



Designation: E1760 – 09

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

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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.

Since dose rate limits have been established by regulation, this approach is a recommended way to demonstrate compliance with them.

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 (E1281). 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 ^{226}Ra) 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 defined by regulation) for its intended use *and* lower than a second specified value via the most restrictive plausible scenario. The first 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 ^{226}Ra 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

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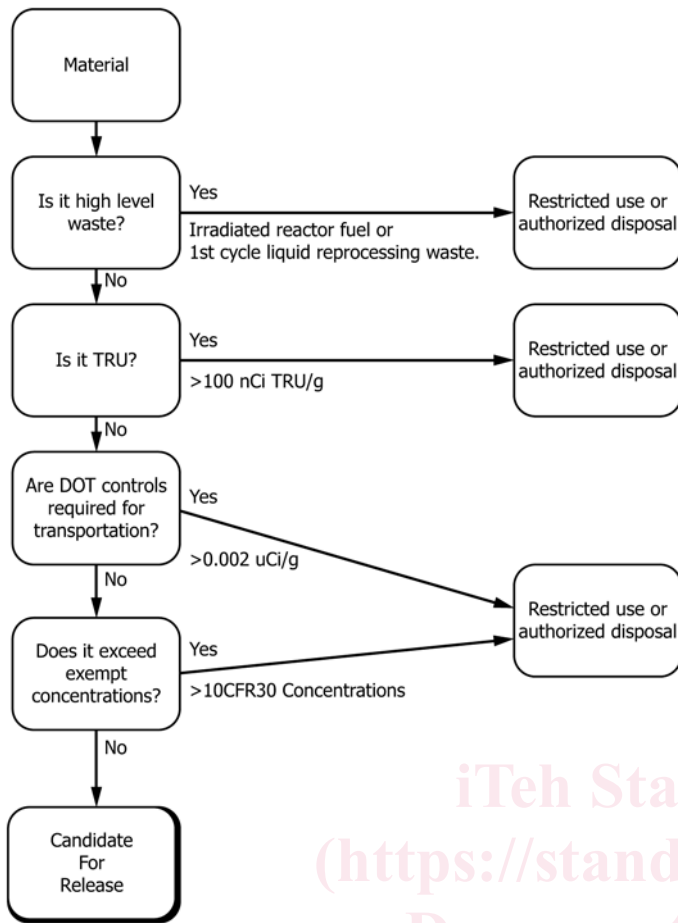


FIG. 1 Prerequisites for Material To Be Candidate For Release

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:²

E2216 Guide for Evaluating Disposal Options for Concrete from Nuclear Facility Decommissioning

E1892 Guide for Preparing Characterization Plans for Decommissioning Nuclear Facilities

E1281 Guide for Nuclear Facility Decommissioning Plans

2.2 American Nuclear Insurers Document:

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

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 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.

2.3 DOE Documents:

DOE Order 5400.5 Radiation Protection of the Public and the Environment⁴

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:

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

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

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

⁷ Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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 (E1892). 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 radiological restriction use. Section 7 describes the methodology shown.

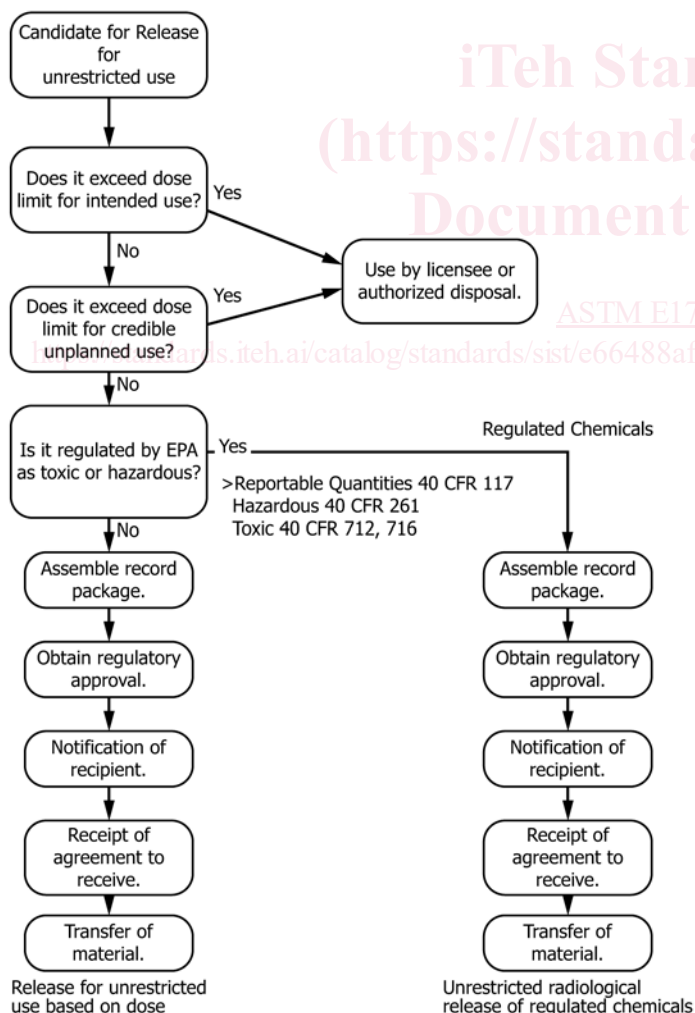


FIG. 2 Methodology for Approving Candidate Material for Unrestricted Release

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 recycled in the economy or disposed of in conventional (landfill) facilities without adverse health effects. Materials that meet the criteria identified in this guide are not simply excluded from regulation because they do not fall precisely in the regulatory scope. They are sufficiently free of radioactive material so that no further efforts at control are justified for radiation protection purposes. Therefore, the release of materials for unrestricted use in accordance with this guide meets the criteria for being an “as low as reasonably achievable” (ALARA) activity.

5.3 For the purpose of this guide, the return of materials containing residual radioactivity to society without regulatory restrictions is referred to as “unrestricted release based on the absence of the credible potential for adverse health effects.” This guide asserts that materials recycled this way will have no statistically measurable health effects regardless of use. It does not guarantee that the materials are suitable for use in every possible application, for example, trace amounts of radionuclides in materials may not be acceptable for certain photographic and electronic applications.

5.4 This guide also asserts that the owner of the materials is responsible for ensuring that society’s criteria for “no measurable health effects” is met before release, and that the responsibility for providing materials with the purity required for a special application rests not with the owner, but with the developer of that application.

6. Criteria for Unrestricted Release

6.1 There are three criteria for the release of bulk materials that are candidates for release (that is, that have negotiated the logic diagram shown in Fig. 1). First, the material must not be expected to cause more than the intended use dose limit when used for the intended purpose. Second, the material must not be expected to cause more than the unplanned use dose limit when used for the most restrictive credible unplanned purpose. Finally, the materials must maneuver the procedural gates described in this guide successfully. The RESRAD computer code system and NUREG/CR-5512 provide methodologies for supporting the logic determinations. Regulatory limits that must be addressed are found in the CFRs referenced in Section 2.