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Standard Guide for Unrestricted Disposition of Bulk Materials Containing Residual Amounts of Radioactivity¹

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^{ε1}Note—1.5 was added editorially in November 2005.

INTRODUCTION

The feasibility of the recycle of bulk material containing trace amounts of radioactive contamination depends on the dose to the public that could occur as a result. However, the assessment of this dose depends not only on the measurements of contaminants present, but also on the future use of the material and the pathways by which persons can be exposed. This guide provides a recommended approach to support a petition (to a regulatory agency) seeking approval for the recycle or disposal of the material outside of the radioactive materials regulatory arena.

If dose rate limits are established by regulation, this approach is a recommended way to demonstrate compliance with them. Until that occurs, the limits will have to be proposed by the owners that advance the argument that recycle should be permitted because the dose is very small.

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The Scope defines the range of applicability of this guide; the Summary identifies the two major steps that comprise the method; and the significance of the guide is given in Section 5. Section 6 discusses the need for dose rate based release criteria, and Section 7 delineates the steps for deciding whether or not a material should be considered for recycle. Section 8 describes the steps needed to implement the recommendations of this guide including the development of a data package to support the petition and to serve as a permanent record.

1. Scope

1.1 This guide covers the techniques for obtaining approval for release of materials encountered in decontamination and decommissioning (D&D) from restricted use. This would be addressed in the decommissioning plan (E 1281). It applies to materials that do not meet any of the requirements for regulatory control because of radioactivity content. Fig. 1 shows the logic diagram for determining the materials that could be considered for release. Materials that negotiate this logic tree are referred to as “candidate for release based on dose.”

1.2 The objective of this guide is to provide a methodology for distinguishing between material that must be carefully isolated to prevent human contact from that that can be recycled or otherwise disposed of. It applies to material in which the radioactivity is dispersed more or less uniformly throughout the volume of the material (termed residual in bulk form) as opposed to surface contaminated objects.

1.3 Surface contaminated objects are materials externally contaminated with radioactive material. Provisions already exist for their release for recycle if it can be shown that they meet applicable federal and state regulations for surface contamination. Regulatory Guide 1.86 and DOE Order 5400.5 specify the upper limits for radioactive surface contamination on material to be released for unrestricted use.

1.4 The release of material containing residual radioactive material (except for ²²⁶Ra) in bulk form (for example, soil or slightly activated metal) is based on the demonstration that the dose to a member of the public will be lower than a specified value (proposed by the petitioner or ~~to be determined defined by future regulation~~) for its intended use *and* lower than a second specified value (~~also proposed by the petitioner or to be determined by future regulation~~) via the most restrictive plausible scenario. The first

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proposed value should be lower than the second since the dose to any member of the public (via the intended use scenario) will almost certainly be realized, whereas the dose from the alternate scenario will only accrue if an unintended (and presumably less probable) circumstance arises. Federal regulation already exists for the release of ²²⁶Ra contaminated soils.

1.5 **Warning**—Breathing of asbestos dust is hazardous. Asbestos and asbestos products present demonstrated health risks for users and for those with whom they come into contact. In addition to other precautions, when working with asbestos products, minimize the dust that results. For information on the safe use of chrysotile asbestos, refer to “Safe Use of Chrysotile Asbestos: A Manual on Preventive and Control Measures.”

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard see 1.5.

2. Referenced Documents

2.1 ASTM Standards:

- E1278 [Guide for Radioactive Pathway Methodology for Release of Sites Following Decommissioning](#)²
- E 2216 [Guide for Evaluating Disposal Options for Concrete from Nuclear Facility Decommissioning](#)
- E 1892 [Guide for Preparing Characterization Plans for Decommissioning Nuclear Facilities](#)
- E 1281 [Guide for Nuclear Facility Decommissioning Plans](#)

2.2 American Nuclear Insurers Document:

ANI/MAELU Information Bulletin 80-1A, Nuclear Liability Insurance Records Retention³

2.3 DOE Document—DOE Documents:

DOE Order 5400.5, DOE Order 5400.5 Radiation Protection of the Public and the Environment⁴

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards, Vol 12.02, volume information, refer to the standard’s Document Summary page on the ASTM website.

³ Available from American Nuclear Insurers, 29 South Main, Suite 300 S, West Hartford, CT 06107-2445.

⁴ Available from Department of Energy, National Technical Information Service, U.S. Dept. of Commerce, Springfield, VA 22161.

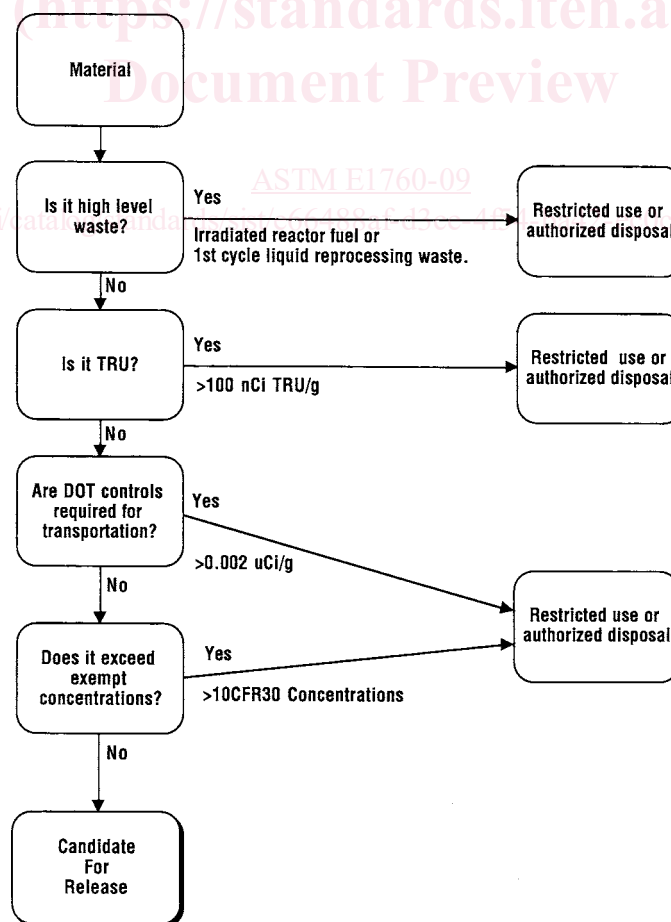


FIG. 1 Prerequisites for Material To Be Candidate For Release

Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors⁴

RESRAD RESidual RADioactivity Family of Computer Codes Developed for DOE by the Argonne National Laboratory⁵

2.4 *International Atomic Energy Agency Document:*

Safety Series No. 111-P-1.1, Application of Exemption Principles to the Recycle and Reuse of Materials from Nuclear Facilities⁶

2.5 *Nuclear Regulatory Commission Documents:*⁷

NUREG/CR-5512, Residual Radioactive Contamination from Decommissioning

Regulatory Guide 1.86 Termination of Operating Licenses for Nuclear Reactors

2.6 *U.S. Government Documents:*

40CFR 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings⁶

10 CFR 20, Standards for Protection Against Radiation, Subpart E, Radiological Criteria for License Termination

40 CFR 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings⁷

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geological Repositories⁷

10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste⁷

40 CFR 117, Determination of Reportable Quantities for Hazardous Substances⁷

40 CFR 261, Identification and Listing of Hazardous Waste⁷

40 CFR 268, Land Disposal Restrictions⁷

40 CFR 712, Chemical Information Rules⁷

40 CFR 716, Health and Safety Data Reporting⁷

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *credible, adj*—offering reasonable grounds for being believed.

3.1.2 *intended use, n*—the first use planned for the material proposed to be released from radiological controls.

3.1.3 *primary dose limit, n*—the limit for exposures that could occur via the intended use scenario.

3.1.4 *secondary dose limit, n*—the limit for exposure that could occur via the unplanned use scenario.

3.1.5 *unplanned use, n*—any use other than the planned use that may occur after the intended use or by accident.

4. Summary of Guide

4.1 The owner of the material must first determine if the material is candidate for release. To do this one must take representative samples of the bulk material and identify the radioactive contaminants and concentrations. Sampling should be done using standard statistical inspection methods. The kinds of analyses shall be appropriate for the potential contaminant expected, and performed using standard techniques (E 1892). For some of these analyses, for example, ³H or ¹⁴C in activated concrete or ⁵⁵Fe in steel, the standard techniques are beyond the capabilities of many laboratories. Material that passes the logic diagram shown in Fig. 1 is candidate for release. The sampling, analysis, and determination of candidacy must be documented and included in the record package. The RESRAD family of computer codes, particularly RESRAD-RECYCLE, provide a methodology for correlating unrestricted disposition criteria with the measurable radiological quantities contained within the bulk materials. For example, end-point receptor dose may be correlated to radioactive concentration through site-specific pathways.

4.2 Fig. 2 diagrammatically shows how a material that is candidate for release should be treated to justify its release from radiologically restricted/radiological restriction use. Section 7 describes the methodology shown.

5. Significance and Use

5.1 Materials encountered during D&D may contain residual radioactivity varying in amounts from that in irradiated fuel to barely detectable quantities in or on building materials. It is clear that highly radioactive materials have to be disposed as radioactive waste pursuant to 10 CFR 60 and 10 CFR 61. Conversely, it is not reasonable to expend a disproportionate amount of resources to isolate materials that contain minute quantities of radioactive materials that will not cause even statistically measurable health effects.

5.2 This guide provides a rationale and methodology for distinguishing between materials that contain sufficient radioactivity to warrant isolation of some type (storage awaiting decay, near-surface disposal, disposal with intruder protection, or placement in a deep repository) from materials with insignificant radioactive content. Materials with insignificant radioactive content can be

⁴ International Atomic Energy Agency, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria.

⁵ C. Yu, et al., "Users Manual for RESRAD, ANL/EAD-4," "Users Manual for RESRAD-BUILD," ANL/EAD-03-1," "Users Manual for RESRAD-OFFSITE," NUREG/CR-6937 and "RESRAD-RECYCLE, A Computer Model for Analyzing the Radiological Dose and Risks Resulting from the Recycle of Scrap Metal and the Reuse of Surface Contaminated Material and Equipment," ANL/EAD-3. Available online at www.ead.anl.gov.

⁶ Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

⁷ International Atomic Energy Agency, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria.

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