



STATE OF MAINE
DEPARTMENT OF HUMAN SERVICES
DIVISION OF HEALTH ENGINEERING
10 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0010

ANGUS S. KING, JR.
GOVERNOR

KEVIN W. CONCANNON
COMMISSIONER

January 7, 2002

To: All Maine Specific License Holders
ACR Members/Consultants/OSTP-NRC

From: Shawn Seeley, Senior Radioactive Materials Inspector
Maine Radiation Control Program

Re: 2002 Rulemaking

Enclosed please find the proposed changes to the State of Maine Rules Relating to Radiation Protection (Parts C, D, E, J, K & L). There will be a public hearing on these proposed rules on January 28, 2002 from 9:00 am – Noon at the DHS offices at 219 Capital Street, Augusta. The comment period for written comments is by the close of business on February 8, 2002. As a reminder, all comments must be submitted to this office in writing to be valid. If you have any questions, do not hesitate to contact this office at 207-287-5676. Thank you.



PRINTED ON RECYCLED PAPER

SP05
1/1

- (b) 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 contained in Appendix C of this Part. A parent company guarantee may not be used in combination with other financial methods to satisfy the requirements of this section. A guarantee of funds by the applicant or licensee for decommissioning costs based on a financial test are as contained in Appendix D of this Part. A guarantee by the applicant or licensee may not be used in combination with any other financial methods to satisfy the requirements of this section or in any other 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 must contain the following conditions:
- (i) The surety 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 Agency, the beneficiary, and the licensee of its intention not to renew. The surety or insurance must also provide that the beneficiary may automatically collect prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Agency within 30 days after receipt of notification of cancellation.
 - (ii) The beneficiary of the surety or insurance must be a trustee acceptable to the Agency such as an appropriate state or Federal government agency or a major financial organization.
 - (iii) The surety or insurance must remain in effect until the Agency has terminated the license.
- (c) 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 the periodic deposit of a prescribed amount into an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of the periodic deposits plus accumulated earnings would be sufficient to pay the necessary 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.
- (d) In the case of State, or local government licensees, a certification that the appropriate government entity will be guarantor of funds.
- (e) Other funding methods, which are demonstrated by the applicant or licensee to provide comparable assurance to methods, listed in paragraphs (4)(a) through (c) of this section.
- (f) Each person licensed under this Part shall keep records of information important to the safe and effective decommissioning of the facility in an identified location until the license is terminated by the Agency. Before licensed activities are transferred or assigned in accordance with this Part, licensees shall transfer all records described in this paragraph to the new licensee. If records of relevant information are kept for other purposes, reference to these records and their locations may be used. Information the Agency considers important to decommissioning consists of:
- (i) 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.

- 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 of 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.
- D. The Agency may terminate a specific license upon request submitted by the licensee to the Agency in writing.

23. 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 Agency; or
- (2) Deliberately submit to the Agency, 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 Agency.

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 Part 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 Agency; 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.

RECIPROCITY

2324. Reciprocal Recognition of Licenses.

A. Licenses of Byproduct, Source, and Special Nuclear Material in Quantities Not Sufficient to Form a Critical Mass.

- (1) Subject to these regulations, any person who holds a specific license from the U.S. Nuclear Regulatory Commission or any Agreement State, and issued by the agency having jurisdiction where the licensee maintains an office for directing the licensed activity and at which radiation safety records are normally maintained, is hereby granted a general license to conduct the activities authorized in such licensing document within this State provided that:
 - (a) the licensing document does not limit the activity authorized by such document to specified installations or locations;

C.24.A.(1)(b)

- (b) the out-of-state licensee notifies the Agency in writing at least 3 working days prior to engaging in such activity and receive Agency approval. Such notification shall indicate the location, period, and type of proposed possession and use within the State, and shall be accompanied by a copy of the pertinent licensing document and HHE form 865. If, for a specific case, the 3 working day period would impose an undue hardship on the out-of-state licensee, he may, upon application to the Agency, obtain permission to proceed sooner. The Agency requires that the applicable Maine annual license fee accompany the initial request for reciprocity (see table 1 to appendix A of this part). This reciprocity fee will cover a period of one year from the time of application, at which time a new fee submittal will be required. This requirement does not waive the requirement for filing additional written notifications during the remainder of the calendar year following the receipt of the initial notification from a person engaging in activities under the general license provided in C.23.A(1).
 - (c) the out-of-state licensee complies with all applicable regulations of the Agency and with all the terms and conditions of his licensing document, except any such terms and conditions which may be inconsistent with applicable regulations of the Agency;
 - (d) the out-of-state licensee supplies such other information as the Agency may request; and
 - (e) the out-of-state licensee shall not transfer or dispose of radioactive material possessed or used under the general license provided in C.23.A(1) except by transfer to a person:
 - (i) specifically licensed by the Agency or by the U.S. Nuclear Regulatory Commission to receive such material, or
 - (ii) exempt from the requirements for a license for such material under C.3.
- (2) Notwithstanding the provisions of C.23.A(1), any person who holds a specific license issued by the U.S. Nuclear Regulatory Commission or an Agreement State authorizing the holder to manufacture, transfer, install, or service a device described in C.6.B(1) within areas subject to the jurisdiction of the licensing body is hereby granted a general license to install, transfer, demonstrate or service such a device in this State provided that:
- (a) the device has been manufactured, labeled, installed, and serviced in accordance with applicable provisions of the specific license issued to such person by the U.S. Nuclear Regulatory Commission or an Agreement State;
 - (b) such person shall assure that any labels required to be affixed to the device under regulations of the authority, which licensed manufacture of the device, bear a statement that "Removal of this label is prohibited";
 - (c) Such person shall file Agency Form HHE 867 "Registration Certificate – Service of Generally Licensed devices". The form shall be submitted within 30 days after the first entry or 30 days after the effective date of these regulations for persons in state prior to the effective date. The general licensee shall furnish such information as may be required by that form as well as the annual fee referenced in Appendix A of this Part. This registration fee will cover a period of one year from the time of application, at which time a new fee submittal will be required.
- (3) The Agency may withdraw, limit, or qualify its acceptance of any specific license or equivalent licensing document issued by another agency the U.S. Nuclear Regulatory Commission or an Agreement State, or any product distributed pursuant to such licensing document, upon determining that such action is necessary in order to prevent undue hazard to public health and safety or property.

B. Licenses of Naturally Occurring and Accelerator-Produced Radioactive Material.

- (1) Subject to these regulations, any person who holds a specific license from any Licensing State, and issued by the agency having jurisdiction where the licensee maintains an office for directing the licensed activity and at which radiation safety records are normally maintained, is hereby granted a general license to conduct the activities authorized in such licensing document within this State provided that:
- (a) the licensing document does not limit the activity authorized by such document to specified installations or locations;
 - (b) the out-of-state licensee notifies the Agency in writing at least 3 working days prior to engaging in such activity and receive Agency approval. Such notification shall indicate the location, period, and type of proposed possession and use within the State, and shall be accompanied by a copy of the pertinent licensing document and HHE form 865. If, for a specific case, the 3 working day period would impose an undue hardship on the out-of-state licensee, he may, upon application to the Agency, obtain permission to proceed sooner. The Agency requires that the applicable Maine annual license fee accompany the initial request for reciprocity (see table 1 to appendix A of this part). This reciprocity fee will cover a period of one year from the time of application, at which time a new fee submittal will be required. This requirement does not waive the requirement for filing additional written notifications during the remainder of the calendar year following the receipt of the initial notification from a person engaging in activities under the general license provided in C.23.B(1).
 - (c) the out-of-state licensee complies with all applicable regulations of the Agency and with all the terms and conditions of his licensing document, except any such terms and conditions which may be inconsistent with applicable regulations of the Agency;
 - (d) the out-of-state licensee supplies such other information as the Agency may request; and
 - (e) the out-of-state licensee shall not transfer or dispose of radioactive material possessed or used under the general license provided in C.23.B(1) except by transfer to a person:
 - (i) specifically licensed by the Agency or by another Licensing State to receive such material, or
 - (ii) exempt from the requirements for a license for such material under C.3.
- (2) Notwithstanding the provisions of C.23.B(1), any person who holds a specific license issued by a Licensing State authorizing the holder to manufacture, transfer, install, or service a device described in C.6.B(1) within areas subject to the jurisdiction of the licensing body is hereby granted a general license to install, transfer, demonstrate or service such a device in this State provided that:
- (a) The device has been manufactured, labeled, installed, and serviced in accordance with applicable provisions of the specific license issued to such person by a Licensing State;
 - (b) Such person shall assure that any labels required to be affixed to the device under regulations of the authority which licensed manufacture of the device bear a statement that "Removal of this label is prohibited"; and
 - (c) Such person shall file Agency Form HHE 867 "Registration Certificate – Service of Generally Licensed devices". The form shall be submitted within 30 days after the first entry or 30 days after the effective date of these regulations for persons in state prior to the effective date. The general licensee shall furnish such information as may be required by that form as well as the annual fee referenced in Appendix A of this Part. This registration fee will cover a period of one year from the time of application, at which time a new fee submittal will be required.

- (5) "Derived air concentration-hour" (DAC-hour) means the product of the concentration of radioactive material in air, expressed as a fraction or multiple of the derived air concentration for each radionuclide, and the time of exposure to that radionuclide, in hours. A licensee or registrant may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 0.05 Sv (5-rem).
- (6) "Dosimetry processor" means an individual or an organization that processes and evaluates individual monitoring devices in order to determine the radiation dose delivered to the monitoring devices.
- (7) "Inhalation class" [see "Class"].
- (8) "Lung class" [see "Class"].
- (9) "Nonstochastic effect" means a health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect. For purposes of these regulations, "deterministic effect" is an equivalent term.
- (10) "Planned special exposure" means an infrequent exposure to radiation, separate from and in addition to the annual occupational dose limits.
- (11) "Quarter" means a period of time equal to one-fourth of the year observed by the licensee, approximately 13 consecutive weeks, providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.
- (12) "Reference Man" means a hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of the Reference Man is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man."
- (13) "Respiratory protection device" means an apparatus, such as a respirator, used to reduce the individual's intake of airborne radioactive materials.
- (1314) "Sanitary sewerage" means a system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee or registrant.
- (1415) "Stochastic effect" means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects. For purposes of these regulations, "probabilistic effect" is an equivalent term.
- (1516) "Very high radiation area" means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 500 rads (5 Gy) in 1 hour at 1 meter from a source of radiation or 1 meter from any surface that the radiation penetrates.^{1/}

^{1/} At very high doses received at high dose rates, units of absorbed dose, gray and rad, are appropriate, rather than units of dose equivalent, sievert and rem.

(4617) "Weighting factor" w_T for an organ or tissue (T) means the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of w_T are:

ORGAN DOSE WEIGHTING FACTORS

<u>Organ/Tissue</u>	<u>w_T</u>
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
<u>Remainder</u>	<u>0.30^a</u>
Whole Body	1.00^b

- a 0.30 results from 0.06 for each of 5 "remainder" organs, excluding the skin and the lens of the eye, that receive the highest doses.
- b For the purpose of weighting the external whole body dose, for adding it to the internal dose, a single weighting factor, $w_T = 1.0$, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

4. Implementation.

- A. Any existing license or registration condition that is more restrictive than Part D remains in force until there is an amendment or renewal of the license or registration.
- B. If a license or registration condition exempts a licensee or registrant from a provision of Part D in effect on or before January 1, 1994, it also exempts the licensee or registrant from the corresponding provision of Part D.
- C. If a license or registration condition cites provisions of Part D in effect prior to January 1, 1994, which do not correspond to any provisions of Part D, the license or registration condition remains in force until there is an amendment or renewal of the license or registration that modifies or removes this condition.

RADIATION PROTECTION PROGRAMS

5. Radiation Protection Programs.

- A. Each licensee or registrant shall develop, document, and implement a radiation protection program sufficient to ensure compliance with the provisions of Part D. See D.41 for record keeping requirements relating to these programs.
- B. The licensee or registrant shall use, to the extent practicable/practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA).
- C. The licensee or registrant shall periodically (at least annually), review the radiation protection program content and implementation.

G. The licensee or registrant records the best estimate of the dose resulting from the planned special exposure in the individual's record and informs the individual, in writing, of the dose within 30 days from the date of the planned special exposure. The dose from planned special exposures shall not be considered in controlling future occupational dose of the individual pursuant to D.6.A but shall be included in evaluations required by D.11.D and E.

12. Occupational Dose Limits for Minors. The annual occupational dose limits for minors are 10 percent of the annual occupational dose limits specified for adult workers in D.6.

13. Dose to an Embryo/Fetus.

- A. The licensee or registrant shall ensure that the dose equivalent to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 5 mSv (0.5 rem). See D.46 for record keeping requirements.
- B. The licensee or registrant shall make efforts to avoid substantial variation^{2/} above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in D.13.A.
- C. The dose equivalent to an embryo/fetus shall be taken as the sum of:
- (1) The deep dose equivalent to the declared pregnant woman; and
 - (2) The dose equivalent to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.
- D. If by the time the woman declares pregnancy to the licensee or registrant, the dose to the embryo/fetus has exceeded 4.5 mSv (0.45 rem), the licensee or registrant shall be deemed to be in compliance with D.13.A if the additional dose to the embryo/fetus does not exceed 0.5 mSv (0.05 rem) during the remainder of the pregnancy. If the dose equivalent to the embryo/fetus is found to have exceeded 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares her pregnancy to the licensee or registrant, the licensee or registrant shall be deemed to be in compliance with paragraph A of this section if the additional dose equivalent does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy.

RADIATION DOSE LIMITS FOR INDIVIDUAL MEMBERS OF THE PUBLIC

14. Dose Limits for Individual Members of the Public.

- A. Each licensee or registrant shall conduct operations so that:
- (1) The total effective dose equivalent to individual members of the public from the licensed or registered operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contribution from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with G.27, from voluntary participation in medical research programs, and from the licensee's or registrant's disposal of radioactive material into sanitary sewerage in accordance with D.35,^{3/} and

^{2/} The National Council on Radiation Protection and Measurements recommended in NCRP Report No. 91 "Recommendations on Limits for Exposure to Ionizing Radiation" (June 1, 1987) that no more than 0.5 mSv (0.05 rem) to the embryo/fetus be received in any one month.

^{3/} Retrofit shall not be required for locations within facilities where only radiation machines existed prior to January 1, 1994 and met the previous requirements of 5 mSv (0.5 rem) in a year.

23. Use of Other Controls.

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

1. Control of access; or
2. Limitation of exposure times; or
3. Use of respiratory protection equipment; or
4. Other controls.

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

24. Use of Individual Respiratory Protection Equipment.

A. If the licensee or registrant assigns or permits the use respiratory protection equipment to limit the intake of radioactive material pursuant to D.23,

- (1) Except as provided in D.24.A(2), the licensee or registrant shall use only respiratory protection equipment that is tested and certified by the National Institute for Occupational Safety and Health (NIOSH).
- (2) If the licensee or registrant wishes to use equipment that has not been tested or certified by the National Institute for Occupational Safety and Health, the licensee or registrant shall submit an application for authorized use of that equipment, including a demonstration by testing, or a demonstration on the basis of reliable test information, that the material and performance characteristics of the equipment are capable of providing the proposed degree of protection under anticipated conditions of use. This must be demonstrated either by licensee testing or on the basis of reliable test information.
- (3) The licensee or registrant shall implement and maintain a respiratory protection program that includes:
 - (a) Air sampling sufficient to identify the potential hazard, permit proper equipment selection, and estimate doses; Note: In those cases where air sampling is difficult or even impossible, the exposure can be calculated based upon the known chemicals and ventilation rates; and
 - (b) Surveys and bioassays, as appropriate, to evaluate actual intakes; and
 - (c) Testing of respirators for operability (user seal check for face sealing devices and functional check for others) immediately prior to each use; and
 - (d) Written procedures regarding respirator selection, fit testing, storage, issuance, maintenance, repair, testing of respirators, including testing for operability immediately prior to each use; quality assurance of respiratory protection equipment supervision and training of respirator users; monitoring, including air sampling and bioassays; breathing air quality, inventory and control, and recordkeeping; and limitations on periods of respirator use and relief from respirator use; and

APPENDIX D

Appendix D

Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests

I. Manifest

- A. A waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a Manifest reflecting information requested on applicable Agency Forms (or other equivalent NRC, Licensing State or Agreement State approved forms) HHE-846 (Uniform Low-Level Radioactive Waste Manifest (Shipping Paper)) and HHE-847 (Uniform Low-Level Radioactive Waste Manifest (Container and Waste Description)) and, if necessary, on an applicable Agency Form HHE-848 (Uniform Low-Level Radioactive Waste Manifest (Manifest Index and Regional Compact Tabulation)). Agency Forms HHE-846 and HHE-846A must be completed and must physically accompany the pertinent low-level waste shipment. Upon agreement between shipper and consignee, Agency Forms HHE-847, HHE-847A, HHE-848 and HHE-848A may be completed, transmitted, and stored in electronic media with the capability for producing legible, accurate, and complete records on the respective forms. Licensees are not required by Agency to comply with the manifesting requirements of this part when they ship:
1. LLW for processing and expect its return (i.e., for storage under their license) prior to disposal at a licensed land disposal facility;
 2. LLW that is being returned to the licensee who is the "waste generator" or "generator," as defined in this part; or
 3. Radioactively contaminated material to a "waste processor" that becomes the processor's "residual waste."
- B. For guidance in completing these forms, refer to the instructions that accompany the forms. Copies of manifests required by this appendix may be legible carbon copies, photocopies, or computer printouts that reproduce the data in the format of the uniform manifest.
- C. Agency Forms HHE-846, HHE-846A, HHE-847, HHE-847A, HHE-848 and HHE-848A, and the accompanying instructions, in hard copy, may be obtained from the Maine Radiation Control Program, 10 SHS, Augusta, Maine 04333-0010
- D. This appendix includes information requirements of the Department of Transportation, as codified in 49 CFR part 172. Information on hazardous, medical, or other waste, required to meet Environmental Protection Agency regulations, as codified in 40 CFR parts 259, 261 or elsewhere, is not addressed in this section, and must be provided on the required EPA forms. However, the required EPA forms must accompany the Uniform Low-Level Radioactive Waste Manifest required by this appendix.
- E. As used in this appendix, the following definitions apply:
1. Agency Forms HHE-846, HHE-846A, HHE-847, HHE-847A, HHE-848 and HHE-848A are official Agency Forms referenced in this appendix. Licensees need not use originals of these Agency Forms as long as any substitute forms are equivalent to the original documentation in respect to content, clarity, size, and location of information. Upon agreement between the shipper and consignee, Agency Forms HHE-847 (and HHE-847A) and Agency Forms HHE-848 (and HHE-848A) may be completed, transmitted, and stored in electronic media. The electronic media must have the capability for producing legible, accurate, and complete records in the format of the uniform manifest.

2. Chemical description means a description of the principal chemical characteristics of a low-level radioactive waste.
3. Computer-readable medium means that the regulatory agency's computer can transfer the information from the medium into its memory.
4. Consignee means the designated receiver of the shipment of low-level radioactive waste.
5. Decontamination facility means a facility operating under a Commission or Agreement State license whose principal purpose is decontamination of equipment or materials to accomplish recycle, reuse, or other waste management objectives, and, for purposes of this part, is not considered to be a consignee for LLW shipments.
6. Disposal container means a container principally used to confine low-level radioactive waste during disposal operations at a land disposal facility (also see "high integrity container"). Note that for some shipments, the disposal container may be the transport package.
7. EPA identification number means the number received by a transporter following application to the Administrator of EPA as required by 40 CFR part 263.
8. Generator means a licensee operating under a Commission or Agreement State license who:
 - (a) is a waste generator as defined in this part, or
 - (b) is the licensee to whom waste can be attributed within the context of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (e.g., waste generated as a result of decontamination or recycle activities).
9. High integrity container (HIC) means a container commonly designed to meet the structural stability requirements of section V of this appendix, and to meet Department of Transportation requirements for a Type A package.
10. Land disposal facility means the land, buildings and structures, and equipment, which are intended to be used for the disposal of radioactive wastes. For purposes of this chapter, a "geologic repository" is not considered a "land disposal facility."
11. Package means the assembly of components necessary to ensure compliance with the packaging requirements of DOT regulations, together with its radioactive contents, as presented for transport.
12. Physical description means the items called for on Agency Form HHE-847 to describe a low-level radioactive waste.
13. Residual waste means low-level radioactive waste resulting from processing or decontamination activities that cannot be easily separated into distinct batches attributable to specific waste generators. This waste is attributable to the processor or decontamination facility, as applicable.
14. Shipper means the licensed entity (i.e., the waste generator, waste collector, or waste processor) who offers low-level radioactive waste for transportation, typically consigning this type of waste to a licensed waste collector, waste processor, or land disposal facility operator.
15. Shipping paper means Agency Form HHE-846 and, if required, Agency Form HHE-846A, which includes the information, required by DOT in 49 CFR part 172.
16. Uniform Low-Level Radioactive Waste Manifest or uniform manifest means the combination of Agency Forms HHE-846, HHE-847, and, if necessary, HHE-848, and their respective continuation sheets as needed, or equivalent.

17. Waste collector means an entity, operating under a Commission or Agreement State license, whose principal purpose is to collect and consolidate waste generated by others, and to transfer this waste, without processing or repackaging the collected waste, to another licensed waste collector, licensed waste processor, or licensed land disposal facility.
18. Waste description means the physical, chemical and radiological description of a low-level radioactive waste as called for on Agency Form HHE-847.
19. Waste generator means an entity, operating under a Commission or Agreement State license, who
- (a) possesses any material or component that contains radioactivity or is radioactively contaminated for which the licensee foresees no further use, and
 - (b) transfers this material or component to a licensed land disposal facility or to a licensed waste collector or processor for handling or treatment prior to disposal. A licensee performing processing or decontamination services may be a "waste generator" if the transfer of low-level radioactive waste from its facility is defined as "residual waste."
20. Waste processor means an entity, operating under a Commission or Agreement State license, whose principal purpose is to process, repackage, or otherwise treat low-level radioactive material or waste generated by others prior to eventual transfer of waste to a licensed low-level radioactive waste land disposal facility.
21. Waste type means a waste within a disposal container having a unique physical description (i.e., a specific waste descriptor code or description; or a waste sorbed on or solidified in a specifically defined media).

II. Information Requirements

A. General Information: The shipper of the radioactive waste, shall provide the following information on the uniform manifest:

1. The name, facility address, and telephone number of the licensee shipping the waste;
2. An explicit declaration indicating whether the shipper is acting as a waste generator, collector, processor, or a combination of these identifiers for purposes of the manifested shipment; and
3. The name, address, and telephone number, or the name and EPA identification number for the carrier transporting the waste.

B. Shipment Information: The shipper of the radioactive waste shall provide the following information regarding the waste shipment on the uniform manifest:

1. The date of the waste shipment;
2. The total number of packages/disposal containers;
3. The total disposal volume and disposal weight in the shipment;
4. The total radionuclide activity in the shipment;
5. The activity of each of the radionuclides H-3, C-14, Tc-99, and I-129 contained in the shipment; and
6. The total masses of U-233, U-235, and plutonium in special nuclear material, and the total mass of uranium and thorium in source material.

C. Disposal Container and Waste Information: The shipper of the radioactive waste shall provide the following information on the uniform manifest regarding the waste and each disposal container of waste in the shipment:

1. An alphabetic or numeric identification that uniquely identifies each disposal container in the shipment;
2. A physical description of the disposal container, including the manufacturer and model of any high integrity container;

3. The volume displaced by the disposal container;
4. The gross weight of the disposal container, including the waste;
5. For waste consigned to a disposal facility, the maximum radiation level at the surface of each disposal container;
6. A physical and chemical description of the waste;
7. The total weight percentage of chelating agent for any waste containing more than 0.1% chelating agent by weight, plus the identity of the principal chelating agent;
8. The approximate volume of waste within a container;
9. The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name;
10. The identities and activities of individual radionuclides contained in each container, the masses of U-233, U-235, and plutonium in special nuclear material, and the masses of uranium and thorium in source material. For discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed source/devices, and wastes in solidification/stabilization media), the identities and activities of individual radionuclides associated with or contained on these waste types within a disposal container shall be reported;
11. The total radioactivity within each container; and
12. For wastes consigned to a disposal facility, the classification of the waste pursuant to section V of this appendix. Waste not meeting the structural stability requirements of section VI.B. of this appendix must be identified.

D. Uncontainerized Waste Information: The shipper of the radioactive waste shall provide the following information on the uniform manifest regarding a waste shipment delivered without a disposal container:

1. The approximate volume and weight of the waste;
 2. A physical and chemical description of the waste;
 3. The total weight percentage of chelating agent if the chelating agent exceeds 0.1% by weight, plus the identity of the principal chelating agent;
 4. For waste consigned to a disposal facility, the classification of the waste pursuant to section V. of this appendix. Waste not meeting the structural stability requirements of section VI.B. of this appendix must be identified;
 5. The identities and activities of individual radionuclides contained in the waste, the masses of U - 233, U - 235, and plutonium in special nuclear material, and the masses of uranium and thorium in source material; and
 6. For wastes consigned to a disposal facility, the maximum radiation levels at the surface of the waste.

E. Multi-Generator Disposal Container Information: This section applies to disposal containers enclosing mixtures of waste originating from different generators. (Note: The origin of the LLW resulting from a processor's activities may be attributable to one or more "generators" (including "waste generators") as defined in this part). It also applies to mixtures of wastes shipped in an uncontainerized form, for which portions of the mixture within the shipment originate from different generators.

1. For homogeneous mixtures of waste, such as incinerator ash, provide the waste description applicable to the mixture and the volume of the waste attributed to each generator.
2. For heterogeneous mixtures of waste, such as the combined products from a large compactor, identify each generator contributing waste to the disposal container, and, for discrete waste types (i.e., activated materials, contaminated equipment, mechanical filters, sealed source/devices, and wastes in solidification/stabilization media), the identities and activities of individual radionuclides contained on these waste types within the disposal container. For each generator, provide the following:
 - (a) The volume of waste within the disposal container;
 - (b) A physical and chemical description of the waste, including the solidification agent, if any;
 - (c) The total weight percentage of chelating agents for any disposal container containing more than 0.1% chelating agent by weight, plus the identity of the principal chelating agent;
 - (d) The sorbing or solidification media, if any, and the identity of the solidification media vendor and brand name if the media is claimed to meet stability requirements in section VI.B. of this appendix; and
 - (e) Radionuclide identities and activities contained in the waste, the masses of U-233, U-235, and plutonium in special nuclear material, and the masses of uranium and thorium in source material if contained in the waste.

III. Certification: An authorized representative of the waste generator, processor, or collector shall certify by signing and dating the shipment manifest that the transported materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and the Agency. A collector in signing the certification is certifying that nothing has been done to the collected waste, which would invalidate the waste generator's certification.

IV. Control and Tracking:

A. Any licensee or registrant who transfers radioactive waste to a land disposal facility or a licensed waste collector shall comply with the requirements in paragraphs A.1 through 9 of this section. Any licensee or registrant who transfers waste to a licensed waste processor for waste treatment or repackaging shall comply with the requirements of paragraphs A.4 through 9 of this appendix. A licensee shall:

1. Prepare all wastes so that the waste is classified according to section V. of this appendix and meets the waste characteristics requirements in section VI. of this appendix;
2. Label each disposal container (or transport package if potential radiation hazards preclude labeling of the individual disposal container) of waste to identify whether it is Class A waste, Class B waste, Class C waste, or greater than Class C waste, in accordance with section V. of this appendix;
3. Conduct a quality assurance program to assure compliance with sections V. and VI. of this appendix (the program must include management evaluation of audits);
4. Prepare the Agency Uniform Low-Level Radioactive Waste Manifest as required by this appendix;
5. Forward a copy or electronically transfer the Uniform Low-Level Radioactive Waste Manifest to the intended consignee so that either

(a) receipt of the manifest precedes the LLW shipment or

(b) the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both (a) and (b) is also acceptable;

6. Include Agency Form HHE-846 (and Agency Form HHE-846A, if required) with the shipment regardless of the option chosen in paragraph A.5 of this section;
7. Receive acknowledgement of the receipt of the shipment in the form of a signed copy of Agency Form HHE-846;
8. Retain a copy of or electronically store the Uniform Low-Level Radioactive Waste Manifest and documentation of acknowledgement of receipt as the record of transfer of licensed material as required by these regulations; and
9. For any shipments or any part of a shipment for which acknowledgement of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with paragraph E of this appendix.

B. Any waste collector licensee who handles only prepackaged waste shall:

1. Acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of Agency Form HHE-846;
2. Prepare a new manifest to reflect consolidated shipments that meet the requirements of this appendix. The waste collector shall ensure that, for each container of waste in the shipment, the manifest identifies the generator of that container of waste;
3. Forward a copy or electronically transfer the Uniform Low-Level Radioactive Waste Manifest to the intended consignee so that either:

(a) Receipt of the manifest precedes the LLW shipment or

(b) the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both (a) and (b) is also acceptable;

4. Include Agency Form HHE-846 (and Agency Form HHE-846A, if required) with the shipment regardless of the option chosen in paragraph B.3 of this section;
5. Receive acknowledgement of the receipt of the shipment in the form of a signed copy of Agency Form HHE-846;

6. Retain a copy of or electronically store the Uniform Low-Level Radioactive Waste Manifest and documentation of acknowledgement of receipt as the record of transfer of licensed material as required by these regulations;
7. For any shipments or any part of a shipment for which acknowledgement of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with paragraph E of this section; and
8. Notify the shipper and the Agency when any shipment, or part of a shipment, has not arrived within 60 days after receipt of an advance manifest, unless notified by the shipper that the shipment has been cancelled.

C. Any licensed waste processor who treats or repackages waste shall:

1. Acknowledge receipt of the waste from the shipper within one week of receipt by returning a signed copy of Agency Form HHE-846;
2. Prepare a new manifest that meets the requirements of this appendix. Preparation of the new manifest reflects that the processor is responsible for meeting these requirements. For each container of waste in the shipment, the manifest shall identify the waste generators, the preprocessed waste volume, and the other information as required in paragraph I.E. of this appendix;
3. Prepare all wastes so that the waste is classified according to section V. of this appendix and meets the waste characteristics requirements in section VI. of this appendix;
4. Label each package of waste to identify whether it is Class A waste, Class B waste, or Class C waste, in accordance with sections V. and VI. of this appendix;
5. Conduct a quality assurance program to assure compliance with sections V. and VI. of this appendix (the program shall include management evaluation of audits);
6. Forward a copy or electronically transfer the Uniform Low-Level Radioactive Waste Manifest to the intended consignee so that either:
 - (a) Receipt of the manifest precedes the LLW shipment or
 - (b) the manifest is delivered to the consignee with the waste at the time the waste is transferred to the consignee. Using both (a) and (b) is also acceptable;
7. Include Agency Forms HHE-846 (and Agency Forms HHE-846A, if required) with the shipment regardless of the option chosen in paragraph C.6 of this section;
8. Receive acknowledgement of the receipt of the shipment in the form of a signed copy of Agency Forms HHE-846;
9. Retain a copy of or electronically store the Uniform Low-Level Radioactive Waste Manifest and documentation of acknowledgement of receipt as the record of transfer of licensed material as required by these regulations;
10. For any shipment or any part of a shipment for which acknowledgement of receipt has not been received within the times set forth in this appendix, conduct an investigation in accordance with paragraph E of this section; and
11. Notify the shipper and the Agency when any shipment, or part of a shipment, has not arrived within 60 days after receipt of an advance manifest, unless notified by the shipper that the shipment has been cancelled.

D. The land disposal facility operator shall:

1. Acknowledge receipt of the waste within one week of receipt by returning, as a minimum, a signed copy of Agency Forms HHE-846 to the shipper. The shipper to be notified is the licensee who last possessed the waste and transferred the waste to the operator. If any discrepancy exists between materials listed on the Uniform Low-Level Radioactive Waste Manifest and materials received, copies or electronic transfer of the affected forms must be returned indicating the discrepancy;
2. Maintain copies of all completed manifests and electronically store the information required by this Appendix until the Agency terminates the license; and
3. Notify the shipper and the Agency when any shipment, or part of a shipment, has not arrived within 60 days after receipt of an advance manifest, unless notified by the shipper that the shipment has been cancelled.

E. Any shipment or part of a shipment for which acknowledgement is not received within the times set forth in this section must:

1. Be investigated by the shipper if the shipper has not received notification or receipt within 20 days after transfer; and
2. Be traced and reported. The investigation shall include tracing the shipment and filing a report with the Agency. Each licensee who conducts a trace investigation shall file a written report with the Agency within 2 weeks of completion of the investigation.

V. Classification of Waste

A. Classification of waste for near surface disposal.

1. Considerations: Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.

2. Classes of waste.

- (a) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in VI.A. of this appendix. If Class A waste also meets the stability requirements set forth in VI.B. of this appendix, it is not necessary to segregate the waste for disposal.
- (b) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in section VI of this appendix.
- (c) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in section VI of this appendix.
- (d) Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in 10 CFR part 60 unless proposals for disposal of such waste in a disposal site licensed pursuant to 10 CFR Part 61 are approved by the Nuclear Regulatory Commission.

3 Classification determined by long-lived radionuclides. If radioactive waste contains only radionuclides listed in Table 1, classification shall be determined as follows:

- (a) If the concentration does not exceed 0.1 times the value in Table 1, the waste is Class A.
- (b) If the concentration exceeds 0.1 times the value in Table 1 but does not exceed the value in Table 1, the waste is Class C.
- (c) If the concentration exceeds the value in Table 1, the waste is not generally acceptable for near-surface disposal.
- (d) For wastes containing mixtures of radionuclides listed in Table 1, the total concentration shall be determined by the sum of fractions

Radionuclide	Concentration curies per cubic meter
C-14	8
C-14 in activated metal	80
Ni-59 in activated metal	220
Nb-94 in activated metal	0.2
Tc-99	3

I-129	0.08
Alpha emitting transuranic nuclides with half-life greater than 5 years	¹ 100
Pu-241	¹ 3,500
Cm-242	¹ 20,000

¹Units are nanocuries per gram.

4 Classification determined by short-lived radionuclides. If radioactive waste does not contain any of the radionuclides listed in Table 1, classification shall be determined based on the concentrations shown in Table 2. However, as specified in paragraph A.6. of this section, if radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

- (a) If the concentration does not exceed the value in Column 1, the waste is Class A.
- (b) If the concentration exceeds the value in Column 1, but does not exceed the value in Column 2, the waste is Class B.
- (c) If the concentration exceeds the value in Column 2, but does not exceed the value in Column 3, the waste is Class C.
- (d) If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.
- (e) For wastes containing mixtures of the nuclides listed in Table 2, the total concentration shall be determined by the sum of fractions rule

Radionuclide	Concentration, curies per cubic meter		
	Col. 1	Col. 2	Col. 3
Total of all nuclides with less than 5 year half-life	700	(¹)	(¹)
H-3	40	(¹)	(¹)
Co-60	700	(¹)	(¹)
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.0 4	150	7000
Cs-137	1	44	4600

¹ There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table 2 determine the waste to the Class C independent of these nuclides.

(5) Classification determined by both long- and short-lived radionuclides. If radioactive waste contains a mixture of radionuclides, some of which are listed in Table 1, and some of which are listed in Table 2, classification shall be determined as follows:

- (a) If the concentration of a nuclide listed in Table 1 does not exceed 0.1 times the value listed in Table 1, the class shall be that determined by the concentration of nuclides listed in Table 2.
- (b) If the concentration of a nuclide listed in Table 1 exceeds 0.1 times the value listed in Table 1 but does not exceed the value in Table 1, the waste shall be Class C, provided the concentration of nuclides listed in Table 2 does not exceed the value shown in Column 3 of Table 2.

(6) Classification of wastes with radionuclides other than those listed in Tables 1 and 2. If radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

(7) The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 50 Ci/m³. and Cs-137 in a concentration of 22 Ci/m³. Since the concentrations both exceed the values in Column 1, Table 2, they must be compared to Column 2 values. For Sr-90 fraction $50/150=0.33$; for Cs-137 fraction, $22/44=0.5$; the sum of the fractions= 0.83 . Since the sum is less than 1.0, the waste is Class B.

(8) Determination of concentrations in wastes. The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as nanocuries per gram.

VI. Waste characteristics.

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

1. Waste must not be packaged for disposal in cardboard or fiberboard boxes.
2. Liquid waste must be solidified or packaged in sufficient absorbent material to absorb twice the volume of the liquid.
3. Solid waste containing liquid shall contain as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume.
4. Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.
5. Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with paragraph A.7. of this section.
6. Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.
7. Waste in a gaseous form must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C. Total activity must not exceed 100 curies per container.
8. Waste containing hazardous, biological, pathogenic, or infectious material must be treated to reduce to the maximum extent practicable the potential hazard from the non-radiological materials.

B. The requirements in this section are intended to provide stability of the waste. Stability is intended to ensure that the waste does not structurally degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.

1. Waste must have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
2. Notwithstanding the provisions in VI.A.2 and 3, liquid wastes, or wastes containing liquid, must be converted into a form that contains as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5% of the volume of the waste for waste processed to a stable form.
3. Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.

VII. Labeling.

Each package of waste must be clearly labeled to identify whether it is Class A waste, Class B waste, or Class C waste, in accordance with section V of this appendix.

~~REQUIREMENTS FOR TRANSFER OF LOW LEVEL RADIOACTIVE WASTE FOR DISPOSAL AT LAND DISPOSAL FACILITIES AND MANIFESTS~~

~~1. Manifest~~

~~The shipment manifest shall contain the name, address, and telephone number of the person generating the waste. The manifest shall also include the name, address, and telephone number or the name and U.S. Environmental Protection Agency hazardous waste identification number of the person transporting the waste to the land disposal facility. The manifest shall also indicate: a physical description of the waste, the volume, radionuclide identity and quantity, the total radioactivity, and the principal chemical form. The solidification agent shall be specified. Waste containing more than 0.1% chelating agents by weight shall be identified and the weight percentage of the chelating agent estimated. Wastes classified as Class A, Class B, or Class C in Section 1 of Appendix E shall be clearly identified as such in the manifest. The total quantity of the radionuclides hydrogen-3, carbon-14, technetium-99, and iodine-129 shall be shown. The manifest required by this paragraph may be shipping papers used to meet U.S. Department of Transportation or U.S. Environmental Protection Agency regulations or requirements of the receiver, provided all the required information is included. Copies of manifests required by this section may be legible carbon copies or legible photocopies.~~

~~2. Certification~~

~~The waste generator shall include in the shipment manifest a certification that the transported materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the U.S. Department of Transportation and the Agency. An authorized representative of the waste generator shall sign and date the manifest.~~

~~3. Control and Tracking~~

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

- ~~(1) Prepare all wastes so that the waste is classified according to Section 1 of Appendix E and meets the waste characteristics requirements in Section 2 of Appendix E;~~
- ~~(2) Label each package of waste to identify whether it is Class A waste, Class B waste, or Class C waste, in accordance with Section 1 of Appendix E;~~
- ~~(3) Conduct a quality control program to ensure compliance with Section 1 and 2 of Appendix E; the program shall include management evaluation of audits;~~
- ~~(4) Prepare shipping manifests to meet the requirements of Section 1 and 2;~~
- ~~(5) Forward a copy of the manifest to the intended recipient, at the time of shipment, or deliver to a collector at the time the waste is collected, obtaining acknowledgment of receipt in the form of a signed copy of the manifest or equivalent documentation from the collector;~~
- ~~(6) Include one copy of the manifest with the shipment;~~

(7) Retain a copy of the manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by C.21 of these regulations; and

(8) For any shipments or any portion of a shipment for which acknowledgment of receipt has not been received within the times set forth in this section, conduct an investigation in accordance with Section 3.(e).

B. Any waste collector licensee who handles only prepackaged waste shall:

- (1) Acknowledge receipt of the waste from the generator within 1 week of receipt by returning a signed copy of the manifest or equivalent documentation;
- (2) Prepare a new manifest to reflect consolidated shipments; the new manifest shall serve as a listing or index for the detailed generator manifests. Copies of the generator manifests shall be a part of the new manifest. The waste collector may prepare a new manifest without attaching the generator manifests, provided the new manifest contains for each package the information specified in Section 1. The collector licensee shall certify that nothing has been done to the waste that would invalidate the generator's certification;
- (3) Forward a copy of the new manifest to the land disposal facility operator at the time of shipment;
- (4) Include the new manifest with the shipment to the disposal site;
- (5) Retain a copy of the manifest and documentation of acknowledgment of receipt as the record of transfer of licensed material as required by C.21 of these regulations, and retain information from generator manifest until disposition is authorized by the Agency; and
- (6) For any shipments or any portion of a shipment for which acknowledgment of receipt is not received within the times set forth in this section, conduct an investigation in accordance with Section 3.E.

C. Any licensed waste processor who treats or repackages wastes shall:

- (1) Acknowledge receipt of the waste from the generator within 1 week of receipt by returning a signed copy of the manifest or equivalent documentation;
- (2) Prepare a new manifest that meets the requirements of Section 1 and 2. Preparation of the new manifest reflects that the processor is responsible for the waste;
- (3) Prepare all wastes so that the waste is classified according to Section 1 of Appendix E and meets the waste characteristics requirements in Section 2 of Appendix E;
- (4) Label each package of waste to identify whether it is Class A waste, Class B waste, or Class C waste, in accordance with Section 1 and 3 of Appendix E;
- (5) Conduct a quality control program to ensure compliance with Section 1 and 2 of Appendix E. The program shall include management evaluation of audits;
- (6) Forward a copy of the new manifest to the disposal site operator or waste collector at the time of shipment, or deliver to a collector at the time the waste is collected, obtaining acknowledgment of receipt in the form of a signed copy of the manifest or equivalent documentation by the collector;
- (7) Include the new manifest with the shipment;
- (8) Retain copies of original manifests and new manifests and documentation of acknowledgment of receipt as the record of transfer of licensed material required by C.21 of these regulations; and
- (9) For any shipment or portion of a shipment for which acknowledgment is not received within the times set forth in this section, conduct an investigation in accordance with Section 3.E.

D. The land disposal facility operator shall:

- ~~(1) Acknowledge receipt of the waste within 1 week of receipt by returning a signed copy of the manifest or equivalent documentation to the shipper. The shipper to be notified is the licensee who last possessed the waste and transferred the waste to the operator. The returned copy of the manifest or equivalent documentation shall indicate any discrepancies between materials listed on the manifest and materials received;~~
- ~~(2) Maintain copies of all completed manifests or equivalent documentation until the Agency authorizes their disposition; and~~
- ~~(3) Notify the shipper, that is, the generator, the collector, or processor, and the Agency when any shipment or portion of a shipment has not arrived within 60 days after the advance manifest was received.~~

E. Any shipment or portion of a shipment for which acknowledgement is not received within the times set forth in this section shall:

- ~~(1) Be investigated by the shipper if the shipper has not received notification or receipt within 20 days after transfer; and~~
- ~~(2) Be traced and reported to whom. The investigation shall include tracing the shipment and filing a report with the Agency. Each licensee who conducts a trace investigation shall file a written report with the Agency within 2 weeks of completion of the investigation.~~

APPENDIX E

~~CLASSIFICATION AND CHARACTERISTICS OF LOW-LEVEL RADIOACTIVE WASTE~~

~~1. Classification of Radioactive Waste for Land Disposal~~

~~A. Considerations. Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.~~

~~B. Classes of waste.~~

~~(1) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in Section 2.A. If Class A waste also meets the stability requirements set forth in Section 2. B., it is not necessary to segregate the waste for disposal.~~

~~(2) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in Section 2.~~

~~(3) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in Section 2.~~

~~C. Classification determined by long-lived radionuclides. If the radioactive waste contains only radionuclides listed in Table I, classification shall be determined as follows:~~

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

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

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

~~(4) For wastes containing mixtures of radionuclides listed in Table I, the total concentration shall be determined by the sum of fractions rule described in Section 1.G.~~

APPENDIX E

CLASSIFICATION AND CHARACTERISTICS OF LOW-LEVEL RADIOACTIVE WASTE

1. Classification of Radioactive Waste for Land Disposal

A. Considerations. Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.

B. Classes of waste.

(1) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in Section 2.A. If Class A waste also meets the stability requirements set forth in Section 2. B., it is not necessary to segregate the waste for disposal.

(2) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in Section 2.

(3) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in Section 2.

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

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

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

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

(4) For wastes containing mixtures of radionuclides listed in Table I, the total concentration shall be determined by the sum of fractions rule described in Section 1.G.

TABLE I

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

^a To convert the Ci/m³ values to gigabecquerel (GBq) per cubic meter, multiply the Ci/m³ value by 37.

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

D. Classification determined by short lived radionuclides. If the waste does not contain any of the radionuclides listed in Table I, classification shall be determined based on the concentrations shown in Table II. However, as specified in Section 1.F., if radioactive waste does not contain any nuclides listed in either Table I or II, it is Class A.

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

H. Determination of concentrations in wastes. The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect method can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as becquerel (nanocurie) per gram.

G. The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each radionuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 1.85 TBq/m³ (50 Ci/m³) and Cs-137 in a concentration of 814 GBq/m³ (22 Ci/m³). Since the concentrations both exceed the values in Column 1, Table II, they must be compared to Column 2 values. For Sr-90 fraction, 50/150 = 0.33, for Cs-137 fraction, 22/44 = 0.5; the sum of the fractions = 0.83. Since the sum is less than 1.0, the waste is Class B.

F. Classification of wastes with radionuclides other than those listed in Tables I and II. If the waste does not contain any radionuclides listed in either Table I or II, it is Class A.

(2) If the concentration of a radionuclide listed in Table I exceeds 0.1 times the value listed in Table I, but does not exceed the value in Table I, the waste shall be Class C, provided the concentration of radionuclides listed in Table II does not exceed the value shown in Column 3 of Table II.

(1) If the concentration of a radionuclide listed in Table I is less than 0.1 times the value listed in Table I, the class shall be that determined by the concentration of radionuclides listed in Table II.

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

There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other radionuclides in Table II determine the waste to be Class C independent of these radionuclides.

* AGENCY NOTE: To convert the Ci/m³ value to gigabecquerel (GBq) per cubic meter, multiply the Ci/m³ value by 37.

Radionuclide	Column 1	Column 2	Column 3
Total of all radionuclides with less than 5-year half-life	700	*	*
H-3	40	*	*
Co-60	700	*	*
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.01	150	7000
Cs-137	1	44	4600

TABLE II

2. Radioactive Waste Characteristics

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

- (1) Wastes shall be packaged in conformance with the conditions of the license issued to the site operator to which the waste will be shipped. Where the conditions of the site license are more restrictive than the provisions of Part D, the site license conditions shall govern.
- (2) Wastes shall not be packaged for disposal in cardboard or fiberboard boxes.
- (3) Liquid waste shall be packaged in sufficient absorbent material to absorb twice the volume of the liquid.
- (4) Solid waste containing liquid shall contain as little freestanding and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume.
- (5) Waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.
- (6) Waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with Section 2.A.(8).
- (7) Waste must not be pyrophoric. Pyrophoric materials contained in wastes shall be treated, prepared, and packaged to be nonflammable.^{8/}
- (8) Wastes in a gaseous form shall be packaged at an absolute pressure that does not exceed 1.5 atmospheres at 20°C. Total activity shall not exceed 3.7 TBq (100 Ci) per container.
- (9) Wastes containing hazardous, biological, pathogenic, or infectious material shall be treated to reduce to the maximum extent practicable the potential hazard from the non-radiological materials.

B. The following requirements are intended to provide stability of the waste. Stability is intended to ensure that the waste does not degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.

- (1) Waste shall have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
- (2) Notwithstanding the provisions in Section 2.A.(3) and (4), liquid wastes, or wastes containing liquid, shall be converted into a form that contains as little free-standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5% of the volume of the waste for waste processed to a stable form.
- (3) Void spaces within the waste and between the waste and its package shall be reduced to the extent practicable.

3. Labeling

Each package of waste shall be clearly labeled to identify whether it is Class A, Class B, or Class C waste, in accordance with Section I.

^{8/} See A.4 of these regulations for definition of pyrophoric.

- D. In addition to the requirements specified in paragraphs A., B., and C. 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 routine 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 radiographic exposure 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 to protect the source assembly from water, mud, sand or other foreign matter during storage and transportation.
 - (4) Each sealed source or source assembly must have attached to it or engraved in it a durable, legible, visible label with the words: "DANGER-RADIOACTIVE". The label must not interfere with the safe operation of the exposure device or associated equipment.
 - (5) Guide tubes, ~~other than "J" tubes,~~ must be able to withstand the crushing forces that closely approximate the crushing forces that are likely to be encountered during use, and be able to withstand the kinking resistance test that closely approximates the kinking likely to be encountered during use.
 - (6) Guide tubes must be used when moving the source out of the device.
 - (7) An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during radiographic operations.
 - (8) The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.
 - (9) Source changers must provide a system for 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.
- 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.
6. **Limits on External Radiation Levels From Radiographic Exposure Devices, Storage Containers and Source Changers.** The maximum exposure rate limits for radiographic exposure devices, 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.

E.16.A.1

- (1) To obtain an Agency-issued trainee status card, the licensee, registrant, or the individual must document to the Agency on Form HHE-851 or equivalent that such individual has successfully completed a course of at least 40 hours on the applicable subjects outlined in E.Appendix A. The course must be one accepted by the Agency, another agreement state, or the NRC.
- (2) The trainee must carry a copy of the completed HHE-851 listed above, in the interim period after submitting documentation to the Agency and before receiving a trainee status card. The copy of the completed HHE-851 that was submitted to the Agency may be used in lieu of the trainee status card for a period of 60 days from the date recorded by the trainee on the documentation.
- (3) The individual shall notify the Agency by telephone, telegram, telefacsimile, electronic media transmission, or in writing of the need for a replacement trainee status card. The individual shall carry a copy of documentation of the request while performing industrial radiographic operations until a replacement trainee status card is received from the Agency.

B. Radiographer. No licensee or registrant shall permit any individual to act as a radiographer until the individual carries a valid radiographer certification. To obtain a radiographer certification, an individual must comply with the following:

- (1) The licensee, registrant, or the individual must document to the Agency on Forms HHE-854 and HHE-856 or equivalent that such individual:

- (a) has completed the requirements of E.16.A.(1);

- (b) has completed 2 months on-the-job training as a radiographer trainee supervised by one or more radiographer trainers authorized on a license or certificate of registration;

- (i) The radiographer trainee must carry a legible trainee status card in accordance with paragraph A of this section while obtaining the on-the-job training specified in (1)(b)(ii)-(vii) of this section.

- (ii) The 2 months on-the-job training shall include at least 200-320 hours of active participation in radioactive materials industrial radiographic operations or 1 month, 120-160 hours, of for active participation in x-ray industrial radiographic operations.

- (iii) Individuals performing industrial radiography utilizing radioactive materials and x-ray machines must complete both segments 3 months (~~320-480~~ hours) of on-the-job training.

- (iv) The hours of on-the-job training do not include safety meetings, classroom training, travel, darkroom activities, film development and interpretation, or use of a cabinet x-ray unit.

- (v) One year of documented experience or on-the-job training as authorized by another agreement state or the NRC may be substituted for (1)(b)(ii) or (iii) of this section. The documentation must be submitted to the Agency on Form HHE-856 or equivalent.

- (vi) The trainee shall be under the personal supervision of a radiographer trainer whenever a radiographer trainee:

- (a) Uses radiation machines, radiographic exposure devices, or associated equipment; or

- (b) Performs radiation surveys required by E.19. to determine that the sealed source has returned to the shielded position after an exposure or the radiation machine has stopped producing radiation.

- (2) Demonstrated competence in the use of sources of radiation, radiographic exposure devices, associated equipment, related handling tools, and radiation survey instruments, that may be employed in industrial radiographic assignments by successful completion of a practical examination administered by the licensee or registrant covering such use.
- E. Records of the administration of and the examinations required by D.1. of this section shall be made and maintained for Agency inspection in accordance with E.26.
- F. The licensee or registrant shall provide annual refresher safety training for each radiographer and radiographer's trainee at intervals not to exceed 12 months.
- G. Except as provided in paragraph .D., the RSO or designee shall conduct an internal audit of the job performance of each radiographer and radiographer's trainee to ensure that the Agency's regulations, license or certificate of registration requirements, and the licensee's or registrants operating and emergency procedures are followed. The audit program must:
- (1) Include observation of the performance of each radiographer and radiographer's trainee during an actual industrial radiographic operation, at intervals not to exceed 6 months; and
 - (2) Provide that, if a radiographer or a radiographer's trainee has not participated in an industrial radiographic operation during the 6 months since the last inspection, the radiographer or radiographer trainee must demonstrate knowledge of the training requirements of E.16.D. by a practical examination, administered by the licensee or registrant, before these individuals can next participate in a radiographic operation.
 - (3) The Agency 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, ~~and an~~ inspection program is not required.
- H. The licensee or registrant shall maintain records of the above training to include certification documents, written and practical examinations, refresher safety training and audits of job performance in accordance with E.26.
- I. The licensee or registrant training shall include the subjects covered in Appendix A of this Part.

17. Operating and Emergency Procedures

- A. Operating and emergency procedures must include, as a minimum, instructions as outlined in E.Appendix C.

18. Personnel Monitoring

- A. The licensee or registrant may not permit any individual to act as a radiographer or a radiographer trainer, or radiographer trainee unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a combination of direct reading dosimeter or an electronic personal dosimeter, an operating alarm ratemeter, and an individual monitoring device that meets the requirements of Part D.17. 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 milliroentgens) and must be recharged at the start of each work shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.
 - (2) Each approved individual monitoring device must be assigned to and worn by only one individual.

- (a) The license or certificate of registration authorizing the use of sources of radiation;
- (b) A copy of Parts D, E, and J of the Agency regulations;
- (c) Utilization records for each radiographic exposure device or radiation machine dispatched from that location.
- (d) Records of equipment problems identified in daily checks of equipment,
- (e) Records of alarm system and entrance control checks, if applicable;
- (f) Records of direct reading dosimeters such as pocket dosimeter and/or electronic personal dosimeter readings, if applicable;
- (g) Operating and emergency procedures;
- (h) Evidence of the latest calibration of the radiation survey instruments in use at the site;
- (i) Evidence of the latest calibrations of alarm rate meters and operability checks of pocket dosimeters and/or electronic personal dosimeters;
- (j) Latest radiation survey records;
- (k) The shipping papers for the transportation of radioactive materials ; and
- (l) When operating under reciprocity; a copy of the NRC, Agreement State, or Licensing State License or certificate of registration authorizing the use of sources of radiation.

REPORTING

27. Reporting Requirements.

- A. In addition to the reporting requirements specified under other sections of this Part and other applicable Parts of these regulations, each licensee shall provide a written report to the Agency; Department of Human Services, Division of Health Engineering, Radiation Control Program, #10 State House Station, Augusta, Maine 04333, 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.
 - (3) Failure of any component (critical to safe operation of the device) to properly perform its intended function.
 - (4) An indicator on a radiation machine fails to show that radiation is being produced;
 - (5) An exposure switch on a radiation machine fails to terminate production of radiation when turned to the off position; or
 - (6) A safety interlock fails to terminate x-ray production.
- B. The licensee or registrant shall include the following information in each report submitted under paragraph E.2427.A.
 - (1) A description of the equipment problem.

(2) Cause of each incident, if known.

E.27.B.(3)

(3) Manufacturer and model and serial number of equipment involved in the incident.

(4) Place, time, and date of the incident

(5) Actions taken to establish normal operations.

(6) Corrective actions taken or planned to prevent recurrence.

(7) Names and qualifications of personnel involved in the incident.

C. Reports of overexposures submitted under Part D that involve failure of safety components of radiography equipment must also include the information specified in E.27.B.

28. Records Required at Temporary Job Sites. Each licensee or registrant conducting industrial radiography at a temporary site shall have the following records available at that site for inspection by the Agency:

A. Appropriate license or certificate of registration authorizing the use of sources of radiation;

B. Operating and emergency procedures;

C. Applicable regulations;

D. Survey records required pursuant to E.19, E.20, and/or E.25.E - for the period of operation at the site;

E. Daily pocket dosimeter records for the period of operation at the site; and

F. The utilization records for each radiographic exposure device and/or radiation machine dispatched from that location in accordance with this Part; and

G. The latest instrument calibration and leak test record for specific devices in use at the site. Acceptable records include tags or labels that are affixed to the device or survey meter.

29. Specific Requirements for Radiographic Personnel Performing Industrial Radiography.

A. At a job site, the following shall be supplied by the licensee or registrant:

(1) At least one operable, calibrated survey instrument for each exposure device or radiation machine in use;

(2) An individual monitoring device for each individual;

(3) An operable, calibrated pocket dosimeter or electronic personal dosimeter with a range of zero to 200 milliroentgens for each worker; and

(4) An operable, calibrated alarm ratemeter for each worker as specified in E.18.

(5) the appropriate barrier ropes and signs.

B. Each radiographer at a job site shall carry a valid certification ID card issued by the Agency or another certifying entity whose certification offers the same or comparable certification standards.

C. Each radiographer trainee at a job site shall carry a trainee status card issued by the Agency or equivalent documentation in accordance with E.16.A.

- D Radiographic personnel shall not perform radiographic operations if any of the items in E.29.A.-C. are not available at the job site or are inoperable. Radiographic personnel shall ensure that the items listed in E.29.A., radiographic exposure devices, and radiation machines are used in accordance with the requirements of this Part.
- E. Each licensee or registrant shall provide as a minimum two person crews when sources of radiation are used at temporary job sites.
- F. No individual other than a radiographer or a radiographer trainee who is under the personal supervision of a radiographer ~~instructor~~ trainer shall manipulate controls or operate equipment used in industrial radiographic operations.
- G During an inspection by the Agency, the Agency inspector may terminate an operation if any of the items in E.29.A.-C. are not available and operable or if the required number of radiographic personnel are not present. Operations shall not be resumed until such conditions are met.

30. Special Requirements and Exemptions for Radiation Machines in Enclosed Radiography.

- A. Systems for enclosed radiography, including shielded-room radiography and cabinet x-ray systems not otherwise exempted, designed to allow admittance of individuals shall:
 - (1) Comply with all applicable requirements of this Part and D.6 of these regulations. If such a system is a certified cabinet x-ray system, it shall comply with all applicable requirements of this Part, Part H and 21 CFR 1020.40.
 - (2) Be evaluated at intervals not to exceed 1 year to assure compliance with the applicable requirements as specified in E.24. Records of these evaluations shall be maintained for inspection by the Agency for a period of 2 years after the evaluation.
- B. Certified and uncertified cabinet x-ray systems designed to exclude individuals are exempt from the requirements of this Part except that:
 - (1) Operating personnel must be provided with an individual monitoring device and reports of the results must be maintained for inspection by the Agency.
 - (2) No registrant shall permit any individual to operate a cabinet x-ray system until such individual has received a copy of and instruction in the operating procedures for the unit and has demonstrated competence in its use. Records, which demonstrate compliance with this section shall be maintained for inspection by the Agency until disposition is authorized by the Agency.
 - (3) Tests for proper operation of high radiation area control devices, interlocks, or alarm systems, where applicable, must be conducted and recorded in accordance with E.25.
 - (4) The registrant shall perform an evaluation, at intervals not to exceed 1 year, to determine conformance with D.6 of these regulations. If such a system is a certified cabinet x-ray system, it shall be evaluated at intervals not to exceed 1 year to determine conformance with 21 CFR 1020.40. Records of these evaluations shall be maintained for inspection by the Agency for a period of 2 years after the evaluation.
- C. Certified cabinet x-ray systems shall be maintained in compliance with 21 CFR 1020.40 unless prior approval has been granted by the Agency pursuant to A.3.(a) of these regulations.

31. Prohibitions.

- A. Industrial radiography performed with a sealed source that is not fastened to or contained in a radiographic exposure device (fish pole technique) is prohibited unless specifically authorized in a license issued by the Agency.

APPENDIX C

Items to be Included in Operating and Emergency Procedures:

- A. Handling and use of sources of radiation for industrial radiography such that no individual is likely to be exposed to radiation doses that exceed the limits established in Part D;
- B. Methods and occasions for conducting radiation surveys, including lock-out survey requirements;
- C. Methods for controlling access to industrial radiography areas;
- D. Methods and occasions for locking and securing sources of radiation;
- E. Personnel monitoring and the use of personnel monitoring equipment, including steps to be taken immediately by industrial radiographic personnel in the event a pocket dosimeter is found to be off-scale (see E.18.);
- F. Methods of transporting equipment to field locations, including packing of sources of radiation in the vehicles, placarding of vehicles, and controlling of sources of radiation during transportation (including applicable DOT requirements);
- G. Methods or procedures for minimizing exposure of individuals in the event of an accident, including procedures for a disconnect accident, a transportation accident, and loss of a sealed source;
- H. Procedures for notifying proper personnel in the event of an accident;
- I. Specific posting requirements;
- J. Maintenance of records (see E.26.);
- K. Inspection, maintenance, and operational checks of radiographic exposure devices, source changers, storage containers, transport containers, source guide tubes, crank-out devices, and radiation machines;
- L. Method of testing and training in accordance with sections E.16. and E.33.; and
- M. Source recovery procedures if the licensee is authorized to perform source recovery; and
- N. The procedure(s) for identifying and reporting defects and noncompliance, as required by E.27 and 10 CFR Part 21, if applicable.

- (2) Each existing licensee, as applicable, shall submit to the agency in accordance with section 11 of part A, by January 27, 1995 a written certification that the quality management program has been implemented along with a copy of the program.

G.10.

10. Statement of Authorities and Responsibilities.

- A. A licensee shall provide sufficient authority and organizational freedom to the Radiation Safety Officer and the Radiation Safety Committee to:
- (1) Identify radiation safety problems;
 - (2) Initiate, recommend, or provide solutions; and
 - (3) Verify implementation of corrective actions.
- B. A licensee shall establish in writing the authorities, duties, responsibilities, and radiation safety activities of the Radiation Safety Officer and the Radiation Safety Committee.

11. Supervision.

- A. A licensee who permits the receipt, possession, use, or transfer of radioactive material by an individual under the supervision of an authorized user as allowed by G.3 shall:
- (1) Instruct the supervised individual in the principles of radiation safety appropriate to that individual's use of radioactive material;
 - (2) Annually (semi-annually for PET isotopes) review the supervised individual's use of radioactive material, provide reinstruction as needed and review records kept to reflect this use;
 - (3) Require the authorized user to be immediately available to communicate with the supervised individual;
 - (4) Require the authorized user to be able to be physically present and available to the supervised individual on 2 hours notice or 3 hours notice for mobile nuclear medicine services;^{2/} and
 - (5) Require that only those individuals specifically trained, and designated by the authorized user, shall be permitted to administer radionuclides or radiation to patients.
- B. A license shall require the supervised individual receiving, possessing, using or transferring radioactive material under G.3 to:
- (1) Follow the instructions of the supervising authorized user;
 - (2) Follow the procedures established by the Radiation Safety Officer; and
 - (3) Comply with these regulations and the license conditions with respect to the use of radioactive material.G.12

12. Visiting Authorized User.

- A. A licensee may permit any visiting authorized user to use licensed material for medical use under the terms of the licensee's license for 60 days each year if:

^{2/} The supervising authorized user need not be present for each use of radioactive material.

- (2) The licensee has a copy of an Agency, Agreement State, Licensing State or U.S. Nuclear Regulatory Commission license that identifies the visiting authorized user by name as an authorized user for medical use; and
 - (3) Only those procedures for which the visiting authorized user is specifically authorized by an Agency, Agreement State, Licensing State or U.S. Nuclear Regulatory Commission license are performed by that individual.
- B. A licensee need not apply for a license amendment in order to permit a visiting authorized user to use licensed material as described in G.12.A..
- C. A licensee shall retain copies of the records specified in G.12.A. for 5 years from the date of the last visit.

13. Mobile Nuclear Medicine Service Administrative Requirements

- A. The Agency will ~~only~~ license mobile nuclear medicine services only in accordance with this part and other applicable requirements of these regulations, ~~to serve clients who do not have an Agency license for the materials listed in those parts.~~
- B. Mobile nuclear medicine service licensees shall obtain a letter signed by the management of each client for which services are rendered that authorizes radioactive material at the client's address of use. The mobile nuclear medicine service shall retain the letter for three years after the last provision of service ~~retain for the duration of service a letter signed by the management of each location where services are rendered that authorizes use of radioactive material.~~
- C. A mobile nuclear medicine service shall ~~not~~ have all radioactive material delivered directly from the manufacturer or the distributor to the client's address of use mobile nuclear medicine facility. At no time may the client take receipt of any radioactive material intended for the mobile nuclear medicine service's use.

14. Notifications, reports, and records of misadministrations.

- A. For a misadministration:
 - (1) The licensee shall notify by telephone the agency no later than the next calendar day after discovery of the misadministration.
 - (2) The licensee shall submit a written report to the agency within 15 days after discovery of the misadministration. The written report must include the licensee's name; a brief description of the event; why the event occurred; the effect on the patient; what improvements are needed to prevent recurrence; whether the licensee notified the patient, or the patient's responsible relative or guardian (this person will be subsequently referred to as "the patient" in this section), and if not, why not, and if the patient was notified, what information was provided to the patient. The report must not include the patient's name or other information that could lead to identification of the patient. G.14.A(3)
 - (3) The licensee shall notify the referring physician and also notify the patient of the misadministration no later than 24 hours after its discovery, unless the referring physician personally informs the licensee either that he will inform the patient or that, based on medical judgment, telling the patient would be harmful. The licensee is not required to notify the patient without first consulting the referring physician. If the referring physician or patient cannot be reached within 24 hours, the licensee shall notify the patient as soon as possible thereafter. The licensee may not delay any appropriate medical care for the patient, including any necessary remedial care as a result of the misadministration, because of any delay in notification.
 - (4) If the patient was notified, the licensee shall also furnish, within 15 days after discovery of the misadministration, a written report to the patient by sending either:

- (5) Sources stored and not being used. The licensee shall, however, test each such source for leakage before any use or transfer unless it has been tested for leakage within 6 months before the date of use or transfer.

G.21.G

- G. A licensee in possession of a sealed source or brachytherapy source shall conduct a physical inventory of all such sources at intervals not to exceed 3 months. The licensee shall retain each inventory record for 5 years. The inventory records shall contain the model number of each source, and serial number if one has been assigned, the identity of each source radionuclide and its estimated activity, the location of each source, date of the inventory, and the signature of the Radiation Safety Officer.
- H. A licensee in possession of a sealed source or brachytherapy source shall survey with a radiation survey instrument at intervals not to exceed 3 months all areas where such sources are stored. This does not apply to teletherapy sources in teletherapy units or sealed sources in diagnostic devices.
- I. A licensee shall retain a record of each survey required in G.21.H. for 2 years. The record shall include the date of the survey, a sketch of each area that was surveyed, and the measured dose rate at several points in each area expressed in millirems (microsieverts) per hour, the model number and serial number of the survey instrument used to make the survey, and the signature of the Radiation Safety Officer.

22. Syringe Shields.

- A. A licensee shall keep syringes that contain radioactive material to be administered in a radiation shield.
- B. A licensee shall require each individual who prepares or administers radiopharmaceuticals to use a syringe radiation shield unless the use of the shield is contraindicated for that patient.

23. Syringe Labels. A licensee shall conspicuously label each syringe, or syringe radiation shield that contains a syringe with a radiopharmaceutical, with the radiopharmaceutical name or its abbreviation, the type of ~~diagnostic study or therapy~~ clinical procedure to be performed, or the patient's name.

24. Vial Shields. A licensee shall require each individual preparing or handling a vial that contains a radiopharmaceutical to keep the vial in a vial radiation shield.

25. Vial Shield Labels. A licensee shall conspicuously label each vial radiation shield that contains a vial of a radiopharmaceutical with the radiopharmaceutical name or its abbreviation.

26. Surveys for Contamination and Ambient Radiation Dose Rate.

- A. A licensee shall survey with a radiation detection survey instrument at the end of each day of use all areas where radiopharmaceuticals are routinely prepared for use or administered.
- B. A licensee shall survey with a radiation detection survey instrument at least once each week all areas where radiopharmaceuticals or radioactive wastes are stored.
- C. A licensee shall conduct the surveys required by G.26.A. and .B. so as to be able to measure dose rates as low as 0.1 millirem (1.0 μ Sv) per hour.
- D. A licensee shall establish dose rate action levels for the surveys required by G.26.A. and .B. and shall require that the individual performing the survey immediately notify the Radiation Safety Officer if a dose rate exceeds an action level.
- E. A licensee shall survey for removable contamination each week all areas where radiopharmaceuticals are routinely prepared for use, administered, or stored.

PART J

NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS

1. **Purpose and Scope.** This part establishes requirements for notices, instructions and reports by licensees or registrants to individuals engaged in activities under a license or registration and options available to such individuals in connection with Agency inspections of licensees or registrants to ascertain compliance with the provisions of the Act and regulations, orders, and licenses issued thereunder regarding radiological working conditions. The regulations in this part apply to all persons who receive, possess, use, own or transfer sources of radiation licensed by or registered with the Agency pursuant to Parts B and C of these regulations.
2. **Posting of Notices to Workers.**
 - A. Each licensee or registrant shall post current copies of the following documents:
 - (1) the regulations in this part and in Part D of these regulations;
 - (2) the license, certificate of registration, conditions or documents incorporated into the license by reference and amendments thereto;
 - (3) the operating procedures applicable to activities under the license or registration; and
 - (4) any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or order issued pursuant to Part A of these regulations, and any response from the licensee or registrant.
 - B. If posting of a document specified in J.2.A. 1, 2, or 3 is not practicable, the licensee or registrant may post a notice which describes the document and states where it may be examined.
 - C. Agency Form HHE-845 "Notice to Employees" shall be posted by each licensee or registrant as required by these regulations.
 - D. Agency documents pursuant to J.2.A.4 shall be posted within 2 working days after receipt of the documents from the Agency; the licensee's or registrant's response, if any, shall be posted within 2 working days after dispatch from the licensee or registrant. Such documents shall remain posted for a minimum of 5 working days or until action correcting the violation has been completed, whichever is later.
 - E. Documents, notices or forms posted pursuant to J.2 shall appear in a sufficient number of places to permit individuals engaged in work under the license or registration to observe them on the way to or from any particular work location to which the document applies, shall be conspicuous, and shall be replaced if defaced or altered.
3. **Instructions to Workers.**
 - A. All individuals working in or frequenting any portion of a restricted area who in the course of employment are likely to receive in a year an occupational dose in excess of 100 mrem (1mSv):
 - (1) shall be kept informed of the storage, transfer, or use of sources of radiation in such portions of the restricted area;
 - (2) shall be instructed in the health protection problems associated with exposure to radiation or radioactive material to the individual and potential offspring, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed;

PART K

RADIATION SAFETY REQUIREMENTS FOR WIRELINE SERVICE OPERATIONS AND SUBSURFACE TRACER STUDIES

~~1. Purpose.~~ The regulations in this part establish radiation safety requirements for persons using sources of radiation for wireline service operations including mineral logging, radioactive markers, and subsurface tracer studies. The requirements of this section are in addition to, and not in substitution for, the requirements of Parts A, B, C, D, and J of these regulations.

1. Purpose and Scope.

A. For the purpose of these regulations, the requirements for persons using sources of radiation for wireline service operations including mineral logging, radioactive markers, and subsurface tracer studies as specified in 10 CFR Part 39, "Licenses and Radiation Safety Requirements for Well Logging", are incorporated by reference. The requirements of this section are in addition to, and not in substitution for, the requirements of Parts A, B, C, D, and J of these regulations.

B. Notwithstanding the requirements incorporated by reference, 10 CFR 39.5 (relating to interpretations), 10 CFR 39.8 (relating to information collection), 10 CFR 39.101 (relating to violations), and 10 CFR 39.103 (relating to criminal penalties) are not incorporated by reference.

2. Effect of Incorporation of 10 CFR Part 39 (effective date April 28, 2000).

A. To reconcile differences between this part and the incorporated sections of 10 CFR Part 39 (relating to using sources of radiation for wireline service operations including mineral logging, radioactive markers, and subsurface tracer studies), the following words and phrases are substituted for the language in 10 CFR Part 39 as follows:

(1) A reference to "NRC" or "Commission" means Agency.

(2) A reference to "NRC or Agreement State", means "Agency, NRC, Agreement State or Licensing State".

(3) The definition of "licensed material" shall be as defined in Part A of these regulations.

(4) The definition of "sealed source" shall be as defined in Part A of these regulations.

~~2. Scope. The regulations in this part apply to all licensees or registrants who use sources of radiation for wireline service operations including mineral logging, radioactive markers, or subsurface tracer studies.~~

~~3. Definitions.~~

~~A. As used in this part, the following definitions apply:~~

~~(1) "Field station" means a facility where radioactive sources may be stored or used and from which equipment is dispatched to temporary jobsites.~~

~~(2) "Injection tool" means a device used for controlled subsurface injection of radioactive tracer material.~~

~~(3) "Logging assistant" means any individual who, under the personal supervision of a logging supervisor, handles sealed sources or tracers that~~

~~are not in logging tools or shipping containers or who performs surveys required by K.22. of these regulations~~

- ~~(4) "Logging supervisor" means the individual who uses sources of radiation or provides personal supervision of the utilization of sources of radiation at the well site.~~
- ~~(5) "Logging tool" means a device used below the surface to perform well-logging.~~
- ~~(6) "Mineral logging" means any logging performed for the purpose of mineral exploration other than oil or gas.~~
- ~~(7) "Personal supervision" means guidance and instruction by the supervisor who is physically present at the jobsite and watching the performance of the operation in such proximity that contact can be maintained and immediate assistance given as required.~~
- ~~(8) "Radioactive marker" means radioactive material placed subsurface or on a structure intended for subsurface use for the purpose of depth determination or direction orientation.~~
- ~~(9) "Source holder" means a housing or assembly into which a radioactive source is placed for the purpose of facilitating the handling and use of the source in well-logging operations.~~
- ~~(10) "Subsurface tracer study" means the release of a substance tagged with radioactive material for the purpose of tracing the movement or position of the tagged substance in the well-bore or adjacent formation.~~
- ~~(11) "Temporary jobsite" means a location to which radioactive materials have been dispatched to perform wireline service operations or subsurface tracer studies.~~
- ~~(12) "Uranium sinker bar" means a weight containing depleted uranium used to pull a logging tool down toward the bottom of a well.~~
- ~~(13) "Well-bore" means a drilled hole in which wireline service operations and subsurface tracer studies are performed.~~

~~K.3.A. (14)~~

- ~~(14) "Well-logging" means all operations involving the lowering and raising of measuring devices or tools which may contain sources of radiation into well-bores or cavities for the purpose of obtaining information about the well and/or adjacent formations.~~
- ~~(15) "Wireline" means a cable containing one or more electrical conductors which is used to lower and raise logging tools in the well-bore.~~
- ~~(16) "Wireline service operation" means any evaluation or mechanical service which is performed in the well-bore using devices on a wireline.~~

~~4. Prohibition. No licensee shall perform wireline service operations with a sealed source(s) unless, prior to commencement of the operation, the licensee has a written agreement with the well operator, well owner, drilling contractor, or land owner that:~~

~~A. in the event a sealed source is lodged downhole, a reasonable effort at recovery will be made; and~~

~~A. in the event a decision is made to abandon the sealed source downhole, the requirements of Part K shall be met.~~

~~Equipment Control~~

~~5. Limits on Levels of Radiation. Sources of radiation shall be used, stored, and transported in such a manner that the transportation requirements of Part L and the dose limitation requirements of Part D of these regulations are met.~~

~~6. Storage Precautions.~~

~~A. Each source of radiation, except accelerators, shall be provided with a storage and/or transport container. The container shall be provided with a lock, or tamper seal for calibration sources, to prevent unauthorized removal of, or exposure to, the source of radiation.~~

~~B. Sources of radiation shall be stored in a manner which will minimize danger from explosion and/or fire.~~

~~7. Transport Precautions. Transport containers shall be physically secured to the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal.~~

~~8. Radiation Survey Instruments.~~

~~A. The licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments at each field station to make physical radiation surveys as required by this part and Part D.9 of these regulations. Instrumentation shall be capable of measuring 0.1 milliroentgen (2.58×10^{-8} C/kg) per hour through at least 50 milliroentgens (1.29×10^{-5} C/kg) per hour.~~

~~B. Each radiation survey instrument shall be calibrated:~~

~~(1) at intervals not to exceed 6 months and after each instrument servicing;~~

~~(2) at energies and radiation levels appropriate for use; and~~

~~(3) so that accuracy within plus or minus 20 percent of the true radiation level can be demonstrated on each scale.~~

~~C. Calibration records shall be maintained for a period of 2 years for inspection by the Agency.~~

~~K.9.~~

~~9. Leak Testing of Sealed Sources.~~

~~A. Requirements. Each licensee using sealed sources of radioactive material shall have the sources tested for leakage. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Agency for 6 months after the next required leak test is performed or until transfer or disposal of the sealed source.~~

~~B. Method of Testing. Tests for leakage shall be performed only by persons specifically authorized to perform such tests by the Agency, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State. The test sample shall be taken from the surface of the source, source holder, or from the surface of the device in which the source is stored or mounted and on which one might expect contamination to accumulate. The test sample shall be analyzed for radioactive contamination, and the analysis shall be capable of detecting the presence of 0.005 microcurie (185 Bq) of radioactive material on the test sample.~~

~~A. Interval of Testing. Each sealed source of radioactive material shall be tested at intervals not to exceed 6 months. In the absence of a certificate from a transferrer indicating that a test has been made prior to the transfer, the sealed source shall not be put into use until tested. If, for any reason, it is suspected that a sealed source may be leaking, it shall be removed from service immediately and tested for leakage as soon as practical.~~

~~D. Leaking or Contaminated Sources. If the test reveals the presence of 0.005 microcurie (185 Bq) or more of leakage or contamination, the licensee shall immediately withdraw the source from use and shall cause it to be decontaminated, repaired, or disposed of in accordance with these regulations. A report describing the equipment involved, the test results, and the corrective action taken shall be filed with the Agency.~~

~~E. Exemptions. The following sources are exempted from the periodic leak test requirements of K.9.A through D:~~

~~(1) hydrogen-3 sources;~~

~~(2) sources of radioactive material with a half-life of 30 days or less;~~

~~(3) sealed sources of radioactive material in gaseous form;~~

~~(4) sources of beta- and/or gamma-emitting radioactive material with an activity of 100 microcuries (3.7 MBq) or less; and~~

~~(5) sources of alpha-emitting radioactive material with an activity of 10 microcuries (0.370 MBq) or less.~~

~~10. Quarterly Inventory. Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation. Records of inventories shall be maintained for 2 years from the date of the inventory for inspection by the Agency and shall include the quantities and kinds of sources of radiation, the location where sources of radiation are assigned, the date of the inventory, and the name of the individual conducting the inventory.~~

~~11. Utilization Records. Each licensee or registrant shall maintain current records, which shall be kept available for inspection by the Agency for 2 years from the date of the recorded event, showing the following information for each source of radiation:~~

~~A. make, model number, and a serial number or a description of each source of radiation used;~~

~~B. the identity of the well-logging supervisor or field unit to whom assigned;~~

~~C. locations where used and dates of use; and~~

~~D. in the case of tracer materials and radioactive markers, the utilization record shall indicate the radionuclide and activity used in a particular well.~~

~~K.12.~~

~~12. Design, Performance and Certification Criteria for Sealed Sources Used in Downhole Operations.~~

~~A. Each sealed source, except those containing radioactive material in gaseous form, used in downhole operations and manufactured after January 1, 1987 shall be certified by the manufacturer, or other testing organization acceptable to the Agency, to meet the following minimum criteria:~~

- ~~(1) be of doubly encapsulated construction;~~
- ~~(2) contain radioactive material whose chemical and physical forms are as insoluble and non-dispersible as practical; and~~
- ~~(3) has been individually pressure tested to at least 24,656 pounds per square inch absolute (170 MN/m²) without failure.~~

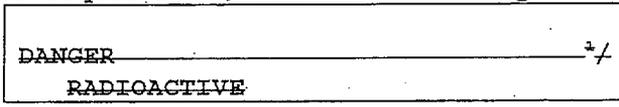
~~B. For sealed sources, except those containing radioactive material in gaseous form, acquired one year after the effective date of this part, in the absence of a certificate from a transferrer certifying that an individual sealed source meets the requirements of K.12.A, the sealed source shall not be put into use until such determinations and testing have been performed.~~

~~C. Each sealed source, except those containing radioactive material in gaseous form, used in downhole operations two years after the effective date of this part shall be certified by the manufacturer, or other testing organization acceptable to the Agency, as meeting the sealed source performance requirements for oil well logging as contained in the American National Standard N542, "Sealed Radioactive Sources, Classification" in effect on the effective date of this part.~~

~~D. Certification documents shall be maintained for inspection by the Agency for a period of 2 years after source disposal. If the source is abandoned downhole, the certification documents shall be maintained until the Agency authorizes disposition.~~

~~13. Labeling.~~

~~A. Each source, source holder, or logging tool containing radioactive material shall bear a durable, legible, and clearly visible marking or label, which has, as a minimum, the standard radiation caution symbol, without the conventional color requirement, and the following wording:~~



~~This labeling shall be on the smallest component transported as a separate piece of equipment.~~

~~1/ or "CAUTION"~~

(1) read or received instruction in the licensee's or registrant's operating and emergency procedures and demonstrated an understanding thereof; and

B. No licensee or registrant shall permit any individual to assist in the handling of sources of radiation until such individual has:

(3) demonstrated competence to use sources of radiation, related handling tools, and radiation survey instruments which will be used on the job.

(2) read and received instruction in the regulations contained in this part and the applicable sections of Parts A, D, and U of these regulations and the appropriate license or certificate of registration, and the licensee's or registrant's operating and emergency procedures, and demonstrated an understanding thereof;

(1) received, in a course recognized by the Agency, the U.S. Nuclear Regulatory Commission, an agreement state, or a licensing state, instruction in the subjects outlined in Appendix A of this part and demonstrated an understanding thereof.

A. No licensee or registrant shall permit any individual to act as a logging supervisor as defined in this part until such individual has:

15. Training Requirements

D. The repair, opening, or modification of any sealed source shall be performed only by persons specifically authorized to do so by the Agency, the U.S. Nuclear Regulatory Commission, an agreement state, or a licensing state.

C. If a sealed source is stuck in the source holder, the licensee shall not perform any operation, such as drilling, cutting, or chiseling, on the source holder unless the licensee is specifically approved by the Agency, the U.S. Nuclear Regulatory Commission, an agreement state, or a licensing state to perform this operation.

B. If any inspection conducted pursuant to Part K.14.A. reveals damage to labeling or components critical to radiation safety, the device shall be removed from service until repairs have been made.

A. Each licensee or registrant shall conduct, at intervals not to exceed 6 months, a program of inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools to assure proper labeling and physical condition. Records of inspection and maintenance shall be maintained for a period of 2 years for inspection by the Agency.

14. Inspection and Maintenance

K.14

DANGER
RADIOACTIVE
NOTIFY CIVIL AUTHORITIES

B. Each transport container shall have permanently attached to it a durable, legible, and clearly visible label which has, as a minimum, the standard radiation caution symbol and the following wording:

~~(2) demonstrated competence to use, under the personal supervision of the logging supervisor the sources of radiation, related handling tools, and radiation survey instruments which will be used on the job.~~

~~C. The licensee or registrant shall maintain employee training records for inspection by the Agency for 2 years following termination of employment.~~

~~16. Operating and Emergency Procedures. The licensee's or registrant's operating and emergency procedures shall include instructions in at least the following:~~

~~A. handling and use of sources of radiation to be employed so that no individual is likely to be exposed to radiation doses in excess of the standards established in Part D of these regulations;~~

~~B. methods and occasions for conducting radiation surveys;~~

~~C. methods and occasions for locking and securing sources of radiation;~~

~~K.16.D.~~

~~D. personnel monitoring and the use of personnel monitoring equipment;~~

~~E. transportation to temporary jobsites and field stations, including the packaging and placing of sources of radiation in vehicles, placarding of vehicles, and securing sources of radiation during transportation;~~

~~F. minimizing exposure of individuals in the event of an accident;~~

~~G. procedure for notifying proper personnel in the event of an accident;~~

~~H. maintenance of records;~~

~~I. inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools;~~

~~J. procedure to be followed in the event a sealed source is lodged downhole; and~~

~~K. procedures to be used for picking up, receiving, and opening packages containing radioactive material.~~

~~L. for the use of tracers, decontamination of the environment, equipment, and personnel;~~

~~M. maintenance of records generated by logging personnel at temporary jobsites;~~

~~N. notifying proper persons in the event of an accident; and~~

~~O. actions to be taken if a sealed source is ruptured, including actions to prevent the spread of contamination and minimize inhalation and ingestion of radioactive material and actions to obtain suitable radiation survey instruments as required by K.8.~~

~~17. Personnel Monitoring.~~

~~A. No licensee or registrant shall permit any individual to act as a logging supervisor or to assist in the handling of sources of radiation unless each such individual wears either a film badge or a thermoluminescent dosimeter (TLD). Each film badge or TLD shall be assigned to and worn by only one individual.~~

~~B. Personnel monitoring records shall be maintained for inspection until the Agency authorizes disposition.~~

~~18. Security. During each logging or tracer application, the logging supervisor or other designated employee shall maintain direct surveillance of the operation to protect against unauthorized and/or unnecessary entry into a restricted area, as defined in Part A of these regulations.~~

~~19. Handling Tools. The licensee shall provide and require the use of tools that will assure remote handling of sealed sources other than low-activity calibration sources.~~

~~20. Subsurface Tracer Studies.~~

~~A. Protective gloves and other appropriate protective clothing and equipment shall be used by all personnel handling radioactive tracer material. Precautions shall be taken to avoid ingestion or inhalation of radioactive material.~~

~~B. No licensee shall cause the injection of radioactive material into potable aquifers without prior written authorization from the Agency.~~

~~21. Particle Accelerators. No licensee or registrant shall permit above-ground testing of particle accelerators, designed for use in well-logging, which results in the production of radiation, except in areas or facilities controlled or shielded so that the requirements of Part D.2 and D.6 of these regulations, as applicable, are met.~~

~~K.22.~~

~~Radiation Surveys and Records~~

~~22. Radiation Surveys.~~

~~A. Radiation surveys and/or calculations shall be made and recorded for each area where radioactive materials are stored.~~

~~B. Radiation surveys and/or calculations shall be made and recorded for the radiation levels in occupied positions and on the exterior of each vehicle used to transport radioactive material. Such surveys and/or calculations shall include each source of radiation or combination of sources to be transported in the vehicle.~~

~~C. After removal of the sealed source from the logging tool and before departing the jobsite, the logging tool detector shall be energized, or a survey meter used, to assure that the logging tool is free of contamination.~~

~~D. Radiation surveys shall be made and recorded at the jobsite or well-head for each tracer operation, except those using hydrogen-3, carbon-14, and sulfur-35. These surveys shall include measurements of radiation levels before and after the operation.~~

~~E. Records required pursuant to K.22.A through D shall include the dates, the identification of individual(s) making the survey, the identification of survey instrument(s) used, and an exact description of the location of the survey. Records of these surveys shall be maintained for inspection by the Agency for 2 years after completion of the survey.~~

~~23. Documents and Records Required at Field Stations. Each licensee or registrant shall maintain, for inspection by the Agency, the following documents and records for the specific devices and sources used at the field station:~~

~~A. appropriate license, certificate of registration, or equivalent document;~~

~~B. operating and emergency procedures;~~

~~C. applicable regulations;~~

~~D. records of the latest survey instrument calibrations pursuant to K.8.~~

~~E. records of the latest leak test results pursuant to K.9;~~

~~F. quarterly inventories required pursuant to K.10;~~

~~G. utilization records required pursuant to K.11;~~

~~H. records of inspection and maintenance required pursuant to K.14; and~~

~~I. survey records required pursuant to K.22.~~

~~J. training records required pursuant to K.15.~~

~~24. Documents and Records Required at Temporary Jobsites. Each licensee or registrant conducting operations at a temporary jobsite shall have the following documents and records available at that site for inspection by the Agency:~~

~~A. operating and emergency procedures;~~

~~B. survey records required pursuant to K.22 for the period of operation at the site;~~

~~K.24.C.~~

~~C. evidence of current calibration for the radiation survey instruments in use at the site; and~~

~~D. when operating in the State under reciprocity, a copy of the appropriate license, certificate of registration, or equivalent document(s).~~

~~E. shipping papers for the transportation of radioactive material.~~

~~25. Notification of Incidents Abandonment and Lost Sources.~~

~~A. Notification of incidents and sources lost in other than downhole logging operations shall be made in accordance with appropriate provisions of Part D of these regulations.~~

~~B. Whenever a sealed source or device containing radioactive material is lodged downhole, the licensee shall~~

~~(1) monitor at the surface for the presence of radioactive contamination with a radiation survey instrument or logging tool during logging tool recovery operations; and~~

~~(2) notify the Agency immediately by telephone and subsequently, within 30 days, by confirmatory letter if radioactive contamination is detected at the surface or if the source appears to be damaged. This letter shall identify the well or other location, describe the magnitude and extent of the escape of radioactive material, assess the consequences of the rupture, and explain efforts planned or being taken to mitigate these consequences.~~

~~C. When it becomes apparent that efforts to recover the radioactive source will not be successful, the licensee shall~~

~~(1) advise the well operator of the state's regulations regarding abandonment and an appropriate method of abandonment, which shall include:~~

~~(a) the immobilization and sealing in place of the radioactive source with a cement plug,~~

~~(b) the setting of a whipstock or other deflection device, and~~

~~(c) the mounting of a permanent identification plaque, at the surface of the well, containing the appropriate information required by K.25.D.~~

~~(2) notify the Agency by telephone, giving the circumstances of the loss, and request approval of the proposed abandonment procedures; and~~

~~(3) file a written report with the Agency within 30 days of the abandonment, setting forth the following information:~~

~~(a) date of occurrence and a brief description of attempts to recover the source,~~

~~(b) a description of the radioactive source involved, including radionuclide, quantity, and chemical and physical form,~~

~~(c) surface location and identification of well,~~

~~(d) results of efforts to immobilize and set the source in place,~~

~~(e) depth of the radioactive source,~~

~~(f) depth of the top of the cement plug,~~

~~(g) depth of the well, and~~

~~K.25.C(3)(h).~~

~~(h) information contained on the permanent identification plaque.~~

~~D. Whenever a sealed source containing radioactive material is abandoned downhole, the licensee shall provide a permanent plaque^{2/} for posting the well or well-bore. This plaque shall:~~

- ~~(1) be constructed of long-lasting material, such as stainless steel or monel, and~~
- ~~(2) contain the following information engraved on its face:~~
 - ~~(a) the word "CAUTION",~~
 - ~~(b) the radiation symbol without the conventional color requirement,~~
 - ~~(c) the date of abandonment,~~
 - ~~(d) the name of the well operator or well owner,~~
 - ~~(e) the well name and well identification number(s) or other designation,~~
 - ~~(f) the sealed source(s) by radionuclide and quantity of activity,~~
 - ~~(g) the source depth and the depth to the top of the plug, and~~
 - ~~(h) an appropriate warning, depending on the specific circumstances of each abandonment.^{3/}~~

~~E. The licensee shall immediately notify the Agency by telephone and subsequently by confirming letter if the licensee knows or has reason to believe that radioactive material has been lost in or to an underground potable water source. Such notice shall designate the well location and shall describe the magnitude and extent of loss of radioactive material, assess the consequences of such loss, and explain efforts planned or being taken to mitigate these consequences.~~

~~THIS PAGE INTENTIONALLY LEFT BLANK~~

~~APPENDIX A~~

~~SUBJECTS TO BE INCLUDED IN TRAINING COURSES
FOR LOGGING SUPERVISORS~~

~~I. Fundamentals of Radiation Safety~~

~~A. Characteristics of radiation~~

~~B. Units of radiation dose and quantity of radioactivity~~

~~C. Significance of radiation dose~~

~~1. Radiation protection standards~~

~~2. Biological effects of radiation dose~~

~~2/ An example of a suggested plaque is show in Appendix B of this section.~~

~~3/ Appropriate warnings may include: (a) "Do not drill below plug back depth"; (b) "Do not enlarge casing"; or (c) "Do not re-enter the hole", followed by the words "before contacting the Department of Human Services, Radiological Health Program".~~

- ~~D. Levels of radiation from sources of radiation~~
- ~~E. Methods of minimizing radiation dose~~
 - ~~1. Working time~~
 - ~~2. Working distances~~
 - ~~3. Shielding~~
- ~~F. Radiation safety practices including prevention of contamination.~~
- ~~II. Radiation Detection Instrumentation to be Used~~
 - ~~A. Use of radiation survey instruments~~
 - ~~1. Operation~~
 - ~~2. Calibration~~
 - ~~3. Limitations~~
 - ~~B. Survey techniques~~
 - ~~C. Use of personnel monitoring equipment~~
- ~~III. Equipment to be Used~~
 - ~~A. Handling equipment~~
 - ~~B. Sources of radiation~~
 - ~~C. Storage and control of equipment~~
 - ~~D. Operation and control of equipment~~
- ~~IV. The Requirements of Pertinent Federal and State Regulations~~
- ~~V. The Licensee's or Registrant's Written Operating and Emergency Procedures~~
- ~~VI. The Licensee's or Registrant's Record Keeping Procedures~~
- ~~THIS PAGE INTENTIONALLY LEFT BLANK~~
- ~~IX B~~
 - ~~Example of Plaque for Identifying Wells Containing Sealed Sources~~
 - ~~Containing Radioactive Material Abandoned Down Hole~~

~~[COMPANY NAME]~~

~~[WELL IDENTIFICATION]~~

~~CAUTION~~



~~ONE 2 CURIE CS-137 RADIOACTIVE SOURCE ABANDONED~~

~~3-3-75 AT 8400 FT. PLUG BACK DEPTH 8200 FT.~~

~~DO NOT RE-ENTER THIS WELL BEFORE CONTACTING~~

~~DEPT. OF HUMAN SERVICES~~

~~DIVISION OF HEALTH ENGINEERING~~

~~287-5676~~

~~The size of the plaque should be convenient for use on active or inactive wells, e.g., a 7-inch square. Letter size of the word "CAUTION" should be approximately twice the letter size of the rest of the information, e.g., 1/2 inch and 1/4-inch letter size, respectively.~~

PART L

TRANSPORTATION OF RADIOACTIVE MATERIAL

1. **Purpose and Scope.** The regulations in this part establish requirements for packaging, preparation for shipment, and transportation of radioactive material and apply to any person who transports radioactive material or delivers radioactive material to a carrier for transport.

2. Incorporations by Reference

All rules, standards and guidelines of agencies of the United States or nationally recognized organizations or associations that are incorporated by reference in this Part are incorporated as of the date specified in the reference and do not include any later amendments or editions. Copies of these rules, standards and guidelines that have been incorporated by reference are available for public inspection at the Division of Health Engineering, Radiation Control Program, 10 State House Station, Augusta, Maine 04333-0010.

2.3. Definitions.

A. As used in this part, the following definitions apply:

(1) "A₁" means the maximum activity of special form radioactive material permitted in a Type A package as listed in 49 CFR 173.435 or as derived from 49 CFR 173.433 ~~maximum activity of special form radioactive material permitted in a Type A package.~~ "A₂" means the maximum activity of radioactive material, other than special form radioactive material, permitted in a Type A package. These values are either listed in Appendix A of this Section, Table A-1, or may be derived in accordance with the procedure prescribed in Appendix A of this Section.

(2) "A[2]" means the maximum activity of radioactive material, other than special form radioactive material, permitted in a Type A package. Values for A[2] are listed in 49 CFR 173.435 or can be derived from 49 CFR 173.433.

AGENCY NOTE: Values for A[1] and A[2] are listed in the U.S. Department of Transportation (U.S. DOT) regulations, 49 CFR 173.435 or can be derived from 49 CFR 173.433, published October 1, 2001, exclusive of subsequent amendments or editions.

(23) "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.

(34) "Exclusive use" (also referred to in other regulations as "sole use" or "full load") means the sole use of a conveyance by a single consignor and for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee.

(45) "Fissile material" means any special nuclear material consisting of or containing one or more fissile radionuclides. Fissile radionuclides are plutonium-238, plutonium-239, plutonium-241, uranium-233, and uranium-235. Neither natural or depleted uranium is fissile material. NOTE: Agency jurisdiction extends only to special nuclear material in quantities not sufficient to form a critical mass as defined in Part A of these regulations.

(a) Fissile Class I: A package which may be transported in unlimited numbers and in any arrangement, and which requires no nuclear criticality safety controls during transportation. A transport index is not assigned for purposes of nuclear criticality safety but may be required because of external radiation levels.

(b) Fissile Class II: A package which may be transported together with other packages in any arrangement but, for criticality control, in numbers which do not exceed an aggregate transport index of 50. These shipments require no other nuclear criticality safety control during transportation. Individual packages may have a transport index not less than 0.1 and not more than 10.

(56) "**Low specific activity material**" means any of the following:

- (a) Uranium or thorium ores and physical or chemical concentrates of these ores;
- (b) Unirradiated natural or depleted uranium or unirradiated natural thorium;
- (c) Tritium oxide in aqueous solutions provided the concentration does not exceed 185 MBq (5.0 millicuries) per milliliter;

L.2.A.(5)(d)

(d) Material in which the radioactivity is essentially uniformly distributed and in which the estimated average concentration per gram of contents does not exceed:

- (i) 3.7 kBq (0.0001 millicurie) of radionuclides for which the A_2 quantity in 49 CFR 173.435 or can be derived from 49 CFR 173.433 Appendix A of this part is not more than 1.85 GBq (0.05 curie);
- (ii) 185 kBq (0.005 millicuries) of radionuclides for which the A_2 quantity in 49 CFR 173.435 or can be derived from 49 CFR 173.433 Appendix A of this part is more than 1.85 GBq (0.05 curie), but not more than 37 GBq (1 curie); or
- (iii) 11.1 MBq (0.3 millicurie) of radionuclides for which the A_2 quantity in 49 CFR 173.435 or can be derived from 49 CFR 173.433 Appendix A of this part is more than 37 GBq (1 curie); and

(e) Objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination, when averaged over an area of 1 square meter, does not exceed 3.7 kBq (220,000 disintegrations per minute) (0.0001 millicurie) per square centimeter of radionuclides for which the A_2 quantity in 49 CFR 173.435 or can be derived from 49 CFR 173.433 Appendix A of this section is not more than 185 GBq (0.05 curie), or 37 kBq (2,200,000 disintegrations per minute) (0.001 millicurie) per square centimeter for other radionuclides.

(6)(7) "**Normal form radioactive material**" means radioactive material, which has not been demonstrated to qualify

_____ as "special form radioactive material."

(7) "**Package**" means the packaging together with its radioactive contents as presented for transport.

(88) "**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 designed as part of the packaging.

(99) "**Regulations of the U.S. Department of Transportation**" means the regulations in 49 CFR Parts 100-189.

(10) "**Special form radioactive material**" means radioactive material which satisfies the following conditions:

(a) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

(b) The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inch); and

(e) ~~It satisfies the test requirements specified by the U.S. NRC. A special form encapsulation designed in accordance with the NRC requirements in effect on June 30, 1983, and constructed prior to July 1, 1985 may continue to be used. A special form encapsulation either designed or constructed after June 30, 1985 must meet requirements of this definition applicable at the time of its design or construction.~~

~~(11)~~(10) **"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.

~~(12)~~11) **"Transport index"** means the dimensionless number (rounded up to the first decimal place) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is the number expressing the maximum radiation level in millirem per hour at 1 meter from the external surface of the package.

L.2.A.(13)

~~(13)~~12) **"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 Appendix A of this part or may be determined by procedures described in 49 CFR 173.435 or can be derived from 49 CFR 173.433. ~~Appendix A of this section.~~

~~(14)~~13) **"Type B package"** means a Type B packaging together with its radioactive contents. A Type B package design is designated as B(U) or B(M). (U) refers to the need for unilateral approval of international shipments; (M) refers to the need for multilateral approval. 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 prior to September 6, 1983 was designated only as Type B. Limitations on its use are specified in Part L.89.

~~(15)~~14) **"Type B packaging"** means a packaging designed to retain the integrity of containment and shielding requirement by U.S. NRC regulations when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR Part 71.

~~(16)~~15) **"Type B quantity"** means a quantity of radioactive material greater than a Type A quantity.

34. Requirement for License. No person shall transport radioactive material or deliver radioactive material to a carrier for transport except as authorized in a general or specific license issued by the Agency or as exempted in L.45.

45. Exemptions.

- A. Common and contract carriers, freight forwarders, and warehousemen who are subject to the requirements of the U.S. Department of Transportation in 49 CFR 170 through 189 or the U.S. Postal Service in the Postal Service Manual (Domestic Mail Manual), Section 124.3 incorporated by reference, 39 CFR 111.11 (1974), are exempt from these regulations to the extent that they transport or store radioactive material in the regular course of their carriage for another or storage incident thereto. Common and contract carriers who are not subject to the requirements of the U.S. Department of Transportation or U. S. Postal Service are subject to Part L.3-4 and other applicable sections of these regulations.
- B. Any licensee is exempt from the requirements of this part to the extent that he delivers to a carrier for transport a package containing radioactive material having a specific activity not greater than 74 Bq (0.002 microcurie) per gram.
- C. A licensee is exempt from all requirements of this part, other than L.5-6 and L.14-15 with respect to shipment or carriage of the following:

- (1) Packages containing no more than Type A quantities of radioactive material if the package contains no fissile material; or
- (2) Packages transported between locations within the United States which contain only americium or plutonium in special form with an aggregated radioactivity not to exceed 740 GBq (20 curies).

L.5.

56. Transportation of Licensed Material.

- A. Each licensee who transports licensed material outside of the confines of his plant or other place of use, or who delivers licensed material to a carrier for transport shall:
- (1) Comply with the applicable requirements, appropriate to the mode of transport, of the regulations of the U.S. Department of Transportation, 49 CFR 170-189, published October 1, 2001, exclusive of subsequent amendments or editions; and;
 - (2) Assure that any special instructions needed to safely open the package are sent to or have been made available to the consignee.
- B. If, for any reason, the regulations of the U.S. Department of Transportation are not applicable to a shipment of licensed material, the licensee shall conform to the standards and requirements of those regulations to the same extent as if the shipment was subject to the regulations.

67. General Licenses for Carriers.

- A. A general license is hereby issued to any common or contract carrier not exempt under L.4-5 to receive, possess, transport, and store radioactive material in the regular course of their carriage for another or storage incident thereto, provided the transportation and storage is in accordance with the applicable requirements, appropriate to the mode of transport, of the U. S. Department of Transportation insofar as such requirements relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.^{1/}
- B. A general license is hereby issued to any private carrier to transport radioactive material, provided the transportation is in accordance with the applicable requirements, appropriate to the mode of transport, of the U.S. Department of Transportation insofar as such requirements relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.^{1/}
- C. Persons who transport radioactive material pursuant to the general license in L.67.A or B are exempt from the requirements of Parts D and J of these regulations to the extent that they transport radioactive material.

78. General License: NRC Approved Packages.

- A. A general license is hereby issued to any licensee of the Agency to transport, or to deliver to a carrier for transport, licensed material in a package for which a license, certificate of compliance, or other approval has been issued by the U.S. Nuclear Regulatory Commission.
- B. This general license applies only to a licensee who:
- (1) Has a copy of the specific license, certificate of compliance, 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 prior to shipment;
 - (2) Complies with the terms and conditions of the license, certificate, or other approval, as applicable, and the applicable requirements of this part;

^{1/} Any notification of incidents referred to in those U.S. Department of Transportation requirements shall be filed with, or made to, the Agency.

- (3) Prior to the licensee's first use of the package, has registered with the U.S. Nuclear Regulatory Commission; and
 - (4) Has a quality assurance program as required by L.20-21 approved by the Agency.
- C. The general license in L.78.A applies only when the package approval authorizes use of the package under this general license.

L.7.D.

- D. For previously approved Type B packages which are not designated as either (B)(U) or B(M) in the NRC Certificate of Compliance, this general license is subject to additional restrictions of L.89.

89. Previously Approved Type B Packages.

- A. A Type B package previously approved by the NRC, but not designated as B(U) or B(M) in the NRC Certificate of Compliance, may be used under the general license of L.7-8 with the following additional limitations:
- (1) Fabrication of the packaging was satisfactorily completed before August 31, 1986, as demonstrated by application of its model number in accordance with U.S. NRC regulations, published January 1, 2001; and
 - (2) The package may not be used for a shipment to a location outside the United States after August 31, 1986, except under special arrangement approved by the U.S. Department of Transportation in accordance with 49 CFR 173.471, published October 1, 2001, exclusive of subsequent amendments or editions.

910. General License: DOT Specification Container.

- A. A general license is issued to any licensee of the Agency to transport or to deliver to a carrier for transport licensed material in a specification container for a Type B quantity of radioactive material as specified in the regulations of the U.S. DOT in 49 CFR Parts 173 and 178, published October 1, 2001, exclusive of subsequent amendments or editions.
- B. This general license applies only to a licensee who has a quality assurance program approved by the Agency as satisfying the provisions of L.2021.
- C. This general license applies only to a licensee who:
- (1) Has a copy of the specification; and
 - (2) Complies with the terms and conditions of the specification and the applicable requirements of this part.
- D. The general license in L.910.A is subject to the limitation that the specification container may not be used for a shipment to a location outside the United States after August 31, 1986 except under special arrangements approved by U.S. DOT in accordance with 49 CFR 173.472, published October 1, 2001, exclusive of subsequent amendments or editions.

1011. General License: Use of Foreign Approved Package.

- A. A general license is issued to any licensee of the Agency 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 which has been revalidated by the U.S. DOT as meeting the applicable requirements of 49 CFR 171.12, published October 1, 2001, exclusive of subsequent amendments or editions.
- B. This general license applies only to shipments made to or from locations outside the United States.
- C. 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 references in the certificate relating to the use and maintenance of the packaging and to the actions to be taken prior to shipment; and
- (2) Complies with the terms and conditions of the certificate and revalidation and with the applicable requirements of this part.

~~L.11.~~

412. General License: Type A, Fissile Class II Packages.

- A. A general license is hereby issued to any licensee to transport fissile material, or to deliver fissile material to a carrier for transport, if the material is shipped as a Fissile Class II package.
- B. This general license applies only when a package contains no more than a Type A quantity of radioactive material, including only one of the following:
 - (1) Up to 40 grams of uranium-235; or
 - (2) Up to 30 grams of uranium-233; or
 - (3) Up to 25 grams of the fissile radionuclides of plutonium, except that for encapsulated plutonium-beryllium neutron sources in special form, an A1 quantity of plutonium may be present; or
 - (4) A combination of fissile radionuclides in which the sum of the ratios of the amount of each radionuclide to the corresponding maximum amounts in L.11.B(1),(2) and (3) does not exceed unity.
- C. (1) This general license applies only when, except as specified below for encapsulated plutonium-beryllium sources, a package containing more than 15 grams of fissile radionuclides is labelled with a transport index not less than the number given by the following equation, where the package contains x grams of uranium-235, y grams of uranium-233, and z grams of the fissile radionuclides of plutonium:

$$\text{Minimum Transport Index} = (0.4x + 0.67y + z) \left(1 - \frac{15}{x+y+z}\right)$$

- (2) For a package in which the only fissile material is in the form of encapsulated plutonium-beryllium neutron sources in special form, the transport index based on criticality considerations may be taken as 0.026 times the number of grams of the fissile radionuclides of plutonium in excess of 15 grams. In all cases, the transport index must be rounded up to one decimal place, and may not exceed 10.0

4213. General License: Restricted, Fissile Class II Package.

- A. A general license is hereby issued to any licensee to transport fissile material, or to deliver fissile material to a carrier for transport, if the material is shipped as a Fissile Class II package.
- B. This general license applies only when:
 - (1) The package contains no more than a Type A quantity of radioactive material; and
 - (2) Neither beryllium nor hydrogenous material enriched in deuterium is present; and
 - (3) The total mass of graphite present does not exceed 150 times the total mass of uranium-235 plus plutonium; and

(4) Substances having a higher hydrogen density than water, e.g. certain hydrocarbon oils, are not present, except that polyethylene may be used for packing or wrapping; and

~~(5)~~(5) Uranium-233 is not present, and the amount of plutonium does not exceed 1 percent of the amount of uranium-235; and

(6) The amount of uranium-235 is limited as follows:

(a) If the fissile radionuclides are not uniformly distributed, the maximum amount of uranium-235 per package may not exceed the value given in the following table:

TABLE 1

Uranium enrichment in weight percent of uranium-235 not exceeding	Permissible maximum grams of uranium-235 per package
24	40
20	42
15	45
11	48
10	51
9.5	52
9	54
8.5	55
8	57
7.5	59
7	60
6.5	62
6	65
5.5	68
5	72
4.5	76
4	80
3.5	88
3	100
2.5	120
2	164
1.5	272
1.35	320
1	680*
0.92	1200*

(b) If the fissile radionuclides are distributed uniformly (i.e., cannot form a lattice arrangement within the packaging) the maximum amount of uranium-235 per package may not exceed the value given in the following table: and

TABLE 2

Uranium enrichment in weight percent of uranium-235 not exceeding	Permissible maximum grams of uranium-235 per package
4	84
3.5	92
3	112
2.5	148
2	240
1.5	560*
1.35	800*

*Pursuant to its agreement with the U.S. Nuclear Regulatory Commission, Agency jurisdiction extends only to 350 grams of uranium-235.

- (7) The transport index of each package based on criticality considerations is taken as 10 times the number of grams of uranium-235 in the package divided by the maximum allowable number of grams per package in accordance with Table 1 or 2 as applicable.

1314. Fissile Material: 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 nuclear reactivity.

1415. Preliminary Determinations. Prior to the first use of any packaging for the shipment of radioactive material:

- A. The licensee shall ascertain that there are no defects in which could significantly reduce the effectiveness of the packaging which could impact on compliance with the standards specified in 10 CFR 71, Subparts E & F, published January 1, 2001, exclusive of subsequent amendments or editions;
- B. Where the maximum normal operating pressure will exceed 34.3 kilopascal (5 psi) 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.
- C. The licensee shall conspicuously and durably mark the packaging with its model number, gross weight, and a package identification number assigned by the U.S. Nuclear Regulatory Commission. Prior to applying the model number, the licensee shall determine that the packaging has been fabricated in accordance with the design approved by the U.S. Nuclear Regulatory Commission.

1516. Routine Determinations. Prior to 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 in accordance with 49 CFR 173.401-435;
- 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 in accordance with 10 CFR 71, Subpart F published January 1, 2001, exclusive of subsequent amendments or editions;
- 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. Any structural part of the package, which could be used to lift or tie down the package during transport is rendered inoperable for that purpose unless it satisfies design requirements specified by the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 71.45, published January 1, 2001, exclusive of subsequent amendments or editions;

- H. (1) The level of non-fixed (removable) radioactive contamination on the external surfaces of each package offered for shipment is as low as reasonably achievable. The level of non-fixed radioactive contamination may be determined by wiping an area of 300 square centimeters of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the non-fixed contamination levels. Except as provided under L.15.16.H(2), the amount of radioactivity measured on any single wiping material when averaged over the surface wiped, must not exceed the limits given in Table 3 of this part at any time during transport. Other methods of assessment of equal or greater efficiency may be used. When other methods are used, the detection efficiency of the method used must be taken into account and in no case may the non-fixed contamination on the external surfaces of the package exceed ten times the limits listed in Table 3.

TABLE 3

Contaminant	Maximum Permissible Limits	
	μ Ci/cm ²	dpm/cm ²
Beta-gamma emitting radionuclides all radionuclides with half-lives less than ten days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-238 and ores or physical concentrates	10 ⁻⁵	22
All other alpha emitting radionuclides	10 ⁻⁶	2.2

- (2) In the case of packages transported as exclusive use shipments by rail or highway only, the non-fixed radioactive contamination at any time during transport must not exceed ten times the levels prescribed in L.15.16.H(1). The levels at the beginning of transport must not exceed the levels prescribed in L.15.16.H(1).
- I. External radiation levels around the package and around the vehicle, if applicable, will not exceed 200 millirem per hour at any point on the external surface of the package at any time during transportation. The transport index shall not exceed 10.
- J. For a package transported as exclusive use by rail, highway or water, radiation levels external to the package may exceed the limits specified in L.15.16(I) but must not exceed any of the following:
- (1) 200 millirem/hour on the accessible external surface of the package unless the following conditions are met, in which case the limit is 1000 millirem per hour:
 - (a) The shipment is made in a closed transport vehicle;
 - (b) Provisions are made to secure the package so that its position within the vehicle remains fixed during transportation; and
 - (c) There are no loading or unloading operations between the beginning and end of the transportation;
 - (2) 200 millirem/hour at any point on the outer surface of the vehicle, including the upper and lower surfaces, or, in the case of an open vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load, and on the lower external surface of the vehicle;
 - (3) 10 millirem/hour at any point two meters from the vertical planes represented by the outer lateral surfaces of the vehicle, or, in the case of an open vehicle, at any point two meters from the vertical planes projected from the outer edges of the vehicle; and
 - (4) Two millirem/hour in any normally occupied positions of the vehicle, except that this provision does not apply to private motor carriers when persons occupying these positions are provided with special health supervision, personnel radiation exposure monitoring devices, and training in accordance with Part J.3. of these regulations.

K. A package must be prepared for transport so that in still air at 100°F(30°C) and in the shade, no accessible surface of a package would have a temperature exceeding 122°F (50°C) in a nonexclusive use shipment or 180°F(82°C) in an exclusive use shipment. Accessible package surface temperatures shall not exceed these limits at any time during transportation.

1617. Air Transport of Plutonium. Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this part or included indirectly by citation of U.S. Department of Transportation regulations, as may be applicable, the licensee shall assure that plutonium in any form is not transported by air or delivered to a carrier for air transport unless:

- A. The plutonium is contained in a medical device designed for individual human application; or
- B. The plutonium is contained in a material in which the specific activity is not greater than 74 Bq (0.002 microcuries (~~74 Bq~~) per gram of material and in which the radioactivity is essentially uniformly distributed; or
- C. 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 ~~Part L.56~~; or
- D. 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 U. S. Nuclear Regulatory Commission.

1718. Records.

- A. Each licensee shall maintain for a period of two years after shipment a record of each shipment of licensed material not exempt under Part L.45, showing, where applicable:
 - (1) Identification of the packaging by model 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) Date of the shipment;
 - (6) Name and address of the transferee;
 - (7) Address to which the shipment was made; and
 - (8) Results of the determination required by L.1516.
- B. The licensee shall make available to the Agency for inspection, upon reasonable notice, all records required by this part.

1819. Reports. The licensee shall report to the Agency within 30 days:

- A. Any instance in which there is significant reduction in the effectiveness of any authorized packaging during use; and
- B. Details of any defects with safety significance in the packaging after first use, with the means employed to repair the defects and prevent their recurrence.

1920. Advance Notification of Transport of Nuclear Waste.

A. Prior to the transport of any nuclear waste outside of the confines of the licensee's facility or other place of use or storage, or prior to the delivery of any nuclear waste to a carrier for transport, each licensee shall provide advance notification of such transport to the governor, or governor's designee,^{2/} of each state through which the waste will be transported.

B. Advance notification is required only when:

- (1) The nuclear waste is required to be in Type B packaging for transportation;
- (2) The nuclear waste is being transported to, through, or across State boundaries to a disposal site or to a collection point for transport to a disposal site;
- (3) The quantity of licensed material in a single package exceeds:
 - (a) 185 TBq (5,000 curies) of special form radionuclides;
 - (b) 185 TBq (5,000 curies) of uncompressed gases of Argon-41, Krypton-85m, Krypton-87, Xenon-131m, or Xenon-135;
 - (c) 1.85 PBq (50,000 curies) of Argon-37, or of uncompressed gases of Krypton-85 or Xenon-133, or of Hydrogen-3 as a gas, as luminous paint, or adsorbed on solid material;
 - (d) 740 GBq (20 curies) of other non-special form radionuclides for which A2 is less than or equal to 148 GBq (4 curies); or
 - (e) 7.4 TBq (200 curies) of other non-special form radionuclides for which A2 is greater than 148 GBq (4 curies).

C. Each advance notification required by L.1920.A. shall contain the following information:

- (1) The name, address, and telephone number of the shipper, carrier, and receiver of the shipment;
- (2) A description of the nuclear waste contained in the shipment as required by the regulations of the U.S. Department of Transportation, 49 CFR 172.202 and 172.203(d), published October 1, 2001, exclusive of subsequent amendments or editions;

AGENCY NOTE: Requirements contained in subsequent amendments or editions of 49 CFR 172 are not incorporated into this rule.

- (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 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.

^{2/} A list of the mailing addresses of the governors and governors' designees is available upon request from the Director, Office of State Programs, U. S. Nuclear Regulatory Commission, Washington, D.C. 30555.

- D. The notification required by L.1920.A. shall be made in writing to the office of each appropriate governor or governor's designee and to the Agency. 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. A notification delivered by messenger must reach the office of the governor, or governor's designee, at least 4 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur. A copy of the notification shall be retained by the licensee for 1 year.
- E. The licensee shall notify each appropriate governor, or governor's designee, and the Agency of any changes to schedule information provided pursuant to L.1920.A.. Such notification shall be by telephone to a responsible individual in the office of the governor, or governor's designee, of the appropriate State or States. The licensee shall maintain for 1 year a record of the name of the individual contacted.
- F. Each licensee who cancels a nuclear waste shipment, for which advance notification has been sent, shall send a cancellation notice to the governor, or governor's designee, of each appropriate State and to the Agency. A copy of the notice shall be retained by the licensee for 1 year.

2021. Quality Assurance Requirements.

- A. Each licensee shall establish, maintain, and execute a quality assurance program to verify, by procedures such as checking, auditing, and inspection, that deficiencies, deviations, and defective material and equipment relating to the shipment of packages containing radioactive materials, are promptly identified and corrected. Prior to the use of any package for the shipment of radioactive material, each licensee shall obtain Agency approval of its quality assurance program.
- B. Each licensee 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 packaging is used. The licensee shall identify the material and components to be covered by the quality assurance program.
- B.C. The licensee shall maintain sufficient written records to demonstrate compliance with the quality assurance program. Records pertaining to the use of a package for shipment of radioactive material must be retained for a period of two years after shipment.

APPENDIX A

DETERMINATION OF A_1 AND A_2

I. SINGLE RADIONUCLIDES.

- (1) FOR A SINGLE RADIONUCLIDE OF KNOWN IDENTITY, THE VALUES OF A_1 AND A_2 ARE TAKEN FROM TABLE A-1 IF LISTED THERE. THE VALUES A_1 AND A_2 IN TABLE A-1 ARE ALSO APPLICABLE FOR RADIONUCLIDE CONTAINED IN (α, n) OR (γ, n) NEUTRON SOURCES.
- (2) FOR ANY SINGLE RADIONUCLIDE WHOSE IDENTITY IS KNOWN BUT WHICH IS NOT LISTED IN TABLE A-1, THE VALUES OF A_1 AND A_2 ARE DETERMINED ACCORDING TO THE FOLLOWING PROCEDURE:

(A) IF THE RADIONUCLIDE EMITS ONLY ONE TYPE OF RADIATION, A_1 IS DETERMINED ACCORDING TO THE RULES IN PARAGRAPHS (I), (II), (III) AND (IV) OF THIS PARAGRAPH. FOR RADIONUCLIDES EMITTING DIFFERENT KINDS OF RADIATION, A_1 IS THE MOST RESTRICTIVE VALUE OF THOSE DETERMINED FOR EACH KIND OF RADIATION. HOWEVER, IN BOTH CASES, A_1 IS RESTRICTED TO A MAXIMUM OF 1000 CI (37 TBQ). IF A PARENT NUCLIDE DECAYS INTO A SHORTER LIVED DAUGHTER WITH A HALF LIFE NOT GREATER THAN 10 DAYS, A_1 IS CALCULATED FOR BOTH THE PARENT AND THE DAUGHTER, AND THE MORE LIMITING OF THE TWO VALUES IS ASSIGNED TO THE PARENT NUCLIDE.

- (I) FOR GAMMA EMITTERS, A_1 IS DETERMINED BY THE EXPRESSION:

$$A_1 = \frac{9 \text{ CURIES}}{T}$$

WHERE T IS THE GAMMA RAY CONSTANT, CORRESPONDING TO THE DOSE IN R/H AT 1 M PER CI. THE NUMBER 9 RESULTS FROM THE CHOICE OF 1 REM/H AT A DISTANCE OF 3 M AS THE REFERENCE DOSE EQUIVALENT RATE.

- (II) FOR X RAY EMITTERS, A_1 IS DETERMINED BY THE ATOMIC NUMBER OF THE NUCLIDE:

$$\text{FOR } Z < 55: A_1 = 1000 \text{ CI (37 TBQ)} \quad \text{OR} \quad \text{FOR } Z > 55: A_1 = 200 \text{ CI (74 TBQ)}$$

WHERE Z IS THE ATOMIC NUMBER OF THE NUCLIDE.

- (III) FOR BETA EMITTERS, A_1 IS DETERMINED BY THE MAXIMUM BETA ENERGY (EMAX) ACCORDING TO TABLE A-2.

- (IV) FOR ALPHA EMITTERS, A_1 IS DETERMINED BY THE EXPRESSION: $A_1 = 1000 A_2$ WHERE A_2 IS THE VALUE LISTED IN TABLE A-3.

- (B) A_2 IS THE MORE RESTRICTIVE OF THE FOLLOWING TWO VALUES:

(i) THE CORRESPONDING VALUE OF A_2 ; AND

(ii) THE VALUE A_2 OBTAINED FROM TABLE A-3.

- (3) FOR ANY SINGLE RADIONUCLIDE WHOSE IDENTITY IS UNKNOWN, THE VALUE OF A_1 IS TAKEN TO BE 2 CI (74 GBQ) AND THE VALUE OF A_2 IS TAKEN TO BE 0.002 CI (74 MBQ). HOWEVER, IF THE ATOMIC NUMBER OF THE RADIONUCLIDE IS KNOWN TO BE LESS THAN 82 THE VALUE OF A_1 IS TAKEN TO BE 10 CI (370 GBQ) AND THE VALUE OF A_2 IS TAKEN TO BE 0.4 CI (44.8 GBQ).

APPENDIX A

II. MIXTURES OF RADIONUCLIDES, INCLUDING RADIOACTIVE DECAY CHAINS.

(1) FOR MIXED FISSION PRODUCTS THE FOLLOWING ACTIVITY LIMITS MAY BE ASSUMED IF A DETAILED ANALYSIS OF THE MIXTURE IS NOT CARRIED OUT:

$$\frac{\text{Total Activity}}{\text{Activity Limit}} = \frac{A_1}{10 \text{ CI (370 GBQ)}}$$

$$\frac{\text{Total Activity}}{\text{Activity Limit}} = \frac{A_2}{0.4 \text{ CI (14.8 GBQ)}}$$

(2) A SINGLE RADIOACTIVE DECAY CHAIN IS CONSIDERED TO BE A SINGLE RADIONUCLIDE WHEN THE RADIONUCLIDES ARE PRESENT IN THEIR NATURALLY OCCURRING PROPORTIONS AND NO DAUGHTER NUCLIDE HAS A HALF-LIFE EITHER LONGER THAN 10 DAYS OR LONGER THAN THAT OF THE PARENT NUCLIDE. THE ACTIVITY TO BE TAKEN INTO ACCOUNT AND THE A_1 OR A_2 VALUE FROM TABLE A-1 TO BE APPLIED ARE THOSE CORRESPONDING TO THE PARENT NUCLIDE OF THAT CHAIN. WHEN CALCULATING A_1 OR A_2 VALUES, RADIATION EMITTED BY DAUGHTERS MUST BE CONSIDERED. HOWEVER, IN THE CASE OF RADIOACTIVE DECAY CHAINS IN WHICH ANY DAUGHTER NUCLIDE HAS A HALF-LIFE EITHER LONGER THAN 10 DAYS OR GREATER THAN THAT OF THE PARENT NUCLIDE, THE PARENT AND DAUGHTER NUCLIDES ARE CONSIDERED TO BE MIXTURES OF DIFFERENT NUCLIDES.

(3) IN THE CASE OF A MIXTURE OF DIFFERENT RADIONUCLIDES, WHERE THE IDENTITY AND ACTIVITY OF EACH RADIONUCLIDE ARE KNOWN, THE PERMISSIBLE ACTIVITY OF EACH RADIONUCLIDE R_1, R_2, \dots, R_N IS SUCH THAT $F_1 + F_2 + \dots + F_N$ IS GREATER THAN UNITY, WHERE

$$F_1 = \frac{\text{TOTAL ACTIVITY OF } R_1}{A_1(R_1)}$$

$$F_2 = \frac{\text{TOTAL ACTIVITY OF } R_2}{A_1(R_2)}$$

$$F_N = \frac{\text{TOTAL ACTIVITY OF } R_N}{A_1(R_N)}$$

$A_1(R_1, R_2, \dots, R_N)$ IS THE VALUE OF A_1 OR A_2 AS APPROPRIATE FOR THE NUCLIDE R_1, R_2, \dots, R_N .

(4) WHEN THE IDENTITY OF EACH RADIONUCLIDE IS KNOWN BUT THE INDIVIDUAL ACTIVITIES OF SOME OF THE RADIONUCLIDES ARE NOT KNOWN, THE FORMULA GIVEN IN PARAGRAPH (3) IS APPLIED TO ESTABLISH THE VALUES OF A_1 OR A_2 AS APPROPRIATE. ALL THE RADIONUCLIDES WHOSE INDIVIDUAL ACTIVITIES ARE NOT KNOWN (THEIR TOTAL ACTIVITY WILL, HOWEVER, BE KNOWN) ARE CLASSED IN A SINGLE GROUP AND THE MOST RESTRICTIVE VALUE OF A_1 OR A_2 APPLICABLE TO ANY ONE OF THEM IS USED AS THE VALUE OF A_1 OR A_2 IN THE DENOMINATOR OF THE FRACTION.

(5) WHERE THE IDENTITY OF EACH RADIONUCLIDE IS KNOWN BUT THE INDIVIDUAL ACTIVITY OF NONE OF THE RADIONUCLIDES IS KNOWN, THE MOST RESTRICTIVE VALUE OF A_1 OR A_2 APPLICABLE TO ANY ONE OF THE RADIONUCLIDES PRESENT IS ADOPTED AS THE APPLICABLE VALUE.

(6) WHEN THE IDENTITY OF NONE OF THE NUCLIDES IS KNOWN, THE VALUE OF A_1 IS TAKEN TO BE 2 CI (74 GBQ) AND THE VALUE OF A_2 IS TAKEN TO BE 0.002 CI (74 MBQ). HOWEVER, IF ALPHA EMITTERS ARE KNOWN TO BE ABSENT, THE VALUE OF A_2 IS TAKEN TO BE 0.4 CI (14.8 GBQ).

APPENDIX A

TABLE A-1

A_1 AND A_2 VALUES FOR RADIONUCLIDES
(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF RADIO NUCLIDE	ELEMENT AND ATOMIC NUMBER	A_1 (CI)****	A_2 (CI)****	SPECIFIC ACTIVITY (CI/G)
227AC	ACTINIUM (89)	1000	0.003	7.2×10^3
22AC		10	4	2.2×10^6
105AG	SILVER (47)	40	40	3.1×10^4
110MAG		7	7	4.7×10^3
111AG		100	20	1.6×10^5
241AM	AMERICIUM (95)	8	0.008	3.2
243AM		8	0.008	1.9×10^4
37AR	ARGON (18) (COMPRESSED OR UNCOMPRESSED)*/	1000	1000	1.0×10^5
41AR	(UNCOMPRESSED)*/	20	20	4.3×10^2
41AR	(COMPRESSED)*/	1	1	4.3×10^2
73AS	ARSENIC (33)	1000	400	2.4×10^4
74AS		20	20	1.0×10^5
76AS		10	10	1.6×10^6
77AS		300	20	1.1×10^5
211AT	ASTATINE (85)	200	7	2.1×10^6
193AU	GOLD (79)	200	200	9.3×10^5
196AU		30	30	1.2×10^5
198AU		40	20	2.5×10^5
199AU		200	25	2.1×10^5
131BA	BARIUM (56)	40	40	8.7×10^4

133BA		40	10	4.0 X 10 ²
140BA		20	20	7.3 X 10 ⁴
7BE	BERYLLIUM (4)	300	300	3.5 X 10 ⁵
206BI	BISMUTH (83)	5	5	9.9 X 10 ⁴
207BI		10	25	2.2 X 10 ²
210BI(RAE)		100	4	1.2 X 10 ⁵
212BI		6	6	1.5 X 10 ²
249BK	BERKELIUM (97)	1000	1	1.8 X 10 ³
77BR	BROMINE (35)	70	25	7.1 X 10 ⁵
82BR		6	6	1.1 X 10 ⁴
11C	CARBON (6)	20	20	8.4 X 10 ⁵
14C		1000	60	4.6
45CA	CALCIUM (20)	1000	25	1.9 X 10 ⁴
47CA		20	20	5.9 X 10 ⁵
109CD	CADMIUM (48)	1000	70	2.6 X 10 ³
115MCD		30	30	2.6 X 10 ⁴
115CD		80	20	5.1 X 10 ⁵
139CE	CERMIUM (58)	100	100	6.5 X 10 ³
141CE		300	25	2.8 X 10 ⁴
143CE		60	20	6.6 X 10 ⁵
144CE		10	7	3.2 X 10 ³

APPENDIX A

TABLE A-1

A₁ AND A₂ VALUES FOR RADIONUCLIDES

(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF ELEMENT AND RADIO NUCLIDE ATOMIC NUMBER A_1 (CP)*** A_2 (CP)*** SPECIFIC ACTIVITY (Ci/g)

249CF	CALIFORNIUM (98)	2	0.002	3.1
250CF		7	0.007	1.3×10^3
252CF		2	0.009	6.5×10^2
36CL	CHLORINE (17)	300	10	3.2×10^{-2}
38CL		10	10	1.3×10^8
242CM	CURIUM (96)	200	0.2	3.3×10^3
243CM		9	0.009	4.2×10
244CM		10	0.01	8.2×10
245CM		6	0.006	1.0×10^{-1}
246CM		6	0.006	3.6×10^{-1}
56CO	COBALT(27)	5	5	3.0×10^4
57CO		90	90	8.5×10^3
58MCO		1000	1000	5.9×10^6
58CO		20	20	3.1×10^4
60CO		7	7	1.1×10^3
51CR	CHROMIUM (24)	600	600	9.2×10^4
129CS	CESIUM (55)	40	40	7.6×10^5
131CS		1000	1000	1.0×10^5
134MGS		1000	10	7.4×10^6
134GS		10	10	1.2×10^3
135CS		1000	25	8.8×10^{-1}
136CS		7	7	7.4×10^{-4}
137CS		30	10	9.8×10
64CU	COPPER (29)	80	25	3.8×10^6
67CU		200	25	7.9×10^5
165DY	DYSPROSIUM (66)	100	20	8.2×10^6

166DY		1000	200	2.3×10^5
169ER	ERBIUM (68)	1000	25	8.2×10^4
171ER		50	20	2.4×10^6
152MEU	EUROPIUM (63)	30	30	2.2×10^6
152EU		20	10	1.9×10^2
154EU		10	5	1.5×10^2
155EU		400	60	1.4×10^3
19F	FLUORINE (9)	20	20	9.3×10^7
52FE	IRON (26)	5	5	7.3×10^6
55FE		1000	1000	2.2×10^3
59FE		10	10	4.9×10^4
67GA	GALLIUM (31)	100	100	6.0×10^5
68GA		20	20	4.0×10^7
72GA		7	7	3.1×10^6

APPENDIX A

TABLE A-1

A₁ AND A₂ VALUES FOR RADIONUCLIDES

(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF RADIO NUCLIDE	ELEMENT AND ATOMIC NUMBER	A ₁ (CI)****	A ₂ (CI)****	SPECIFIC ACTIVITY (CI/G)	
153GD	GADOLINIUM (64)	200	100	3.6×10^3	
159GD		300	20	1.1×10^6	
68GE	GERMANIUM (32)	20	10	7.0×10^3	
71GE		1000	1000	1.6×10^5	
3H	HYDROGEN (1) - SEE T- TRITIUM				
181HF	HAFNIUM (72)	30	25	1.6×10^4	

197MHG	MERCURY (80)	200	200	6.6×10^4
197HG-		200	200	2.5×10^5
203HG		80	25	1.4×10^4
166HO	HOLMIUM (67)	30	30	6.9×10^5
123I	IODINE (53)	50	50	1.9×10^6
125I		1000	70	1.7×10^4
126I		40	10	7.8×10^4
129I		1000	2	1.6×10^{-4}
131I		40	10	1.2×10^5
132I		7	7	1.1×10^2
133I		30	10	1.1×10^6
134I		8	8	2.7×10^2
135I		10	10	3.5×10^6
111IN	INDIUM (49)	30	25	4.2×10^5
113MIN		60	60	1.6×10^2
114MIN		30	20	2.3×10^4
115MIN		100	20	6.1×10^6
190IR	IRIDIUM (77)	10	10	6.2×10^4
192IR-		20	10	9.1×10^3
194IR		10	10	8.5×10^5
42K	POTASSIUM (19)	10	10	6.0×10^6
43K	KRYPTON (36)	20	10	3.3×10^6
85MKR	-(UNCOMPRESSED)*/	100	100	8.4×10^6
85MKR	-(COMPRESSED)*/	3	3	8.4×10^6
85KR	-(UNCOMPRESSED)*/	1000	1000	4.0×10^2
85KR	-(COMPRESSED)*/	5	5	4.0×10^2
87KR	-(UNCOMPRESSED)*/	20	20	2.8×10^7
87KR-	-(COMPRESSED)*/	0.6	0.6	2.8×10^7

140LA	LANTHANUM (57)	30	30	5.6 X 10 ⁵
177LU	LUTETIUM (71)	300	25	1.1 X 10 ⁵
MFP	MIXED FISSION PRODUCTS	10	0.4	—
28MG	MAGNESIUM (12)	6	6	5.2 X 10 ⁶
52MN	MANGANESE (25)	5	5	4.4 X 10 ⁵
54MN		20	20	8.3 X 10 ³
56MN		5	5	2.2 X 10 ⁷

APPENDIX A

TABLE A-1

A₁ AND A₂ VALUES FOR RADIONUCLIDES

(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF RADIO-NUCLIDE ELEMENT AND ATOMIC NUMBER A₁ (CI)**** A₂ (CI)**** SPECIFIC ACTIVITY (CI/G)

99MO	MOLYBDENUM (42)	100	20	4.7 X 10 ⁵
13N	NITROGEN (7)	20	10	1.5 X 10 ⁸
22NA	SODIUM (11)	8	8	6.3 X 10 ³
24NA		5	5	8.7 X 10 ⁶
93MNB	NIObIUM (41)	1000	200	1.1 X 10 ³
95NB		20	20	3.9 X 10 ⁴
97NB		20	20	2.6 X 10 ⁷
147ND	NEODYMIUM (60)	100	20	8.0 X 10 ⁴
149ND		30	20	1.1 X 10 ⁷
59NI	NICKEL (28)	1000	900	8.1 X 10 ⁻²
63NI		1000	100	4.6 X 10
65NI		10	10	1.9 X 10 ⁷
237NP	NEPTUNIUM (93)	5	0.005	6.9 X 10 ⁻⁴
239NP		200	25	2.3 X 10 ⁵

185OS	OSMIUM (76)	20	20	7.3 X 10 ²
191OS		600	200	4.6 X 10 ⁴
191MOS		200	200	1.2 X 10 ⁶
193OS		100	20	5.3 X 10 ⁵
32P	PHOSPHORUS (15)	30	30	2.9 X 10 ⁵
230PA	PROTACTINIUM (91)	20	0.8	3.2 X 10 ⁴
231PA		2	0.002	4.5 X 10 ⁻²
233PA		100	100	2.1 X 10 ⁴
201PB	LEAD (82)	20	20	1.7 X 10 ⁶
210PB		100	0.2	8.8 X 10
212PB		6	5	1.4 X 10 ⁶
103PD	PALLADIUM (46)	100	700	7.5 X 10 ⁴
109PD		100	20	2.1 X 10 ⁶
147PM	PROMETHIUM (61)	100	25	9.4 X 10 ²
149PM		100	20	4.2 X 10 ⁵
210PO	POLONIUM (84)	200	0.2	4.5 X 10 ³
142PR	PRASEODYMIUM (59)	10	10	1.2 X 10 ⁴
143PR		300	20	6.6 X 10 ⁴
191PT	PLATINUM (78)	100	100	2.3 X 10 ⁵
193MPT		200	200	2.0 X 10 ⁵
197MPT		300	20	1.2 X 10 ⁷
197PT		300	20	8.8 X 10 ⁵
238PU	PLUTONIUM (94)	3	0.003	1.7 X 10
239PU		2	0.002	6.2 X 10 ⁻²
240PU		2	0.002	2.3 X 10 ⁻¹
241PU		1000	0.1	1.1 X 10 ²
242PU		3	0.003	3.9 X 10 ⁻³

APPENDIX A

TABLE A-1

A₁ AND A₂ VALUES FOR RADIONUCLIDES
(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF RADIO NUCLIDE	ELEMENT AND ATOMIC NUMBER	A ₁ (CI)****	A ₂ (CI)****	SPECIFIC ACTIVITY (CI/G)
223RA	RADIUM (88)	50	0.2	5.0 X 10 ⁴
224RA		6	0.5	1.6 X 10 ⁵
226RA		10	0.05	1.0
228RA		10	0.05	2.3 X 10 ²
87RB	RUBIDIUM (37)	30	25	8.2 X 10 ⁶
86RB		30	30	8.1 X 10 ⁴
87RB		UNLIMITED	UNLIMITED	6.6 X 10 ⁻³
	RB(NATURAL)	UNLIMITED	UNLIMITED	1.8 X 10 ⁻³
186RE	RHENIUM (75)	100	20	1.9 X 10 ⁵
187RE		UNLIMITED	UNLIMITED	3.8 X 10 ⁻³
189RE		10	10	1.0 X 10 ⁶
	RE(NATURAL)	UNLIMITED	UNLIMITED	2.4 X 10 ⁻³
103MRH	RHODIUM (45)	1000	1000	3.2 X 10 ²
105MRH		200	25	8.2 X 10 ⁵
222RN	RADON (86)	10	2	1.5 X 10 ⁵
97RLU	RUTHENIUM (44)	80	80	5.5 X 10 ⁵
103RLU		30	25	3.2 X 10 ⁴
105RLU		20	20	6.6 X 10 ⁶
106RLU		10	7	3.4 X 10 ³
35S	SULPHUR (16)	1000	60	4.3 X 10 ⁴
123SB	ANTIMONY (51)	30	30	3.9 X 10 ⁵
124SB		5	5	1.8 X 10 ⁴

125SB		40	25	1.4 X 10 ³
46SC	SCANDIUM (21)	8	8	3.4 X 10 ⁴
47SC		200	20	8.2 X 10 ⁵
48SC		5	5	1.5 X 10 ⁶
75SE	SELENIUM (34)	40	40	1.4 X 10 ⁴
31SI	SILICON (14)	100	20	3.9 X 10 ²
147SM	SAMARIUM (62)	UNLIMITED	UNLIMITED	2.0 X 10 ⁻⁵
151SM		1000	90	2.6 X 10
153SM		300	20	4.4 X 10 ⁵
113SN	TIN (50)	60	60	1.0 X 10 ⁴
119MSN		100	100	1.1 X 10 ³
125SN		10	10	1.1 X 10 ⁵
85MSR	STRONTIUM (38)	80	80	3.2 X 10 ²
85SR		30	30	2.4 X 10 ⁴
87MSR		50	50	1.2 X 10 ²
89SR		100	10	2.9 X 10 ⁴
90SR		10	0.4	1.5 X 10 ³
91SR		10	10	3.6 X 10 ⁶
92SR		10	10	1.3 X 10 ⁷

APPENDIX A

TABLE A-1

A₁ AND A₂ VALUES FOR RADIONUCLIDES

(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF RADIO NUCLIDE	ELEMENT AND ATOMIC NUMBER	A ₁ (CI)****		A ₂ (CI)****		SPECIFIC ACTIVITY (CI/G)
		1000	1000	1000	1000	

T	TRITIUM (1)	1000	1000	1000	1000	9.7 X 10 ³
T	(UNCOMPRESSED) ^{7/}	1000	1000	1000	1000	9.7 X 10 ³

1F	(COMPRESSED) ^{#7}	1000	1000	9.7 X 10 ³
1F	(ACTIVATED LUMINOUS PAINT)	1000	1000	9.7 X 10 ³
1F	(ADSORBED ON SOLID CARRIER)	1000	1000	9.7 X 10 ³
1F	(TRITIATED WATER)	1000	1000	9.7 X 10 ³
1F	(OTHER FORMS)	20	20	9.7 X 10 ³
182TA	TANTALUM (73)	20	20	6.2 X 10 ³
160TB	TERBIUM (65)	20	10	1.1 X 10 ⁴
96MTC	TECHNETIUM (43)	1000	1000	3.8 X 10 ⁷
96TC		6	6	3.2 X 10 ⁵
97MTC		1000	200	1.5 X 10 ⁴
97TC		1000	400	1.4 X 10 ³
99MTC		100	100	5.2 X 10 ⁶
99TC		1000	25	1.7 X 10 ²
125MTE	TELLURIUM (52)	1000	100	1.8 X 10 ⁴
127MTE		300	20	4.0 X 10 ⁴
127TE		300	20	2.6 X 10 ⁶
129MTE		30	10	2.5 X 10 ⁴
129TE		100	20	2.0 X 10 ⁷
131MTE		10	10	8.0 X 10 ⁵
132TE		7	7	3.1 X 10 ⁵
227TH	THORIUM (90)	200	0.2	3.2 X 10 ⁴
228TH		6	0.008	8.3 X 10 ³
230TH		3	0.003	1.9 X 10 ²
231TH		1000	25	5.3 X 10 ⁵
232TH		UNLIMITED	UNLIMITED	1.1 X 10 ²
234TH		10	10	2.3 X 10 ⁴
TH	(NATURAL)	UNLIMITED	UNLIMITED	2.2 X 10 ²

TH	(IRRADIATED)**/	—	—	—
200TI	THALLIUM (81)	20	20	5.8×10^5
201TI		200	200	2.2×10^5
202TI		40	40	5.4×10^4
204TI		300	10	4.3×10^2
170TM	THULIUM (69)	300	10	6.0×10^3
171TM		1000	100	1.1×10^3
230U	URANIUM (92)	100	0.1	2.7×10^4
232U		30	0.03	2.1×10
233U		100	0.1	9.5×10^{-3}
234U		100	0.1	6.2×10^{-3}
235U		100	0.2	2.1×10^{-6}

APPENDIX A

TABLE A-1

A₁ AND A₂ VALUES FOR RADIONUCLIDES

(SEE FOOTNOTES AT END OF TABLE)

SYMBOL OF RADIO- NUCLIDE	ELEMENT AND ATOMIC NUMBER	A ₁ (CI)****	A ₂ (CI)****	SPECIFIC ACTIVITY (CI/G)
236U	URANIUM (92)	200	0.2	6.3×10^5
238U		UNLIMITED	UNLIMITED	3.3×10^{-2}
U	(NATURAL)	UNLIMITED	UNLIMITED	(SEE TABLE A-4)
U	(ENRICHED) <20 PERCENT	UNLIMITED	UNLIMITED	(SEE TABLE A-4)
	>20 PERCENT			
48V	VANADIUM (23)	6	6	1.7×10^5
181W	TUNGSTEN (74)	200	100	5.0×10^3
185W		1000	25	9.7×10^{-3}
187W		40	20	7.0×10^5

XE	XENON (54)	—	—	—
127XE	(UNCOMPRESSED)*/	70	70	2.8×10^4
127XE	(COMPRESSED)*/	5	5	2.8×10^4
131MXE	(COMPRESSED)*/	10	10	1.0×10^5
131MXE	(UNCOMPRESSED)*/	100	100	1.0×10^5
133XE	(UNCOMPRESSED)*/	1000	1000	1.9×10^5
133XE	(COMPRESSED)*/	5	5	1.9×10^5
135XE	(UNCOMPRESSED)*/	70	70	2.5×10^5
135XE	(COMPRESSED)*/	2	2	2.5×10^5
87Y	YTTRIUM (39)	20	20	4.5×10
90Y		10	10	2.5×10^5
91MY		30	30	4.1×10^7
91Y		30	30	2.5×10^4
92Y		10	10	9.5×10^6
93Y		10	10	3.2×10^6
169YB	YTTERBIUM (70)	80	80	2.3×10^5
175YB		400	25	1.8×10^5
65ZN	ZINC (30)	30	30	8.0×10^3
69MZN		40	20	3.3×10^6
69ZN		300	20	5.3×10^7
93ZR	ZIRCONIUM (40)	1000	200	3.5×10^3
95ZR		20	20	2.1×10^4
97ZR		20	20	2.0×10^6

~~*/ — FOR THE PURPOSE OF TABLE A-1, COMPRESSED GAS MEANS A GAS AT A PRESSURE WHICH EXCEEDS THE AMBIANT ATMOSPHERIC PRESSURE AT THE LOCATION WHERE THE CONTAINMENT SYSTEM WAS CLOSED.~~

~~**/ — THE VALUES OF A_1 AND A_2 MUST BE CALCULATED IN ACCORDANCE WITH THE PROCEDURE SPECIFIED IN APPENDIX A, PARAGRAPH II(3), TAKING INTO ACCOUNT THE ACTIVITY OF THE FISSION PRODUCTS AND OF THE URANIUM-233 IN ADDITION TO THAT OF THE THORIUM.~~

***/ THE VALUES OF A_1 AND A_2 MUST BE CALCULATED IN ACCORDANCE WITH THE PROCEDURE SPECIFIED IN APPENDIX A, PARAGRAPH II(3), TAKING INTO ACCOUNT THE ACTIVITY OF THE FISSION PRODUCTS AND PLUTONIUM ISOTOPES IN ADDITION TO THAT OF THE URANIUM.

***// " A_1 " MEANS THE MAXIMUM ACTIVITY OF SPECIAL FORM RADIOACTIVE MATERIAL PERMITTED IN A TYPE A PACKAGE. " A_2 " MEANS THE MAXIMUM ACTIVITY OF RADIOACTIVE MATERIAL, OTHER THAN SPECIAL FORM RADIOACTIVE MATERIAL, PERMITTED IN A TYPE A PACKAGE.

APPENDIX A

TABLE 2

RELATIONSHIP BETWEEN A_1 AND E_{MAX} FOR BETA EMITTERS

$E_{MAX}(MEV)$	$A_1(CI)$
<0.5	1000
0.5 < 1.0	300
1.0 < 1.5	100
1.5 < 2.0	30
≥ 2.0	10

TABLE 3

RELATIONSHIP BETWEEN A_2 AND THE ATOMIC NUMBER OF THE RADIONUCLIDE

ATOMIC NUMBER	A_2		
	HALF-LIFE LESS THAN 1000 DAYS	HALF-LIFE 1000 DAYS TO 10^6 YEARS	HALF-LIFE GREATER THAN 10^6 YEARS
1 TO 81	3 CI	0.05 CI	3 CI
82 AND ABOVE	0.002 CI	0.002 CI	3 CI

* THE FIGURES FOR URANIUM INCLUDE REPRESENTATIVE VALUES FOR THE ACTIVITY OF THE URANIUM 234 WHICH IS CONCENTRATED DURING THE ENRICHMENT PROCESS. THE ACTIVITY FOR THORIUM INCLUDES THE EQUILIBRIUM CONCENTRATION OF THORIUM 230.

THORIUM AND URANIUM ENRICHMENT*		WT PERCENT 235U PRESENT
SPECIFIC ACTIVITY	G/G	
		0.45
		0.72(NATURAL)
1.3 X 10 ⁶	7.6 X 10 ⁻⁷	1.0
1.0 X 10 ⁶	1.0 X 10 ⁻⁶	1.5
3.7 X 10 ⁵	2.7 X 10 ⁻⁶	5.0
2.1 X 10 ⁵	4.8 X 10 ⁻⁶	10.0
1.0 X 10 ⁵	1.0 X 10 ⁻⁵	20.0
5.0 X 10 ⁴	2.0 X 10 ⁻⁵	35.0
4.0 X 10 ⁴	2.5 X 10 ⁻⁵	50.0
1.7 X 10 ⁴	5.8 X 10 ⁻⁵	90.0
1.4 X 10 ⁴	7.0 X 10 ⁻⁵	93.0
1.1 X 10 ⁴	9.1 X 10 ⁻⁵	95.0
4.6 X 10 ⁶	2.2 X 10 ⁻⁷	NATURAL THORIUM

ACTIVITY-MASS RELATIONSHIPS FOR URANIUM/THORIUM

TABLE 4

PART N

REGULATION AND LICENSING OF TECHNOLOGICALLY ENHANCED NATURALLY OCCURRING RADIOACTIVE MATERIALS (TENORM)

1. **Purpose.** This Part establishes radiation protection standards for the possession, use, transfer, and disposal of Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM). This includes the possession, use, processing, distribution, transfer, disposal and manufacture of products of TENORM. This Part also establishes requirements for issuance of specific and general licenses to possess and use TENORM, including license termination.
2. **Scope.**
 - A. These regulations apply Except as otherwise excluded in this Part, Part N applies to any person who receives, owns, possesses, uses, processes, transfers, distributes, or disposes of TENORM.
 - B. The regulations in this Part address the introduction of TENORM into products in which neither the TENORM, nor the radiation emitted from the TENORM, is considered to be beneficial to the products.
 - C. The manufacture and distribution of products containing TENORM, in which the TENORM and/or its emitted radiation is considered to be a beneficial attribute, are licensed under the provisions of Part C of these regulations.
 - D. This Part does not apply to radionuclides for which the Nuclear Regulatory Commission (NRC) retains exclusive jurisdiction source material and byproduct material as both are defined in the Atomic Energy Act of 1954, as amended (42 USC §2011 *et seq.*) as implemented by the US Nuclear Regulatory Commission.
 - E. The transportation and storage incident to transportation are governed by Parts T and D respectively of these regulations.
3. **Definitions.**
 - A: As used in this Part, the following definitions apply:
 - (1) "Beneficial attribute" means the radioactivity of the product necessary to the use of the product.
 - (2) "Beneficial to the product" see "Beneficial attribute" means the radioactivity of the TENORM is necessary to the product.
 - (3) "General environment" means the total terrestrial, atmospheric, and aquatic environments outside the site boundary within which any activity, operation, or process authorized by a general or specific license issued under this Part, is performed.
 - (2) "Conditional release" means the release by a licensee for a specified use, not release for unrestricted use.
 - (3) "Consumer" means a member of the public exposed to TENORM from final end-use products available on a retail basis.

(4) "Consumer or retail product" means any product, article, or component part thereof, produced, distributed or sold for use by a consumer in or around a permanent or temporary household or residence, or for the personal use, consumption, or enjoyment of a consumer, or for use in or around a school or playground.

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

~~(4) "Institutional controls" means: (a) Permanent markers placed at a disposal site, (b) public records and archives, (c) government ownership and regulations regarding land or resource use, and (d) other methods of preserving knowledge about the location, design, and contents of a disposal system.~~

~~(56) "Product" means something produced, made, manufactured, refined, or benefitedbeneficiated.~~

~~(67) "Reasonably maximally exposed individual" means a representative of a population who is exposed to TENORM at the maximum TENORM concentration measured in environmental media found at a site along with reasonable maximum case exposure assumptions. The exposure is determined by using maximum values for one or more of the most sensitive parameters affecting exposure, based on cautious but reasonable assumptions, while leaving the others at their mean value.~~

(78) "Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)" means naturally occurring radionuclides ~~radioactive material whose radionuclide concentrations are increased by or as a result of past or present human practices.~~ TENORM does not include background radiation or the natural radioactivity of rocks or soils. TENORM does not include uranium or thorium in "source material" as defined in the AEA and US NRC regulations ~~source material and byproduct material as both are defined in the Atomic Energy Act of 1954, as amended (42 USC §2011 et seq.) as implemented by the Nuclear Regulatory Commission.~~

(89) "Transfer" means the physical relocation of TENORM ~~containing materials not directly associated with commercial distribution within a business's operation or between general or specific licensees.~~ This term does not include commercial distribution or a change in legal title to TENORM containing materials that does not involve physical movement of those materials.

4. Exemptions.

- A. Persons who receive, own, possess, use, process, transfer, distribute, or dispose of TENORM are exempt from the requirements of Part N with respect to any combination of ^{226}Ra and ^{228}Ra if the materials contain, or are contaminated at, concentrations less than 185 becquerel per kilogram (5 pCi/gm) excluding natural background. ~~This exemption does not apply to consumer or retail products which that are discussed in regulated pursuant to N.1213.C. and N.1314**. Using purposeful dilution to render TENORM waste exempt shall not be allowed without prior Agency approval.~~
- B. Persons who receive products or materials containing TENORM distributed in accordance with a specific license issued by the Agency pursuant to N.1011.A., or to an equivalent license issued by another Licensing State, are exempt from ~~these regulations~~ this Part with regard to those products or materials.
- C. The distribution, including custom blending, possession, and use and disposal of fertilizers and zircon, zirconia, and zircon products containing TENORM, is exempt from the requirements of this Part.
- D. TENORM waste regulated by the Comprehensive Environmental Response, Compensation Liability Act (CERCLA 42 USC §9601 et seq. as amended) or RCRA (by the Resources Conservation and Recovery Act (RCRA 42 USC §6901 et seq. as amended)) are exempt from this Part.
- E. ~~The transportation and storage incident to transportation are governed by Parts D and L of these regulations.~~ Other TENORM shall be exempt when the Agency makes a determination, upon its own initiative or upon request for such determination, that the reasonably maximally exposed individual will not receive a TEDE of more than 1 mSv (0.1 rem) in one year from all exposure pathways. The dose specified in this subsection does not include occupational dose, dose received from background radiation, or dose received as a result of administration of radioactive material to a patient.

5. Standards for Radiation Protection for TENORM.

- A. ~~No person licensed under N.9-10 or N.10-11 shall conduct operations, use process, distribute or transfer TENORM in a manner such that a member of the general public will receive an annual Total Effective Dose TEDE in excess of 100 mrem (1 millisievert) per year from all licensed sources including TENORM.~~
- B. Persons subject to a license under this Part shall comply with the radiation protection standards for radiation protection for members of the public set out in Part D of these regulations.

** To apply this exemption to equipment such as pipe, it must be determined that the concentration of total radium is less than 185 pCi per gram) excluding the weight of the pipe or object contaminated with TENORM.

- C. Doses from inhalation of indoor radon and its short half-life (less than 1 hour) progeny shall not be included in Total Effective Dose Equivalent calculations of the TEDE, unless specifically directed otherwise by the Agency. The Agency will provide its basis if it directs the inclusion of radon in such calculations.
- D. No person shall release TENORM for unrestricted use in such a manner that the reasonably maximally exposed individual will receive an annual total effective dose equivalent TEDE from the released TENORM, excluding inhalation of radon and its short half-life (less than 1 hour) radon progeny, in excess of 10 mrem (0.1 millisievert) per year, excluding natural background.
- E. Actions taken to confine TENORM on site or to remediate sites shall be based on expected longevity related controls for 1000 years.

6. Protection of Workers During Operations. Each person subject to a specific or general license under Part N shall conduct operations such that protection of workers is in compliance with the standards for radiation protection set out in Parts D and J of these regulations.

7 - Unrestricted Use and Conditional Release. Each person subject to a specific or general license under this Part shall only:

- A. Transfer or release equipment for unrestricted use or release for unrestricted use facilities contaminated with TENORM which are not greater than the levels in Appendix A of this Part. Upon application, specific approval of alternative levels may be granted by the Agency;
- B. Release land for unrestricted use where the concentration of TENORM ²²⁶Ra and ²²⁸Ra, averaged over 100 square meters, is less than 185 becquerel per kilogram (5 pCi/gm) above the background concentration, averaged over any 15 cm layer of soil below the surface, or compliance with N.5.B. through N.5.D. is demonstrated;
- C. Transfer or release for conditional use in metal recycle, equipment contaminated with TENORM producing a maximum exposure level of 50 microrentgen per hour, including background radiation, at any accessible location. Recycling shall not include the processing or use of materials in a manner that constitutes disposal without specific written approval of the Agency; ⁷
- D. Transfer or conditionally release with written documentation by the licensee to a specified facility. Written documentation shall include the date, recipient name and location, description and quantity of the material, and a description of the procedures and mechanisms used to ensure that material will not be released in another manner, as an unrestricted release; or
- E. Transfer equipment contaminated with TENORM in excess of levels specified in Appendix A pursuant to N.10.E.

N.7.

~~7. Release for Unrestricted Use.~~ Each person subject to a license under this Part shall:

- A. ~~Not transfer or release for unrestricted use facilities or equipment contaminated with TENORM in excess of levels in Appendix A of this Part;~~

⁷ States may establish screening levels based on gamma survey instrument results for use in releasing facilities and equipment, consistent with N.5.

- ~~B. Not transfer or release for unrestricted use equipment contaminated with TENORM in excess of limits outlined in D.60 – D.65; and~~
- ~~C. Not transfer land for unrestricted use where the concentration of ²²⁶Ra or ²²⁸Ra in soil averaged over any 100 square meters exceeds the background level by more than 185 Becquerel per kilogram (5 pCi/gm), averaged over any 15 cm layer of soil below the surface, unless compliance with N.5.B. through D. can be demonstrated.~~

8. Disposal and Transfer of Waste for Disposal.

- A. Each person subject to a specific or general license under this Rule-Part shall manage and dispose of wastes containing TENORM:
- (1) By transfer of the wastes for disposal to a facility licensed under requirements for uranium or thorium byproduct materials in either 40 CFR 192, or 10 CFR 40 Appendix A, or equivalent regulations of an Agreement State that do not exclude disposal of TENORM; or
 - ~~_____~~ (2) By transfer of the wastes for disposal to a disposal facility licensed by the US Nuclear Regulatory Commission, an agreement-Agreement stateState, or a Licensing State pursuant to an authorization that does not exclude disposal of TENORM; or
 - (3) In accordance with alternate methods authorized by the permitting Agency for the disposal site upon application or upon the Agency's initiative, consistent with N.5 and where applicable the Clean Water Act, Safe Drinking Water Act and other requirements of the US Environmental Protection Agency for disposal of such wastes.
- B. Equipment contaminated with TENORM in excess of levels specified in Appendix AN.7.A. or N.7.B., which is to be disposed of as waste, shall be disposed of:
- (1) ~~So as to~~ In a manner that will prevent any reintroduction into commerce or unrestricted use; and
 - (2) Within disposal areas specifically designed to meet the criteria of-referred to in N.8.A.
- C. Transfers of waste containing TENORM for disposal shall be made only to a person specifically authorized by the-the US Nuclear Regulatory Commission, an Agreement State or a licensing-Licensing stateState, to receive such waste, or other agency with appropriate permitting authority. However, TENORM waste may also be transferred to authorized solid waste disposal facilities, providing such facility is not expressly prohibited from receiving and disposing such TENORM waste and the disposal is in accordance with applicable federal and state law.-
- D. Records of disposal, including manifests, shall be maintained pursuant to the provisions of Part D of these regulations.
- E. Purposeful dilution to render TENORM waste exempt shall not be performed without prior Agency approval.
- F. A licensee may dispose of TENORM [not away from the point of generation] in an injection well approved in accordance with Maine Department of Environmental Protection permitting requirements.

9. Prohibition

Purposeful dilution to render TENORM exempt shall not be performed without prior Agency approval.

General License

910. General License.

- A. Subject to the requirements of N.5 through N.8 and N.910, a general license is hereby issued to possess, own, use, transfer, distribute or dispose of TENORM without regard to quantity.
- B. This general license does not authorize the manufacturing of consumer or retail products containing TENORM in concentrations greater than those specified in N.4.A. nor the receipt and disposal of wastes from other persons.

N.9.C.

- C. ~~The decontamination of equipment, facilities, and land shall be performed only by persons specifically licensed by the Agency or another licensing state to conduct such work. However, employees~~ Employees or contractors under control and supervision of a general licensee can perform routine maintenance on equipment, facilities, and land owned or controlled by the general licensee. Maintenance that provides a different pathway for exposure different from that than is found in daily operations and that increases the potential for additional exposure is not considered routine maintenance. The decontamination of equipment, facilities, and land shall be performed only by persons specifically licensed by the Agency or another Licensing State to conduct such work.

- D. Any person subject to the general license issued by ~~this section~~ section 10.A. shall notify the Agency within 60 days of the effective date of this Part or of becoming subject to the general license. Such notification shall include:

- (1) Name and address of the licensee;
- (2) Location and description of the facility or operation;
- (3) Description of the TENORM including estimates of the amount and extent of TENORM.

- E. Transfer of material, equipment or real property.

- (1) The transfer of TENORM not exempt from these regulations from one general licensee to another general licensee is authorized if:

- (a) The equipment and facilities contaminated with TENORM are to be used by the recipient for the same a similar purpose, provided a dose in excess of N.5.A. is not exceeded; or
- (b) The transfer of control or ownership of land contaminated with TENORM includes, an annotation of the deed records and/or notice to owners of surface and mineral rights to indicate the presence of TENORM.

- (2) Transfers not made in accordance with N.910.E.(1) require prior approval by the Agency.

- (3) ~~For transfers made under N.910.E.(1) do not relieve the general licensee who makes the transfer from the responsibilities of assessing~~ shall assess the extent of TENORM contamination or material present, informing the general licensee receiving the TENORM of these assessments prior to such transfer, and maintaining records required by these regulations.

- (4) A general licensee intending to transfer material or real property for unrestricted use shall document

compliance with the requirements of N.7 of this regulation. Records of such compliance shall be kept until the registration is terminated with this Agency.

- (5) For Transfers not made in accordance with N.10.E.(1), prior written approval by the Agency is required. [To obtain Agency approval, the transferor shall submit information that demonstrates compliance with N.7. Records of such compliance shall be maintained as specified in Part D].

- F. Distribution of TENORM products between general licensees. The distribution of TENORM products not exempt from these regulations from one general licensee to another general licensee is authorized provided the product is accompanied by written disclosure of labels or manifests which identify the type and amount of TENORM.

- G. The Agency may, by written notice, require any person authorized by a general licensee to apply for and obtain a specific license if the Agency determines that specific licensure is necessary to ensure that exposures do not exceed the criteria. The notice shall state the reason or reasons for requiring a specific license.

- (4) A general licensee intending to transfer material or real property for unrestricted use shall document compliance with the requirements of N.7 of this regulation. Records of such compliance shall be kept until the registration is terminated with this Agency.
- (5) For Transfers not made in accordance with N.10.E.(1), prior written approval by the Agency is required. [To obtain Agency approval, the transferor shall submit information that demonstrates compliance with N.7. Records of such compliance shall be maintained as specified in Part D].
- F. Distribution of TENORM products between general licensees. The distribution of TENORM products not exempt from these regulations from one general licensee to another general licensee is authorized provided the product is accompanied by written disclosure of labels or manifests which identify the type and amount of TENORM.
- G. The Agency may, by written notice, require any person authorized by a general licensee to apply for and obtain a specific license if the Agency determines that specific licensure is necessary to ensure that exposures do not exceed the criteria. The notice shall state the reason or reasons for requiring a specific license.

Specific Licenses

4011. Specific Licenses. Unless otherwise exempt, a specific license is required to:

- A. A specific license is required under N.13 and N.14 to manufacture and distribute any material or consumer or retail product containing TENORM unless: authorized by N.9.F, exempted under the provisions of N.4, or licensed under the provisions of Part C of these regulations;
- 1: Authorized as specified by N.10.A or N.10.F.;
- 2: Licensed under the provisions of part C of these regulations;
- 3: Exempted under the provisions of N.4; or
- 4: Otherwise exempt in accordance with another Part of these regulations.
- B. Except as provided in N.9.C, a specific license is required to decontaminate equipment or land not otherwise exempted under the provisions of N.4 or facilities to decontaminated facilities contaminated with TENORM in excess of the levels set forth in N.7, except as provided in N.10.C as applicable; for purposes of this subsection, the term "decontaminate" shall not include routine maintenance which incidentally results in removal of contamination;
- C. A specific license is required to Receive receive TENORM from other persons for disposal unless otherwise exempt, or authorized in writing by the Agency.

4412. Filing Application for Specific Licenses.

- A. Applications for specific licenses shall be in English and filed in a manner and on a form prescribed by the Agency, and in accordance with C.7.
- B. – The Agency may at any time after the filing of the original application, and before the expiration termination of the license, require further statements in order to enable the Agency to determine whether the application should be granted or denied or whether a license should be modified or revoked.
- C. Each application shall be signed by the applicant or licensee or a person duly authorized to act for and on the licensee's behalf.
- D. An application for a license may include a request for a license authorizing one or more activities.
- E. Each application for a specific license shall be accompanied by the fee prescribed in Part C.

4213. Requirements for the Issuance of Specific Licenses.

- A. A license application will be approved if the Agency determines that:
- (1) The applicant is qualified by reason of training and experience to use the TENORM in question for the purpose requested in accordance with these rules in such a manner as to protect the public health and safety or property;
 - (2) The applicant's proposed equipment, facilities, and procedures are adequate to protect the public health and safety or property;

- (3) The issuance of the license will not be inimical to the health and safety of the public;
- (4) The applicant satisfied all applicable special requirements in this Part; and
- (5) The applicant has met the financial ~~surety~~ assurance requirements of N.2326.
- (6) The applicant has adequately addressed the following items in the application:
 - (a) Procedures and equipment for monitoring and protecting workers;

N.12.A.(6)(b)

- (b) An evaluation of the radiation levels and concentrations of contamination expected during normal operations;
 - (c) Operating and emergency procedures, including procedures for waste reduction and a quality assurance program designed to assess the adequacy of measurements made for the purpose of releasing of items released for unrestricted use; and
 - (d) A method for managing the radioactive material removed from contaminated equipment and facilities.
- (7) For each location to be listed on the license as an authorized use location, the applicant shall submit either:
- (a) A statement that the applicant owns the facility where radioactive material is to be used or stored; or
 - (b) A statement verifying that the facility owner has been informed, in writing, of the use or storage of radioactive material at the facility, and that the use of such material is subject to the regulations of the Agency.

B. An application for a specific license to decontaminate equipment, land, or facilities contaminated with TENORM in excess of the levels set forth in N.4.A., N.7.B., or Appendix A of this Part, as applicable, and to dispose of the resulting waste will be approved if:

- (1) The applicant satisfies the general requirements specified in N.4213.A.; and
- (2) The applicant has adequately addressed the following items in the application:
 - (a) Procedures and equipment for monitoring and protection of workers;
 - (b) An evaluation of the radiation levels and concentrations of contamination expected during normal operations;
 - (c) Operating and emergency procedures, including procedures for waste reduction and a quality assurance program designed to assess the adequacy of measurements made for the purpose of releasing of items released for unrestricted use; and
 - (d) Method of disposing of the TENORM removed from contaminated equipment, facilities, and/or land.

C. An application for a specific license to transfer ~~materials~~ or manufacture or distribute consumer or retail products containing TENORM to persons exempted from these regulations pursuant to N.4.B. will be approved if:

- (1) The applicant satisfies the general requirements specified in N.4213.A.;
- (2) The TENORM is not contained in any food, beverage, cosmetic, drug, or other commodity designed for ingestion or inhalation by, or application to, a human being; and
- (3) The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control procedures, labeling or marking, and conditions of handling, storage, use, and disposal of the TENORM material or product to demonstrate that the material or product will meet the safety criteria set forth in N.13. The information shall include:
 - (a) A description of the material or product and its intended use or uses;
 - (b) The type, quantity, and concentration of TENORM in each material or product;
 - (c) The chemical and physical form of the TENORM in the material or product, and changes in chemical and physical form that may occur during the useful life of the material or product;
 - (d) An analysis of the solubility in water and body fluids of the TENORM radionuclides in the material or product;
 - (e) The details of manufacture and design of the material or product relating to containment and shielding of the TENORM and other safety features under normal and severe conditions of handling, storage, use, reuse, and disposal of the material or product;

N.22.C(3)(f)

- (f) The degree of access of human beings to the material or product during normal handling, use, and disposal;
- (g) The total quantity of TENORM expected to be distributed annually in the material or product;
- (h) The expected useful life of the material or product;
- (i) The proposed method of labeling or marking each unit of the material or product with identification of the manufacturer or initial transferor of the product and the radionuclides and quantity of TENORM in the material or product;
- (j) The procedures for prototype testing of the material or product to demonstrate the effectiveness of the containment, shielding, and other safety features under both normal and severe conditions of handling, storage, use, reuse, and disposal;
- (k) The results of the prototype testing of the material or product, including any change in the form of the TENORM contained in it, the extent to which the TENORM may be released to the environment, any change in radiation levels, and any other changes in safety features;
- (l) The estimated external radiation doses and dose commitments relevant to the safety criteria in N.43-14 and the basis for such estimates;
- (m) A determination that the probabilities with respect to doses referred to in N.43-14 meet the safety criteria;
- (n) The quality control procedures to be followed in the production processing of production lots of the material or product, and the quality control standards the material or product will be required to meet; and

(o Any additional information, including experimental studies and tests, required by the Agency to facilitate a determination of the radiation safety of the material or product.

D. Notwithstanding the provisions of N.4314.B., the Agency may deny an application for a specific license if the end uses of the product are frivolous or cannot be reasonably foreseen.

43.14 — Safety Criteria for Products. An applicant for a license under N.4213.C. shall demonstrate that the product is designed and will be manufactured so that:

A. In normal use and disposal of a single exempt item, as defined in Part C, and in normal handling and storage of the quantities of exempt items likely to accumulate in one location during marketing, distribution, installation, and servicing of the product, it is unlikely that the TEDE in any one year, to a suitable sample of the group of individuals expected to be most highly exposed to radiation or radioactive material from the product will exceed the doses in Column I of N.4415.

N.13.B.

B. In use and disposal of a single exempt item and in handling and storage of the quantities of exempt items likely to accumulate in one location during marketing, distribution, installation, and servicing of the product, the probability is low¹ that the containment, shielding, or other safety features of the product would fail under such circumstances that a person would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in Column II of the table in N.14 and the probability is negligible² that a person would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in Column III of the table in N.4415.²

C. It is unlikely that there will be a significant reduction in the effectiveness of the containment, shielding, or other safety features of the product from wear and abuse likely to occur in normal handling and use of the product during its useful life.

4415. Table of Organ Doses.

Part of Body	Column I* Dose	Column II* Dose	Column III* Dose
Whole body; head and trunk; active blood-forming organs; gonads; or lens of eye	0.05 mSv (0.005 rem)	5 mSv (0.5 rem)	150 mSv (15 rem)
Hands and forearms; feet and ankles; localized areas of skin averaged over areas no larger than 1 square centimeter	0.75 mSv (0.075 rem)	75 mSv (7.5 rem)	2000 mSv (200 rem)

Other organs	0.15mSv rem)	(0.015	15 mSv rem)	(1.5	500 mSv rem)	(50
*Dose limit is the dose above background from the product.						

1/ Low – not more than one such failure per year for each 10,000 exempt units distributed. Negligible – not more than one such failure per year for each one million exempt units distributed.

2/ It is the intent of this paragraph that as the magnitude of the potential dose increases above that permitted under normal conditions, the probability that any individual will receive such a dose must decrease. The probabilities have been expressed in general terms to emphasize the approximate nature of the estimates which are to be made. The above values may be used as guidelines in estimating compliance with the criteria.

N.15.

4516. Issuance of Specific Licenses.

- A. Upon a determination that an application meets the requirements of Part C, the Agency will issue a specific license authorizing the proposed activity in such form and containing such conditions and limitations as it deems appropriate or necessary.
- B. The Agency may incorporate in any license at the time of issuance, or thereafter by amendment, such additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of TENORM subject to this Part as it deems appropriate or necessary in order to:
- (1) Protect public health and safety or property;
 - (2) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be appropriate or necessary; and
 - (3) Prevent loss, theft, or loss of control of TENORM subject to this Part.

4617. Conditions of Specific Licenses Issued Under N.4213.

A. General Terms and Conditions

- (1) Each specific license issued pursuant to this Part shall be subject to all the provisions of Title 22 MRSA, Maine Radiation Protection Statutes, now or hereafter in effect, and to all rules, regulations, and orders of the Agency.
- (2) No specific license issued or granted under this Part and no right to possess or utilize TENORM granted by any license issued pursuant to 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 Agency shall, after securing full information, find that the transfer is in accordance with the provisions of the Title 22 MRSA, Maine Radiation Protection Statutes, and shall give its consent in writing.

- (3) Each person specifically licensed by the Agency pursuant to this Part shall confine use and possession of the TENORM licensed to the locations and purposes authorized in the specific license.
- (4) Each person specifically licensed by the Agency pursuant to this Part is subject to the general license provisions of N.6, N.7, and 5 through N.8.
- (5) ~~Each licensee shall~~ Notification of Bankruptcy:
 - (a) Each licensee shall ~~Notify~~ notify the Agency, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapters of Title II (Bankruptcy) of the United States Code (11 U.S.C.) by or against:
 - (i) A licensee;
 - (ii) An entity, as defined in 11 U.S.C. 101 (4415), controlling a licensee or listing the license or licensee as property of the estate; or
 - (iii) An affiliate, as defined in 11 U.S.C. 101 (2), of the licensee. This notification shall indicate

N.16.A.(5)(b)

~~(b) Indicate in their Bankruptcy notification:~~

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

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

(6) Each licensee shall notify the Agency in writing and receive approval prior to commencing activities to reclaim the licensed facility.

(7) Notification of Site or Area Closure. When a licensee has permanently ceased use of radioactive materials at a site or portion of a facility and the licensee has not decontaminated the area, or when an area has not been used for a period of two years, the licensee shall, within 60 days, provide the following information in writing to the Agency:

(1) The location of the site or area;

(2) The plan for reclaiming or decontaminating the site or area; and

(3) An evaluation of any changes to the financial assurance submitted in accordance with N.26.

(8) Temporary Jobsites*

(1) When temporary jobsites are authorized on a specific license, TENORM may be used at temporary jobsites throughout the State of Maine in accordance with N.25 in areas not under exclusive federal jurisdiction.

- (2) Before TENORM can be used at a temporary jobsite at any federal facility within the State of Maine, the jurisdictional status of the jobsite shall be determined as it pertains to the TENORM. Authorization for use of TENORM at jobsites under exclusive federal jurisdiction shall be obtained from the federal agency with jurisdiction for TENORM at the temporary jobsite.

*[Authorization for use of TENORM at jobsites under exclusive federal jurisdiction must be obtained from the federal agency having jurisdiction of the property. Also, specific licenses issued by the Agency do not authorize activities in other states or in areas of exclusive federal jurisdiction in this state or in any other state. Before radioactive materials can be used at a temporary jobsite in another state or an area of exclusive federal jurisdiction, a license must be obtained from the appropriate state or federal agency.]

B. Quality Control, Labeling, and Reports of Transfer. Each person licensed under N.4213.C. shall:

- (1) Carry out adequate control procedures in the manufacture of the product to assure that each production lot meets the quality control standards approved by the Agency;
- (2) Label or mark each unit so that the manufacturer, processor, producer, or initial transferor of the material or product and the TENORM in the product can be identified; and
- (3) Maintain records. By identifying, by name and address, each person to whom TENORM is transferred for use under N.4.B. or the equivalent regulations of another Licensing State, and stating the kinds, quantities, and uses of TENORM transferred. An annual summary report stating the total quantity of each radionuclide transferred under the specific license shall be filed with the Agency. Each report shall cover the year ending December 31, and shall be filed within 90 days thereafter. If no transfers of TENORM have been made pursuant to N.4213.C. during the reporting period, the report shall so indicate.

4718. Expiration and Termination of Specific Licenses.

- A. Except as provided in N.18.B., the authority to engage in licensed activities as specified in the specific license shall expire at the end of the specified day in the month and year stated therein. Any expiration date on a specific license applies only to the authority to engage in licensed activities. Expiration of a specific license shall not relieve the licensee of responsibility for decommissioning its facility and terminating the specific license. Except as provided in N.17.D.(6) and N.18.B., each specific license shall expire at the end of the specified day in the month and year stated therein.
- B. Each licensee shall notify the Agency immediately in writing and request termination of the license when the licensee decides to terminate all activities involving TENORM-radioactive material authorized under the license. This notification and request for termination of the license mustshall include the reports and information specified in documents require by N.4718.D(4) and shall otherwise substantiate that the licensee has met all of the requirements in N.18.D. The licensee is subject to the provisions of N.17.D. and N.17.E., as applicable.
- C. No less than 30 days before the expiration date specified in a specific license, the licensee shall either:
- (1) Submit an application for license renewal under pursuant to N.4819; or
 - (2) Notify the Agency in writing, under N.4718.B., if the licensee decides to discontinue all activities involving TENORMnot renew the license. The licensee requesting termination of a license shall comply with the requirements of N.18.D.

D. ~~If a licensee does not submit an application for license renewal under N.18, the licensee shall, on or before the expiration date specified in the license~~Termination of Licenses:

~~(1)~~ (1) If a licensee does not submit a complete application for license renewal pursuant to N.19, the licensee shall, on or before the expiration date specified in the license;

(a) Terminate use of the TENORM specified in the license;

(b) Remove radioactive contamination to the level outlined in N.7, to the extent practicable;

(c) Properly dispose of the TENORM specified in the license;

(d) Submit a completed Agency Form HHE-892 "Certificate-Disposition of Radioactive Materials"; and

(e) Submit a radiation monitoring report to confirm the absence of TENORM specified in the license or to establish the levels of residual radioactive contamination, unless the licensee demonstrates the absence of residual radioactive contamination in some other manner. The radiation monitoring report shall specify the instrumentation used and certify that each instrument was properly calibrated and tested. The licensee shall, as applicable, report levels or quantities of:

(i) Beta and gamma radiation at 1 centimeter from surfaces in units, multiples, or subunits of sieverts or rem per hour or microroentgens per hour;

(ii) Gamma radiation at 1 meter from surfaces in units, multiples, or subunits of sieverts or rem per hour or microroentgens per hour;

(iii) Removable radioactivity on surfaces in units, multiples, or subunits of becquerels or curies per 100 square centimeters of surface area or in disintegrations (transformations) per minute per 100 square centimeters of surface area;

(iv) Fixed radioactivity on surfaces in units, multiples, or subunits of becquerels or curies per 100 square centimeters of surface areas or in disintegrations (transformations) per minute per 100 square centimeters of surface area;

(v) Radioactivity in contaminated liquids such as water, oils or solvents in units, multiples, or subunits of becquerels or curies per milliliter of volume or per gram of liquid; and

(vi) Radioactivity in contaminated solids such as soils or concrete in units, multiples, or subunits of becquerels or curies per gram of solid.

~~Terminate use of TENORM;~~

(22) If levels of residual radioactive contamination attributable to activities conducted under the license are less than those established in N.7, the licenses shall so certify. If the Agency determines that this certification and the information submitted pursuant to N.18.D.1(v) is adequate and monitoring confirms the findings, then the Agency will notify the licensee, in writing, of the termination of the license. Remove TENORM contamination consistent with the requirements of N.7;

~~(33)~~ If residual radioactive contamination attributable to activities conducted under the license are not in conformance with criteria established in N.7:

(a) The license continues in effect beyond the expiration date, if necessary, with respect

to possession of residual TENORM material present as contamination until the Agency notifies the licensee in writing that the license is terminated. During this time the licensee is subject to the provisions of N.18.E..

(b) In addition to the information submitted pursuant to N.18.D.(1)(d) and N.18.D.(1)(e), the licensee shall submit a plan for decontamination and disposal, if required, as regards residual TENORM contamination remaining at the time the license expires. Properly dispose of TENORM; and

(44) Submit a report of disposal of TENORM and radiation surveys to confirm the absence of TENORM or to establish the levels of residual TENORM contamination. The licensee shall, as appropriate:

~~(a) Report levels of radiation in units of microrems per hour of beta and gamma radiation at one centimeter and gamma radiation at one meter from surfaces and report levels of radioactivity in units of disintegrations per minute (or microcuries) per 100 square centimeters removable and fixed on surfaces, microcuries or Becquerel per milliliter in water, and picocuries or Becquerels per gram in contaminated solids such as soils or concrete; and~~

~~(b) Specify the instruments used and certify that each instrument is properly calibrated and tested.~~

~~(5) If levels of residual activity are less than those established in N.7, the licensee shall so certify. If the Agency determines that this certification and the information submitted under N.17.D(4) is adequate and surveys confirm the findings, the Agency will notify the licensee in writing that the license is terminated.~~

~~(6) If levels of residual TENORM are not in conformance with criteria established in N.7, the license continues in effect beyond the expiration date, if necessary, with respect to possession of residual TENORM until the Agency notifies the licensee in writing that the license is terminated. During this time, the licensee is subject to the provisions of N.17.E. In addition to the information submitted under N.17.D(4), the licensee shall submit a plan, if appropriate, for decontaminating the location(s) and disposing of the residual TENORM.~~

E. Each licensee who possesses residual TENORM material under pursuant to N.17.D(6), following the expiration date specified in the license, shall:

(1) ~~Be limited to actions involving TENORM as specified in the license to those related to decontamination and other activities related to preparation related to preparing the locations for release for unrestricted use; and~~

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

1819. Renewal of Specific Licenses.

A. Applications for renewal of specific licenses shall be filed in accordance with N.4412.

B. In any case in which a licensee, not less than 30 days prior to expiration of an existing license, has filed an application in proper form for renewal or for a new license authorizing the same activities, such existing license shall not expire until final action by the Agency.

1920. Amendment of Specific Licenses at Request of Licensee. Applications for amendment of a license shall be filed in accordance with N.4412 and shall specify the respects in which the licensee desires the license to be amended and the grounds for such amendment.

2021. Agency Action on Applications to Renew and Amend Specific Licenses. In considering an application by a licensee to renew or amend the license, the Agency will apply the criteria set forth in N.4213.

2122. Modification and Revocation of Specific Licenses.

A. The terms and conditions of all licenses shall be subject to amendment, revision, or modification or the license may be suspended or revoked by reason of amendments to Title 22 MRSA, Maine Radiation Protection Statutes, or by reason of rules, regulations, and orders issued by the Agency.

- B. Any license may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application or any statement of fact required under provisions of Title 22 MRSA, Maine Radiation Protection Statutes, 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 Agency 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 Title 22 MRSA, Maine Radiation Protection Statutes, or of the license, or of any rule, regulation, or order of the Agency.
- C. Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, the Agency ~~no license shall not modify~~ be modified, suspended or revoked a license unless prior to the institution of proceedings unless 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.

23 - Agency Action to Remove an Authorized User or a Radiation Safety Officer.

- A. The Agency may act to remove authorized users or the appointed Radiation Safety Officer from a license for any one or more of the following causes:
1. Willfully evading the statute or regulations pertaining to the radiation safety program, or willfully aiding another person in evading such statute or regulations;
 2. Having been convicted of a felony under the laws of this State, another state, or the United States, unless the convicted individual demonstrates to the Agency that he has been sufficiently rehabilitated, by restoration of all civil rights, to warrant the public trust;
 3. Exhibiting significant or repeated incompetence in the handling of radioactive material, or in the performance of Radiation Safety Officer duties;
 4. Performing authorized user duties or Radiation Safety Officer duties in such a manner that requirements of the Agency are violated resulting in a threat to health and safety of an individual, other workers or the public; and
- B. If, based upon any of the above grounds, the Agency determines that action to remove an authorized user or the appointed Radiation Safety Officer from a radioactive material license is warranted, the Agency shall notify the individual and shall provide an opportunity for a hearing in accordance with Part B of these regulations. An opportunity for a hearing shall be provided before the Agency takes action to remove an authorized user or a Radiation Safety Officer from a license unless the Agency finds that an immediate removal is required to protect against immediate danger to health or safety, Title 22 MRSA, in which case the Agency shall remove the individual pending a hearing.
- C. If the Agency finds that removal of an authorized user or a Radiation Safety Officer is warranted, the usual action shall be a suspension of duties for up to one year. The term of suspension may be reduced by the Commissioner of the Department of Human Services or their designee, upon the recommendation of the hearing officer, if the hearing officer finds, based upon evidence presented during a hearing, that the conditions leading to the Order for Suspension can be cured in less than one year. However, if the Agency finds that the causes are of a serious or continuous nature, such as past actions which posed an immediate threat to occupational or public health or safety or deficiencies that cannot be cured within one year, the Agency shall remove the individual from the radioactive material license.

within the State, and shall be accompanied by a copy of the pertinent licensing document. If, for a specific case, the 3 day period would impose an undue hardship on the out-of-state licensee, the licensee may, upon application to the Agency, obtain permission to proceed sooner. The Agency may waive the requirement for filing additional written notifications during the remainder of the calendar year following the receipt of the initial notification from a person engaging in activities under the general license provided in N.2225.A.;

- C. The out-of-state licensee complies with all applicable regulations of the Agency and with all the terms and conditions of the licensing document, except any such terms and conditions which may be inconsistent with applicable regulations of the Agency;
- D. The out-of-state licensee supplies such other information as the Agency may request; and
- E. The out-of-state licensee shall not transfer or dispose of TENORM possessed or used under the general license provided in N.2225.A. except by transfer to a person:
 - (1) Specifically licensed by the Agency or by another Licensing State to receive such TENORM; or
 - (2) Exempt from the requirements for a license for such TENORM under N.4.

2326. Financial Surety Assurance Arrangements. Pursuant to Part D, each licensee or applicant for a license under N.12 shall post with the Agency financial ~~surety~~assurance, or security, to ensure the protection of the public health and safety and the environment in the event of abandonment, default, or other inability or unwillingness of the licensee to meet the requirements of the Act and these regulations. Financial ~~surety~~assurance arrangements shall be one of the methods listed in C.8 and:

- A. Be in an amount sufficient to meet the applicant's or licensee's obligations under the Act and these regulations and shall be based upon Agency approved cost estimates; **N.23.B.**
- B. Be established prior to issuance of the license or the commencement of operations to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the facility;
- C. Be continuous for the duration of the license and for a period coincident with the applicant or licensee's responsibility under the Act and these regulations;
- D. Be available in Maine subject to judicial process and execution in the event required for the purposes set forth; and
- E. Be established within 90 days of the effective date of this regulation for licenses in effect on that date.

2427. Effective Date. The provisions and requirements of this Part shall take effect on the effective date of the regulations and shall apply to all facilities or sites owned or controlled by a person on that date. Note: Products introduced into commerce and disposals approved prior to that date are not subject to the provisions of this Part.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A

ACCEPTABLE SURFACE CONTAMINATION¹ LEVELS FOR TENORM

	AVERAGE ^{2, 3, 6}	MAXIMUM ^{2, 4, 6}	REMOVABLE ^{2, 3, 5, 6}
Alpha	5,000 dpm/100 cm ²	15,000 dpm /100 cm ²	1,000 dpm /100 cm ²
Beta-gamma	5,000 dpm/100 cm ²	15,000 dpm /100 cm ²	1,000 dpm /100 cm ²

¹ Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.

² As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

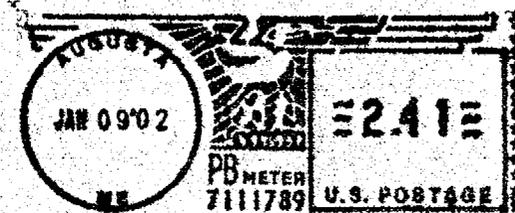
³ Measurements of average contamination level should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each object.

⁴ The maximum contamination level applies to an area of not more than 100 cm².

⁵ The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area A (where A is less than 100 sq. cm) is determined, the entire surface should be wiped and the contamination level multiplied by 100/A to convert to a "per 100 sq cm" basis.

⁶ The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr (2 μ Gy/hr) at 1 cm and 1.0 mR/hr (10 μ Gy/hr) at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

DEPARTMENT OF HUMAN SERVICES
DIVISION OF HEALTH ENGINEERING &
EAC/HAZARD CONTROL PROGRAMS
MAIL ROOM STATION
Rockville, MD 20852



USNRC-OSTP
ATTN: Paul Lohaus
One White Flint North
11555 Rockville Pike, 3rd Floor
Rockville, MD 20852