

E. DISPOSITION CRITERIA

E.1 Department of Energy

Disposition criteria specified by DOE regulations and orders are found in the Code of Federal Regulations, Title 10 (especially 10 CFR 835, Occupational Radiation Protection) and in applicable DOE Orders (especially DOE Order 5400.5, Radiation Protection of the Public and the Environment). The DOE regulations and orders govern the conduct of DOE employees and contractors in the operation of DOE facilities and in the disposition of real property (e.g., buildings and land) and non-real property (“personal property” such as materials, equipment, materials in containers, clothing, etc.). The DOE Order requirements are applicable to DOE activities only and are enforceable as contractual provisions in most DOE contracts. DOE rules are enforceable under 10 CFR Part 820. The following list of DOE requirements is not exhaustive. In addition, a listing of some non-mandatory guidance documents is also provided.

E.1.1 10 CFR 835 (Non-Exhaustive Excerpts)

E.1.1.1 § 835.405 Receipt of Packages Containing Radioactive Material

(a) If packages containing quantities of radioactive material in excess of a Type A quantity (as defined at 10 CFR 71.4) are expected to be received from radioactive material transportation, arrangements shall be made to either:

- (1) Take possession of the package when the carrier offers it for delivery; or
- (2) Receive notification as soon as practicable after arrival of the package at the carrier’s terminal and to take possession of the package expeditiously after receiving such notification.

(b) Upon receipt from radioactive material transportation, external surfaces of packages known to contain radioactive material shall be monitored if the package:

- (1) Is labeled with a Radioactive White I, Yellow II, or Yellow III label (as specified at 49 CFR 172.403 and 172.436–440); or
- (2) Has been transported as low specific activity material (as defined at 10 CFR 71.4) on an exclusive use vehicle (as defined at 10 CFR 71.4); or
- (3) Has evidence of degradation, such as packages that are crushed, wet, or damaged.

(c) The monitoring required by paragraph (b) of this section shall include:

- (1) Measurements of removable contamination levels, unless the package contains only special form (as defined at 10 CFR 71.4) or gaseous radioactive material; and
- (2) Measurements of the radiation levels, unless the package contains less than a Type A quantity (as defined at 10 CFR 71.4) of radioactive material.

(d) The monitoring required by paragraph (b) of this section shall be completed as soon as practicable following receipt of the package, but not later than 8 hours after the beginning of the working day following receipt of the package.

E.1.1.2 § 835.605 Labeling Items and Containers

Except as provided at § 835.606, each item or container of radioactive material shall bear a durable, clearly visible label bearing the standard radiation warning trefoil and the words “Caution, Radioactive Material” or “Danger, Radioactive Material.” The label shall also provide sufficient information to permit individuals handling, using, or working in the vicinity of the items or containers to take precautions to avoid or control exposures.

E.1.1.3 § 835.606 Exceptions to Labeling Requirements

(a) Items and containers may be excepted from the radioactive material labeling requirements of § 835.605 when:

- (1) Used, handled, or stored in areas posted and controlled in accordance with this subpart and sufficient information is provided to permit individuals to take precautions to avoid or control exposures; or
- (2) The quantity of radioactive material is less than one tenth of the values specified in appendix E of this part; or
- (3) Packaged, labeled, and marked in accordance with the regulations of the Department of Transportation or DOE Orders governing radioactive material transportation; or
- (4) Inaccessible, or accessible only to individuals authorized to handle or use them, or to work in the vicinity; or
- (5) Installed in manufacturing, process, or other equipment, such as reactor components, piping, and tanks; or
- (6) The radioactive material consists solely of nuclear weapons or their components.

(b) Radioactive material labels applied to sealed radioactive sources may be excepted from the color specifications of § 835.601(a).

E.1.1.4 § 835.1101 Control of Material and Equipment

(a) Except as provided in paragraphs (b) and (c) of this section, material and equipment in contamination areas, high contamination areas, and airborne radioactivity areas shall not be released to a controlled area if:

- (1) Removable surface contamination levels on accessible surfaces exceed the removable surface contamination values specified in appendix D of this part; or
- (2) Prior use suggests that the removable surface contamination levels on inaccessible surfaces are likely to exceed the removable surface contamination values specified in Appendix D of this part.

(b) Material and equipment exceeding the removable surface contamination values specified in Appendix D of this part may be conditionally released for movement on-site from one radiological area for immediate placement in another radiological area only if appropriate monitoring is performed and appropriate controls for the movement are established and exercised.

(c) Material and equipment with fixed contamination levels that exceed the total contamination values specified in Appendix D of this part may be released for use in controlled areas outside of radiological areas only under the following conditions:

- (1) Removable surface contamination levels are below the removable surface contamination values specified in Appendix D of this part; and (2) The material or equipment is routinely monitored and clearly marked or labeled to alert personnel of the contaminated status.

E.1.1.5 § 835.1102 Control of Areas

- (a) Appropriate controls shall be maintained and verified which prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions.
- (b) Any area in which contamination levels exceed the values specified in appendix D of this part shall be controlled in a manner commensurate with the physical and chemical characteristics of the contaminant, the radionuclides present, and the fixed and removable surface contamination levels.
- (c) Areas accessible to individuals where the measured total surface contamination levels exceed, but the removable surface contamination levels are less than, corresponding surface contamination values specified in Appendix D of this part, shall be controlled as follows when located outside of radiological areas:
 - (1) The area shall be routinely monitored to ensure the removable surface contamination level remains below the removable surface contamination values specified in Appendix D of this part; and
 - (2) The area shall be conspicuously marked to warn individuals of the contaminated status.
- (d) Individuals exiting contamination, high contamination, or airborne radioactivity areas shall be monitored, as appropriate, for the presence of surface contamination.
- (e) Protective clothing shall be required for entry to areas in which removable contamination exists at levels exceeding the removable surface contamination values specified in Appendix D of this part.

E.1.2 Appendix D to 10 CFR 835 – Surface Contamination Values

The data presented in Appendix D are to be used in identifying the need for posting of contamination and high contamination areas in accordance with § 835.603(e) and (f) and identifying the need for surface contamination monitoring and control in accordance with §§ 835.1101 and 835.1102.

Table E.1 Surface Contamination Values¹ in dpm/100 cm² as Reported in Appendix D to 10 CFR 835

Radionuclide	Removable^{2,4}	Total (Fixed+Removable)^{2,3}
U-nat, U-235, U-238, and associated decay products	1,000 ⁷	5,000 ⁷
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above ⁵	1,000	5,000
Tritium and tritiated compounds ⁶	10,000	N/A

¹ The values in this appendix, with the exception noted in footnote 5, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha-and beta-gamma-emitting nuclides exists, the limits established for alpha-and beta-gamma-emitting nuclides 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 The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) From measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds three times the applicable value.

⁴ The amount of removable radioactive material per 100 cm² of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note: The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

⁵ This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

⁶ Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a "Total" value does not apply.

⁷ (alpha)

DOE Order 5400.5 (Non-exhaustive Excerpts) from Chapter II

5. Release of Property Having Residual Radioactive Material

- (a) Release of Real Property. Release of real property (land and structures) shall be in accordance with the guidelines and requirements for residual radioactive material presented in Chapter IV. These guidelines and requirements apply to both DOE-owned facilities and to private properties that are being prepared by DOE for release. Real properties owned by DOE that are being sold to the public are subject to the requirements of Section 120(h) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended, concerning hazardous substances, and to any other applicable Federal, State, and local requirements. The requirements of 40 CFR Part 192 are applicable to properties remediated by DOE under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA).

- (b) Release of Personal Property. Personal property, which potentially could be contaminated, may be released for unrestricted use if the results of a survey with appropriate instruments indicate that the property is less than the contamination limits presented in Figure IV-1.
- (c) Release of Materials and Equipment.
 - (1) Surface Contamination Levels. Prior to being released, property shall be surveyed to determine whether both removable and total surface contamination (Including contamination present on and under any coating) are in compliance with the levels given in Figure IV-1 and that the contamination has been subjected to the ALARA process.
 - (2) Potential for Contamination. Property shall be considered to be potentially contaminated if it has been used or stored in radiation areas that could contain unconfined radioactive material or that are exposed to beams of particles capable of causing activation (neutrons, protons, etc.).
 - (3) Surveys. Surfaces of potentially contaminated property shall be surveyed using instruments and techniques appropriate for detecting the limits stated in Figure IV-1.
 - (4) Inaccessible Areas. Where potentially contaminated surfaces are not accessible for measurement (as in some pipes, drains, and ductwork), such property may be released after case-by-case evaluation and documentation based on both the history of its use and available measurements demonstrate that the unsurveyable surfaces are likely to be within the limits given in Figure IV-1.
 - (5) Records. The records of released property shall include:
 - (a) A description or identification of the property;
 - (b) The date of the last radiation survey;
 - (c) The identity of the organization and the individual who performed the monitoring operation;
 - (d) The type and identification number of monitoring instruments;
 - (e) The results of the monitoring operation; and
 - (f) The identity of the recipient of the released material.
 - (6) Volume Contamination. No guidance is currently available for release of material that has been contaminated in depth, such as activated material or smelted contaminated metals (e.g., radioactivity per unit volume or per unit mass). Such materials may be released if criteria and survey techniques are approved by EH-1.

E.1.3 DOE Guidance and Similar Documents

The following discussion summarizes DOE policy, practice, and guidance for the disposition of personal property, including materials and equipment from several DOE guidance documents.

“Application of DOE 5400.5 requirements for release and control of property containing residual radioactive material,” a guidance memorandum dated November 17, 1995. This guidance memorandum explains the procedures through which authorized limits can be approved for the disposition of waste materials to sanitary waste landfills. It also discusses the disposition criteria for certain radionuclides. Finally, it delegates some responsibilities for the approval of release of volumetrically contaminated materials to DOE field office managers when specified conditions are met.

Table E.2 Figure IV-1, from DOE Order 5400.5, as Supplemented in November, 1995
Memorandum: Surface Activity Guidelines – Allowable Total Residual Surface Activity
(dpm/100 cm²)¹

Radionuclides²	Average^{3,4}	Maximum^{4,5}	Removable^{4,6}
Group 1 - Transuranics, I-125, I-129, Ac-227, Ra - 226, Ra-228, Th-228, Th-230, Pa-231	100	300	20
Group 2 - Th-natural, Sr-90, I-126, I-131, I-133, Ra-223, Ra-224, U-232, Th-232	1,000	3,000	200
Group 3 - U-natural, U-235, U-238, and associated decay products, alpha emitters	5,000	15,000	1,000
Group 4 - Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above ⁷	5,000	15,000	1,000
Tritium (applicable to surface and subsurface) ⁸	N/A	N/A	10,000

¹ 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 measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

² Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

³ Measurements of average contamination should not be averaged over an area of more than 1 m². For objects of less surface area, the average should be derived for each such object.

⁴ The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

⁵ The maximum contamination level applies to an area of not more than 100 cm².

⁶ The amount of removable material per 100 cm² of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

⁷ This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

⁸ Property recently exposed or decontaminated, [sic] should have measurements (smears) at regular time intervals to ensure that there is not a build-up of contamination over time. Because tritium typically penetrates material it contacts, the surface guidelines in group 4 are not applicable to tritium. The Department has reviewed the analysis conducted by the DOE Tritium Surface Contamination Limits Committee ("Recommended Tritium Surface Contamination Release Guides," February 1991), and has assessed potential doses associated with the release of property containing residual tritium. The Department recommends the use of the stated guideline as an interim value for removable tritium. Measurements demonstrating compliance of the removable fraction of tritium on surfaces with this guideline are acceptable to ensure that non-removable fractions and residual tritium in mass will not cause exposures that exceed DOE dose limits and constraints.

"Control and Release of Property with Residual Radioactive Material for use with DOE Order 5400.5, Radiation Protection of the Public and the Environment," DOE G 441.1-XX, a draft guidance document approved for interim use and issued on May 1, 2002. This guidance document contains detailed discussions of the disposition approaches for real and personal property, as well as summaries of DOE's policies regarding the disposition or release of property.

"Cross-Cut Guidance on Environmental Requirements for DOE Real Property Transfers (Update)," DOE/EH-413/97-12, originally issued October, 1997, revised March, 2005. This

guidance document contains a summary of various environmental requirements for the release or transfer of real property.

“Managing the Release of Surplus and Scrap Materials,” January 19, 2001, from DOE Secretary Richardson to all DOE elements. This memorandum provides direction as well as guidance regarding the release of property from DOE radiological control. It also restricts the release of metal from radiological areas for recycle until certain steps are taken by DOE.

E.2 International Organizations

In general, each country establishes its own disposition criteria for materials and equipment. These national disposition criteria may be consistent with guidance promulgated by multi-national organizations, such as the International Atomic Energy Agency (IAEA) or the European Commission (EC). One example of widely accepted regulations is the “Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material SAFETY GUIDE No. TS-G-1.1 (ST-2).” The references listed below provide the detailed information on guidance from the IAEA and the EC. URLs are provided for internet access of this information. Disposition criteria from specific nations should be obtained from those nations.

E.2.1 International Atomic Energy Agency (IAEA)

Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material SAFETY GUIDE No. TS-G-1.1 (ST-2):

http://www-pub.iaea.org/MTCD/publications/PDF/Pub1109_scr.pdf.

Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material, SAFETY GUIDE No. TS-G-1.2 (ST-3)

http://www-pub.iaea.org/MTCD/publications/PDF/Pub1119_scr.pdf.

Application of the Concepts of Exclusion, Exemption and Clearance SAFETY GUIDE No. RS-G-1.7: http://www-pub.iaea.org/MTCD/publications/PDF/Pub1202_web.pdf.

E.2.2 European Commission

The publication list for radiation protection may be found on the EC website at:

http://europa.eu.int/comm/energy/nuclear/radioprotection/publication_en.htm. Contact information for most of the authorities in the European Union may be found in Annex 3, in the last pages of publication 139, “A review of consumer products containing radioactive substances in the European Union,” which can be found at:

http://europa.eu.int/comm/energy/nuclear/radioprotection/publication/doc/139_en.pdf.

Radiation protection publications pertaining to disposition criteria for materials and equipment include:

134: Evaluation of the application of the concepts of exemption and clearance for practices according to title III of Council Directive 96/29/Euratom of 13 May 1996 in EU Member States, Volume 1, Main Report:

http://europa.eu.int/comm/energy/nuclear/radioprotection/publication/doc/134_en.pdf.

122: Practical Use of the Concepts of Clearance and Exemption Part I: Guidance on General Clearance Levels for Practices:

http://europa.eu.int/comm/energy/nuclear/radioprotection/publication/doc/122_part1_en.pdf.

122: Practical Use of the Concepts of Clearance and Exemption Part II: Application of the Concepts of Exemption and Clearance to Natural Radiation Sources:

http://europa.eu.int/comm/energy/nuclear/radioprotection/publication/doc/122_part2_en.pdf.

114: Definition of Clearance Levels for the Release of Radioactively Contaminated Buildings and Building Rubble:

http://europa.eu.int/comm/energy/nuclear/radioprotection/publication/doc/114_en.pdf.

European legislation related to the transport of radioactive materials (database):

http://europa.eu.int/comm/energy/nuclear/transport/legislation_en.htm.

E.3 Nuclear Regulatory Commission

Disposition criteria specified by NRC regulations are found in the Code of Federal Regulations, Title 10 (10 CFR). NRC regulations in 10 CFR are structured in Parts, which apply to respective areas of applicability. For example, 10 CFR Part 20 addresses “Standards for Protection against Radiation.” The regulatory citations below indicate the specific Part by the number to the left of the decimal point, for example, §20.2003 is in 10 CFR Part 20, and 2003 indicates a specific portion. In this appendix only the radiological component of those criteria pertaining to quantitative measurement attributes are listed; there are almost always additional regulatory requirements. “Disposition criteria” refers to the quantitative radiological portion of the complete criteria. In some circumstances, disposition criteria are not addressed in the regulations, and these cases are handled by existing policy and practices. A list of NRC disposition criteria, which is not necessarily exhaustive, follows.

E.3.1 § 20.2003 Disposal by Release into Sanitary Sewerage.

- (2) The quantity of licensed or other radioactive material that the licensee releases into the sewer in 1 month divided by the average monthly volume of water released into the sewer by the licensee does not exceed the concentration listed in table 3 of appendix B to part 20; and
- (4) The total quantity of licensed and other radioactive material that the licensee releases into the sanitary sewerage system in a year does not exceed 5 curies (185 GBq) of hydrogen-3, 1 curie (37 GBq) of carbon-14, and 1 curie (37 GBq) of all other radioactive materials combined.

E.3.2 § 20.2005 Disposal of Specific Wastes

- (a) A licensee may dispose of the following licensed material as if it were not radioactive
 - (1) 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and
 - (2) 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.

E.3.3 § 35.92 Decay-in-Storage

- (a) A licensee may hold byproduct material with a physical half-life of less than 120 days for decay-in-storage before disposal without regard to its radioactivity if it–
- (1) Monitors byproduct material at the surface before disposal and determines that its radioactivity cannot be distinguished from the background radiation level with an appropriate radiation detection survey meter set on its most sensitive scale and with no interposed shielding.

E.3.4 § 35.315 Safety Precautions

- (4) Either monitor material and items removed from the patient's or the human research subject's room to determine that their radioactivity cannot be distinguished from the natural background radiation level with a radiation detection survey instrument set on its most sensitive scale and with no interposed shielding, or handle the material and items as radioactive waste.

E.3.5 § 36.57 Radiation Surveys

- (e) Before releasing resins for unrestricted use, they must be monitored before release in an area with a background level less than 0.5 microsievert (0.05 millirem) per hour. The resins may be released only if the survey does not detect radiation levels above background radiation levels. The survey meter used must be capable of detecting radiation levels of 0.5 microsievert (0.05 millirem) per hour.

E.3.6 Appendix A to Part 40—Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content

- (6) The design requirements in this criterion for longevity and control of radon releases apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land, averaged over areas of 100 square meters, which, as a result of byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15 cm below the surface.

E.3.7 § 71.4 Definitions

The following terms are as defined here for the purpose of this part. To ensure compatibility with international transportation standards, all limits in this part are given in terms of dual units: The International System of Units (SI) followed or preceded by U.S. standard or customary units. The U.S. customary units are not exact equivalents but are rounded to a convenient value, providing a functionally equivalent unit. For the purpose of this part, either unit may be used.

A_1 means the maximum activity of special form radioactive material permitted in a Type A package. This value is either listed in Appendix A, Table A-1, of this part, or may be derived in accordance with the procedures prescribed in Appendix A of this part.

A_2 means the maximum activity of radioactive material, other than special form material, LSA, and SCO material, permitted in a Type A package. This value is either listed in Appendix A, Table A-1, of this part, or may be derived in accordance with the procedures prescribed in Appendix A of this part.

Low Specific Activity (LSA) material means radioactive material with limited specific activity which is nonfissile or is excepted under §71.15, and which satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of three groups:

(1) LSA-I

- (i) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radioactive radionuclides which are not intended to be processed for the use of these radionuclides;
- (ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures;
- (iii) Radioactive material for which the A_2 value is unlimited; or
- (iv) Other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentration determined in accordance with Appendix A.

(2) LSA-II

- (i) Water with tritium concentration up to 0.8 TBq/L (20.0 Ci/L); or
- (ii) Other material in which the activity is distributed throughout and the average specific activity does not exceed $10^{-4}A_2/\text{g}$ for solids and gases, and $10^{-5}A_2/\text{g}$ for liquids.

(3) LSA-III. Solids (e.g., consolidated wastes, activated materials), excluding powders, that satisfy the requirements of § 71.77, in which:

- (i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);
- (ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that even under loss of packaging, the loss of radioactive material per package by leaching, when placed in water for 7 days, would not exceed $0.1 A_2$; and
- (iii) The estimated average specific activity of the solid does not exceed $2 \times 10^{-3}A_2/\text{g}$.

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

Surface Contaminated Object (SCO) means a solid object that is not itself classed as radioactive material, but which has radioactive material distributed on any of its surfaces. SCO must be in one of two groups with surface activity not exceeding the following limit:

- (1) SCO-I: A solid object on which:
 - (i) The non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 (10^4 microcurie/ cm^2) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm^2 (10^{-5} microcurie/ cm^2) for all other alpha emitters;
 - (ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ (1.0 microcurie/ cm^2) for beta and gamma and low toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ (0.1 microcurie/ cm^2) for all other alpha emitters; and
 - (iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ (1 microcurie/ cm^2) for beta and gamma and low toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ (0.1 microcurie/ cm^2) for all other alpha emitters.
- (2) SCO-II: A solid object on which the limits for SCO-I are exceeded and on which:
 - (i) The nonfixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 400 Bq/cm^2 (10^2 microcurie/ cm^2) for beta and gamma and low toxicity alpha emitters or 40 Bq/cm^2 (10^3 microcurie/ cm^2) for all other alpha emitters;
 - (ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8 \times 10^5 \text{ Bq/cm}^2$ (20 microcuries/ cm^2) for beta and gamma and low toxicity alpha emitters, or $8 \times 10^4 \text{ Bq/cm}^2$ (2 microcuries/ cm^2) for all other alpha emitters; and
 - (iii) The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8 \times 10^5 \text{ Bq/cm}^2$ (20 microcuries/ cm^2) for beta and gamma and low toxicity alpha emitters, or $8 \times 10^4 \text{ Bq/cm}^2$ (2 microcuries/ cm^2) for all other alpha emitters.

E.3.8 § 71.14 Exemption for Low-Level Materials

- (a) A licensee is exempt from all the requirements of this part with respect to shipment or carriage of the following low-level materials:
 - (1) Natural material and ores containing naturally occurring radionuclides that are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values specified in Appendix A, Table A-2, of this part.
 - (2) Materials for which the activity concentration is not greater than the activity concentration values specified in Appendix A, Table A-2 of this part, or for which the consignment activity is not greater than the limit for an exempt consignment found in Appendix A, Table A-2, of this part.
- (b) A licensee is exempt from all the requirements of this part, other than §§ 71.5 and 71.88, with respect to shipment or carriage of the following packages, provided the packages do not

contain any fissile material, or the material is exempt from classification as fissile material under § 71.15:

- (1) A package that contains no more than a Type A quantity of radioactive material;
- (2) A package transported within the United States that contains no more than 0.74 TBq (20 Ci) of special form plutonium-244; or
- (3) The package contains only LSA or SCO radioactive material, provided--
 - (i) That the LSA or SCO material has an external radiation dose of less than or equal to 10 mSv/h (1 rem/h), at a distance of 3 m from the unshielded material; or
 - (ii) That the package contains only LSA-I or SCO-I material.

E.3.9 § 110.22 General License for the Export of Source Material

- (3) Th-227, Th-228, U-230, and U-232 when contained in a device, or a source for use in a device, in quantities of less than 100 millicuries of alpha activity (3.12 micrograms Th-227, 122 micrograms Th-228, 3.7 micrograms U-230, 4.7 milligrams U-232) per device or source.

E.3.10 § 110.23 General License for the Export of Byproduct Material

- (2) Actinium-225 and -227, americium-241 and -242m, californium-248, -249, -250, -251, -252, -253, and -254, curium-240, -241, -242, -243, -244, -245, -246 and -247, einsteinium-252, -253, -254 and -255, fermium-257, gadolinium-148, mendelevium-258, neptunium-235 and -237, polonium-210, and radium-223 must be contained in a device, or a source for use in a device, in quantities of less than 100 millicurie of alpha activity (see Sec. 110.2 for specific activity) per device or source, unless the export is to a country listed in Sec. 110.30. Exports of americium and neptunium are subject to the reporting requirements listed in paragraph (b) of this section.
- (3) For americium-241, exports must not exceed one curie (308 milligrams) per shipment or 100 curies (30.8 grams) per year to any country listed in Sec. 110.29, and must be contained in industrial process control equipment or petroleum exploration equipment in quantities not to exceed 20 curies (6.16 grams) per device or 200 curies (61.6 grams) per year to any one country.
- (5) For polonium-210, the material must be contained in static eliminators and may not exceed 100 curies (22 grams) per individual shipment.
- (6) For tritium in any dispersed form, except for recovery or recycle purposes (e.g., luminescent light sources and paint, accelerator targets, calibration standards, labeled compounds), exports must not exceed the quantity of 10 curies (1.03 milligrams) or less per item, not to exceed 1,000 curies (103 milligrams) per shipment or 10,000 curies (1.03 grams) per year to any one country. Exports of tritium to the countries listed in Sec. 110.30 must not exceed the quantity of 40 curies (4.12 milligrams) or less per item, not to exceed 1,000 curies (103 milligrams) per shipment or 10,000 curies (1.03 grams) per year to any one country, and exports of tritium in luminescent safety devices installed in aircraft must not exceed a quantity of 40 curies (4.12 milligrams) or less per light source.

E.3.11 Policies and Practices

Disposition criteria for the release of materials and equipment that are not specified in NRC regulations are determined by the current policies and practices. NRC's current approaches for making decisions on disposition of solid materials is different for materials licensees, i.e., industrial, research, and medical facilities, and for reactors, which include power, test, and research reactors. These are summarized in Table E-3, and discussed in more detail below.

For non-reactor licensees—materials licensees—licensee requests for release of solid material will continue to be evaluated using the nuclide concentration tables in Regulatory Guide 1.86 and its equivalent, Fuel Cycle Policy and Guidance Directive FC 83-23. Many materials licensees obtain approval, as a license condition, to routinely use these guidelines. For residual radioactivity within the volume of solid materials (for example, within a concrete or soil matrix), non-reactor licensee requests for release of solid material may continue to be approved under a disposal request (10 CFR 20.2002); a license termination plan; decommissioning plan review; or other specific license amendment. In verifying that the dose from such release is maintained ALARA and below the limits of our regulations in 10 Part 20, approval of a release is possible. The disposition of materials with volumetrically distributed radioactivity from materials licensees is considered on a case-by-case basis with a reference of an annual individual dose criterion of a “few mrem per year (a few 0.01 mSv/a).”

Non-reactor licensees, that is, materials licensees, and reactor licensees have essentially the same detection level criteria for surface activity. But for materials licensees, radioactivity below these detection level criteria is allowed—detectable radioactivity is not allowed at any level for reactor licensees.

For reactor licensees, licensees may release of solid material using the “no detectable” policy of NRC's Inspection and Enforcement Circular 81-07 and Information Notices 85-92 and 88-22. For reactors, the policy is that released material can have no detectable licensed radioactivity. The levels of detection are specified by each reactor licensee's procedures and are frequently consistent with a now discontinued Regulatory Guide issued in 1974. In practice, these detection levels for radioactivity on surfaces are: $5/6 \text{ Bq/cm}^2$ ($5,000 \text{ dpm}/100 \text{ cm}^2$) total β - γ and $1/6 \text{ Bq/cm}^2$ ($1,000 \text{ dpm}/100 \text{ cm}^2$) removable β - γ . Non-detection at these levels of detectability was considered to result in potential doses to an individual significantly less than 5 mrem/y ($<<0.05 \text{ mSv/a}$) from any non-detectable radioactivity that could remain on surfaces.

Detection levels for α -emitting radioactivity are specified as $1/60 \text{ Bq/cm}^2$ ($100 \text{ dpm}/100 \text{ cm}^2$) total and $1/300 \text{ Bq/cm}^2$ ($20 \text{ dpm}/100 \text{ cm}^2$) for removable α -emitting radioactivity. For volumetric radioactivity from reactors, the detection levels are from guidance written in the late 1970s and specifies β - γ concentrations in the general range of 3–4 Bq/kg (81–108 pCi/kg).

Table E.3 Summary of NRC Disposition Criteria from Current Practices for the Release of Materials and Equipment

	Surficial Radioactivity	Volumetric Radioactivity
Reactor Licenses	β-γ: Non-detectable [MDC 5/6 Bq/cm ² ; 1/6 Bq/cm ² removable]	β-γ: Non-detectable [MDC in General range of $\approx$ 3-4 Bq/kg]
	α: Non-detectable [MDC 1/60 Bq/cm ² ; 1/300 Bq/cm ² removable]	α: Non-detectable [MDC not indicated]
Materials Licenses	β-γ: 5/6 Bq/cm ² ; 1/6 Bq/cm ² removable ¹	β-γ: Case-by-case [Reference to a few 0.01 mSv in a year]
	α: 1/60 Bq/cm ² ; 1/300 Bq/cm ² removable ²	α: Case-by-case [Reference to a few 0.01 mSv in a year]

¹ Except Sr-90, I-126, I-131, and I-133, where 1/6 Bq/cm² and 1/30 Bq/cm² removable applies; and except I-125, and I-129 where 1/60 Bq/cm² and 1/300 Bq/cm² removable applies.

² Except natural U, U-235, U-238, and associated decay products where 5/6 Bq/cm² and 1/6 Bq/cm² removable applies; and except transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, and Ac-227, where 1/60 Bq/cm² and 1/300 Bq/cm² removable applies.

E.3.12 Issues Related to International Trade

With regard to issues relating to international trade of solid materials released from facilities, NRC's regulations contain requirements for export and import of material and could be considered in handling materials that meet established international clearance criteria and, at the same time, do not meet the guidelines for NRC licensees. Among other things, these regulations require that "the proposed import does not constitute an unreasonable risk to the public health and safety."