+100°F) which is most unfavorable for the feature under consideration. The initial internal pressure within the containment

system must be considered to be the maximum normal operating pressure, unless a lower internal pressure consistent with the ambient temperature considered to precede and follow the tests is more unfavorable.

(c) *Conditions and tests.*

(1) *Heat.* An ambient temperature of 38°C (100°F) in still air, and insolation according to the following table:

INSOLATION DATA

Form and location of surface		Total insolation for a 12-hour period (g cal/cm ²)
Flat surfaces transported horizontally;		
	Base	None
	Other surfaces	800
Flat surfaces not transported horizontally		200
Curved surfaces		400

(2) *Cold.* An ambient temperature of -40°C (-40°F) in still air and shade.

(3) *Reduced external pressure.* An external pressure of 25 kPa (3.5 lbf/in²) absolute.

(4) *Increased external pressure.* An external pressure of 140 kPa (20 lbf/in²) absolute.

(5) *Vibration.* Vibration normally incident to transport.

(6) *Water spray.* A water spray that simulates exposure to rainfall of approximately 5 cm/h (2 in/h) for at least 1 hour.

(7) *Free drop.* Between 1.5 and 2.5 hours after the conclusion of the water spray test, a free drop through the distance specified below onto a flat, essentially unyielding, horizontal surface, striking the surface in a position for which maximum damage is expected.

Criteria for Free Drop Test (Weight/Distance)

Package weight		Free drop distance	
Kilograms	(Pounds)	Meters	(Feet)
Less than 5,000	(Less than 11,000)	1.2	(4)
5,000 to 10,000	(11,000 to 22,000)	0.9	(3)
10,000 to 15,000	(22,000 to 33,100)	0.6	(2)
More than 15,000	(More than 33,100)	0.3	(1)

(8) *Corner drop.* A free drop onto each corner of the package in succession, or in the case of a cylindrical package onto each quarter of each rim, from a height of 0.3 m (1 ft) onto a flat, essentially unyielding, horizontal surface. This test applies only to fiberboard, wood, or fissile material rectangular packages not exceeding 50 kg (110 lbs) and fiberboard, wood, or fissile material cylindrical packages not exceeding 100 kg (220 lbs).

(9) *Compression*. For packages weighing up to 5000 kg (11,000 lbs), the package must be subjected, for a period of 24 hours, to a compressive load applied uniformly to the top and bottom of the package in the position in which the package would normally be transported. The compressive load must be the greater of the following:

- (i) The equivalent of 5 times the weight of the package; or
- (ii) The equivalent of 13 kPa (2 lbf/in²) multiplied by the vertically projected area of the package.

(10) *Penetration*. Impact of the hemispherical end of a vertical steel cylinder of 3.2 cm (1.25 in) diameter and 6 kg (13 lbs) mass, dropped from a height of 1 m (40 in) onto the exposed surface of the package that is expected to be most vulnerable to puncture. The long axis of the cylinder must be perpendicular to the package surface.

² The package standards related to the tests in this subpart are contained in subpart E of this part.

§ 71.73 Hypothetical accident conditions.

(a) *Test procedures*. Evaluation for hypothetical accident conditions is to be based on sequential application of the tests specified in this section, in the order indicated, to determine their cumulative effect on a package or array of packages. An undamaged specimen may be used for the water immersion tests specified in paragraph (c)(6) of this section.

(b) *Test conditions*. With respect to the initial conditions for the tests, except for the water immersion tests, to demonstrate compliance with the requirements of this part during testing, the ambient air temperature before and after the tests must remain constant at that value between -29°C (-20°F) and +38°C (+100°F) which is most unfavorable for the feature under consideration. The initial internal pressure within the containment system must be the maximum normal operating pressure, unless a lower internal pressure, consistent with the ambient temperature assumed to precede and follow the tests, is more unfavorable.

(c) *Tests*. Tests for hypothetical accident conditions must be conducted as follows:

(1) *Free Drop*. A free drop of the specimen through a distance of 9 m (30 ft) onto a flat, essentially unyielding, horizontal surface, striking the surface in a position for which maximum damage is expected.

(2) *Crush*. Subjection of the specimen to a dynamic crush test by positioning the specimen on a flat, essentially unyielding horizontal surface so as to suffer maximum damage by the drop of a 500-kg (1100-lb) mass from 9 m (30 ft) onto the specimen. The mass must consist of a solid mild steel plate 1 m (40 in) by 1 m (40 in) and must fall in a horizontal attitude. The crush test is required only when the specimen has a mass not greater than 500 kg (1100 lb), an overall density not greater than 1000 kg/m³ (62.4 lb/ft³) based on external dimension, and radioactive contents greater than 1000 A₂ not as special form radioactive material. For packages containing fissile material, the radioactive contents greater than 1000 A₂ criterion does not apply.

(3) *Puncture*. A free drop of the specimen through a distance of 1 m (40 in) in a position for which maximum damage is expected, onto the upper end of a solid, vertical, cylindrical, mild steel bar mounted on an essentially unyielding, horizontal surface. The bar must be 15 cm (6 in) in diameter, with the top horizontal and its edge rounded to a radius of not more than 6 mm (0.25 in), and of a length as to cause maximum damage to the package, but not less than 20 cm (8 in) long. The long axis of the bar must be vertical.

(4) *Thermal*. Exposure of the specimen fully engulfed, except for a simple support system, in a hydrocarbon fuel/air fire of sufficient extent, and in sufficiently quiescent ambient conditions, to provide an average emissivity coefficient of at least 0.9, with an average flame temperature of at least 800°C (1475°F) for a period of 30 minutes, or any other thermal test that provides the equivalent total heat input to the package and which provides a time averaged environmental temperature of 800°C. The fuel source must extend horizontally at least 1 m (40 in), but may not extend more than 3 m (10 ft), beyond any external surface of the specimen, and the specimen must be positioned 1 m (40 in) above the surface of the fuel source. For purposes of calculation, the surface absorptivity coefficient must be either that value which the package may be expected to possess if exposed to the fire specified or 0.8, whichever is greater; and the convective coefficient must be that value which may be demonstrated to exist if the package were exposed to the fire specified. Artificial cooling may not be applied after cessation of external heat input, and any combustion of materials of construction, must be allowed to proceed until it terminates naturally.

(5) *Immersion--fissile material*. For fissile material subject to § 71.55, in those cases where water inleakage has not been assumed for criticality analysis, immersion under a head of water of at least 0.9 m (3 ft) in the attitude for which maximum leakage is expected.

(6) *Immersion--all packages*. A separate, undamaged specimen must be subjected to water pressure equivalent to immersion under a head of water of at least 15 m (50 ft). For test purposes, an external pressure of water of 150 kPa (21.7 lbf/in²) gauge is considered to meet these conditions.

[69 FR 3795, Jan. 26, 2004]

§ 71.74 Accident conditions for air transport of plutonium.

(a) *Test conditions--Sequence of tests*. A package must be physically tested to the following conditions in the order indicated to determine their cumulative effect.

(1) Impact at a velocity of not less than 129 m/sec (422 ft/sec) at a right angle onto a flat, essentially unyielding, horizontal surface, in the orientation (e.g., side, end, corner) expected to result in maximum damage at the conclusion of the test sequence.

(2) A static compressive load of 31,800 kg (70,000 lbs) applied in the orientation expected to result in maximum damage at the conclusion of the test sequence. The force on the package must be developed between a flat steel surface and a 5 cm (2 in) wide, straight, solid, steel bar. The length of the bar must be at least as long as the diameter of the package, and the longitudinal axis of the bar must be parallel to the plane of the flat surface. The load must be applied to the bar in a manner that prevents any members or devices used to support the bar from contacting the package.

(3) Packages weighing less than 227 kg (500 lbs) must be placed on a flat, essentially unyielding, horizontal surface, and subjected to a weight of 227 kg (500 lbs) falling from a height of 3 m (10 ft) and striking in the position expected to result in maximum damage at the conclusion of the test sequence. The end of the weight contacting the package must be a solid probe made of mild steel. The probe must be the shape of the frustum of a right circular cone, 30 cm (12 in) long, 20 cm (8 in) in diameter at the base, and 2.5 cm (1 in) in diameter at the end. The longitudinal axis of the probe must be perpendicular to the horizontal surface. For packages weighing 227 kg (500 lbs) or more, the base of the probe must be placed on a flat, essentially unyielding horizontal surface, and the package dropped from a height of 3 m (10 ft) onto the probe, striking in the position expected to result in maximum damage at the conclusion of the test sequence.

(4) The package must be firmly restrained and supported such that its longitudinal axis is inclined approximately 45° to the horizontal. The area of the package that made first contact with the impact surface

in paragraph (a)(1) of this section must be in the lowermost position. The package must be struck at approximately the center of its vertical projection by the end of a structural steel angle section falling from a height of at least 46 m (150 ft). The angle section must be at least 1.8 m (6 ft) in length with equal legs at least 13 cm (5 in) long and 1.3 cm (0.5 in) thick. The angle section must be guided in such a way as to fall end-on, without tumbling. The package must be rotated approximately 90° about its longitudinal axis and struck by the steel angle section falling as before.

(5) The package must be exposed to luminous flames from a pool fire of JP-4 or JP-5 aviation fuel for a period of at least 60 minutes. The luminous flames must extend an average of at least 0.9 m (3 ft) and no more than 3 m (10 ft) beyond the package in all horizontal directions. The position and orientation of the package in relation to the fuel must be that which is expected to result in maximum damage at the conclusion of the test sequence. An alternate method of thermal testing may be substituted for this fire test, provided that the alternate test is not of shorter duration and would not result in a lower heating rate to the package. At the conclusion of the thermal test, the package must be allowed to cool naturally or must be cooled by water sprinkling, whichever is expected to result in maximum damage at the conclusion of the test sequence.

(6) Immersion under at least 0.9 m (3 ft) of water.

(b) Individual free-fall impact test.

(1) An undamaged package must be physically subjected to an impact at a velocity not less than the calculated terminal free-fall velocity, at mean sea level, at a right angle onto a flat, essentially unyielding, horizontal surface, in the orientation (e.g., side, end, corner) expected to result in maximum damage.

(2) This test is not required if the calculated terminal free-fall velocity of the package is less than 129 m/sec (422 ft/sec), or if a velocity not less than either 129 m/sec (422 ft/sec) or the calculated terminal free-fall velocity of the package is used in the sequential test of paragraph (a)(1) of this section.

(c) Individual deep submersion test. An undamaged package must be physically submerged and physically subjected to an external water pressure of at least 4 MPa (600 lbs/in²).

§ 71.75 Qualification of special form radioactive material.

(a) Special form radioactive materials must meet the test requirements of paragraph (b) of this section. Each solid radioactive material or capsule specimen to be tested must be manufactured or fabricated so that it is representative of the actual solid material or capsule that will be transported, with the proposed radioactive content duplicated as closely as practicable. Any differences between the material to be transported and the test material, such as the use of non-radioactive contents, must be taken into account in determining whether the test requirements have been met. In addition:

(1) A different specimen may be used for each of the tests;

(2) The specimen may not break or shatter when subjected to the impact, percussion, or bending tests;

(3) The specimen may not melt or disperse when subjected to the heat test;

(4) After each test, leaktightness or indispersibility of the specimen must be determined by a method no less sensitive than the leaching assessment procedure prescribed in paragraph (c) of this section. For a capsule resistant to corrosion by water, and which has an internal void volume greater than 0.1 milliliter, an alternative to the leaching assessment is a demonstration of leaktightness of $\times 10^{-4}$ torr-liter/s (1.3×10^{-4}

atm-cm³/s) based on air at 25°C (77°F) and one atmosphere differential pressure for solid radioactive content, or $\times 10^{-6}$ torr-liter/s (1.30×10^{-6} atm-cm³/s) for liquid or gaseous radioactive content; and

(5) A specimen that comprises or simulates radioactive material contained in a sealed capsule need not be subjected to the leaktightness procedure specified in this section, provided it is alternatively subjected to any of the tests prescribed in ISO/TR4826-1979(E), "Sealed radioactive sources leak test methods" which is available from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

(b) *Test methods.* (1) *Impact Test.* The specimen must fall onto the target from a height of 9 m (30 ft) or greater in the orientation expected to result in maximum damage. The target must be a flat, horizontal surface of such mass and rigidity that any increase in its resistance to displacement or deformation, on impact by the specimen, would not significantly increase the damage to the specimen.

(2) *Percussion Test.* (i) The specimen must be placed on a sheet of lead that is supported by a smooth solid surface, and struck by the flat face of a steel billet so as to produce an impact equivalent to that resulting from a free drop of 1.4 kg (3 lbs) through 1 m (40 in);

(ii) The flat face of the billet must be 25 millimeters (mm) (1 inch) in diameter with the edges rounded off to a radius of $3 \text{ mm} \pm 0.3 \text{ mm}$ ($.12 \text{ in} \pm 0.012 \text{ in}$);

(iii) The lead must be hardness number 3.5 to 4.5 on the Vickers scale and thickness 25 mm (1 in) or greater, and must cover an area greater than that covered by the specimen;

(iv) A fresh surface of lead must be used for each impact; and

(v) The billet must strike the specimen so as to cause maximum damage.

(3) *Bending test.* (i) This test applies only to long, slender sources with a length of 10 cm (4 inches) or greater and a length to width ratio of 10 or greater;

(ii) The specimen must be rigidly clamped in a horizontal position so that one half of its length protrudes from the face of the clamp;

(iii) The orientation of the specimen must be such that the specimen will suffer maximum damage when its free end is struck by the flat face of a steel billet;

(iv) The billet must strike the specimen so as to produce an impact equivalent to that resulting from a free vertical drop of 1.4 kg (3 lbs) through 1 m (40 in); and

(v) The flat face of the billet must be 25 mm (1 inch) in diameter with the edges rounded off to a radius of $3 \text{ mm} \pm 0.3 \text{ mm}$ ($.12 \text{ in} \pm 0.012 \text{ in}$).

(4) *Heat test.* The specimen must be heated in air to a temperature of not less than 800°C (1475°F), held at that temperature for a period of 10 minutes, and then allowed to cool.

(c) *Leaching assessment methods.* (1) For indispersible solid material --

(i) The specimen must be immersed for 7 days in water at ambient temperature. The water must have a pH of 6-8 and a maximum conductivity of 10 micromho per centimeter at 20° (68°F);

(ii) The water with specimen must then be heated to a temperature of $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ($122^{\circ}\text{F} \pm 9^{\circ}\text{F}$) and maintained at this temperature for 4 hours.

(iii) The activity of the water must then be determined;

(iv) The specimen must then be stored for at least 7 days in still air of relative humidity not less than 90 percent at 30°C (86°F);

(v) The specimen must then be immersed in water under the same conditions as in paragraph (c)(1)(i) of this section, and the water with specimen must be heated to $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ($122^{\circ}\text{F} \pm 9^{\circ}\text{F}$) and maintained at that temperature for 4 hours;

(vi) The activity of the water must then be determined. The sum of the activities determined here and in paragraph (c)(1)(iii) of this section must not exceed 2 kilobecquerels (kBq) (0.05 microcurie (μCi)).

(2) For encapsulated material --

(i) The specimen must be immersed in water at ambient temperature. The water must have a pH of 6-8 and a maximum conductivity of 10 micromho per centimeter;

(ii) The water and specimen must be heated to a temperature of $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ($122^{\circ}\text{F} \pm 9^{\circ}\text{F}$) and maintained at this temperature for 4 hours;

(iii) The activity of the water must then be determined;

(iv) The specimen must then be stored for at least 7 days in still air at a temperature of 30°C (86°F) or greater;

(v) The process in paragraph (c)(2)(i), (ii), and (iii) of this section must be repeated; and

(vi) The activity of the water must then be determined. The sum of the activities determined here and in paragraph (c)(2)(iii) of this section must not exceed 2 kilobecquerels (kBq) (0.05 microcurie (Ci)).

(d) A specimen that comprises or simulates radioactive material contained in a sealed capsule need not be subjected to --

(1) The impact test and the percussion test of this section, provided that the specimen is alternatively subjected to the Class 4 impact test prescribed in ISO 2919-1980(e), "Sealed Radioactive Sources Classification" (see § 71.75(a)(5) for statement of availability); and

(2) The heat test of this section, provided the specimen is alternatively subjected to the Class 6 temperature test specified in the International Organization for Standardization document ISO 2919-1980(e), "Sealed Radioactive Sources Classification."

§ 71.77 Qualification of LSA-III Material

(a) LSA-III material must meet the test requirements of paragraph (b) of this section. Any differences between the specimen to be tested and the material to be transported must be taken into account in determining whether the test requirements have been met.

(b) *Leaching Test.* (1) The specimen, representing no less than the entire contents of the package, must be immersed for 7 days in water at ambient temperature;

(2) The volume of water to be used in the test must be sufficient to ensure that at the end of the test period the free volume of the unabsorbed and unreacted water remaining will be at least 10% of the volume of the specimen itself;

(3) The water must have an initial pH of 6-8 and a maximum conductivity 10 micromho/cm at 20°C (68°F); and

(4) The total activity of the free volume of water must be measured following the 7 day immersion test and must not exceed 0.1 A₂.

Subpart G--Operating Controls and Procedures

§ 71.81 Applicability of operating controls and procedures.

A licensee subject to this part, who, under a general or specific license, transports licensed material or delivers licensed material to a carrier for transport, shall comply with the requirements of this subpart G, with the quality assurance requirements of subpart H of this part, and with the general provisions of subpart A of this part.

§ 71.83 Assumptions as to unknown properties.

When the isotopic abundance, mass, concentration, degree of irradiation, degree of moderation, or other pertinent property of fissile material in any package is not known, the licensee shall package the fissile material as if the unknown properties have credible values that will cause the maximum neutron multiplication.

§ 71.85 Preliminary determinations.

Before the first use of any packaging for the shipment of licensed material --

(a) The licensee shall ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce the effectiveness of the packaging;

(b) Where the maximum normal operating pressure will exceed 35 kPa (5 lbf/in²) gauge, the licensee shall test the containment system at an internal pressure at least 50 percent higher than the maximum normal operating pressure, to verify the capability of that system to maintain its structural integrity at that pressure; and

(c) The licensee shall conspicuously and durably mark the packaging with its model number, serial number, gross weight, and a package identification number assigned by NRC. Before applying the model number, the licensee shall determine that the packaging has been fabricated in accordance with the design approved by the Commission.

§ 71.87 Routine determinations.

Before each shipment of licensed material, the licensee shall ensure that the package with its contents satisfies the applicable requirements of this part and of the license. The licensee shall determine that --

- (a) The package is proper for the contents to be shipped;
- (b) The package is in unimpaired physical condition except for superficial defects such as marks or dents;
- (c) Each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects;
- (d) Any system for containing liquid is adequately sealed and has adequate space or other specified provision for expansion of the liquid;
- (e) Any pressure relief device is operable and set in accordance with written procedures;
- (f) The package has been loaded and closed in accordance with written procedures;
- (g) For fissile material, any moderator or neutron absorber, if required, is present and in proper condition;
- (h) Any structural part of the package that could be used to lift or tie down the package during transport is rendered inoperable for that purpose, unless it satisfies the design requirements of § 71.45;
- (i) The level of non-fixed (removable) radioactive contamination on the external surfaces of each package offered for shipment is as low as reasonably achievable, and within the limits specified in DOT regulations in 49 CFR 173.443;
- (j) External radiation levels around the package and around the vehicle, if applicable, will not exceed the limits specified in § 71.47 at any time during transportation; and
- (k) Accessible package surface temperatures will not exceed the limits specified in § 71.43(g) at any time during transportation.

§ 71.88 Air transport of plutonium.

- (a) Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this part or included indirectly by citation of 49 CFR chapter I, as may be applicable, the licensee shall assure that plutonium in any form, whether for import, export, or domestic shipment, is not transported by air or delivered to a carrier for air transport unless:
- (1) The plutonium is contained in a medical device designed for individual human application; or
 - (2) The plutonium is contained in a material in which the specific activity is less than or equal to the activity concentration values for plutonium specified in Appendix A, Table A-2, of this part, and in which the radioactivity is essentially uniformly distributed; or
 - (3) The plutonium is shipped in a single package containing no more than an A₂ quantity of plutonium in any isotope or form, and is shipped in accordance with § 71.5; or
 - (4) The plutonium is shipped in a package specifically authorized for the shipment of plutonium by air in the Certificate of Compliance for that package issued by the Commission.
- (b) Nothing in paragraph (a) of this section is to be interpreted as removing or diminishing the requirements of § 73.24 of this chapter.

(c) For a shipment of plutonium by air which is subject to paragraph (a)(4) of this section, the licensee shall, through special arrangement with the carrier, require compliance with 49 CFR 175.704, U.S. Department of Transportation regulations applicable to the air transport of plutonium.

[69 FR 3795, Jan. 26, 2004]

§ 71.89 Opening instructions.

Before delivery of a package to a carrier for transport, the licensee shall ensure that any special instructions needed to safely open the package have been sent to, or otherwise made available to, the consignee for the consignee's use in accordance with 10 CFR 20.1906(e).

§ 71.91 Records.

(a) Each licensee shall maintain, for a period of 3 years after shipment, a record of each shipment of licensed material not exempt under § 71.10, showing where applicable --

- (1) Identification of the packaging by model number and serial number;
- (2) Verification that there are no significant defects in the packaging, as shipped;
- (3) Volume and identification of coolant;
- (4) Type and quantity of licensed material in each package, and the total quantity of each shipment;
- (5) For each item of irradiated fissile material --
 - (i) Identification by model number and serial number;
 - (ii) Irradiation and decay history to the extent appropriate to demonstrate that its nuclear and thermal characteristics comply with license conditions; and
 - (iii) Any abnormal or unusual condition relevant to radiation safety;
- (6) Date of the shipment;
- (7) For fissile packages and for Type B packages, any special controls exercised;
- (8) Name and address of the transferee;
- (9) Address to which the shipment was made; and
- (10) Results of the determinations required by § 71.87 and by the conditions of the package approval.

(b) Each certificate holder shall maintain, for a period of 3 years after the life of the packaging to which they apply, records identifying the packaging by model number, serial number, and date of manufacture.

(c) The licensee, certificate holder, and an applicant for a CoC, shall make available to the Commission for inspection, upon reasonable notice, all records required by this part. Records are only valid if stamped, initialed, or signed and dated by authorized personnel, or otherwise authenticated.

(d) The licensee, certificate holder, and an applicant for a CoC shall maintain sufficient written records to furnish evidence of the quality of packaging. The records to be maintained include results of the determinations required by § 71.85; design, fabrication, and assembly records; results of reviews, inspections, tests, and audits; results of monitoring work performance and materials analyses; and results of maintenance, modification, and repair activities. Inspection, test, and audit records must identify the inspector or data recorder, the type of observation, the results, the acceptability, and the action taken in connection with any deficiencies noted. These records must be retained for 3 years after the life of the packaging to which they apply.

[69 FR 3796, Jan. 26, 2004]

§ 71.93 Inspection and tests.

(a) The licensee, certificate holder, and applicant for a CoC shall permit the Commission, at all reasonable times, to inspect the licensed material, packaging, premises, and facilities in which the licensed material or packaging is used, provided, constructed, fabricated, tested, stored, or shipped.

(b) The licensee, certificate holder, and applicant for a CoC shall perform, and permit the Commission to perform, any tests the Commission deems necessary or appropriate for the administration of the regulations in this chapter.

(c) The certificate holder and applicant for a CoC shall notify the NRC, in accordance with § 71.1, 45 days in advance of starting fabrication of the first packaging under a CoC. This paragraph applies to any packaging used for the shipment of licensed material which has either--

- (1) A decay heat load in excess of 5 kW; or
- (2) A maximum normal operating pressure in excess of 103 kPa (15 lbf/in²) gauge.

[69 FR 3796, Jan. 26, 2004]

§ 71.95 Reports.

(a) The licensee, after requesting the certificate holder's input, shall submit a written report to the Commission of--

(1) Instances in which there is a significant reduction in the effectiveness of any NRC-approved Type B or Type AF packaging during use; or

(2) Details of any defects with safety significance in any NRC-approved Type B or fissile material packaging, after first use.

(3) Instances in which the conditions of approval in the Certificate of Compliance were not observed in making a shipment.

(b) The licensee shall submit a written report to the Commission of instances in which the conditions in the certificate of compliance were not followed during a shipment.

(c) Each licensee shall submit, in accordance with § 71.1, a written report required by paragraph (a) or (b) of this section within 60 days of the event or discovery of the event. The licensee shall also provide a copy of each report submitted to the NRC to the applicable certificate holder. Written reports prepared under

other regulations may be submitted to fulfill this requirement if the reports contain all the necessary information, and the appropriate distribution is made. Using an appropriate method listed in § 71.1(a), the licensee shall report to: ATTN: Document Control Desk, Director, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards. These written reports must include the following:

- (1) A brief abstract describing the major occurrences during the event, including all component or system failures that contributed to the event and significant corrective action taken or planned to prevent recurrence.
- (2) A clear, specific, narrative description of the event that occurred so that knowledgeable readers conversant with the requirements of part 71, but not familiar with the design of the packaging, can understand the complete event. The narrative description must include the following specific information as appropriate for the particular event.
 - (i) Status of components or systems that were inoperable at the start of the event and that contributed to the event;
 - (ii) Dates and approximate times of occurrences;
 - (iii) The cause of each component or system failure or personnel error, if known;
 - (iv) The failure mode, mechanism, and effect of each failed component, if known;
 - (v) A list of systems or secondary functions that were also affected for failures of components with multiple functions;
 - (vi) The method of discovery of each component or system failure or procedural error;
 - (vii) For each human performance-related root cause, a discussion of the cause(s) and circumstances;
 - (viii) The manufacturer and model number (or other identification) of each component that failed during the event; and
 - (ix) For events occurring during use of a packaging, the quantities and chemical and physical form(s) of the package contents.
- (3) An assessment of the safety consequences and implications of the event. This assessment must include the availability of other systems or components that could have performed the same function as the components and systems that failed during the event.
- (4) A description of any corrective actions planned as a result of the event, including the means employed to repair any defects, and actions taken to reduce the probability of similar events occurring in the future.
- (5) Reference to any previous similar events involving the same packaging that are known to the licensee or certificate holder.
- (6) The name and telephone number of a person within the licensee's organization who is knowledgeable about the event and can provide additional information.
- (7) The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.

(d) Report legibility. The reports submitted by licensees and/or certificate holders under this section must be of sufficient quality to permit reproduction and micrographic processing.

[60 FR 50264, Sept. 28, 1995, as amended at 67 FR 3585, Jan. 25, 2002; 68 FR 58818, Oct. 10, 2003; 69 FR 3796, Jan. 26, 2004]

§ 71.97 Advance notification of shipment of irradiated reactor fuel and nuclear waste.

(a) ~~(1)~~ As specified in paragraphs (b), (c) and (d) of this section, each licensee shall provide advance notification to the governor of a State, or the governor's designee, of the shipment of licensed material, ~~within the State,~~ or across the boundary of the State, before the transport, or delivery to a carrier, for transport, of licensed material outside the confines of the licensee's plant or other place of use or storage.

(2) As specified in paragraphs (b), (c), and (d) of this section, after June 11, 2013, each licensee shall provide advance notification to the Tribal official of participating Tribes referenced in paragraph (c)(3)(iii) of this section, or the official's designee, of the shipment of licensed material, within or across the boundary of the Tribe's reservation, before the transport, of delivery to a carrier, for transport, of licensed material outside the confines of the licensee's plant or other place of use or storage.

(b) Advance notification is required under this section for shipments of irradiated reactor fuel in quantities less than that subject to advance notification requirements of § 73.37(f) of this chapter. Advance notification is also required under this section for shipment of licensed material, other than irradiated fuel, meeting the following three conditions:

- (1) The licensed material is required by this part to be in Type B packaging for transportation;
- (2) The licensed material is being transported to or across a State boundary en route to a disposal facility or to a collection point for transport to a disposal facility; and
- (3) The quantity of licensed material in a single package exceeds the least of the following:
 - (i) 3000 times the A₁ value of the radionuclides as specified in appendix A, Table A-1 for special form radioactive material;
 - (ii) 3000 times the A₂ value of the radionuclides as specified in appendix A, Table A-1 for normal form radioactive material; or
 - (iii) 1000 TBq (27,000 Ci).

(c) *Procedures for submitting advance notification.*

(1) The notification must be made in writing to:

(i) The office of each appropriate governor or governor's designee;

(ii) The office of each appropriate Tribal official of Tribal official's designee; and

(iii) To the Director, Division of ~~Nuclear~~ Security Policy, Office of Nuclear Security and Incident Response.

(2) A notification delivered by mail must be postmarked at least 7 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur.

(3) A notification delivered by any other means than mail must reach the office of the governor or of the governor's designee [or the Tribal official or Tribal official's designee](#) at least 4 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur.

(i) A list of the names and mailing addresses of the governors' designees receiving advance notification of transportation of nuclear waste was published in the Federal Register on June 30, 1995 (60 FR 34306).

(ii) ~~The list will be published annually in the Federal Register on or about June 30 to reflect any changes in information. The list of governor's designees and Tribal official's designees of participating Tribes will be published annually in the Federal Register on or about June 30th to reflect any changes in information.~~

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(iii) A list of the names and mailing addresses of the governors' designees [and Tribal official's designees of participating Tribes](#) is available on request from the Director, [Division of Intergovernmental Liaison and Rulemaking, Office of Federal and State Materials and Environmental Management Programs](#) ~~Office of State Programs~~, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

(4) The licensee shall retain a copy of the notification as a record for 3 years.

(d) *Information to be furnished in advance notification of shipment.* Each advance notification of shipment of irradiated reactor fuel or nuclear waste must contain the following information:

(1) The name, address, and telephone number of the shipper, carrier, and receiver of the irradiated reactor fuel or nuclear waste shipment;

(2) A description of the irradiated reactor fuel or nuclear waste contained in the shipment, as specified in the regulations of DOT in 49 CFR 172.202 and 172.203(d);

(3) The point of origin of the shipment and the 7-day period during which departure of the shipment is estimated to occur;

(4) The 7-day period during which arrival of the shipment at State boundaries [or Tribal reservation boundaries](#) is estimated to occur;

(5) The destination of the shipment, and the 7-day period during which arrival of the shipment is estimated to occur; and

(6) A point of contact, with a telephone number, for current shipment information.

(e) *Revision notice.* A licensee who finds that schedule information previously furnished to a governor or governor's designee [or a Tribal official of Tribal official's designee](#), in accordance with this section, will not be met, shall telephone a responsible individual in the office of the governor of the State or of the governor's designee [or the Tribal official or the Tribal official's designee](#) and inform that individual of the extent of the delay beyond the schedule originally reported. The licensee shall maintain a record of the name of the individual contacted for 3 years.

(f) *Cancellation notice.* (1) Each licensee who cancels an irradiated reactor fuel or nuclear waste shipment for which advance notification has been sent shall send a cancellation notice to the governor of each State or to the governor's designee previously notified, [each Tribal official or to the Tribal official's designee](#)

[previously notified](#), and to the Director, Division of ~~Nuclear~~ Security [Policy](#), Office of Nuclear Security and Incident Response.

(2) The licensee shall state in the notice that it is a cancellation and identify the advance notification that is being canceled. The licensee shall retain a copy of the notice as a record for 3 years.

[60 FR 50264, Sept. 28, 1995, as amended at 67 FR 3586, Jan. 25, 2002; 68 FR 58818, Oct. 10, 2003]

§ 71.99 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of --

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or (3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violations of --

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section; or

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

§ 71.100 Criminal penalties.

(a) Section 223 of the Atomic Energy Act of 1954, as amended, provides for criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any regulation issued under sections 161b, 161i, or 161o of the Act. For purposes of section 223, all the regulations in part 71 are issued under one or more of sections 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.

(b) The regulations in part 71 that are not issued under sections 161b, 161i, or 161o for the purposes of section 223 are as follows: §§ 71.0, 71.2, 71.4, 71.6, 71.7, 71.10, 71.31, 71.33, 71.35, 71.37, 71.38, 71.39, 71.40, 71.41, 71.43, 71.45, 71.47, 71.51, 71.55, 71.59, 71.65, 71.71, 71.73, 71.74, 71.75, 71.77, 71.99, and 71.100.

[69 FR 3796, Jan. 26, 2004]

Subpart H--Quality Assurance

Source: 69 FR 3797, Jan. 26, 2004, unless otherwise noted.

§ 71.101 Quality assurance requirements.

(a) *Purpose.* This subpart describes quality assurance requirements applying to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, and modification of components of packaging that are important to safety. As used in this subpart, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to control of the physical characteristics and quality of the material or component to predetermined requirements. The licensee, certificate holder, and applicant for a CoC are responsible for the quality assurance requirements as they apply to design, fabrication, testing, and modification of packaging. Each licensee is responsible for the quality assurance provision which applies to its use of a packaging for the shipment of licensed material subject to this subpart.

(b) *Establishment of program.* Each licensee, certificate holder, and applicant for a CoC shall establish, maintain, and execute a quality assurance program satisfying each of the applicable criteria of §§ 71.101 through 71.137 and satisfying any specific provisions that are applicable to the licensee's activities including procurement of packaging. The licensee, certificate holder, and applicant for a CoC shall execute the applicable criteria in a graded approach to an extent that is commensurate with the quality assurance requirement's importance to safety.

(c) *Approval of program.* (1) Before the use of any package for the shipment of licensed material subject to this subpart, each licensee shall obtain Commission approval of its quality assurance program. Using an appropriate method listed in § 71.1(a), each licensee shall file a description of its quality assurance program, including a discussion of which requirements of this subpart are applicable and how they will be satisfied, by submitting the description to: ATTN: Document Control Desk, Director, Spent Fuel Project Office, Office of Nuclear Material Safety and Safeguards.

(2) Before the fabrication, testing, or modification of any package for the shipment of licensed material subject to this subpart, each licensee, certificate holder, or applicant for a CoC shall obtain Commission approval of its quality assurance program. Each certificate holder or applicant for a CoC shall, in accordance with § 71.1, file a description of its quality assurance program, including a discussion of which requirements of this subpart are applicable and how they will be satisfied.

(d) *Existing package designs.* The provisions of this paragraph deal with packages that have been approved for use in accordance with this part before January 1, 1979, and which have been designed in accordance with the provisions of this part in effect at the time of application for package approval. Those packages will be accepted as having been designed in accordance with a quality assurance program that satisfies the provisions of paragraph (b) of this section.

(e) *Existing packages.* The provisions of this paragraph deal with packages that have been approved for use in accordance with this part before January 1, 1979, have been at least partially fabricated before that date, and for which the fabrication is in accordance with the provisions of this part in effect at the time of application for approval of package design. These packages will be accepted as having been fabricated and assembled in accordance with a quality assurance program that satisfies the provisions of paragraph (b) of this section.

(f) *Previously approved programs.* A Commission-approved quality assurance program that satisfies the applicable criteria of subpart H of this part, Appendix B of part 50 of this chapter, or subpart G of part 72 of this chapter, and that is established, maintained, and executed regarding transport packages, will be accepted as satisfying the requirements of paragraph (b) of this section. Before first use, the licensee, certificate holder, and applicant for a CoC shall notify the NRC, in accordance with § 71.1, of its intent to apply its previously approved subpart H, Appendix B, or subpart G quality assurance program to transportation activities. The licensee, certificate holder, and applicant for a CoC shall identify the program by date of submittal to the Commission, Docket Number, and date of Commission approval.

(g) *Radiography containers.* A program for transport container inspection and maintenance limited to radiographic exposure devices, source changers, or packages transporting these devices and meeting the requirements of § 34.31(b) of this chapter or equivalent Agreement State requirement, is deemed to satisfy the requirements of §§ 71.17(b) and 71.101(b).

§ 71.103 Quality assurance organization.

(a) The licensee,² certificate holder, and applicant for a CoC shall be responsible for the establishment and execution of the quality assurance program. The licensee, certificate holder, and applicant for a CoC may delegate to others, such as contractors, agents, or consultants, the work of establishing and executing the quality assurance program, or any part of the quality assurance program, but shall retain responsibility for the program. These activities include performing the functions associated with attaining quality objectives and the quality assurance functions.

(b) The quality assurance functions are--

(1) Assuring that an appropriate quality assurance program is established and effectively executed; and

(2) Verifying, by procedures such as checking, auditing, and inspection, that activities affecting the functions that are important to safety have been correctly performed.

(c) The persons and organizations performing quality assurance functions must have sufficient authority and organizational freedom to--

(1) Identify quality problems;

(2) Initiate, recommend, or provide solutions; and

(3) Verify implementation of solutions.

(d) The persons and organizations performing quality assurance functions shall report to a management level that assures that the required authority and organizational freedom, including sufficient independence from cost and schedule, when opposed to safety considerations, are provided.

(e) Because of the many variables involved, such as the number of personnel, the type of activity being performed, and the location or locations where activities are performed, the organizational structure for executing the quality assurance program may take various forms, provided that the persons and organizations assigned the quality assurance functions have the required authority and organizational freedom.

(f) Irrespective of the organizational structure, the individual(s) assigned the responsibility for assuring effective execution of any portion of the quality assurance program, at any location where activities subject

to this section are being performed, must have direct access to the levels of management necessary to perform this function.

² While the term "licensee" is used in these criteria, the requirements are applicable to whatever design, fabrication, assembly, and testing of the package is accomplished with respect to a package before the time a package approval is issued.

§ 71.105 Quality assurance program.

(a) The licensee, certificate holder, and applicant for a CoC shall establish, at the earliest practicable time consistent with the schedule for accomplishing the activities, a quality assurance program that complies with the requirements of §§ 71.101 through 71.137. The licensee, certificate holder, and applicant for a CoC shall document the quality assurance program by written procedures or instructions and shall carry out the program in accordance with those procedures throughout the period during which the packaging is used. The licensee, certificate holder, and applicant for a CoC shall identify the material and components to be covered by the quality assurance program, the major organizations participating in the program, and the designated functions of these organizations.

(b) The licensee, certificate holder, and applicant for a CoC, through its quality assurance program, shall provide control over activities affecting the quality of the identified materials and components to an extent consistent with their importance to safety, and as necessary to assure conformance to the approved design of each individual package used for the shipment of radioactive material. The licensee, certificate holder, and applicant for a CoC shall assure that activities affecting quality are accomplished under suitably controlled conditions. Controlled conditions include the use of appropriate equipment; suitable environmental conditions for accomplishing the activity, such as adequate cleanliness; and assurance that all prerequisites for the given activity have been satisfied. The licensee, certificate holder, and applicant for a CoC shall take into account the need for special controls, processes, test equipment, tools, and skills to attain the required quality, and the need for verification of quality by inspection and test.

(c) The licensee, certificate holder, and applicant for a CoC shall base the requirements and procedures of its quality assurance program on the following considerations concerning the complexity and proposed use of the package and its components:

- (1) The impact of malfunction or failure of the item to safety;
- (2) The design and fabrication complexity or uniqueness of the item;
- (3) The need for special controls and surveillance over processes and equipment;
- (4) The degree to which functional compliance can be demonstrated by inspection or test; and
- (5) The quality history and degree of standardization of the item.

(d) The licensee, certificate holder, and applicant for a CoC shall provide for indoctrination and training of personnel performing activities affecting quality, as necessary to assure that suitable proficiency is achieved and maintained. The licensee, certificate holder, and applicant for a CoC shall review the status and adequacy of the quality assurance program at established intervals. Management of other organizations participating in the quality assurance program shall review regularly the status and adequacy of that part of the quality assurance program they are executing.

§ 71.107 Package design control.

(a) The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that applicable regulatory requirements and the package design, as specified in the license or CoC for those materials and components to which this section applies, are correctly translated into specifications, drawings, procedures, and instructions. These measures must include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from standards are controlled. Measures must be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the functions of the materials, parts, and components of the packaging that are important to safety.

(b) The licensee, certificate holder, and applicant for a CoC shall establish measures for the identification and control of design interfaces and for coordination among participating design organizations. These measures must include the establishment of written procedures, among participating design organizations, for the review, approval, release, distribution, and revision of documents involving design interfaces. The design control measures must provide for verifying or checking the adequacy of design, by methods such as design reviews, alternate or simplified calculational methods, or by a suitable testing program. For the verifying or checking process, the licensee shall designate individuals or groups other than those who were responsible for the original design, but who may be from the same organization. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, the licensee, certificate holder, and applicant for a CoC shall include suitable qualification testing of a prototype or sample unit under the most adverse design conditions. The licensee, certificate holder, and applicant for a CoC shall apply design control measures to the following:

- (1) Criticality physics, radiation shielding, stress, thermal, hydraulic, and accident analyses;
- (2) Compatibility of materials;
- (3) Accessibility for inservice inspection, maintenance, and repair;
- (4) Features to facilitate decontamination; and
- (5) Delineation of acceptance criteria for inspections and tests.

(c) The licensee, certificate holder, and applicant for a CoC shall subject design changes, including field changes, to design control measures commensurate with those applied to the original design. Changes in the conditions specified in the CoC require prior NRC approval.

§ 71.109 Procurement document control.

The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that adequate quality is required in the documents for procurement of material, equipment, and services, whether purchased by the licensee, certificate holder, and applicant for a CoC or by its contractors or subcontractors. To the extent necessary, the licensee, certificate holder, and applicant for a CoC shall require contractors or subcontractors to provide a quality assurance program consistent with the applicable provisions of this part.

§ 71.111 Instructions, procedures, and drawings.

The licensee, certificate holder, and applicant for a CoC shall prescribe activities affecting quality by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall require that these instructions, procedures, and drawings be followed. The instructions, procedures, and drawings must include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

§ 71.113 Document control.

The licensee, certificate holder, and applicant for a CoC shall establish measures to control the issuance of documents such as instructions, procedures, and drawings, including changes, that prescribe all activities affecting quality. These measures must assure that documents, including changes, are reviewed for adequacy, approved for release by authorized personnel, and distributed and used at the location where the prescribed activity is performed.

§ 71.115 Control of purchased material, equipment, and services.

(a) The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures must include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products on delivery.

(b) The licensee, certificate holder, and applicant for a CoC shall have available documentary evidence that material and equipment conform to the procurement specifications before installation or use of the material and equipment. The licensee, certificate holder, and applicant for a CoC shall retain, or have available, this documentary evidence for the life of the package to which it applies. The licensee, certificate holder, and applicant for a CoC shall assure that the evidence is sufficient to identify the specific requirements met by the purchased material and equipment.

(c) The licensee, certificate holder, and applicant for a CoC shall assess the effectiveness of the control of quality by contractors and subcontractors at intervals consistent with the importance, complexity, and quantity of the product or services.

§ 71.117 Identification and control of materials, parts, and components.

The licensee, certificate holder, and applicant for a CoC shall establish measures for the identification and control of materials, parts, and components. These measures must assure that identification of the item is maintained by heat number, part number, or other appropriate means, either on the item or on records traceable to the item, as required throughout fabrication, installation, and use of the item. These identification and control measures must be designed to prevent the use of incorrect or defective materials, parts, and components.

§ 71.119 Control of special processes.

The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that special processes, including welding, heat treating, and nondestructive testing are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements.

§ 71.121 Internal inspection.

The licensee, certificate holder, and applicant for a CoC shall establish and execute a program for inspection of activities affecting quality by or for the organization performing the activity, to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity. The inspection must be performed by individuals other than those who performed the activity being inspected. Examination, measurements, or tests of material or products processed must be performed for each work operation where necessary to assure quality. If direct inspection of processed material or

products is not carried out, indirect control by monitoring processing methods, equipment, and personnel must be provided. Both inspection and process monitoring must be provided when quality control is inadequate without both. If mandatory inspection hold points, which require witnessing or inspecting by the licensee's designated representative and beyond which work should not proceed without the consent of its designated representative, are required, the specific hold points must be indicated in appropriate documents.

§ 71.123 Test control.

The licensee, certificate holder, and applicant for a CoC shall establish a test program to assure that all testing required to demonstrate that the packaging components will perform satisfactorily in service is identified and performed in accordance with written test procedures that incorporate the requirements of this part and the requirements and acceptance limits contained in the package approval. The test procedures must include provisions for assuring that all prerequisites for the given test are met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. The licensee, certificate holder, and applicant for a CoC shall document and evaluate the test results to assure that test requirements have been satisfied.

§ 71.125 Control of measuring and test equipment.

The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specified times to maintain accuracy within necessary limits.

§ 71.127 Handling, storage, and shipping control.

The licensee, certificate holder, and applicant for a CoC shall establish measures to control, in accordance with instructions, the handling, storage, shipping, cleaning, and preservation of materials and equipment to be used in packaging to prevent damage or deterioration. When necessary for particular products, special protective environments, such as inert gas atmosphere, and specific moisture content and temperature levels must be specified and provided.

§ 71.129 Inspection, test, and operating status.

(a) The licensee, certificate holder, and applicant for a CoC shall establish measures to indicate, by the use of markings such as stamps, tags, labels, routing cards, or other suitable means, the status of inspections and tests performed upon individual items of the packaging. These measures must provide for the identification of items that have satisfactorily passed required inspections and tests, where necessary to preclude inadvertent bypassing of the inspections and tests.

(b) The licensee shall establish measures to identify the operating status of components of the packaging, such as tagging valves and switches, to prevent inadvertent operation.

§ 71.131 Nonconforming materials, parts, or components.

The licensee, certificate holder, and applicant for a CoC shall establish measures to control materials, parts, or components that do not conform to the licensee's requirements to prevent their inadvertent use or installation. These measures must include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Nonconforming items must be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures.

§ 71.133 Corrective action.

The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that conditions adverse to quality, such as deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of a significant condition adverse to quality, the measures must assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken must be documented and reported to appropriate levels of management.

§ 71.135 Quality assurance records.

The licensee, certificate holder, and applicant for a CoC shall maintain sufficient written records to describe the activities affecting quality. The records must include the instructions, procedures, and drawings required by § 71.111 to prescribe quality assurance activities and must include closely related specifications such as required qualifications of personnel, procedures, and equipment. The records must include the instructions or procedures which establish a records retention program that is consistent with applicable regulations and designates factors such as duration, location, and assigned responsibility. The licensee, certificate holder, and applicant for a CoC shall retain these records for 3 years beyond the date when the licensee, certificate holder, and applicant for a CoC last engage in the activity for which the quality assurance program was developed. If any portion of the written procedures or instructions is superseded, the licensee, certificate holder, and applicant for a CoC shall retain the superseded material for 3 years after it is superseded.

§ 71.137 Audits.

The licensee, certificate holder, and applicant for a CoC shall carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program. The audits must be performed in accordance with written procedures or checklists by appropriately trained personnel not having direct responsibilities in the areas being audited. Audited results must be documented and reviewed by management having responsibility in the area audited. Followup action, including reaudit of deficient areas, must be taken where indicated.

Appendix A to Part 71--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 A-1. The curie (Ci) values specified are obtained by converting from the Terabecquerel (TBq) value. The Terabecquerel values are the regulatory standard. The curie values are for information only and are not intended to be the regulatory standard. Where values of A_1 and A_2 are unlimited, it is for radiation control purposes only. For nuclear criticality safety, some materials are subject to controls placed on fissile material.

II. a. For individual radionuclides whose identities are known, but which are not listed in Table A-1, the A_1 and A_2 values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior Commission approval of the A_1 and A_2 values for radionuclides not listed in Table A-1, before shipping the material.

b. For individual radionuclides whose identities are known, but which are not listed in Table A-2, the exempt material activity concentration and exempt consignment activity values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior Commission approval of the exempt material activity concentration and exempt consignment activity values for radionuclides not listed in Table A-2, before shipping the material.

c. The licensee shall submit requests for prior approval, described under paragraphs II(a) and II(b) of this Appendix, to the Commission, in accordance with § 71.1 of this part.

III. In the calculations of A_1 and A_2 for a radionuclide not in Table A-1, a single radioactive decay chain, in which radionuclides are present in their naturally occurring proportions, and in which no daughter radionuclide has a half-life either longer than 10 days, or longer than that of the parent radionuclide, 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 radionuclide of that chain. In the case of radioactive decay chains in which any daughter radionuclide has a half-life either longer than 10 days, or greater than that of the parent radionuclide, the parent and those daughter radionuclides shall be considered as mixtures of different radionuclides.

IV. For mixtures of radionuclides whose identities and respective activities are known, the following conditions apply:

a. For special form radioactive material, the maximum quantity transported in a Type A package is as follows:

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

where $B(i)$ is the activity of radionuclide i , and $A_1(i)$ is the A_1 value for radionuclide i .

b. For normal form radioactive material, the maximum quantity transported in a Type A package is as follows:

$$\sum B(i)/A_2(i) \leq 1$$

where $B(i)$ is the activity of radionuclide i , and $A_2(i)$ is the A_2 value for radionuclide i .

c. Alternatively, the A_1 value for mixtures of special form material may be determined as follows:

$$A_1 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_1(i)}}$$

where $f(i)$ is the fraction of activity for radionuclide i in the mixture, and $A_1(i)$ is the appropriate A_1 value for radionuclide i .

d. Alternatively, the A_2 value for mixtures of normal form material may be determined as follows:

$$A_2 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where $f(i)$ is the fraction of activity for radionuclide i in the mixture, and $A_2(i)$ is the appropriate A_2 value for radionuclide i .

e. The exempt activity concentration for mixtures of nuclides may be determined as follows:

$$\text{Exempt activity concentration for mixture} = \frac{1}{\sum_i \frac{f(i)}{[A](i)}}$$

where f(i) is the fraction of activity concentration of radionuclide I in the mixture, and [A] is the activity concentration for exempt material containing radionuclide I.

f. The activity limit for an exempt consignment for mixtures of radionuclides may be determined as follows:

$$\text{Exempt consignment activity limit for mixture} = \frac{1}{\sum_i \frac{f(i)}{A(i)}}$$

where f(i) is the fraction of activity of radionuclide I in the mixture, and A is the activity limit for exempt consignments for radionuclide I.

V. 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 A₁ or A₂ 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 A₁ or A₂ values for the alpha emitters and beta/gamma emitters.

Table A-1—A₁ and A₂ VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
Ac-225 (a)	Actinium (89)	8.0X10 ⁻¹	2.2X10 ¹	6.0X10 ⁻³	1.6X10 ⁻¹	2.1X10 ³	5.8X10 ⁴
Ac-227 (a)		9.0X10 ⁻¹	2.4X10 ¹	9.0X10 ⁻⁵	2.4X10 ⁻³	2.7	7.2X10 ¹
Ac-228		6.0X10 ⁻¹	1.6X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	8.4X10 ⁴	2.2X10 ⁶
Ag-105	Silver (47)	2.0	5.4X10 ¹	2.0	5.4X10 ¹	1.1X10 ³	3.0X10 ⁴
Ag-108m (a)		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	9.7X10 ⁻¹	2.6X10 ¹
Ag-110m (a)		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	1.8X10 ²	4.7X10 ³
Ag-111		2.0	5.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	5.8X10 ³	1.6X10 ⁵
Al-26	Aluminum (13)	1.0X10 ⁻¹	2.7	1.0X10 ⁻¹	2.7	7.0X10 ⁻⁴	1.9X10 ⁻²
Am-241	Americium (95)	1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	1.3X10 ⁻¹	3.4
Am-242m (a)		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	3.6X10 ⁻¹	1.0X10 ¹
Am-243 (a)		5.0	1.4X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	7.4X10 ⁻³	2.0X10 ⁻¹
Ar-37	Argon (18)	4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	3.7X10 ³	9.9X10 ⁴
Ar-39		4.0X10 ¹	1.1X10 ³	2.0X10 ¹	5.4X10 ²	1.3	3.4X10 ¹
Ar-41		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	1.5X10 ⁶	4.2X10 ⁷
As-72	Arsenic (33)	3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	6.2X10 ⁴	1.7X10 ⁶
As-73		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	8.2X10 ²	2.2X10 ⁴
As-74		1.0	2.7X10 ¹	9.0X10 ⁻¹	2.4X10 ¹	3.7X10 ³	9.9X10 ⁴

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As-76		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	5.8X10 ⁴	1.6X10 ⁶
As-77		2.0X10 ¹	5.4X10 ²	7.0X10 ⁻¹	1.9X10 ¹	3.9X10 ⁴	1.0X10 ⁶
At-211 (a)	Astatine (85)	2.0X10 ¹	5.4X10 ²	5.0X10 ⁻¹	1.4X10 ¹	7.6X10 ⁴	2.1X10 ⁶
Au-193	Gold (79)	7.0	1.9X10 ²	2.0	5.4X10 ¹	3.4X10 ⁴	9.2X10 ⁵
Au-194		1.0	2.7X10 ¹	1.0	2.7X10 ¹	1.5X10 ⁴	4.1X10 ⁵
Au-195		1.0X10 ¹	2.7X10 ²	6.0	1.6X10 ²	1.4X10 ²	3.7X10 ³
Au-198		1.0	2.7X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	9.0X10 ³	2.4X10 ⁵
Au-199		1.0X10 ¹	2.7X10 ²	6.0X10 ⁻¹	1.6X10 ¹	7.7X10 ³	2.1X10 ⁵
Ba-131 (a)	Barium (56)	2.0	5.4X10 ¹	2.0	5.4X10 ¹	3.1X10 ³	8.4X10 ⁴
Ba-133		3.0	8.1X10 ¹	3.0	8.1X10 ¹	9.4	2.6X10 ²
Ba-133m		2.0X10 ¹	5.4X10 ²	6.0X10 ⁻¹	1.6X10 ¹	2.2X10 ⁴	6.1X10 ⁵
Ba-140 (a)		5.0X10 ⁻¹	1.4X10 ¹	3.0X10 ⁻¹	8.1	2.7X10 ³	7.3X10 ⁴
Be-7	Beryllium (4)	2.0X10 ¹	5.4X10 ²	2.0X10 ¹	5.4X10 ²	1.3X10 ⁴	3.5X10 ⁵
Be-10		4.0X10 ¹	1.1X10 ³	6.0X10 ⁻¹	1.6X10 ¹	8.3X10 ⁻⁴	2.2X10 ⁻²
Bi-205	Bismuth (83)	7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	1.5X10 ³	4.2X10 ⁴
Bi-206		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	3.8X10 ³	1.0X10 ⁵
Bi-207		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	1.9	5.2X10 ¹
Bi-210		1.0	2.7X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	4.6X10 ³	1.2X10 ⁵
Bi-210m (a)		6.0X10 ⁻¹	1.6X10 ¹	2.0X10 ⁻²	5.4X10 ⁻¹	2.1X10 ⁻⁵	5.7X10 ⁻⁴
Bi-212 (a)		7.0X10 ⁻¹	1.9X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	5.4X10 ⁵	1.5X10 ⁷
Bk-247	Berkelium (97)	8.0	2.2X10 ²	8.0X10 ⁻⁴	2.2X10 ⁻²	3.8X10 ⁻²	1.0
Bk-249 (a)		4.0X10 ¹	1.1X10 ³	3.0X10 ⁻¹	8.1	6.1X10 ¹	1.6X10 ³
Br-76	Bromine (35)	4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	9.4X10 ⁴	2.5X10 ⁶
Br-77		3.0	8.1X10 ¹	3.0	8.1X10 ¹	2.6X10 ⁴	7.1X10 ⁵
Br-82		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁴	1.1X10 ⁶
C-11	Carbon (6)	1.0	2.7X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	3.1X10 ⁷	8.4X10 ⁸
C-14		4.0X10 ¹	1.1X10 ³	3.0	8.1X10 ¹	1.6X10 ⁻¹	4.5
Ca-41	Calcium (20)	Unlimited	Unlimited	Unlimited	Unlimited	3.1X10 ⁻³	8.5X10 ⁻²
Ca-45		4.0X10 ¹	1.1X10 ³	1.0	2.7X10 ¹	6.6X10 ²	1.8X10 ⁴
Ca-47 (a)		3.0	8.1X10 ¹	3.0X10 ⁻¹	8.1	2.3X10 ⁴	6.1X10 ⁵
Cd-109	Cadmium (48)	3.0X10 ¹	8.1X10 ²	2.0	5.4X10 ¹	9.6X10 ¹	2.6X10 ³
Cd-113m		4.0X10 ¹	1.1X10 ³	5.0X10 ⁻¹	1.4X10 ¹	8.3	2.2X10 ²
Cd-115 (a)		3.0	8.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	1.9X10 ⁴	5.1X10 ⁵
Cd-115m		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	9.4X10 ²	2.5X10 ⁴
Ce-139	Cerium (58)	7.0	1.9X10 ²	2.0	5.4X10 ¹	2.5X10 ²	6.8X10 ³
Ce-141		2.0X10 ¹	5.4X10 ²	6.0X10 ⁻¹	1.6X10 ¹	1.1X10 ³	2.8X10 ⁴
Ce-143		9.0X10 ⁻¹	2.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	2.5X10 ⁴	6.6X10 ⁵

Ce-144 (a)		2.0X10 ⁻¹	5.4	2.0X10 ⁻¹	5.4	1.2X10 ²	3.2X10 ³
Cf-248	Californium (98)	4.0X10 ¹	1.1X10 ³	6.0X10 ⁻³	1.6X10 ⁻¹	5.8X10 ¹	1.6X10 ³
Cf-249		3.0	8.1X10 ¹	8.0X10 ⁻⁴	2.2X10 ⁻²	1.5X10 ⁻¹	4.1
Cf-250		2.0X10 ¹	5.4X10 ²	2.0X10 ⁻³	5.4X10 ⁻²	4.0	1.1X10 ²
Cf-251		7.0	1.9X10 ²	7.0X10 ⁻⁴	1.9X10 ⁻²	5.9X10 ⁻²	1.6
Cf-252 (h)		5.0X10 ⁻²	1.4	3.0X10 ⁻³	8.1X10 ⁻²	2.0X10 ¹	5.4X10 ²
Cf-253 (a)		4.0X10 ¹	1.1X10 ³	4.0X10 ⁻²	1.1	1.1X10 ³	2.9X10 ⁴
Cf-254		1.0X10 ⁻³	2.7X10 ⁻²	1.0X10 ⁻³	2.7X10 ⁻²	3.1X10 ²	8.5X10 ³
Cl-36	Chlorine (17)	1.0X10 ¹	2.7X10 ²	6.0X10 ⁻¹	1.6X10 ¹	1.2X10 ⁻³	3.3X10 ⁻²
Cl-38		2.0X10 ⁻¹	5.4	2.0X10 ⁻¹	5.4	4.9X10 ⁶	1.3X10 ⁸
Cm-240	Curium (96)	4.0X10 ¹	1.1X10 ³	2.0X10 ⁻²	5.4X10 ⁻¹	7.5X10 ²	2.0X10 ⁴
Cm-241		2.0	5.4X10 ¹	1.0	2.7X10 ¹	6.1X10 ²	1.7X10 ⁴
Cm-242		4.0X10 ¹	1.1X10 ³	1.0X10 ⁻²	2.7X10 ⁻¹	1.2X10 ²	3.3X10 ³
Cm-243		9.0	2.4X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	1.9X10 ⁻³	5.2X10 ¹
Cm-244		2.0X10 ¹	5.4X10 ²	2.0X10 ⁻³	5.4X10 ⁻²	3.0	8.1X10 ¹
Cm-245		9.0	2.4X10 ²	9.0X10 ⁻⁴	2.4X10 ⁻²	6.4X10 ⁻³	1.7X10 ⁻¹
Cm-246		9.0	2.4X10 ²	9.0X10 ⁻⁴	2.4X10 ⁻²	1.1X10 ⁻²	3.1X10 ⁻¹
Cm-247 (a)		3.0	8.1X10 ¹	1.0X10 ⁻³	2.7X10 ⁻²	3.4X10 ⁻⁶	9.3X10 ⁻⁵
Cm-248		2.0X10 ⁻²	5.4X10 ⁻¹	3.0X10 ⁻⁴	8.1X10 ⁻³	1.6X10 ⁻⁴	4.2X10 ⁻³
Co-55	Cobalt (27)	5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	1.1X10 ⁵	3.1X10 ⁶
Co-56		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	1.1X10 ³	3.0X10 ⁴
Co-57		1.0X10 ¹	2.7X10 ²	1.0X10 ¹	2.7X10 ²	3.1X10 ²	8.4X10 ³
Co-58		1.0	2.7X10 ¹	1.0	2.7X10 ¹	1.2X10 ³	3.2X10 ⁴
Co-58m		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	2.2X10 ⁵	5.9X10 ⁶
Co-60		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	4.2X10 ¹	1.1X10 ³
Cr-51	Chromium (24)	3.0X10 ¹	8.1X10 ²	3.0X10 ¹	8.1X10 ²	3.4X10 ³	9.2X10 ⁴
Cs-129	Cesium (55)	4.0	1.1X10 ²	4.0	1.1X10 ²	2.8X10 ⁴	7.6X10 ⁵
Cs-131		3.0X10 ¹	8.1X10 ²	3.0X10 ¹	8.1X10 ²	3.8X10 ³	1.0X10 ⁵
Cs-132		1.0	2.7X10 ¹	1.0	2.7X10 ¹	5.7X10 ³	1.5X10 ⁵
Cs-134		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	4.8X10 ¹	1.3X10 ³
Cs-134m		4.0X10 ¹	1.1X10 ³	6.0X10 ⁻¹	1.6X10 ¹	3.0X10 ⁵	8.0X10 ⁶
Cs-135		4.0X10 ¹	1.1X10 ³	1.0	2.7X10 ¹	4.3X10 ⁻⁵	1.2X10 ⁻³
Cs-136		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	2.7X10 ³	7.3X10 ⁴
Cs-137 (a)		2.0	5.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	3.2	8.7X10 ¹
Cu-64	Copper (29)	6.0	1.6X10 ²	1.0	2.7X10 ¹	1.4X10 ⁵	3.9X10 ⁶
Cu-67		1.0X10 ¹	2.7X10 ²	7.0X10 ⁻¹	1.9X10 ¹	2.8X10 ⁴	7.6X10 ⁵
Dy-159	Dysprosium (66)	2.0X10 ¹	5.4X10 ²	2.0X10 ¹	5.4X10 ²	2.1X10 ²	5.7X10 ³
Dy-165		9.0X10 ⁻¹	2.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	3.0X10 ⁵	8.2X10 ⁶

Dy-166 (a)		9.0X10 ⁻¹	2.4X10 ¹	3.0X10 ⁻¹	8.1	8.6X10 ³	2.3X10 ⁵
Er-169	Erbium (68)	4.0X10 ¹	1.1X10 ³	1.0	2.7X10 ¹	3.1X10 ³	8.3X10 ⁴
Er-171		8.0X10 ⁻¹	2.2X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	9.0X10 ⁴	2.4X10 ⁶
Eu-147	Europium (63)	2.0	5.4X10 ¹	2.0	5.4X10 ¹	1.4X10 ³	3.7X10 ⁴
Eu-148		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	6.0X10 ²	1.6X10 ⁴
Eu-149		2.0X10 ¹	5.4X10 ²	2.0X10 ¹	5.4X10 ²	3.5X10 ²	9.4X10 ³
Eu-150 (short lived)		2.0	5.4X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	6.1X10 ⁴	1.6X10 ⁶
Eu-150 (long lived)		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	6.1X10 ⁴	1.6X10 ⁶
Eu-152		1.0	2.7X10 ¹	1.0	2.7X10 ¹	6.5	1.8X10 ²
Eu-152m		8.0X10 ⁻¹	2.2X10 ¹	8.0X10 ⁻¹	2.2X10 ¹	8.2X10 ⁴	2.2X10 ⁶
Eu-154		9.0X10 ⁻¹	2.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	9.8	2.6X10 ²
Eu-155		2.0X10 ¹	5.4X10 ²	3.0	8.1X10 ¹	1.8X10 ¹	4.9X10 ²
Eu-156		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	2.0X10 ³	5.5X10 ⁴
F-18	Fluorine (9)	1.0	2.7X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	3.5X10 ⁶	9.5X10 ⁷
Fe-52 (a)	Iron (26)	3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	2.7X10 ⁵	7.3X10 ⁶
Fe-55		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	8.8X10 ¹	2.4X10 ³
Fe-59		9.0X10 ⁻¹	2.4X10 ¹	9.0X10 ⁻¹	2.4X10 ¹	1.8X10 ³	5.0X10 ⁴
Fe-60 (a)		4.0X10 ¹	1.1X10 ³	2.0X10 ⁻¹	5.4	7.4X10 ⁻⁴	2.0X10 ⁻²
Ga-67	Gallium (31)	7.0	1.9X10 ²	3.0	8.1X10 ¹	2.2X10 ⁴	6.0X10 ⁵
Ga-68		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	1.5X10 ⁶	4.1X10 ⁷
Ga-72		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	1.1X10 ⁵	3.1X10 ⁶
Gd-146 (a)	Gadolinium (64)	5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	6.9X10 ²	1.9X10 ⁴
Gd-148		2.0X10 ¹	5.4X10 ²	2.0X10 ⁻³	5.4X10 ⁻²	1.2	3.2X10 ¹
Gd-153		1.0X10 ¹	2.7X10 ²	9.0	2.4X10 ²	1.3X10 ²	3.5X10 ³
Gd-159		3.0	8.1X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	3.9X10 ⁴	1.1X10 ⁶
Ge-68 (a)	Germanium (32)	5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	2.6X10 ²	7.1X10 ³
Ge-71		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	5.8X10 ³	1.6X10 ⁵
Ge-77		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	1.3X10 ⁵	3.6X10 ⁶
Hf-172 (a)	Hafnium (72)	6.0X10 ⁻¹	1.6X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	4.1X10 ¹	1.1X10 ³
Hf-175		3.0	8.1X10 ¹	3.0	8.1X10 ¹	3.9X10 ²	1.1X10 ⁴
Hf-181		2.0	5.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	6.3X10 ²	1.7X10 ⁴
Hf-182		Unlimited	Unlimited	Unlimited	Unlimited	8.1X10 ⁻⁶	2.2X10 ⁻⁴
Hg-194 (a)	Mercury (80)	1.0	2.7X10 ¹	1.0	2.7X10 ¹	1.3X10 ⁻¹	3.5
Hg-195m (a)		3.0	8.1X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	1.5X10 ⁴	4.0X10 ⁵
Hg-197		2.0X10 ¹	5.4X10 ²	1.0X10 ¹	2.7X10 ²	9.2X10 ³	2.5X10 ⁵
Hg-197m		1.0X10 ¹	2.7X10 ²	4.0X10 ⁻¹	1.1X10 ¹	2.5X10 ⁴	6.7X10 ⁵

Hg-203		5.0	1.4X10 ²	1.0	2.7X10 ¹	5.1X10 ²	1.4X10 ⁴
Ho-166	Holmium (67)	4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	2.6X10 ⁴	7.0X10 ⁵
Ho-166m		6.0X10 ⁻¹	1.6X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	6.6X10 ⁻²	1.8
I-123	Iodine (53)	6.0	1.6X10 ²	3.0	8.1X10 ¹	7.1X10 ⁴	1.9X10 ⁶
I-124		1.0	2.7X10 ¹	1.0	2.7X10 ¹	9.3X10 ³	2.5X10 ⁵
I-125		2.0X10 ¹	5.4X10 ²	3.0	8.1X10 ¹	6.4X10 ²	1.7X10 ⁴
I-126		2.0	5.4X10 ¹	1.0	2.7X10 ¹	2.9X10 ³	8.0X10 ⁴
I-129		Unlimited	Unlimited	Unlimited	Unlimited	6.5X10 ⁻⁶	1.8X10 ⁻⁴
I-131		3.0	8.1X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	4.6X10 ³	1.2X10 ⁵
I-132		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	3.8X10 ⁵	1.0X10 ⁷
I-133		7.0X10 ⁻¹	1.9X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	4.2X10 ⁴	1.1X10 ⁶
I-134		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	9.9X10 ⁵	2.7X10 ⁷
I-135 (a)		6.0X10 ⁻¹	1.6X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	1.3X10 ⁵	3.5X10 ⁶
In-111	Indium (49)	3.0	8.1X10 ¹	3.0	8.1X10 ¹	1.5X10 ⁴	4.2X10 ⁵
In-113m		4.0	1.1X10 ²	2.0	5.4X10 ¹	6.2X10 ⁵	1.7X10 ⁷
In-114m (a)		1.0X10 ¹	2.7X10 ²	5.0X10 ⁻¹	1.4X10 ¹	8.6X10 ²	2.3X10 ⁴
In-115m		7.0	1.9X10 ²	1.0	2.7X10 ¹	2.2X10 ⁵	6.1X10 ⁶
Ir-189 (a)	Iridium (77)	1.0X10 ¹	2.7X10 ²	1.0X10 ¹	2.7X10 ²	1.9X10 ³	5.2X10 ⁴
Ir-190		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	2.3X10 ³	6.2X10 ⁴
Ir-192 (c)		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
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	6.8×10^{-5}	1.8×10^{-3}
Mn-54		1.0	2.7×10^1	1.0	2.7×10^1	2.9×10^2	7.7×10^3
Mn-56		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	8.0×10^5	2.2×10^7
Mo-93	Molybdenum (42)	4.0×10^1	1.1×10^3	2.0×10^1	5.4×10^2	4.1×10^{-2}	1.1
Mo-99 (a) (i)		1.0	2.7×10^1	6.0×10^{-1}	1.6×10^1	1.8×10^4	4.8×10^5
N-13	Nitrogen (7)	9.0×10^{-1}	2.4×10^1	6.0×10^{-1}	1.6×10^1	5.4×10^7	1.5×10^9
Na-22	Sodium (11)	5.0×10^{-1}	1.4×10^1	5.0×10^{-1}	1.4×10^1	2.3×10^2	6.3×10^3
Na-24		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	3.2×10^5	8.7×10^6
Nb-93m	Niobium (41)	4.0×10^1	1.1×10^3	3.0×10^1	8.1×10^2	8.8	2.4×10^2
Nb-94		7.0×10^{-1}	1.9×10^1	7.0×10^{-1}	1.9×10^1	6.9×10^{-3}	1.9×10^{-1}
Nb-95		1.0	2.7×10^1	1.0	2.7×10^1	1.5×10^3	3.9×10^4
Nb-97		9.0×10^{-1}	2.4×10^1	6.0×10^{-1}	1.6×10^1	9.9×10^5	2.7×10^7
Nd-147	Neodymium (60)	6.0	1.6×10^2	6.0×10^{-1}	1.6×10^1	3.0×10^3	8.1×10^4
Nd-149		6.0×10^{-1}	1.6×10^1	5.0×10^{-1}	1.4×10^1	4.5×10^5	1.2×10^7
Ni-59	Nickel (28)	Unlimited	Unlimited	Unlimited	Unlimited	3.0×10^{-3}	8.0×10^{-2}
Ni-63		4.0×10^1	1.1×10^3	3.0×10^1	8.1×10^2	2.1	5.7×10^1
Ni-65		4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	7.1×10^5	1.9×10^7
Np-235	Neptunium (93)	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	5.2×10^1	1.4×10^3
Np-236 (short-lived)		2.0×10^1	5.4×10^2	2.0	5.4×10^1	4.7×10^{-4}	1.3×10^{-2}
Np-236 (long-lived)		9.0×10^0	2.4×10^2	2.0×10^{-2}	5.4×10^{-1}	4.7×10^{-4}	1.3×10^{-2}
Np-237		2.0×10^1	5.4×10^2	2.0×10^{-3}	5.4×10^{-2}	2.6×10^{-5}	7.1×10^{-4}
Np-239		7.0	1.9×10^2	4.0×10^{-1}	1.1×10^1	8.6×10^3	2.3×10^5
Os-185	Osmium (76)	1.0	2.7×10^1	1.0	2.7×10^1	2.8×10^2	7.5×10^3
Os-191		1.0×10^1	2.7×10^2	2.0	5.4×10^1	1.6×10^3	4.4×10^4
Os-191m		4.0×10^1	1.1×10^3	3.0×10^1	8.1×10^2	4.6×10^4	1.3×10^6
Os-193		2.0	5.4×10^1	6.0×10^{-1}	1.6×10^1	2.0×10^4	5.3×10^5
Os-194 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.1×10^1	3.1×10^2
P-32	Phosphorus (15)	5.0×10^{-1}	1.4×10^1	5.0×10^{-1}	1.4×10^1	1.1×10^4	2.9×10^5
P-33		4.0×10^1	1.1×10^3	1.0	2.7×10^1	5.8×10^3	1.6×10^5
Pa-230 (a)	Protactinium (91)	2.0	5.4×10^1	7.0×10^{-2}	1.9	1.2×10^3	3.3×10^4
Pa-231		4.0	1.1×10^2	4.0×10^{-4}	1.1×10^{-2}	1.7×10^{-3}	4.7×10^{-2}
Pa-233		5.0	1.4×10^2	7.0×10^{-1}	1.9×10^1	7.7×10^2	2.1×10^4
Pb-201	Lead (82)	1.0	2.7×10^1	1.0	2.7×10^1	6.2×10^4	1.7×10^6
Pb-202		4.0×10^1	1.1×10^3	2.0×10^1	5.4×10^2	1.2×10^{-4}	3.4×10^{-3}
Pb-203		4.0	1.1×10^2	3.0	8.1×10^1	1.1×10^4	3.0×10^5

Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	4.5X10 ⁻⁶	1.2X10 ⁻⁴
Pb-210 (a)		1.0	2.7X10 ¹	5.0X10 ⁻²	1.4	2.8	7.6X10 ¹
Pb-212 (a)		7.0X10 ⁻¹	1.9X10 ¹	2.0X10 ⁻¹	5.4	5.1X10 ⁴	1.4X10 ⁶
Pd-103 (a)	Palladium (46)	4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	2.8X10 ³	7.5X10 ⁴
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	1.9X10 ⁻⁵	5.1X10 ⁻⁴
Pd-109		2.0	5.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	7.9X10 ⁴	2.1X10 ⁶
Pm-143	Promethium (61)	3.0	8.1X10 ¹	3.0	8.1X10 ¹	1.3X10 ²	3.4X10 ³
Pm-144		7.0X10 ⁻¹	1.9X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	9.2X10 ¹	2.5X10 ³
Pm-145		3.0X10 ¹	8.1X10 ²	1.0X10 ¹	2.7X10 ²	5.2	1.4X10 ²
Pm-147		4.0X10 ¹	1.1X10 ³	2.0	5.4X10 ¹	3.4X10 ¹	9.3X10 ²
Pm-148m (a)		8.0X10 ⁻¹	2.2X10 ¹	7.0X10 ⁻¹	1.9X10 ¹	7.9X10 ²	2.1X10 ⁴
Pm-149		2.0	5.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	1.5X10 ⁴	4.0X10 ⁵
Pm-151		2.0	5.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	2.7X10 ⁴	7.3X10 ⁵
Po-210	Polonium (84)	4.0X10 ¹	1.1X10 ³	2.0X10 ⁻²	5.4X10 ⁻¹	1.7X10 ²	4.5X10 ³
Pr-142	Praseodymium (59)	4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	4.3X10 ⁴	1.2X10 ⁶
Pr-143		3.0	8.1X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	2.5X10 ³	6.7X10 ⁴
Pt-188 (a)	Platinum (78)	1.0	2.7X10 ¹	8.0X10 ⁻¹	2.2X10 ¹	2.5X10 ³	6.8X10 ⁴
Pt-191		4.0	1.1X10 ²	3.0	8.1X10 ¹	8.7X10 ³	2.4X10 ⁵
Pt-193		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	1.4	3.7X10 ¹
Pt-193m		4.0X10 ¹	1.1X10 ³	5.0X10 ⁻¹	1.4X10 ¹	5.8X10 ³	1.6X10 ⁵
Pt-195m		1.0X10 ¹	2.7X10 ²	5.0X10 ⁻¹	1.4X10 ¹	6.2X10 ³	1.7X10 ⁵
Pt-197		2.0X10 ¹	5.4X10 ²	6.0X10 ⁻¹	1.6X10 ¹	3.2X10 ⁴	8.7X10 ⁵
Pt-197m		1.0X10 ¹	2.7X10 ²	6.0X10 ⁻¹	1.6X10 ¹	3.7X10 ⁵	1.0X10 ⁷
Pu-236	Plutonium (94)	3.0X10 ¹	8.1X10 ²	3.0X10 ⁻³	8.1X10 ⁻²	2.0X10 ¹	5.3X10 ²
Pu-237		2.0X10 ¹	5.4X10 ²	2.0X10 ¹	5.4X10 ²	4.5X10 ²	1.2X10 ⁴
Pu-238		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	6.3X10 ⁻¹	1.7X10 ¹
Pu-239		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	2.3X10 ⁻³	6.2X10 ⁻²
Pu-240		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	8.4X10 ⁻³	2.3X10 ⁻¹
Pu-241 (a)		4.0X10 ¹	1.1X10 ³	6.0X10 ⁻²	1.6	3.8	1.0X10 ²
Pu-242		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	1.5X10 ⁻⁴	3.9X10 ⁻³
Pu-244 (a)		4.0X10 ⁻¹	1.1X10 ¹	1.0X10 ⁻³	2.7X10 ⁻²	6.7X10 ⁻⁷	1.8X10 ⁻⁵
Ra-223 (a)	Radium (88)	4.0X10 ⁻¹	1.1X10 ¹	7.0X10 ⁻³	1.9X10 ⁻¹	1.9X10 ³	5.1X10 ⁴
Ra-224 (a)		4.0X10 ⁻¹	1.1X10 ¹	2.0X10 ⁻²	5.4X10 ⁻¹	5.9X10 ³	1.6X10 ⁵
Ra-225 (a)		2.0X10 ⁻¹	5.4	4.0X10 ⁻³	1.1X10 ⁻¹	1.5X10 ³	3.9X10 ⁴
Ra-226 (a)		2.0X10 ⁻¹	5.4	3.0X10 ⁻³	8.1X10 ⁻²	3.7X10 ⁻²	1.0
Ra-228 (a)		6.0X10 ⁻¹	1.6X10 ¹	2.0X10 ⁻²	5.4X10 ⁻¹	1.0X10 ¹	2.7X10 ²
Rb-81	Rubidium (37)	2.0	5.4X10 ¹	8.0X10 ⁻¹	2.2X10 ¹	3.1X10 ⁵	8.4X10 ⁶

Rb-83 (a)		2.0	5.4X10 ¹	2.0	5.4X10 ¹	6.8X10 ²	1.8X10 ⁴
Rb-84		1.0	2.7X10 ¹	1.0	2.7X10 ¹	1.8X10 ³	4.7X10 ⁴
Rb-86		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	3.0X10 ³	8.1X10 ⁴
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	3.2X10 ⁻⁹	8.6X10 ⁻⁸
Rb(nat)		Unlimited	Unlimited	Unlimited	Unlimited	6.7X10 ⁶	1.8X10 ⁸
Re-184	Rhenium (75)	1.0	2.7X10 ¹	1.0	2.7X10 ¹	6.9X10 ²	1.9X10 ⁴
Re-184m		3.0	8.1X10 ¹	1.0	2.7X10 ¹	1.6X10 ²	4.3X10 ³
Re-186		2.0	5.4X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	6.9X10 ³	1.9X10 ⁵
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	1.4X10 ⁻⁹	3.8X10 ⁻⁸
Re-188		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	3.6X10 ⁴	9.8X10 ⁵
Re-189 (a)		3.0	8.1X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	2.5X10 ⁴	6.8X10 ⁵
Re(nat)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	2.4X10 ⁻⁸
Rh-99	Rhodium (45)	2.0	5.4X10 ¹	2.0	5.4X10 ¹	3.0X10 ³	8.2X10 ⁴
Rh-101		4.0	1.1X10 ²	3.0	8.1X10 ¹	4.1X10 ¹	1.1X10 ³
Rh-102		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	4.5X10 ¹	1.2X10 ³
Rh-102m		2.0	5.4X10 ¹	2.0	5.4X10 ¹	2.3X10 ²	6.2X10 ³
Rh-103m		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	1.2X10 ⁶	3.3X10 ⁷
Rh-105		1.0X10 ¹	2.7X10 ²	8.0X10 ⁻¹	2.2X10 ¹	3.1X10 ⁴	8.4X10 ⁵
Rn-222 (a)	Radon (86)	3.0X10 ⁻¹	8.1	4.0X10 ⁻³	1.1X10 ⁻¹	5.7X10 ³	1.5X10 ⁵
Ru-97	Ruthenium (44)	5.0	1.4X10 ²	5.0	1.4X10 ²	1.7X10 ⁴	4.6X10 ⁵
Ru-103 (a)		2.0	5.4X10 ¹	2.0	5.4X10 ¹	1.2X10 ³	3.2X10 ⁴
Ru-105		1.0	2.7X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	2.5X10 ⁵	6.7X10 ⁶
Ru-106 (a)		2.0X10 ⁻¹	5.4	2.0X10 ⁻¹	5.4	1.2X10 ²	3.3X10 ³
S-35	Sulphur (16)	4.0X10 ¹	1.1X10 ³	3.0	8.1X10 ¹	1.6X10 ³	4.3X10 ⁴
Sb-122	Antimony (51)	4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	1.5X10 ⁴	4.0X10 ⁵
Sb-124		6.0X10 ⁻¹	1.6X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	6.5X10 ²	1.7X10 ⁴
Sb-125		2.0	5.4X10 ¹	1.0	2.7X10 ¹	3.9X10 ¹	1.0X10 ³
Sb-126		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	3.1X10 ³	8.4X10 ⁴
Sc-44	Scandium (21)	5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	6.7X10 ⁵	1.8X10 ⁷
Sc-46		5.0X10 ⁻¹	1.4X10 ¹	5.0X10 ⁻¹	1.4X10 ¹	1.3X10 ³	3.4X10 ⁴
Sc-47		1.0X10 ¹	2.7X10 ²	7.0X10 ⁻¹	1.9X10 ¹	3.1X10 ⁴	8.3X10 ⁵
Sc-48		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	5.5X10 ⁴	1.5X10 ⁶
Se-75	Selenium (34)	3.0	8.1X10 ¹	3.0	8.1X10 ¹	5.4X10 ²	1.5X10 ⁴
Se-79		4.0X10 ¹	1.1X10 ³	2.0	5.4X10 ¹	2.6X10 ⁻³	7.0X10 ⁻²
Si-31	Silicon (14)	6.0X10 ⁻¹	1.6X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	1.4X10 ⁶	3.9X10 ⁷

Si-32		4.0X10 ¹	1.1X10 ³	5.0X10 ⁻¹	1.4X10 ¹	3.9	1.1X10 ²
Sm-145	Samarium (62)	1.0X10 ¹	2.7X10 ²	1.0X10 ¹	2.7X10 ²	9.8X10 ¹	2.6X10 ³
Sm-147		Unlimited	Unlimited	Unlimited	Unlimited	8.5X10 ⁻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
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	3.1X10 ⁴	3.0X10 ⁵
Th-227	Thorium (90)	1.0X10 ¹	2.7X10 ²	5.0X10 ⁻³	1.4X10 ⁻¹	1.1X10 ³	3.1X10 ⁴
Th-228 (a)		5.0X10 ⁻¹	1.4X10 ¹	1.0X10 ⁻³	2.7X10 ⁻²	3.0X10 ¹	8.2X10 ²
Th-229		5.0	1.4X10 ²	5.0X10 ⁻⁴	1.4X10 ⁻²	7.9X10 ⁻³	2.1X10 ⁻¹
Th-230		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	7.6X10 ⁻⁴	2.1X10 ⁻²
Th-231		4.0X10 ¹	1.1X10 ³	2.0X10 ⁻²	5.4X10 ⁻¹	2.0X10 ⁴	5.3X10 ⁵
Th-232		Unlimited	Unlimited	Unlimited	Unlimited	4.0X10 ⁻⁹	1.1X10 ⁻⁷
Th-234 (a)		3.0X10 ⁻¹	8.1	3.0X10 ⁻¹	8.1	8.6X10 ²	2.3X10 ⁴
Th(nat)		Unlimited	Unlimited	Unlimited	Unlimited	8.1X10 ⁻⁹	2.2X10 ⁻⁷
Ti-44 (a)	Titanium (22)	5.0X10 ⁻¹	1.4X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	6.4	1.7X10 ²
Tl-200	Thallium (81)	9.0X10 ⁻¹	2.4X10 ¹	9.0X10 ⁻¹	2.4X10 ¹	2.2X10 ⁴	6.0X10 ⁵
Tl-201		1.0X10 ¹	2.7X10 ²	4.0	1.1X10 ²	7.9X10 ³	2.1X10 ⁵
Tl-202		2.0	5.4X10 ¹	2.0	5.4X10 ¹	2.0X10 ³	5.3X10 ⁴
Tl-204		1.0X10 ¹	2.7X10 ²	7.0X10 ⁻¹	1.9X10 ¹	1.7X10 ¹	4.6X10 ²
Tm-167	Thulium (69)	7.0	1.9X10 ²	8.0X10 ⁻¹	2.2X10 ¹	3.1X10 ³	8.5X10 ⁴
Tm-170		3.0	8.1X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	2.2X10 ²	6.0X10 ³
Tm-171		4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³	4.0X10 ¹	1.1X10 ³
U-230 (fast lung absorption) (a)(d)	Uranium (92)	4.0X10 ¹	1.1X10 ³	1.0X10 ⁻¹	2.7	1.0X10 ³	2.7X10 ⁴
U-230 (medium lung absorption) (a)(e)		4.0X10 ¹	1.1X10 ³	4.0X10 ⁻³	1.1X10 ⁻¹	1.0X10 ³	2.7X10 ⁴
U-230 (slow lung absorption) (a)(f)		3.0X10 ¹	8.1X10 ²	3.0X10 ⁻³	8.1X10 ⁻²	1.0X10 ³	2.7X10 ⁴
U-232 (fast lung absorption)		4.0X10 ¹	1.1X10 ³	1.0X10 ⁻²	2.7X10 ⁻¹	8.3X10 ⁻¹	2.2X10 ¹

(d)							
U-232 (medium lung absorption) (e)		4.0X10 ¹	1.1X10 ³	7.0X10 ⁻³	1.9X10 ⁻¹	8.3X10 ⁻¹	2.2X10 ¹
U-232 (slow lung absorption) (f)		1.0X10 ¹	2.7X10 ²	1.0X10 ⁻³	2.7X10 ⁻²	8.3X10 ⁻¹	2.2X10 ¹
U-233 (fast lung absorption) (d)		4.0X10 ¹	1.1X10 ³	9.0X10 ⁻²	2.4	3.6X10 ⁻⁴	9.7X10 ⁻³
U-233 (medium lung absorption) (e)		4.0X10 ¹	1.1X10 ³	2.0X10 ⁻²	5.4X10 ⁻¹	3.6X10 ⁻⁴	9.7X10 ⁻³
U-233 (slow lung absorption) (f)		4.0X10 ¹	1.1X10 ³	6.0X10 ⁻³	1.6X10 ⁻¹	3.6X10 ⁻⁴	9.7X10 ⁻³
U-234 (fast lung absorption) (d)		4.0X10 ¹	1.1X10 ³	9.0X10 ⁻²	2.4	2.3X10 ⁻⁴	6.2X10 ⁻³
U-234 (medium lung absorption) (e)		4.0X10 ¹	1.1X10 ³	2.0X10 ⁻²	5.4X10 ⁻¹	2.3X10 ⁻⁴	6.2X10 ⁻³
U-234 (slow lung absorption) (f)		4.0X10 ¹	1.1X10 ³	6.0X10 ⁻³	1.6X10 ⁻¹	2.3X10 ⁻⁴	6.2X10 ⁻³
U-235 (all lung absorption types) (a),(d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	8.0X10 ⁻⁸	2.2X10 ⁻⁶
U-236 (fast lung absorption) (d)		Unlimited	Unlimited	Unlimited	Unlimited	2.4X10 ⁻⁶	6.5X10 ⁻⁵
U-236 (medium lung absorption) (e)		4.0X10 ¹	1.1X10 ³	2.0X10 ⁻²	5.4X10 ⁻¹	2.4X10 ⁻⁶	6.5X10 ⁻⁵

U-236 (slow lung absorption) (f)		4.0X10 ¹	1.1X10 ³	6.0X10 ⁻³	1.6X10 ⁻¹	2.4X10 ⁻⁶	6.5X10 ⁻⁵
U-238 (all lung absorption types) (d),(e),(f)		Unlimited	Unlimited	Unlimited	Unlimited	1.2X10 ⁻⁸	3.4X10 ⁻⁷
U (nat)		Unlimited	Unlimited	Unlimited	Unlimited	2.6X10 ⁻⁸	7.1X10 ⁻⁷
U (enriched to 20% or less) (g)		Unlimited	Unlimited	Unlimited	Unlimited	See Table A-4	See Table A-4
U (dep)		Unlimited	Unlimited	Unlimited	Unlimited	See Table A-4	(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 (70)	4.0	1.1X10 ²	1.0	2.7X10 ¹	8.9X10 ²	2.4X10 ⁴
Yb-175		3.0X10 ¹	8.1X10 ²	9.0X10 ⁻¹	2.4X10 ¹	6.6X10 ³	1.8X10 ⁵
Zn-65	Zinc (30)	2.0	5.4X10 ¹	2.0	5.4X10 ¹	3.0X10 ²	8.2X10 ³
Zn-69		3.0	8.1X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	1.8X10 ⁶	4.9X10 ⁷
Zn-69m (a)		3.0	8.1X10 ¹	6.0X10 ⁻¹	1.6X10 ¹	1.2X10 ⁵	3.3X10 ⁶
Zr-88	Zirconium (40)	3.0	8.1X10 ¹	3.0	8.1X10 ¹	6.6X10 ²	1.8X10 ⁴

Zr-93		Unlimited	Unlimited	Unlimited	Unlimited	9.3X10 ⁻⁵	2.5X10 ⁻³
Zr-95 (a)		2.0	5.4X10 ¹	8.0X10 ⁻¹	2.2X10 ¹	7.9X10 ²	2.1X10 ⁴
Zr-97 (a)		4.0X10 ⁻¹	1.1X10 ¹	4.0X10 ⁻¹	1.1X10 ¹	7.1X10 ⁴	1.9X10 ⁶

^a A₁ and/or A₂ values include contributions from daughter nuclides with half-lives less than 10 days.

^b The values of A₁ and A₂ in Curies (Ci) are approximate and for information only; the regulatory standard units are Terabecquerels (TBq); (see Appendix A to Part 71 - Determination of A₁ and A₂, Section I-).

^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 notes (d) and (e) of this table.

^g These values apply to unirradiated uranium only.

^h A₁ = 0.1 TBq (2.7 Ci) and A₂ = 0.001 TBq (0.027 Ci) for Cf-252 for domestic use.

ⁱ A₂ = 0.74 TBq (20 Ci) for Mo-99 for domestic use.

Table A-2—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	Actinium (89)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Ac-227		1.0X10 ⁻¹	2.7X10 ⁻¹²	1.0X10 ³	2.7X10 ⁻⁸
Ac-228		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Ag-105	Silver (47)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ag-108m (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Ag-110m		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Ag-111		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Al-26	Aluminum (13)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Am-241	Americium (95)	1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Am-242m (b)		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Am-243 (b)		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Ar-37	Argon (18)	1.0X10 ⁶	2.7X10 ⁻⁵	1.0X10 ⁸	2.7X10 ⁻³
Ar-39		1.0X10 ⁷	2.7X10 ⁻⁴	1.0X10 ⁴	2.7X10 ⁻⁷
Ar-41		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁹	2.7X10 ⁻²
As-72	Arsenic (33)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶

As-73		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
As-74		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
As-76		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
As-77		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
At-211	Astatine (85)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Au-193	Gold (79)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Au-194		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Au-195		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Au-198		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Au-199		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ba-131	Barium (56)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ba-133		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ba-133m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ba-140 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Be-7	Beryllium (4)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Be-10		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁶	2.7X10 ⁻⁵
Bi-205	Bismuth (83)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Bi-206		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Bi-207		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Bi-210		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Bi-210m		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Bi-212 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Bk-247	Berkelium (97)	1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Bk-249		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Br-76	Bromine (35)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Br-77		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Br-82		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
C-11	Carbon (6)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
C-14		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Ca-41	Calcium (20)	1.0X10 ⁵	2.7X10 ⁻⁶	1.0X10 ⁷	2.7X10 ⁻⁴
Ca-45		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Ca-47		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Cd-109	Cadmium (48)	1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁶	2.7X10 ⁻⁵
Cd-113m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Cd-115		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Cd-115m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵

Ce-139	Cerium (58)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ce-141		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Ce-143		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ce-144 (b)		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Cf-248	Californium (98)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Cf-249		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Cf-250		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Cf-251		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Cf-252		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Cf-253		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Cf-254		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Cl-36	Chlorine (17)	1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁶	2.7X10 ⁻⁵
Cl-38		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Cm-240	Curium (96)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Cm-241		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Cm-242		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Cm-243		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Cm-244		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Cm-245		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Cm-246		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Cm-247		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Cm-248		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Co-55	Cobalt (27)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Co-56		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Co-57		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Co-58		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Co-58m		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Co-60		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Cr-51	Chromium (24)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Cs-129	Cesium (55)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Cs-131		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Cs-132		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Cs-134		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Cs-134m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁵	2.7X10 ⁻⁶
Cs-135		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Cs-136		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶

Cs-137 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Cu-64	Copper (29)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Cu-67		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Dy-159	Dysprosium (66)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Dy-165		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Dy-166		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Er-169	Erbium (68)	1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Er-171		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-147	Europium (63)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-148		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-149		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Eu-150 (short lived)		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-150 (long lived)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-152		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-152m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-154		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Eu-155		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Eu-156		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
F-18	Fluorine (9)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Fe-52	Iron (26)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Fe-55		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁶	2.7X10 ⁻⁵
Fe-59		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Fe-60		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Ga-67	Gallium (31)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ga-68		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Ga-72		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Gd-146	Gadolinium (64)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Gd-148		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Gd-153		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Gd-159		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Ge-68	Germanium (32)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Ge-71		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁸	2.7X10 ⁻³
Ge-77		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Hf-172	Hafnium (72)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵

Hf-175		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Hf-181		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Hf-182		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Hg-194	Mercury (80)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Hg-195m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Hg-197		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Hg-197m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Hg-203		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Ho-166	Holmium (67)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁵	2.7X10 ⁻⁶
Ho-166m		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
I-123	Iodine (53)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
I-124		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
I-125		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
I-126		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
I-129		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
I-131		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
I-132		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
I-133		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
I-134		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
I-135		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
In-111	Indium (49)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
In-113m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
In-114m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
In-115m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ir-189	Iridium (77)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Ir-190		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Ir-192		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Ir-194		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
K-40	Potassium (19)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
K-42		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
K-43		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Kr-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	Magnesium (12)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Mn-52	Manganese (25)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Mn-53		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁹	2.7X10 ⁻²
Mn-54		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Mn-56		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Mo-93	Molybdenum (42)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁸	2.7X10 ⁻³
Mo-99		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
N-13	Nitrogen (7)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁹	2.7X10 ⁻²
Na-22	Sodium (11)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Na-24		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Nb-93m	Niobium (41)	1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Nb-94		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Nb-95		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Nb-97		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Nd-147	Neodymium (60)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Nd-149		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ni-59	Nickel (28)	1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁸	2.7X10 ⁻³
Ni-63		1.0X10 ⁵	2.7X10 ⁻⁶	1.0X10 ⁸	2.7X10 ⁻³
Ni-65		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Np-235	Neptunium (93)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Np-236 (short-lived)		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Np-236 (long-lived)		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Np-237 (b)		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Np-239		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Os-185	Osmium (76)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Os-191		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Os-191m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Os-193		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵

Os-194		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
P-32	Phosphorus (15)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁵	2.7X10 ⁻⁶
P-33		1.0X10 ⁵	2.7X10 ⁻⁶	1.0X10 ⁸	2.7X10 ⁻³
Pa-230	Protactinium (91)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Pa-231		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Pa-233		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Pb-201	Lead (82)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Pb-202		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Pb-203		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Pb-205		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Pb-210 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Pb-212 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Pd-103	Palladium (46)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁸	2.7X10 ⁻³
Pd-107		1.0X10 ⁵	2.7X10 ⁻⁶	1.0X10 ⁸	2.7X10 ⁻³
Pd-109		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Pm-143	Promethium (61)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Pm-144		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Pm-145		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Pm-147		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Pm-148m		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Pm-149		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Pm-151		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Po-210	Polonium (84)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Pr-142	Praseodymium (59)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Pr-143		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁶	2.7X10 ⁻⁵
Pt-188	Platinum (78)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Pt-191		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Pt-193		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Pt-193m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Pt-195m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Pt-197		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Pt-197m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Pu-236	Plutonium (94)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Pu-237		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Pu-238		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Pu-239		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷

Pu-240		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Pu-241		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Pu-242		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Pu-244		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Ra-223 (b)	Radium (88)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Ra-224 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Ra-225		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Ra-226 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Ra-228 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Rb-81	Rubidium (37)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Rb-83		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Rb-84		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Rb-86		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Rb-87		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Rb(nat)		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Re-184	Rhenium (75)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Re-184m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Re-186		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Re-187		1.0X10 ⁶	2.7X10 ⁻⁵	1.0X10 ⁹	2.7X10 ⁻²
Re-188		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Re-189		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Re(nat)		1.0X10 ⁶	2.7X10 ⁻⁵	1.0X10 ⁹	2.7X10 ⁻²
Rh-99	Rhodium (45)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Rh-101		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Rh-102		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Rh-102m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Rh-103m		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁸	2.7X10 ⁻³
Rh-105		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Rn-222 (b)	Radon (86)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁸	2.7X10 ⁻³
Ru-97	Ruthenium (44)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Ru-103		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Ru-105		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Ru-106 (b)		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
S-35	Sulphur (16)	1.0X10 ⁵	2.7X10 ⁻⁶	1.0X10 ⁸	2.7X10 ⁻³
Sb-122	Antimony (51)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁴	2.7X10 ⁻⁷
Sb-124		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵

Sb-125		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Sb-126		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Sc-44	Scandium (21)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Sc-46		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Sc-47		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Sc-48		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Se-75	Selenium (34)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Se-79		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Si-31	Silicon (14)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Si-32		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Sm-145	Samarium (62)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Sm-147		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Sm-151		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁸	2.7X10 ⁻³
Sm-153		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Sn-113	Tin (50)	1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Sn-117m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Sn-119m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Sn-121m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Sn-123		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Sn-125		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Sn-126		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Sr-82	Strontium (38)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Sr-85		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Sr-85m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Sr-87m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Sr-89		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Sr-90 (b)		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁴	2.7X10 ⁻⁷
Sr-91		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Sr-92		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
T(H-3)	Tritium (1)	1.0X10 ⁶	2.7X10 ⁻⁵	1.0X10 ⁹	2.7X10 ⁻²
Ta-178 (long-lived)	Tantalum (73)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Ta-179		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Ta-182		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Tb-157	Terbium (65)	1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Tb-158		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵

Tb-160		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Tc-95m	Technetium (43)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Tc-96		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Tc-96m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Tc-97		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁸	2.7X10 ⁻³
Tc-97m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Tc-98		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Tc-99		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
Tc-99m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Te-121	Tellurium (52)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Te-121m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 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		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Te-129		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Te-129m		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Te-131m		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Te-132		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Th-227	Thorium (90)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
Th-228 (b)		1.0	2.7X10 ⁻¹¹	1.0X10 ⁴	2.7X10 ⁻⁷
Th-229 (b)		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 (b)		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁵	2.7X10 ⁻⁶
Th (nat) (b)		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
Ti-44	Titanium (22)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
Tl-200	Thallium (81)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Tl-201		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Tl-202		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Tl-204		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁴	2.7X10 ⁻⁷
Tm-167	Thulium (69)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Tm-170		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Tm-171		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁸	2.7X10 ⁻³
U-230 (fast lung	Uranium (92)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶

absorption) (b),(d)					
U-230 (medium lung absorption) (e)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
U-230 (slow lung absorption) (f)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
U-232 (fast lung absorption) (b),(d)		1.0	2.7X10 ⁻¹¹	1.0X10 ³	2.7X10 ⁻⁸
U-232 (medium lung absorption) (e)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
U-232 (slow lung absorption) (f)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
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 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
U-233 (slow lung absorption) (f)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
U-234 (fast lung absorption) (d)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
U-234 (medium lung absorption) (e)		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
U-234 (slow lung absorption) (f)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶
U-235 (all lung absorption types) (b),(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 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
U-236 (slow lung absorption) (f)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
U-238 (all lung absorption types) (b),(d),(e),(f)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁴	2.7X10 ⁻⁷
U (nat) (b)		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	Tungsten (74)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
W-181		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
W-185		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁷	2.7X10 ⁻⁴
W-187		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
W-188		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Xe-122	Xenon (54)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁹	2.7X10 ⁻²
Xe-123		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁹	2.7X10 ⁻²
Xe-127		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁵	2.7X10 ⁻⁶
Xe-131m		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁴	2.7X10 ⁻⁷
Xe-133		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁴	2.7X10 ⁻⁷
Xe-135		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ¹⁰	2.7X10 ⁻¹
Y-87	Yttrium (39)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Y-88		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Y-90		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁵	2.7X10 ⁻⁶
Y-91		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁶	2.7X10 ⁻⁵
Y-91m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Y-92		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Y-93		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁵	2.7X10 ⁻⁶
Yb-169	Ytterbium (70)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁷	2.7X10 ⁻⁴
Yb-175		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Zn-65	Zinc (30)	1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Zn-69		1.0X10 ⁴	2.7X10 ⁻⁷	1.0X10 ⁶	2.7X10 ⁻⁵
Zn-69m		1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Zr-88	Zirconium (40)	1.0X10 ²	2.7X10 ⁻⁹	1.0X10 ⁶	2.7X10 ⁻⁵
Zr-93 (b)		1.0X10 ³	2.7X10 ⁻⁸	1.0X10 ⁷	2.7X10 ⁻⁴
Zr-95		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁶	2.7X10 ⁻⁵
Zr-97 (b)		1.0X10 ¹	2.7X10 ⁻¹⁰	1.0X10 ⁵	2.7X10 ⁻⁶

^a [Reserved]

^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, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

^c [Reserved]

^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 notes (d) and (e) of this table.

^g These values apply to unirradiated uranium only.

TABLE A-3—GENERAL VALUES FOR A₁ AND A₂

Contents	A ₁		A ₂		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)
	(TBq)	(Ci)	(TBq)	(Ci)				
Only beta or gamma	1 x 10 ⁻¹	2.7 x 10 ⁰	2 x 10 ⁻²	5.4 x 10 ⁻¹	1 x 10 ¹	2.7 x10 ⁻¹⁰	1 x 10 ⁴	2.7 x10 ⁻⁷

emitting radionuclides are known to be present								
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 A-4—ACTIVITY-MASS RELATIONSHIPS FOR URANIUM

Uranium Enrichment ¹ 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}	5.8×10^{-5}
93	2.6×10^{-6}	7.0×10^{-5}
95	3.4×10^{-6}	9.1×10^{-5}

¹ The figures for uranium include representative values for the activity of the uranium-234 that is concentrated during the enrichment process.

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