

DATE: April 4, 2002

FROM: STEPHEN M. SMITH, DEPUTY DIRECTOR  
OFFICE OF CORPORATE SOLUTIONS, ME-80

TO: DIRECTIVES POINTS OF CONTACT

SUBJECT: DRAFT DOE G 441.1-XX, CONTROL AND RELEASE OF PROPERTY WITH  
RESIDUAL RADIOACTIVE MATERIAL for use with DOE 5400.5, *Radiation  
Protection of the Public and the Environment*

This is to notify you that the subject draft Guide has been posted in the “Draft” section of the Explorit system for simultaneous use and coordination. The Guide provides DOE’s guidance for the control and release of property that may contain residual radioactive material. Implementation guidance is also provided for Department and contractor personnel who perform cleanup of property contaminated with residual radioactive material.

***Comments on the Guide are due June 4, 2002. Comments on Guides should not be designated “major” or “suggested”, they should be simply labeled as “comments”. The following procedures should be followed for the submission of comments:***

Directives Points of Contact at Headquarters Elements: Submit one set of consolidated comments to the originator of the Guide: Stephen Domotor, EH-412, Room GA-098, Forrestal, facsimile (202) 586-3915; or INTERNET address: [STEPHEN.DOMOTOR@eh.doe.gov](mailto:STEPHEN.DOMOTOR@eh.doe.gov)

Send an additional copy of comments to LaVerne Fuller, ME-80, Room 4B-222, Forrestal, facsimile: 202-586-1972, or to: [laverne.fuller@hq.doe.gov](mailto:laverne.fuller@hq.doe.gov).

Directives Points of Contact at Field Elements: Submit consolidated comments to the writer as well as a copy to ME-80. The package submitted by Field Elements shall include as an attachment the comments provided by contractors.

Contractors will submit comments directly to their appropriate Field Elements.

Questions concerning the content of the Guide should be directed to Stephen Domotor, (202) 586-0871. Questions on the directives system should be directed to LaVerne Fuller at (202) 586-1996.

Attachment



**NOT MEASUREMENT  
SENSITIVE**

**DOE G 441.1-XX  
XX-XX-02**

## **IMPLEMENTATION GUIDE**

# **CONTROL AND RELEASE OF PROPERTY WITH RESIDUAL RADIOACTIVE MATERIAL** *for use with DOE 5400.5, Radiation Protection of the Public and the Environment*

*[This Guide describes suggested nonmandatory approaches for meeting requirements. Guides are not requirements documents and are not construed as requirements in any audit or appraisal for compliance with the parent Policy, Order, Notice, or Manual.]*

---



**U.S. Department of Energy  
Washington, D.C. 20585**

---

**DISTRIBUTION:**  
All Departmental Elements

**INITIATED BY:**  
Office of Environment, Safety and Health

**CONTENTS**

ACRONYMS .....	vii
1. PURPOSE, SCOPE, AND ORGANIZATION .....	1
1.1 PURPOSE AND SCOPE .....	1
1.2 ORGANIZATION .....	1
1.3 ENHANCEMENTS AND IMPROVEMENTS TO DOE'S MONITORING AND RELEASE PRACTICES .....	2
2. DEFINITIONS .....	5
3. PRINCIPAL REQUIREMENTS .....	7
3.1 DOSE LIMITS AND CONSTRAINTS .....	7
3.1.1 Dose Limit .....	7
3.1.2 Dose Constraint .....	7
3.2 ALARA PROCESS .....	8
3.3 RADIOLOGICAL SURVEYS .....	8
3.4 PUBLIC INVOLVEMENT AND NOTIFICATION .....	8
3.5 VERIFICATION AND QUALITY ASSURANCE .....	9
3.5.1 Verification .....	9
3.5.2 Quality Assurance .....	9
3.6 PROCESS AND HISTORICAL KNOWLEDGE CLEARANCE OF PROPERTY .....	10
3.7 COMPLIANCE WITH OTHER APPLICABLE FEDERAL OR STATE REQUIREMENTS .....	10
3.8 FINAL DOCUMENTATION AND AVAILABILITY .....	10
3.8.1 Specific Elements of the Final Documentation .....	10
3.8.2 A Graded Approach to Documentation .....	11
3.9 RECORDS MAINTENANCE AND REPORTING .....	11
4. THE RELEASE OPTIONS ANALYSIS PROCESS .....	13
4.1 DOE ALARA PRINCIPLES AND PROCESS AS THE BASIS FOR AUTHORIZED RELEASE LIMITS .....	13
4.1.1 ALARA Requirements .....	13
4.1.2 ALARA Principles and Process .....	13
4.1.3 Guidance for Implementing the ALARA Process .....	13
4.2 USE SCENARIOS AND LIMITS FOR AUTHORIZED RELEASE .....	14
4.2.1 Doses Under Likely Use Scenarios .....	14
4.2.2 Doses Under Worst Plausible Use Scenarios .....	14

**CONTENTS (continued)**

4.3	EVALUATION OF INDIVIDUAL DOSE IN THE RELEASE OPTIONS ANALYSIS PROCESS .....	15
4.4	EVALUATION OF COLLECTIVE DOSE IN THE RELEASE OPTIONS ANALYSIS PROCESS .....	15
4.4.1	Collective Dose .....	16
4.4.2	Appropriate Time Intervals for Integrating Collective Doses and for Assessing Doses to Current versus Future Generations .....	16
4.5	EVALUATION OF OTHER FACTORS IN THE RELEASE OPTIONS ANALYSIS PROCESS .....	18
5.	SPECIFIC APPLICATIONS OF THE AUTHORIZED RELEASE PROCESS .....	19
5.1	NATURALLY OCCURRING AND ACCELERATOR-PRODUCED RADIOACTIVE MATERIAL .....	19
5.2	SOILS .....	19
5.2.1	Appropriate Averaging Areas for Authorized Releases .....	19
5.2.2	Hot-Spot Criteria .....	20
5.3	RADIUM AND RADON .....	21
5.3.1	Radium .....	21
5.3.2	Radon .....	22
5.4	SURFACE ACTIVITY ON PROPERTY (STRUCTURES AND PERSONAL PROPERTY) .....	22
5.4.1	Surface Activity Guidelines .....	22
5.4.2	Surface Activity Guidelines and Their Use in Setting Authorized Limits for Buildings .....	23
5.4.3	Surface Activity Guidelines for Tritium .....	23
5.4.4	Surveys and Measurements .....	25
5.5	VOLUME AND MASS CONTAMINATION AND ALTERNATE SURFACE LIMITS .....	25
5.6	RELEASE OF PERSONAL PROPERTY INCLUDING EQUIPMENT .....	26
5.7	RELEASE OF PROPERTY TO DOE ONSITE LANDFILLS .....	27
5.8	RELEASE OF PROPERTY TO OFFSITE LANDFILLS .....	29
6.	POSTING AND PROPERTY CONTROL .....	31
6.1	UNRESTRICTED AND RESTRICTED RELEASE OF PROPERTY .....	31
6.2	DOE-OWNED PROPERTY .....	31
6.3	NOTEWORTHY DIFFERENCES BETWEEN 10 CFR 835 AND DOE 5400.5 POSTING REQUIREMENTS .....	31
7.	ORGANIZATIONAL APPROVALS .....	35

**CONTENTS (continued)**

7.1 CONDITIONS FOR EXPEDITED APPROVAL ..... 35

7.2 REQUESTS FOR TECHNICAL ASSISTANCE ..... 36

8. REFERENCES ..... 39

APPENDIX A. SECRETARIAL MEMORANDUMS REGARDING POLICY  
AND GUIDANCE FOR MANAGING THE RELEASE OF  
DOE SURPLUS AND SCRAP MATERIALS ..... A-1

APPENDIX B. OVERVIEW OF SUPPORTING GUIDANCE AND TOOLS ..... B-1

**This page intentionally left blank.**

**ACRONYMS**

$A_{hs}$	area of the hot spot
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
<i>FR</i>	<i>Federal Register</i>
MARSSIM	<i>Multi-Agency Radiation Survey and Site Investigation Manual</i>
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act
RESRAD	RESidual RADioactivity
TEDE	total effective dose equivalent
WL	working level

**This page intentionally left blank.**



## 1. PURPOSE, SCOPE, AND ORGANIZATION

### 1.1 PURPOSE AND SCOPE

The U.S. Department of Energy (DOE) operates a variety of nuclear facilities including reactors, accelerators, and weapons test facilities. Many of these facilities are undergoing remediation and decommissioning. This Implementation Guide (hereafter referred to as Guide) references DOE's requirements and presents DOE's guidance for the control and release of property that may contain residual radioactive material. Implementation guidance is provided for Department and contractor personnel who perform cleanup of property contaminated with residual radioactive material and who must determine the disposition of property under the requirements in DOE 5400.5, *Radiation Protection of the Public and the Environment* (DOE, 1990), and its proposed successor, 10 CFR 834, "Radiation Protection of the Public and the Environment."<sup>1</sup> This Guide is applicable to decommissioning, deactivation, decontamination, and remedial action of property with residual radioactive contamination.

Guidance for implementing DOE 5400.5 requirements for the release of property has been provided by the Office of Environmental Policy and Guidance over the past 10 years through individual memorandums, guidance documents and handbooks, and modeling and analysis tools. A principal objective of this Guide is to integrate the key elements of these individual guidance documents and tools into one document as a principal resource for DOE and contractor personnel.

### 1.2 ORGANIZATION

Definitions of key terms used in this Guide are provided in Section 2. The Guide then presents the principal requirements for control and release of property (Section 3); provides implementation guidance on essential elements of the authorized release options analysis process (Section 4); and follows with guidance on the authorized release process for specific types of materials (Section 5). Posting and property control for unrestricted and restricted release of property is presented in Section 6. Section 7 reviews the organizational approvals required and the conditions that must be met for DOE field office approval of the release of property. References are provided in Section 8. Appendix A provides a copy of each of the Secretarial memorandums cited in Section 1.3. Appendix B provides a list of supporting guidance and tools for implementing the authorized release process.

---

<sup>1</sup>DOE proposed rule that would essentially reissue DOE 5400.5 requirements through the rule-making process to make DOE Order requirements subject to the civil penalty provisions of the 1988 amendments to the Price-Anderson Act. The rule was proposed in response to 1991 recommendations made by the Defense Nuclear Facilities Safety Board for strengthening DOE's nuclear safety standards. The proposed rule (August 31, 1995) included requirements for the decontamination, survey, and release of buildings, land, equipment, and personal property containing residual radioactive material.

### 1.3 ENHANCEMENTS AND IMPROVEMENTS TO DOE'S MONITORING AND RELEASE PRACTICES

DOE has been actively reviewing ways to improve its management of materials that might be released from Departmental control. Several Secretarial memorandums describing recent policy changes and guidance relative to the control and release of DOE surplus and scrap materials have been issued during the past 3 years.

On January 12, 2000, DOE placed a moratorium on the release of volumetrically contaminated metals pending a decision by the Nuclear Regulatory Commission (NRC) on whether to establish national standards (DOE, 2000a). The NRC continues to review this issue and the moratorium remains in effect.

On July 13, 2000, DOE suspended the unrestricted release for recycling of scrap metal from radiological areas within DOE facilities (DOE, 2000b). This suspension was to remain in effect until improvements in DOE release criteria and information management were developed and implemented through a revision of DOE 5400.5.

On January 19, 2001, DOE issued a memorandum stating that although DOE had developed procedures that, when implemented, would permit unrestricted releases of metals for recycling without detectable radioactive contamination, internal and public comments on these proposed changes raised significant and substantive issues (DOE, 2001). Consequently additional deliberation is necessary, and the new requirements are not complete. Therefore, the moratorium on the unrestricted release for recycling of scrap metals from radiation areas within DOE facilities remains in effect. The Department also determined that an environmental impact statement should be prepared to allow an open, healthy discussion of the broadest range of concerns associated with the unrestricted release of materials from DOE sites. The memorandum also provided guidance to help DOE sites improve their monitoring and release practices. These steps are consistent with and serve to emphasize existing provisions of DOE 5400.5 and, therefore, should be incorporated into DOE's existing release programs.

Details of the Department's guidance for improvements to its monitoring and release practices are presented and emphasized in the appropriate sections of this Guide. A summary of the key elements of the guidance is provided below.

**Clearly define areas and activities that potentially can contaminate property.** It is important that DOE evaluate the potential for radiological contamination before property is released from DOE radiological control. It is necessary for DOE to establish and document clear process-knowledge-based procedures for those releases that have no potential to violate DOE's radiological protection requirements. There should be an opportunity for public participation in establishing and implementing these procedures.

**Clearly define release criteria, including measurement and survey protocols, for property released from areas or activities that have potential to contaminate.** Property that cannot be certified for release through process knowledge procedures must be reviewed using authorized limit-based release procedures consistent with DOE 5400.5 requirements and associated guidance. All such property must be appropriately surveyed and its compliance with DOE-approved authorized limits confirmed.

**Ensure that released property meets DOE requirements.** DOE has both the authority and responsibility for regulating the release of property under DOE radiological control. Line management, in particular field offices, is responsible for ensuring contractors and DOE personnel comply with DOE requirements. DOE encourages line management to internally review property release and control systems to ensure they are compliant with DOE directives. In addition, DOE field offices, working with their lead program offices, should establish independent verification programs to further confirm that survey and evaluation processes are in place and are being appropriately implemented and that property released from DOE radiological control meets authorized limits.

**Better inform and involve the public, and improve DOE reporting on releases.** Field office managers should incorporate information on property control and release programs, including information on authorized limits, certification and verification survey programs, and process knowledge decisions, into site public involvement and communications programs. Site release policies and protocols should be coordinated with the public, and public input considered in DOE's development and approval of site release programs. Field office managers should ensure information on authorized limits and surveys and independent verification program results are included in the site's annual environmental reports.

This Guide is responsive to the requirements contained in DOE 5400.5 and the policy and guidance put forth in the Secretarial Memorandums summarized above regarding DOE's control and release of surplus and scrap materials. The Secretarial Memorandums cited above are provided in Appendix A of this Guide. They can also be downloaded from the Department's Web site for the management and release of surplus materials, <http://www.eh.doe.gov/oepa>, (click on "Focus Areas," then select "DOE Directives Development Initiative for the Management and Release of Surplus Materials"). A set of answers to frequently asked questions regarding the July 13, 2000, suspension of the unrestricted release for recycling of scrap metal from radiological areas within DOE facilities is also available (DOE, 2000c), and can be downloaded from the Web site referenced above.

**This page intentionally left blank.**

## 2. DEFINITIONS

**Unrestricted Release of Property:** A transfer of personal or real property from DOE control without restrictions or controls on current or future use of the property.

**Restricted Release:** A transfer of personal or real property from DOE control for a limited, specifically stated application subject to controls or restrictions on use implemented by a designated party or through a specific process.

**Authorized Limit:** A limit on the concentrations of residual radioactive material on the surfaces of or within property that has been derived consistent with the as low as reasonably achievable (ALARA) process, given the anticipated use of the property (either restricted or unrestricted), and that has been authorized by the Department to permit the release of the property from DOE control.

**Supplemental Limit:** A DOE-approved limit on the release of property with residual radioactive material. The supplemental limit is used when circumstances make the authorized limit inappropriate or impracticable to apply.

**Real Property:** Refers to land and anything permanently affixed to the land such as buildings, fences, and those things attached to buildings, such as light fixtures, plumbing and heating fixtures, or other such items, that would be personal property if not attached.

**Personal Property:** Property of any kind, except for real estate and interests therein (such as easements and rights-of-way), and permanent fixtures that are Government-owned, chartered, rented, or leased from commercial sources by and in the custody of DOE or its designated contractors. For the purposes of this Guide, examples of personal property include consumable items such as wood, containers, “labware,” and paper; personal items such as clothing, brief cases, respirators and gloves; office items such as computers, unused office supplies, and furniture; tools and equipment such as hand tools, power tools, construction machinery, vehicles, tool boxes, ladders, and scales; and debris such as wood, tanks, scrap metal, concrete, wiring, doors, and windows.

**This page intentionally left blank.**

### 3. PRINCIPAL REQUIREMENTS

The principal requirements relating to the control and release of property containing residual radioactive material are presented in DOE 5400.5 (Chapters II and IV). Releases must also be in compliance with other applicable Federal or State requirements. The principal DOE requirements are summarized in this section.

#### **DOE's Principal Requirements are Intended to Achieve the Following Goals:**

- Property is evaluated, radiologically characterized, and, where appropriate, decontaminated before release.
- The level of residual radioactive material in property to be released is as near background levels as is reasonably practicable, as determined through DOE ALARA process requirements, and meets DOE authorized limits.
- All property releases are appropriately certified, verified, documented, and reported; public involvement and notification needs are addressed; and processes are in place to appropriately maintain records.

### 3.1 DOSE LIMITS AND CONSTRAINTS

#### 3.1.1 Dose Limit

The primary dose<sup>2</sup> limit for any member of the general public is 100 millirem (mrem) total effective dose equivalent (TEDE) in a year. This limit applies to the sum of internal and external doses resulting from **all** modes of exposure to **all** radiation sources other than background radiation and doses received as a patient from medical sources [DOE 5400.5, II.1.a.(3)(a)].

#### 3.1.2 Dose Constraint

Because the primary dose limit is for all sources, a dose constraint of one quarter of the primary dose limit (i.e., 25 mrem/year) is applied to each DOE source or practice. Therefore, authorized limits for annual dose from the release of property should be as far below 25 mrem as is practicable. This dose constraint represents an upper bound or “cap” for ALARA-based authorized limits for release of property containing residual radioactive material. This dose constraint ensures DOE real property releases are consistent with dose requirements in 10 CFR 20, “Standards for Protection Against Radiation,” subpart E, “Radiological Criteria for

---

<sup>2</sup>The term “dose” is used in the generic sense. Usually, dose will be expressed as total effective dose equivalent (TEDE) and, in the case of dose limits, will be stated “in a year.” However, where internal dose is a component, dose will always mean the committed dose equivalent (e.g., the dose delivered over a period of 50 years) from 1 year of exposure.

License Termination.” Additionally, depending on circumstances, DOE 5400.5 either permits or requires use of concentration-based constraints as well.

### **3.2 ALARA PROCESS**

An ALARA analysis is to be conducted in the assessment of potential release options and to support the final authorized release option selected for the property being released. DOE requires all releases and exposures to the public be controlled to ensure they are maintained at levels that are as low as reasonably achievable below the applicable dose limits. Releases are to be assessed in a manner consistent with the DOE ALARA process for protection of the public and environment (DOE, 1997a).

### **3.3 RADIOLOGICAL SURVEYS**

Any property known or suspected to have residual radioactive material must be appropriately surveyed or characterized (DOE 5400.5). Radiological surveys and measurements of residual radioactive material on and in property must be adequate to demonstrate that authorized limits (e.g., established to ensure compliance with the dose limits and based on ALARA process decisions) are met. Survey protocols, procedures, and equipment must be sufficient to meet data quality objectives for radiological screening, characterization, certification, or verification, as appropriate, to ensure the authorized limits for release have been met. Surveys for real (e.g., land, structures, and associated fixtures) and personal (e.g., hand tools, material, and equipment) property should be conducted in a manner consistent with the recommendations contained in the Environmental Implementation Guide for Radiological Survey Procedures (DOE, 1997b) or, for real property, the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (DOD-DOE-EPA-NRC, 2000). Although the MARSSIM only addresses the survey of surfaces on real property, the methods and statistical analysis approaches may be useful when evaluating subsurface conditions and personal property. Surveys designed to support process knowledge clearance of property should be commensurate with the complexity of the site or property use history and potential for contamination.

### **3.4 PUBLIC INVOLVEMENT AND NOTIFICATION**

Public participation is a fundamental component of program operations, planning activities, and decision making within the Department. DOE P 1210.1, *Public Participation* (DOE, 1994), presents the purpose, scope, goals, and core values of the Department’s policy on public participation. As mandated by this Policy, public participation programs are being implemented to promote openness and two-way communication tailored to meet specific program, site, and stakeholder needs. DOE managers need to include information on the process for evaluating and setting authorized limits in existing public participation programs. This need was highlighted in the Department’s July 2000 and January 2001 memorandums regarding improvements needed for DOE’s release criteria, information management, and monitoring practices (see Appendix A).



Field office managers should incorporate information on property control and release programs, including information on authorized limits, certification and verification survey programs, and process knowledge decisions into site public involvement and communications programs. Site release policies and protocols are to be coordinated with the public and public input considered in DOE's development and approval of site release programs. Documentation on all releases must be made available to the public and the property owner or recipient, as appropriate.

### **3.5 VERIFICATION AND QUALITY ASSURANCE**

#### **3.5.1 Verification**

In consultation with the responsible program secretarial offices, DOE field offices should establish independent verification programs to confirm that survey and evaluation processes are in place and are being appropriately implemented and that property released from DOE radiological control meets authorized limits. The DOE organization responsible for the release of property should verify or provide for independent verification of the radiological condition of the property before release. *Personnel involved in verification must be independent of the operating contractor and DOE project management responsible for certifying the release or releasing the property and must report directly to DOE* (DOE, 2001). The results of the verification should also be part of the permanent record of the release. The independent verification should be commensurate with the scope, complexity, and hazard associated with the action. It may be accomplished by DOE or independent contractor review of survey protocols and post-remedial-action data. In more complex situations, it may be necessary to evaluate split samples or conduct onsite radiological investigations to confirm post-remedial-action survey results. Where releases are part of regular operations such as the release of excess personal property, field offices should consider periodic audits of the releases to verify that the authorized limits are being appropriately implemented.

#### **3.5.2 Quality Assurance**

All DOE activities are subject to the Department's quality assurance requirements contained in 10 CFR 830, "Nuclear Safety Management," subpart A, "Quality Assurance Requirements." These requirements apply to the release and control processes for property containing residual radioactive material.

DOE elements and DOE contractors or subcontractors involved in radiochemical sampling and analysis should participate in an interlaboratory comparison program such as the Department's Environmental Measurement Laboratory Quality Assessment Program and should evaluate the results to ensure the analyses are meeting data quality objectives. Participation and performance in this program should be documented as part of the radiological characterization record.

### **3.6 PROCESS AND HISTORICAL KNOWLEDGE CLEARANCE OF PROPERTY**

It is important to evaluate and clearly define areas and activities that potentially can contaminate property. DOE activities and areas should be evaluated for radiological contamination before property is released from them. Property may be released from DOE control if it has been evaluated and determined not to be contaminated with residual radioactive material or has not been impacted since a previously documented authorized release. Operational records, operating history, and process knowledge for the property being released should be evaluated. Property that cannot be certified for release through process knowledge procedures (i.e., if records and process knowledge are not fully adequate) must be reviewed using DOE's authorized limit-based release procedures consistent with DOE 5400.5 requirements. All such property must be appropriately surveyed and its compliance with DOE-approved authorized limits confirmed. The evaluation process for property clearance should include a periodic review and verification program to ensure historical and process knowledge clearance is being effectively implemented.

### **3.7 COMPLIANCE WITH OTHER APPLICABLE FEDERAL OR STATE REQUIREMENTS**

Releases must also be in compliance with other applicable Federal or State requirements. For example, property may be subject to NRC or Agreement State licensing. The Department will not transfer licensable materials to members of the public who are not licensed to receive them. See Section 5.6, "Release of Personal Property Including Equipment," for detailed guidance in this area.

### **3.8 FINAL DOCUMENTATION AND AVAILABILITY**

Final documentation supporting the release of property [per DOE 5400.5, II.5.c.(5), II.8 and IV.2] should be made part of the Department's permanent record and should be publicly available. Documentation should indicate the authorized limits and include other data supporting the release of property, such as radiological certification and independent verification results.

#### **3.8.1 Specific Elements of the Final Documentation**

The final documentation should—

- describe the property being released and its radiological history;
- identify the DOE-approved authorized limits;
- describe the ALARA options analysis and the application of its results in decision making relative to the property being released;

- describe the survey and provide details on instruments used, dates of the surveys, and results of the surveys;
- indicate the final radiological condition of the property;
- indicate the quantity and disposition of waste resulting from decontamination of the property;
- identify the disposition of the property;
- identify public involvement and notification programs to ensure the public was appropriately involved and informed of the release of property; and
- identify how the final documentation was/will be made available to the public.

Documentation should be at least available in DOE public reading rooms at field or operations offices. It may also be useful to distribute all or some of the material to local government organizations and public libraries.

### **3.8.2 A Graded Approach to Documentation**

The contents of documentation or the mechanism for documenting information should be tailored to the need, situation, and type of property being released. Documentation may describe the release process and the property regulated by the specific authorized limits, or it may be specific to the property or to an area from which individual items are released. For example, the documentation associated with releasing small-sized personal property (e.g., hand tools) may be different from that for large-sized personal property (e.g., a tractor), and the documentation associated with releasing real property (e.g., a 1,000-acre site) would be different from that associated with personal property. Documentation for small-sized personal property, such as hand tools, could be the record of the clearance process and oversight of the clearance program. Documentation for large-sized personal property, such as a tractor or bulldozer, could be specific to the item being released. For real property, such as a 1,000-acre site, one could maintain a docket on the site.

## **3.9 RECORDS MAINTENANCE AND REPORTING**

All records relating to the release of property from a controlled area are to be maintained in compliance with DOE O 200.1, *Information Management Program* (DOE, 1996a), and when finalized, DOE O 243.X, *Records Management Program* (DOE, 2000d). DOE sites and facilities releasing property are to summarize and report these activities in their annual site environmental reports as required by DOE O 231.1, *Environment, Safety, and Health Reporting*, (DOE, 1996b). The annual site environmental report should include DOE authorized limits and survey and independent verification program results.

**This page intentionally left blank.**

## 4. THE RELEASE OPTIONS ANALYSIS PROCESS

### 4.1 DOE ALARA PRINCIPLES AND PROCESS AS THE BASIS FOR AUTHORIZED RELEASE LIMITS

#### 4.1.1 ALARA Requirements

Doses to the public from residual radioactive material must be maintained as low as is reasonably achievable below the primary dose limits (DOE 5400.5, II.2). A remedial action goal should be to return the levels of residual radioactive material in property being considered for release to near-background levels. In certain cases this may not be practical or even technically possible. DOE 5400.5 requires that all releases of property be assessed and the ALARA analysis process applied no matter how small the potential dose from residual radioactive material. However, the level of detail in the ALARA analysis should be commensurate with the value of potential-dose reductions.

#### 4.1.2 ALARA Principles and Process

DOE has established a graded level of control and oversight to ensure doses to the public are low. The degree of control, treatment, processing, and remedial action or other method of limiting doses to workers and to members of the general public should be determined by implementing a process that identifies and considers all factors important to decision making (e.g., in this case, selection of an authorized release option).

#### **ALARA, as Applied by DOE, is a Process**

ALARA, as applied by DOE, is not a level or limit to be achieved in controlling radiation exposures or doses, but rather a process to ensure appropriate factors are taken into consideration in arriving at decisions that affect the degree of protection against radiation for workers and the public.

#### 4.1.3 Guidance for Implementing the ALARA Process

Guidance has been developed for applying the ALARA process to environmental releases (DOE, 1991a; DOE, 1997a). The guidance (1) identifies factors that should be considered; (2) presents a logical sequence for assessing these factors to support decision making or options selection; and (3) references a number of analysis techniques and tools (e.g., cost-benefit analysis; multiattribute decision theory) that may be used to quantify some of these factors. The guidance recognizes the difficulties in ascertaining quantitative evaluations of alternative options using tools such as cost-benefit analyses and acknowledges that decisions must inevitably involve a great deal of technical and managerial judgment.

## 4.2 USE SCENARIOS AND LIMITS FOR AUTHORIZED RELEASE

### 4.2.1 Doses Under Likely Use Scenarios

As stated in DOE 5400.5, authorized limits and, where appropriate, supplemental limits must be developed for the release of property. DOE line program elements (and under certain circumstances the Office of Environment, Safety and Health) must review and approve authorized limits before properties with residual radioactive material are released for unrestricted or restricted use. The limits should be selected to ensure doses to individuals using the property under “actual” and “likely use” scenarios<sup>3</sup> will be **well below the primary dose limit** and at a level that provides a reasonable expectation doses will be less than the dose constraint of 25 mrem in a year. Based on DOE experience gained in applying these requirements under DOE 5400.5, it is expected doses will be on the order of a few millirem or less in a year. To the extent practicable, property to be released for use where close contact by users is likely (e.g., personal property such as hand tools and chairs) should have no measurable contamination when leaving DOE control areas.

### 4.2.2 Doses Under Worst Plausible Use Scenarios

The evaluation to support establishment of an authorized limit also should consider the “worst plausible use”<sup>4</sup> of the property over the long term. Allowable doses for release of the property calculated under this type of scenario may be a relatively large fraction of the general dose limit if the probability of the scenario occurring is relatively low. It is not expected that the worst plausible use of property will occur, and it is not DOE’s intent to permit releases expected to cause doses that are a significant fraction of the primary dose limit. Rather, this analysis is conducted to assess potential consequences should restrictions that control use of the material fail or expectations of use be incorrect. Where analysis of this option suggests the potential for high doses or a high likelihood for failure of control mechanisms, additional restrictions should be imposed to reduce such potential or additional measures taken to reduce the potential consequences. In cases where the probability of the worst plausible use scenario is high and reasonably certain, the 25-mrem/year dose constraint should be applied, ensuring doses associated with the potential release would be limited to a very small fraction of the 100-mrem/year dose limit. In such instances, the worst plausible use may be considered the likely use. No assessment of worst plausible use scenario dose is required where authorized limits are set at “indistinguishable from background” levels.

---

<sup>3</sup>“Actual” and “likely use” scenarios are those that have a fairly high probability of occurring. They represent expected use of the property. As a general guide, they should include scenarios that are plausible, unlikely to substantially underestimate the dose, and have a reasonable chance of occurring within at least the first 50 years. Scenarios not expected to occur for at least 100 years after release of the property normally need not be considered as likely use.

<sup>4</sup>The “worst plausible use” represents a scenario that is credible over the long term. The period of assessment may extend beyond several hundred years and the probability of the scenario ever occurring must be considered in the review.

### 4.3 EVALUATION OF INDIVIDUAL DOSE IN THE RELEASE OPTIONS ANALYSIS PROCESS

Within the authorized release process, it is required that no action will cause individual doses to a member of the public in excess of the primary dose limit. Given the fact that the primary dose limit applies to all sources and pathways combined and the assumption there is real potential for an individual to receive radiation doses from other sources (e.g., NRC- or State- licensed facilities; normal DOE operating releases), it is not acceptable to release property that is likely to cause an individual to receive a dose at or near the primary dose limit.

On this basis, DOE requires that authorized limits derived through ALARA options analysis be constrained at 25 mrem in a year to the maximum exposed individual, considering actual and likely future use. The ALARA options analysis should assess the benefits, costs, and other considerations associated with several levels below this dose constraint and result in the selection of an authorized release option having a dose that is as low as is reasonably achievable.

#### **ALARA Analysis to Demonstrate a Release Option Meets the 25-mrem/year Dose Constraint**

- Analysis should be completed for several dose levels, with at least two dose levels below the 25-mrem/year recommended limit.
- The dose levels should be spaced to adequately describe the dose cost-benefit relationship.
- At least one alternative that controls potential annual individual doses to about 3 mrem or less should be evaluated. For personal property at least one alternative below 1 mrem/year should be considered.
- This *quantitative* ALARA analysis is recommended for a dose-based process. If DOE-approved surface activity guides are used, a more *qualitative* ALARA analysis can be conducted.

### 4.4 EVALUATION OF COLLECTIVE DOSE IN THE RELEASE OPTIONS ANALYSIS PROCESS

Although the individual dose constraint is used to ensure an individual or group of individuals does not receive an inordinate fraction of a potential dose, in general, it is the collective dose averted that should be compared to costs and other factors when conducting the release options analysis process. Therefore, in those cases where collective dose is significant, it should be a controlling factor in the ALARA analysis on which the authorized limits are based.

#### **4.4.1 Collective Dose**

Collective dose is the term used to describe the sum of the doses to all persons from exposures from a particular radiation source, activity, or site. The unit of collective dose is person-rem. The collective dose is important because it is assumed to be indicative of the potential number of radiation-induced health effects to the population from the activity being evaluated. Although most of the references cited here address potential doses to individuals and do not provide guidance on estimating collective doses, the dose estimates for individuals should be useful in making collective-dose estimates.

Collective-dose estimates should be provided for actual or likely use scenarios. In most cases, collective doses relating to actual use of the site or property need to be assessed quantitatively. If collective dose under one or more of the various options considered is likely to exceed 100 person-rem from the annual release or the release of the property in that year, an optimization analysis should be considered. When collective dose from the release is less than 10 person-rem, the primary focus of the ALARA analysis is more likely to be on doses to individuals; qualitative consideration of collective impacts may be all that is warranted for situations where collective dose is not significant. It is recommended that ALARA analyses of one or more alternatives that reduce collective doses to less than 10 person-rem and individual doses to less than a few millirem in a year be considered.

#### **4.4.2 Appropriate Time Intervals for Integrating Collective Doses and for Assessing Doses to Current versus Future Generations**

Most residual contamination concerns stem from the presence of long-lived radionuclides. In many instances, for economic reasons, short-lived radionuclides would be permitted to decay rather than be removed by remedial actions. However, the long-lived contamination might have the potential for causing doses to persons for more than one generation. In many cases (primarily those involving personal property), when developing authorized limits for release of property, evaluations of the potential doses for the first generation of users (i.e., those affected by the selected scenarios) will provide sufficient data to compare options. However, if screening assessments suggest doses to future generations may be important to the evaluation of options (which might be the case for release of real property), optimization analyses should integrate collective doses for periods longer than the first generation of use, possibly up to 200 years. Although longer periods may be useful for comparing otherwise equal alternatives, uncertainties in such data are too large for the data to be useful in quantitative ALARA assessments. It is therefore recommended that the data for periods exceeding 200 years, when considered, only be evaluated qualitatively. Where long periods of time are being considered, a multiattribute utility analysis considering all factors would be a more appropriate assessment tool than standard cost-benefit techniques.

Ultimate disposal of property with residual radioactive material, by recycle or other means, should be factored into the policy decision on the cleanup efforts. Determination of the entire collective doses from unrestricted use of property with residual radioactive material would require integrating the doses over all time and space, including all affected populations. In most



situations, extensive calculations over time and space are unnecessary for the decision-making process and may actually be counterproductive. For practical reasons, the integration of environmental doses for real property assessments are generally limited spatially to about 50 miles (80 kilometers)<sup>5</sup> or less from the source because of the limited availability of population distribution information and the incomplete knowledge of dispersion of the material in the environment (DOE, 1997a).

In most cases, collective doses relating to actual use of the site or property need to be evaluated quantitatively. Offsite exposures or secondary uses need only be addressed if they are likely to significantly affect the incremental collective dose (e.g., by more than 10 percent). Similarly, as noted above, the time-integral used for action or site-specific assessments is generally limited to the first generation and in some cases a few generations of users or a few half-lives of the radionuclide, whichever is shorter. Evaluations that might extend the dose-integral over all time and space should only be necessary for generic policy or standards development, if at all. There is no *de minimis* dose value or a dose level that has been determined to be below regulatory concern. Significant contributions to collective doses should be evaluated. However, at some level, the uncertainty involved in modeling the dose distribution overwhelms the significance of the incremental collective dose and there is no need to continue the integration. It will be sufficient, generally, to determine that most of the total collective dose has been quantified. Uncertainties in modeling are factors that may be considered in making this judgment. Volume II of the DOE ALARA Technical Standard (DOE, 1997a) contains a number of example assessments that evaluate doses for periods that are reasonable for the decision-making process.

#### **Important Considerations When Evaluating Collective Dose**

- It is important to focus on the objective of the calculation, which is to provide data to support comparison of alternative remedial actions or authorized limits.
- Conservative overestimates of collective dose are useful as a screening tool to demonstrate collective dose is insignificant for all alternatives. In such cases, a clear statement that collective dose is not a significant factor in evaluating alternatives, using the screening estimates as a basis, should be sufficient.
- It is not necessary to estimate collective dose to all populations and all places over all time. Representative values provide adequate information for comparative assessments. However, care is needed to ensure such results are not biased for selected alternative actions.

---

<sup>5</sup>The 50-mile limitation is a guideline intended for evaluating the impact of exposures of persons in the immediate environs to effluents. However, the 50-mile distance might not be appropriate for evaluating potential exposures by other than primary exposure modes. For instance, the collective dose resulting from the release of property with residual radioactive material might require consideration of a different population group. Similarly, contamination of agricultural areas might, through distribution of affected food stuff, impact populations outside the 50-mile radius. If such activities have potential for significant dose, they should be included in the ALARA evaluation and considered when determining the appropriate authorized limit.

#### **4.5 EVALUATION OF OTHER FACTORS IN THE RELEASE OPTIONS ANALYSIS PROCESS**

Assessments of potential doses associated with releases should be specific to the particular release being considered. Although this Guide is limited to control of radionuclides, coincident nonradioactive contaminants and their possible impacts also need to be considered. When nonradioactive contaminants are present coincident with residual radioactive material, decontamination or remedial measures should be rational and effective considering the hazards of all materials and in compliance with other applicable regulations governing such materials.

DOE ALARA guidance recognizes other factors in addition to dose/health risk and cost may be important in establishing authorized limits. Public concerns and political sensitivity, although difficult to quantify, should be considered in the development of authorized limits. Applicable State and local standards also need to be addressed. Factors of a site-specific nature may also be important. For example, specific waste management units may have waste acceptance criteria based on local background radiation levels. Wastes, such as soil, from a region having high background radiation levels could conceivably exceed waste acceptance criteria if local radiation background levels are low, even if the wastes had very little residual contamination. Similarly, actions to remove soil with small amounts of residual radioactive material in low background soils may in balance have a negative dose reduction (i.e., increase dose to the public) if background levels in the replacement soil are high. Such factors should be considered when selecting remedial alternatives for mitigating the effects of residual radioactive material.

## **5. SPECIFIC APPLICATIONS OF THE AUTHORIZED RELEASE PROCESS**

### **5.1 NATURALLY OCCURRING AND ACCELERATOR-PRODUCED RADIOACTIVE MATERIAL**

DOE regulates the use of naturally occurring and accelerator-produced radioactive material at its facilities under the authority and responsibilities provided through the Atomic Energy Act, the Energy Reorganization Act, and the Department of Energy Act relating to the protection of health and safety. Property affected by accelerator-produced radioactive material should be evaluated and authorized limits determined consistent with the goals and recommendations provided in this Guide and associated DOE directives. This guidance and the DOE 5400.5 requirements are applicable to residual radioactive material above background levels. These background levels include natural and anthropogenic radioactive materials. Background does not include materials containing natural radionuclides whose concentrations are significantly enhanced as a result of DOE activities. If DOE activities or processes significantly enhance the concentrations of radionuclides in a material (e.g., if doses are a significant fraction of the dose limit for soils, liquids, wastes, and equipment), the material must be evaluated under the ALARA process to determine whether it is acceptable for general release. This requirement is not applicable to small quantities of materials such as reagents used for laboratory analysis, especially where the material is used for its intended, commercial purpose.

### **5.2 SOILS**

Authorized limits<sup>6</sup> for release or control of residual radioactive material in soils should be developed consistent with the requirements, goals, and recommendations noted above. The RESRAD (RESidual RADioactivity) code was developed at Argonne National Laboratory with technical direction and support from DOE's Office of Environment, Safety and Health and the Office of Environmental Management. Supporting documentation in the RESRAD user's manual (Yu, C., et al., 2001) and the RESRAD data collection handbook (Yu, C., et al., 1993) is intended for use in assessing the potential dose associated with the release or use of soils containing radionuclides. Although use of other codes is permitted, unless there are site-specific requirements that necessitate the use of an alternative model or it is determined such alternate approaches will provide better results, RESRAD should be used in such assessments. DOE line management should ensure there is appropriate justification for use of alternative models and that such models meet DOE quality assurance and quality control requirements.

#### **5.2.1 Appropriate Averaging Areas for Authorized Releases**

DOE 5400.5 requires authorized limits for soils to be applicable to each 100-square-meter (m<sup>2</sup>) area. In 1995, DOE's proposed rule, "Radiation Protection of the Public and the Environment"

---

<sup>6</sup>Authorized limits are typically expressed as concentration limits in picocuries per gram (pCi/g) or becquerels per kilogram (Bq/kg).

(10 CFR 834), did not include a requirement for a specific averaging area for residual radioactive material in soil. However, under the proposed rule the derived soil limits should be applied to concentrations of residual radioactive material above background averaged over 100-m<sup>2</sup> areas unless specific analyses are completed to support alternative averaging areas. Averaging areas larger than 100-m<sup>2</sup> are permitted, subject to DOE approval, in cases where concentrations are relatively uniform. Sampling should be consistent with DOE survey guidance (DOE, 1997b; DOD-DOE-EPA-NRC, 2000). Where the modeling in support of the authorized limits specifically addresses the averaging area or defines the survey unit, larger areas may also be appropriate. Methods and rationale for site-specific survey and averaging areas (survey units) and statistically based sampling protocols are discussed in the MARSSIM (DOD-DOE-EPA-NRC, 2000). These methods are acceptable for establishing measurement protocols for authorized limits under proposed 10 CFR 834, and can be incorporated as alternative approaches under DOE 5400.5 through the supplemental limit process (see DOE 5400.5, Chapter IV).

### 5.2.2 Hot-Spot Criteria

In areas where residual radioactive material concentrations are not uniform, the need for hot-spot criteria should be considered. Hot spots are small areas (e.g., less than 100 m<sup>2</sup>) with residual radioactive material above levels in the surrounding area. Authorized limits for soil assume a homogeneous distribution of radionuclides for large areas and are to be averaged over 100-m<sup>2</sup> areas (default) or other survey units based on modeling and MARSSIM-based considerations. Because of this averaging process, hot spots with radionuclide concentrations significantly higher than the authorized limit can exist. To ensure individuals are adequately protected from nonhomogeneous levels of residual radioactive material, the following hot-spot criteria may be applied along with the approved authorized limit.

#### Formula for Hot-Spot Criteria

The hot-spot criteria for field application are concentrations of radionuclides in areas equal to or less than 25 m<sup>2</sup> and should average less than the approved authorized limit for the property times the square root of the quotient of 100 m<sup>2</sup> and the area of the hot spot ( $A_{hs}$ ) in square meters:

$$\text{Hot-Spot Criteria} = \text{Authorized Limit} * (100/A_{hs})^{0.5}$$

(Note: For practical application, Table 1 of this Guide may be used in place of the formula.)

In many cases, authorized limits are selected at levels that represent very low potential doses, and the hot-spot criteria suggested above are not relevant. These hot-spot criteria were derived conservatively, assuming the authorized limits were based on a dose constraint of 25 mrem in a year and selected to ensure unlikely exposure conditions would not cause the primary dose limit to be exceeded. In cases where authorized limits are based on much lower doses or where sampling protocols are based on site-specific survey areas (e.g., MARSSIM-based protocols), site-specific hot-spot criteria may be derived in place of the generic guidelines to ensure the public is protected from inhomogeneous levels of residual radioactivity. Note that proposed rule

10 CFR 834 permits these considerations as part of the authorized limit process; however, under DOE 5400.5, Chapter IV, alternative hot-spot criteria must be implemented under the supplemental limit process.

**Table 1. Guidelines for Nonhomogeneous Residual Radioactive Material in Soil<sup>a</sup>**

<b>Aerial Range for Criteria<sup>b, c</sup></b>	<b>Factor (Multiple of Authorized Limit for 100 m<sup>2</sup>)</b>
< 1 square meter	10
1 to < 3 square meters	6
3 to < 10 square meters	3
10 to 25 square meters	2

<sup>a</sup> As specified in DOE 5400.5 requirements, Chapter IV, 4.8.1; and in DOE, 1989.

<sup>b</sup> Areas greater than 25 m<sup>2</sup> are subject to authorized limits.

<sup>c</sup> Areas less than 1 m<sup>2</sup> are to be averaged over a 1-m<sup>2</sup> area and that average shall not exceed 10 times the authorized limit for the property.

### 5.3 RADIUM AND RADON

#### 5.3.1 Radium

DOE 5400.5 provides specific concentration limits for radium in soils (5 pCi/g within the top 0.15 m of soils and 15 pCi/g in any subsequent 0.15-m layer). These levels represent the maximum concentrations permitted in soils for properties being released from DOE control. They are largely based on EPA analyses for uranium mill tailings, which EPA indicates are based on considerations specific to mill tailings sites. The Department has evaluated the EPA standard and finds the limits generally acceptable for most situations. However, this standard was derived for 40 CFR 192 (“Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings”) actions specifically; DOE requires that ALARA be implemented when these standards are applied. Authorized limits for any project should be selected at or below these concentrations consistent with the DOE ALARA process unless site-specific dose assessments can justify alternative concentrations. Such justifications must consider the potential impacts of the soil concentrations on indoor radon levels if habitable structures are likely to be constructed on the soil.

### 5.3.2 Radon

Indoor  $^{222}\text{Rn}$  doses are exempted from the DOE primary dose limits. Instead, specific indoor radon limits are provided in DOE 5400.5. They require that remedial actions be taken to remove residual radioactive materials to reduce radon levels, including background, below 0.02 working level (WL). If this is not possible, active controls (e.g., ventilation or building modification) should be taken to reduce levels to at least 0.03 WL. These limits are provided as annual average radon decay product concentrations. If measurements of radon are made, it may generally be assumed that 4 pCi/L radon is equivalent to the 0.02 WL limit. While the limits include background, they are applied to situations where residual radioactive material derived from DOE or DOE predecessor activities are causing the limits to be exceeded. They are not applicable to situations where indoor concentrations are due entirely to natural background radiation.

## 5.4 SURFACE ACTIVITY ON PROPERTY (STRUCTURES AND PERSONAL PROPERTY)

The guidelines for surface activity on property released from DOE control are provided in DOE 5400.5, Chapter IV, and in Office of Environment, Safety and Health guidance, including the following.

- March 15, 1984: guidance memorandum from J. Maher, Office of Nuclear Safety, to field elements (DOE, 1984).
- June 1989: DOE/CH/8901, *Manual for Implementing Residual Radioactive Material Guidelines* (DOE, 1989).
- November 17, 1995: memorandum from Raymond Pelletier, “Application of DOE 5400.5 Requirements for Release and Control of Property Containing Residual Radioactive Material” (DOE, 1995).

These surface activity guidelines are also generally equivalent to existing NRC guidelines (NRC, 1974, 1987) and may be used in lieu of the dose constraint for managing the release of personal property and structures having the potential for residual radioactivity on surfaces.

### 5.4.1 Surface Activity Guidelines

DOE total residual surface activity guidelines, which provide for allowable total residual surface activity in disintegrations per minute per hundred square centimeters (dpm/100 cm<sup>2</sup>), are in the references above and Table 2 of this Guide. The guidelines in Table 2 are applicable to both real (except lands) and personal property. The surface activity guidelines are also generally equivalent to existing NRC and DOE guidelines (NRC 1974, 1987; DOE 1995b).

These guideline values were set on the basis of past measurement capabilities and do not equate to uniform doses or risks. Both the NRC and DOE criteria are being reevaluated to determine

whether a risk-/dose-based approach would be more appropriate.<sup>7</sup> However, the Department has reviewed the guidelines several times. The potential doses associated with the surface activity limits provided in Table 2 (as implemented by DOE) are generally consistent with the DOE dose limits and dose constraints. Release of property consistent with these surface activity guidelines will provide reasonable assurance that doses are well below the primary dose limit and less than 25 mrem in a year for even the most radiotoxic radionuclides. Application of the ALARA process to determine whether these levels are as low as is reasonably achievable is required, but the effort expended in this analysis should be commensurate with the risks from the residual radioactive material. The analysis should consider the costs associated with reducing levels further than those defined in Table 2 and the difficulty in measuring levels lower than those specified. The authorized limit should be based on an ALARA assessment giving due consideration to these and other factors. For several radionuclides<sup>8</sup> potential doses are so low or measurements are so difficult that a reduction of these levels is not practical, and the ALARA analysis should be no more than a qualitative statement of fact regarding the potential risks or measurement difficulties. For other radionuclides<sup>9</sup> under certain conditions of use, potential doses at measurable levels may be sufficiently near the 25-mrem-in-a-year dose constraint to warrant a more detailed ALARA assessment.

#### **5.4.2 Surface Activity Guidelines and Their Use in Setting Authorized Limits for Buildings**

When using the ALARA process and the surface activity guidelines in Table 2 to establish authorized limits for release of buildings, primary emphasis should be placed on continued use of the structure under an appropriate use scenario. However, secondary consideration should be given to the ultimate disposition of the structure in the future. If the facility is likely to be demolished or sections recycled, appropriate analyses should be completed to ensure concentrations of residual radionuclides in such materials do not exceed existing authorized limits for these uses.

#### **5.4.3 Surface Activity Guidelines for Tritium**

The Department has reviewed the analysis conducted by the DOE Tritium Surface Contamination Limits Committee in the report *Recommended Tritium Surface Contamination Release Guides* (DOE 1991b) and has assessed potential doses associated with the release of property containing residual tritium. The Department recommends the use of 10,000 dpm/100 cm<sup>2</sup> as a guideline for removable tritium. This guideline for removable surface contamination ensures nonremovable fractions will not cause exposures that approach DOE dose constraints.

---

<sup>7</sup>The NRC regulations (10 CFR, Part 20, Subpart E) no longer use surface activity guidelines. Rather, NRC has adopted a dose-based approach. ANSI/N13.12 also contains a table of dose-based surface and mass guidelines.

<sup>8</sup>Radionuclides <sup>125</sup>I and <sup>129</sup>I at Group 1 levels and <sup>90</sup>Sr, <sup>131</sup>I, and <sup>133</sup>I at Group 2 levels represent very low potential doses.

<sup>9</sup>Radionuclides uranium and <sup>232</sup>Th are examples of radionuclides that pose a risk (under very conservative use scenarios) of doses greater than a few millirem per year and may warrant more detailed ALARA consideration.

**Table 2. DOE Total Residual Surface Activity Guidelines:  
Allowable Total Residual Surface Activity (dpm/100 cm<sup>2</sup>)<sup>a, b</sup>**  
(From: DOE 5400.5)

Radionuclides <sup>c</sup>	Avg <sup>d, e</sup>	Max <sup>d, e</sup>	Removable <sup>f</sup>
Group 1—Transuranics, <sup>125</sup> I, <sup>129</sup> I, <sup>227</sup> Ac, <sup>226</sup> Ra, <sup>228</sup> Ra, <sup>228</sup> Th, <sup>230</sup> Th, <sup>231</sup> Pa	100	300	20
Group 2—Th-natural, <sup>90</sup> Sr, <sup>126</sup> I, <sup>131</sup> I, <sup>133</sup> I, <sup>223</sup> Ra, <sup>224</sup> Ra, <sup>232</sup> U, <sup>232</sup> Th	1,000	3,000	200
Group 3—U-natural, <sup>235</sup> U, <sup>238</sup> U, 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 <sup>90</sup> Sr and others noted above <sup>g</sup>	5,000	15,000	1,000
Tritium (applicable to surface and subsurface) <sup>h</sup>	N/A	N/A	10,000

<sup>a</sup> The values in this table (except for tritium) apply to radioactive material deposited on but not incorporated into the interior or matrix of the property. No generic concentration guidelines have been approved 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). Authorized limits for residual radioactive material in volume must be approved separately.

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

<sup>c</sup> Where surface contamination by both alpha-emitting and beta-gamma-emitting radionuclides exists, the limits established for alpha-emitting and beta-gamma-emitting radionuclides should apply independently.

<sup>d</sup> Measurements of average contamination should not be averaged over an area of more than 1 m<sup>2</sup>. Where scanning surveys are not sufficient to detect levels in the table, static counting must be used to measure surface activity. Representative sampling (static counts on the areas) may be used to demonstrate by analyses of the static counting data. The maximum contamination level applies to an area of not more than 100 cm<sup>2</sup>.

<sup>e</sup> The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 millirad per hour (mrad/h) and 1.0 mrad/h, respectively, at 1 cm.

<sup>f</sup> The amount of removable material per 100 cm<sup>2</sup> 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 of objects on surfaces of less than 100 cm<sup>2</sup> 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 the total residual surface contamination levels are within the limits for removable contamination.

<sup>g</sup> This category of radionuclides includes mixed fission products, including the <sup>90</sup>Sr that is present in them. It does not apply to <sup>90</sup>Sr that has been separated from the other fission products or mixtures where the <sup>90</sup>Sr has been enriched.

<sup>h</sup> Measurement should be conducted by a standard smear measurement but using a damp swipe or material that will readily absorb tritium, such as polystyrene foam. Property recently exposed or decontaminated should have measurements (smears) at regular time intervals to prevent a buildup of contamination over time. Because tritium typically penetrates material it contacts, the surface guidelines in group 4 do not apply to tritium. Measurements demonstrating compliance of the removable fraction of tritium on surfaces with this guideline are acceptable to ensure nonremovable fractions and residual tritium in mass will not cause exposures that exceed DOE dose limits and constraints.



#### 5.4.4 Surveys and Measurements

Measurements to demonstrate compliance with the residual surface activity requirements should be completed in accordance with the recommendations in the *Environmental Implementation Guide for Radiological Survey Procedures* (DOE, 1997b) or other DOE-approved procedures.<sup>10</sup> Per the survey procedures Guide, surveys and measurements should be sufficient to demonstrate that the limits are achieved with a 90 to 95 percent confidence level for measurement. In some cases, confidence limits between 1 and 2 sigma may be appropriate but should be clearly defined and justified in the survey plans or procedures. In many cases and for many radionuclides, conventional scanning-type surveys cannot achieve this level of confidence (i.e., the Table 2 levels). As a result, it will be necessary to make static measurements at representative locations of the item or property being surveyed. Because it is not possible to survey 100 percent of a surface in this manner, the location and number of static measurement locations should be selected to produce a statistical average (or other measure of central tendency) that is representative of the items or property being surveyed. The methodology used should be clearly described in the survey plan and in the final documentation for the release of any property. It should be approved by DOE as part of the authorized limit for any project before the initiation of decontamination and release activities.

For tritium, the measurements should be conducted by a standard smear measurement but using a wet swipe or piece of polystyrene foam (DOE, 1997b). If the property has been recently contaminated or recently decontaminated, follow-up measurements (smears) should be conducted at regular time intervals before release to ensure there is not a buildup of tritium on the surface over time.

Several radionuclides in categories listed in Table 2 are extremely difficult to detect but have low radiotoxicity (e.g., <sup>125</sup>I and <sup>129</sup>I from Group 1) and pose low dose and risk of exposure to levels in Table 2. For these radionuclides, measurement confidence of 70 percent (e.g., one sigma) would be appropriate when it is impractical, because of time or resource constraints, to achieve greater than 90 percent confidence in the measurement system.

#### 5.5 VOLUME AND MASS CONTAMINATION AND ALTERNATE SURFACE LIMITS

DOE has not established DOE-wide approved guidelines for release of personal property or structures containing residual radioactive material in mass or volume. Authorized limits for property subject to contamination in mass or volume must be derived consistent with the requirements and processes discussed previously in this Guide and approved by DOE.<sup>11</sup> Similarly, authorized limits for residual radioactive material on surfaces different than those in

---

<sup>10</sup>Procedures may also be approved as part of a radiological survey plan.

<sup>11</sup>On January 12, 2000, the Secretary of Energy established a Department-wide moratorium on the unrestricted release of all volumetrically contaminated metals. This moratorium remains in effect. Such material may only be released when the volumetric contamination decays, the metal is treated to remove detectable contamination, or controls (restrictions) are placed on its use.

Table 2 may be approved by DOE on a case-by-case basis specific to the properties of the materials being released. As noted in Table 2, the surface guidelines are tied to specific averaging areas. These averaging areas may not be appropriate for ALARA-based authorized limits and, therefore, alternative authorized limits should specify measurement procedures appropriate for their application. Refer to the *Environmental Implementation Guide for Radiological Survey Procedures* (DOE, 1997b) or MARSSIM (DOD, DOE, EPA, NRC, 2000) for additional details. Additional tools that are available for developing alternative limits for release of personal property or structures containing residual radioactive material include the RESRAD-BUILD and RESRAD-RECYCLE computer codes (Yu, C., et al., 1994, 2000).

In August 1999, the American National Standards Institute (ANSI) approved ANSI/N13.12, *Surface and Volume Radioactivity Standards for Clearance* (ANSI, 1999). Consistent with the requirements of the National Technology Transfer and Advancement Act of 1995 and Office of Management and Budget circular A-119 (*Federal Register* v.63(33), 2/19/98), DOE is evaluating the standard for use within the Department. However, the evaluation is not complete, and therefore, ANSI/N13.12 may only be used in place of the DOE-approved surface guidelines on the basis of a case-by-case review and approval. Although ANSI/N13.12 includes numeric guideline values for residual radioactivity on surfaces (as do the DOE surface activity guidelines) and in volume, the standard has many other conditions and requirements; it is not merely a table that can be substituted for the DOE surface activity guideline values in Table 2 (see Section 5.4.1 of this Guide). Users of this Guide who are considering seeking DOE approval for use of ANSI/N13.12 need to recognize these limitations and requirements in their request for use of the standard. Such requests should be consistent with a request for DOE approval for authorized limits using derived or alternative standards recommended in this guidance. Note that the ANSI/N13.12 standard is not applicable to the release of regulated facilities for unrestricted use [i.e., it is not a decontamination and decommissioning (D&D) standard for real property].

The NRC, as part of its development of guidance for the NRC D&D standard in 10 CFR 20, subpart E, has developed and issued screening surface activity levels for the release of structures. NRC's general standards for the control and release of structures are consistent with DOE requirements and guidance as they require derivation of dose-based criteria constrained to 25 mrem/year and application of the ALARA process. NRC has determined the screening levels generally meet this criteria. However, as with the ANSI standard, DOE has not made a specific determination with regard to the NRC screening activity guidelines and their generic applicability to DOE. Use of these levels in lieu of the Table 2 (Section 5.4.1) values or an ALARA-based authorized limit requires DOE approval on a case-by-case basis.

## **5.6 RELEASE OF PERSONAL PROPERTY INCLUDING EQUIPMENT**

When the Department releases personal property from DOE radiological control or transfers ownership (either by sale or other means) to members of the public, the limits for equipment and personal property are the same as for those applied to real property. Although DOE and DOE contractors generally are exempt from 10 CFR 61, "Licensing Requirements for Land Disposal

of Radioactive Waste,” and 10 CFR 20, individuals receiving materials are not. The Department will not transfer licensable materials to members of the public who are not licensed to receive them. Therefore, as part of the process for developing authorized limits for residual radioactive material, the Department must ensure such property and material do not contain licensable amounts or concentrations of radionuclides. Therefore, the following criteria should be implemented to comply with DOE 5400.5 residual radioactive material requirements.

- Authorized limits for property must ensure doses to the public from all sources are less than the primary dose limit for all sources (100 mrem in a year).
- Authorized limits for the property must be developed and approved by DOE consistent with the ALARA process. Appropriate protocols for survey and review of the release of such property must accompany the approval of the authorized limits. These limits will be based on a documented finding that they are as low as practicable as determined through the ALARA process with a goal being to maintain individual doses low in comparison to background (e.g., a few millirem in a year or less). In any case, the limits must be a fraction of the primary dose limit for the public (e.g., one-fourth or 25 mrem in a year or less). The ALARA analysis should be consistent with DOE ALARA guidance (DOE, 1997a).
- Authorized limits for the release of property from DOE control should be coordinated with the NRC or with appropriate Agreement State representatives to ensure DOE releases do not violate NRC licensing requirements.

The all-source criterion may be assumed satisfied if the ALARA criterion and its associated dose constraint and goals are adequately addressed. Generally, the use of the surface activity guidelines discussed above will satisfy all the criteria and will not require a quantitative dose assessment or detailed ALARA analysis; however, a qualitative review should be done and documented to determine whether it is practicable to set authorized limits for surfaces lower than the surface activity guidelines.

## **5.7 RELEASE OF PROPERTY TO DOE ONSITE LANDFILLS**

The Department has the responsibility and authority to establish limits for protection of the public and environment either in the form of radionuclide release criteria or waste acceptance criteria for disposal of materials in a DOE onsite landfill. Disposal of such material must conform to the requirements of DOE 5400.5 and to applicable portions of DOE O 435.1, *Radioactive Waste Management* (DOE, 1999) if the property is managed as radioactive waste. In any case, DOE must implement controls to ensure doses to the public will be as far below the dose limits in DOE 5400.5 as is practicable. This is determined on the basis of the ALARA analysis. Unless the landfill is authorized to receive radioactive waste under DOE O 435.1, the criteria should be such that it is not likely disposal of materials into the landfill will result in a future need to remediate the landfill to meet the requirements of Chapter IV of DOE 5400.5. In making this determination, consideration should also be given to radionuclide limits established

in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) corrective action Records of Decisions in neighboring areas of the site.

To ensure these requirements and goals are achieved, authorized limits for material sent to a DOE landfill (which is not an authorized low-level waste disposal facility) should be—

- selected on the basis of an assessment under the ALARA process to optimize the balance between risks and benefits, including costs and collective doses, and selected to ensure individual doses to the public are less than 25 mrem in a year with a goal of a few millirem in a year or less;
- evaluated to ensure groundwater will be protected in a manner consistent with the site's Groundwater Protection Management Program (as required by DOE 5400.1, *General Environmental Protection Program*; DOE, 1988) and other applicable State regulations and guidelines;
- evaluated to verify release of the landfill property would not be expected to require remediation under DOE 5400.5 requirements for release of property containing residual radioactive material, giving due consideration to experience gained from past or ongoing CERCLA or RCRA cleanup actions; and
- approved by DOE.

The ALARA process should consider factors such as (1) estimated concentrations in waste, (2) total activity (source term) likely to be disposed in the landfill, (3) fraction of total waste containing residual radioactivity, (4) estimated individual doses from expected or likely use scenarios, (5) estimate or assessment of collective doses in relation to other alternatives, and (6) potential impacts on natural resources such as groundwater. Land-use plans, site maintenance, benchmark cleanup standards, and special waste form characteristics may be considered in assessing doses for the development of authorized limits and acceptance criteria. The detail and complexity of the analysis should be commensurate with potential risks and costs (i.e., if potential individual and collective doses are very low, a semiquantitative or screening analysis may be acceptable).

Other factors may also be important in determining the level of detail needed to approve such limits. For example, although screening analyses (conservative bounding estimates) of activity and potential doses that demonstrate low risk potential may be adequate to show ALARA has been implemented, they are likely to significantly overestimate residual activity. The use of bounding estimates without adequate documentation of uncertainties, likely doses, or quantities of material may result in misleading documentation that in turn could lead to costly and unnecessary investigations in the future. Therefore, it is recommended that procedures be established to document source-term estimates as realistically as practicable or that bounding estimates be qualified with a discussion of uncertainty or estimates of expected quantities of residual radioactive material. Documentation supporting the authorized limits or acceptance

criteria and disposal records should be sufficient to ensure the site will not have to be remediated in the future or unnecessarily surveyed to document its radiological condition.

## **5.8 RELEASE OF PROPERTY TO OFFSITE LANDFILLS**

DOE may establish and approve authorized limits and associated survey and release protocols for material that will be disposed in a non-DOE landfill. The recommended criteria for such a situation are similar to those established for release of property except that there is an additional consideration. Many local landfills have waste acceptance criteria or are subject to State requirements for radioactive material.

In addition to meeting DOE requirements to establish authorized limits and surveys and the required review and documentation protocols that ensure doses are as far below the primary dose limit as is practicable, authorized limits and release protocols must meet waste acceptance criteria and State requirements for the subject landfills.

To ensure these requirements and goals are achieved, authorized limits for material sent to a non-DOE landfill (which is not an authorized low-level waste disposal facility) should be—

- selected (and approved by DOE) on the basis of an assessment under the ALARA process to optimize the balance between risks and benefits (e.g., collective doses and costs) and to ensure individual doses to the public are less than 25 mrem in a year, with a goal of a few millirem in a year or less;
- evaluated to ensure groundwater will be protected consistent with the objectives of the applicable State regulations and guidelines;
- assessed to ensure release of the landfill property would not be expected to require remediation under DOE 5400.5 or other applicable requirements for release of property containing residual radioactive material as a result of DOE disposals; and
- coordinated with and acceptable to the landfill authority (e.g., municipal or private operator) implementing the acceptance criteria, and with State representatives responsible for implementing solid waste regulations to ensure DOE releases do not violate landfill-specific radiological protection requirements.

These criteria may also be applied to disposal of material at RCRA-regulated hazardous waste treatment, storage, and disposal facilities (see the guidance memorandum, “Establishment and Coordination of Authorized Limits for Release of Hazardous Waste Containing Residual Radioactive Material;” DOE, 1997c). The Department has also developed the computer model “TSD-dose” to assist in the assessment of such disposals and the development of appropriate authorized limits (Pfingston, M., et al., 1997).

**This page intentionally left blank.**

## **6. POSTING AND PROPERTY CONTROL**

### **6.1 UNRESTRICTED AND RESTRICTED RELEASE OF PROPERTY**

DOE residual radioactive material control requirements addressed in this Guide relate to unrestricted and restricted release of property. This includes transfer of the property through sale, lease, gift, or otherwise. Restrictions associated with any of these actions may be taken into account in assessing and evaluating potential doses and in making ALARA determinations. However, where restrictions are necessary to control potential doses, there must be a reasonable expectation that these restrictions will be implemented and in the unlikely event that restrictions fail, levels of residual radioactive material should be such that doses will not exceed the primary dose limit. DOE may choose to implement active institutional controls in lieu of the restriction failure constraint. These controls may be in the form of periodic reviews (at least every 5 years) to ensure restrictions are being maintained, and the Department must have sufficient authority to take corrective actions should they be needed.

### **6.2 DOE-OWNED PROPERTY**

If DOE chooses to continue to own and actively control access or use of property, this guidance and DOE 5400.5 (Chapter IV) requirements do not specifically apply. Rather, the radiation protection requirements in the other sections of DOE 5400.5 apply to DOE-owned and maintained facilities. DOE previously issued guidance recommending that soil contamination areas not meeting DOE 5400.5 release requirements should be posted as soil contamination areas (see the *Radiological Control Manual*; DOE, 1992). Where these guidelines are being applied, it is not necessary to develop authorized limits for unrestricted release under DOE 5400.5 (Chapter IV) to establish soil posting criteria. That is, the soil posting criteria should be developed based on actual or likely use conditions and assumptions that consider DOE ownership and appropriate continued control, rather than on the basis of assumptions that presume release of the site for general public use. They should be developed considering accessibility of the property to the public and the associated potential for exposure and to minimize the potential for spread of contamination and the consequences associated with anticipated maintenance activities in the area. Although DOE continued use or control can be considered (where justifiable) for the likely and actual use assessments, reviews of potential impacts under worst plausible use should consider loss of such DOE control for a permanent or temporary period as is appropriate to the circumstances.

### **6.3 NOTEWORTHY DIFFERENCES BETWEEN 10 CFR 835 AND DOE 5400.5 POSTING REQUIREMENTS**

DOE recognizes some differences in 10 CFR 835, "Occupational Radiation Protection," posting requirements compared to DOE 5400.5 requirements for controlling and releasing property containing residual radioactive material. The regulation has promulgated a set of surface

concentration guidelines that constitute the basis for continued radiological control under that rule. DOE 5400.5 allows dose-based authorized limits for structures and personal property that may be different than the 10 CFR 835 limits. In many cases, dose-based limits result in derived concentration limits that can and do exceed the 10 CFR 835 concentration guidelines. In these cases, apparent conflicts or confusion arises between DOE 5400.5 release requirements compared with 10 CFR 835 control requirements. Specifically, this relates to requirements in the monitoring, entry control, and posting sections of 10 CFR 835, where some degree of monitoring, posting, and control are necessary in contamination areas [835.603(e)] that exceed 10 CFR 835 Appendix D values. However, for most situations where DOE 5400.5 requirements are met there are no conflicts.

Appendix D (Surface Contamination Values) of 10 CFR 835 is not applicable to soils (open land). Therefore, lands released under DOE 5400.5 authorized limits are not subject to 10 CFR 835 posting, monitoring, or control requirements except that such releases should not create a condition where the tracking or movement of soil will cause structures to exceed 10 CFR 835 Appendix D values. Where other property (e.g., structures or personal property) is being released from DOE control (e.g., transfer ownership to another non-DOE party), DOE 5400.5 limits are applicable and 10 CFR 835 requirements do not apply. When compliance with approved DOE 5400.5 authorized limits is demonstrated and documented, property may be released from DOE control without further consideration of 10 CFR 835 posting, monitoring, or control requirements. The only exception to this requirement is restricted release where a specific use restriction requires consideration or implementation of a portion of 10 CFR 835. In such cases, the specific 10 CFR 835 requirement becomes part of the authorized limit.

There may be some situations where DOE or DOE contractors may prepare property for release under DOE 5400.5 but choose to maintain control of the property for some undetermined period of time. Based on DOE experience and because the DOE surface activity guidelines (Section 5.4.1, Table 2) are equal to or more restrictive than 10 CFR 835, Appendix D, in most cases, property meeting these requirements also will meet all 10 CFR 835 requirements. However, because authorized limits may also be derived on a dose basis, situations may exist for some structures where the dose-based authorized limits exceed Appendix D values. Although part 835.603(e) requires posting as contamination areas where Appendix D values are exceeded, 10 CFR 835 provides flexibility in § 835.1101, which waives the entry control and posting requirements of §§ 835.501 and 835.603 if conditions of §835. 1101(c) are met. Section 835.1101(c)(1) indicates areas with fixed contamination exceeding the fixed contamination levels in Appendix D may be located outside a radiological area if the removable residual radioactive material is less than Appendix D requirements. This is conditional on requirements that dose rates are below 10 CFR 835 requirements, and the location is appropriately marked and routinely monitored [§ 835.1101(c)(2)]. In the case of a structure demonstrated to meet DOE-approved authorized limits, the dose limit requirements are presumed to be met provided the DOE-approved authorized limits are met. The marking requirement may be satisfied by a sign or label indicating the property meets DOE authorized limits. The sign or label should specifically reference the authorized limits. Routine monitoring requirements are considered satisfied by that level of monitoring required under the authorized limits. Therefore, under these



conditions, there should be no conflict between DOE 5400.5 release requirements and 10 CFR 835 posting, control, or monitoring requirements.

If the authorized limit derived under the DOE process, including ALARA, exceeds the 10 CFR 835, Appendix D, removable values, an exemption from part 835 (sections 835.501, 835.601, 835.603, and 835.1101) may need to be obtained to be in full compliance with DOE requirements. The Assistant Secretary for Environment, Safety and Health will expedite review and approval of such exemption requests if—

- the authorized limits have been approved by DOE consistent with the Order and this guidance, including the required approvals as discussed in this guidance;
- DOE has confirmed (or will confirm before release) the radiological condition of the property complies with the authorized limits and mechanisms are in place to provide reasonable assurance any necessary restrictions will be implemented; and
- the authorized limits, radiological condition, and exemption process are documented, with this documentation being available to the public.

**This page intentionally left blank.**

## **7. ORGANIZATIONAL APPROVALS**

Under DOE 5400.5, implementation of the control and release requirements for property containing residual radioactive material is the responsibility of DOE line management, in particular the heads of DOE field elements. Table 3 summarizes responsibilities and authorities. Implementation and oversight is the responsibility of heads of DOE field elements. They must ensure all property released conforms to DOE requirements and is released consistent with DOE approved authorized limits. They are also responsible for coordination with program offices and, where necessary, with the Office of Environment, Safety and Health in the implementation of the requirements.

Line management is empowered to review and, as appropriate, approve authorized limits for lands (e.g., soils) and for structures or personal property (to the extent such limits conform to the surface concentration guidelines in DOE 5400.5 and this Guide). Authorized limits for property containing residual radioactivity distributed in mass or volume and authorized limits based on alternatives to the surface activity guidelines must be approved by both the Assistant Secretary for Environment, Safety and Health and the field office. Field offices, in coordination with the appropriate program office, may approve supplemental limits as alternative limits to the surface activity guidelines for real property consistent with Chapter IV of DOE 5400.5. However, it is recommended that such limits be coordinated with the Office of Environment, Safety and Health in a manner similar to the approval process for residual radioactive material in mass or alternative surface limits for personal property discussed in Section 7.1.

Neither DOE 5400.5 nor this guidance establishes time limits for reviews of authorized or supplemental limit requests. In those cases where program and field offices have approval authority, they are better positioned to assess program priorities and assign the appropriate level of qualified staff to complete an independent and comprehensive review of the request in a timely manner. In those cases where Office of Environment, Safety and Health approval or consultation is required, the staff will strive to complete timely and responsive reviews. To aid in this process, the Office of Environment, Safety and Health has established a graded approach to its review process that enables staff to respond to requests within 60 to 90 working days, under normal circumstances. Early involvement of the Office in the process can help reduce these time periods. Under certain conditions, the Office may conduct expedited reviews. These conditions are discussed in Section 7.1.

### **7.1 CONDITIONS FOR EXPEDITED APPROVAL**

Authorized limits and survey protocols for residual radioactive material in mass or volume or personal property limits for residual radioactive material on surfaces in lieu of surface activity guidelines (Section 5.4.1, Table 2) may be derived and approved by DOE field office managers without written approval of the Assistant Secretary for Environment, Safety and Health if all of the following conditions are met.

- The applicable criteria described in this Guide are appropriately addressed.
- The release or releases of the subject material will not cause a maximum individual dose to a member of the public in excess of 1 mrem in a year or a collective dose of more than 10 person-rem in a year.
- A procedure is in place to ensure records of the releases are maintained consistent with DOE 5400.5 requirements and survey or measurement results are reported consistent with the data reporting guidelines in the Environmental Implementation Guide for Radiological Survey Procedures (DOE, 1997b) and the DOE Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE, 1991c).
- A copy of the authorized limits; measurement and survey protocols and procedures; supporting documentation, including a statement that the ALARA process requirements have been achieved; and appropriate material documenting any necessary coordination with the States or NRC are provided to the Office of Environment, Safety and Health, Office of Environment, (Office of Environment) at least 45 working days before the authorized limits become effective. The Office of Environment will provide written notification to the field office upon receipt of the material, and will notify the field office within 30 days of receipt if the authorized limits or supporting material are incomplete or not acceptable. In cases where the Office of Environment determines the material is incomplete or not acceptable, the field office must address those incomplete or unacceptable elements of the proposed authorized limits and then resubmit revised authorized limits and documentation for a second Office of Environment notification and review cycle. A new notification and review cycle, using the same time frames identified above, would be conducted by the Office of Environment on this revised submission of authorized limits and supporting material. Otherwise, the authorized limits (including any conditions or limitations set forth by the approving DOE field elements) may be considered approved without written approval from the Assistant Secretary for Environment, Safety and Health.

Where the responsible program office is within the National Nuclear Security Administration (NNSA), approval of alternative limits must be granted by the NNSA Administrator in consultation with the Assistant Secretary for Environment, Safety and Health.

## **7.2 REQUESTS FOR TECHNICAL ASSISTANCE**

Field elements may request technical assistance in the review or development of authorized limits. However, such assistance should be requested as early as possible in the process and at least 90 working days before the desired implementation date for the authorized limits. Nothing in this Guide should be construed to override or replace the need for field elements to coordinate or consult with DOE program offices having jurisdiction over actions or portions of the actions covered by the authorized limits. Authorized limits for residual radioactive material in mass or volume that do not meet the criteria for approval by the field office as stated above must be

approved in writing by the Assistant Secretary for Environment, Safety and Health. It is recommended that the DOE elements responsible for requesting approval from the Office of Environment, Safety and Health coordinate the analyses with the Office of Environmental Policy and Guidance's Air, Water and Radiation Division before submitting the request to the Assistant Secretary for Environment, Safety and Health.

**Table 3. Approval Responsibilities for the Authorized Release Process**

<b>Action and Condition</b>	<b>Organizational Functions</b>
Approval of authorized limits for the recycle and reuse of personal property containing residual radioactivity and for disposal of wastes.	See Sections 5.4, 5.5, 5.6, 5.7, and 5.8 of this Guide.
1. Limits consistent with surface activity guidelines or other DOE-approved concentration guidelines.	1. Request reviewed and approved by DOE field elements consistent with Section 5.4 in coordination with program offices.
2. Alternate ALARA/dose-based derived authorized limits for surfaces or activity in mass or volume where potential doses are less than 1 mrem and 10 person-rem in a year.	2. Request reviewed and approved by DOE field elements in coordination with program office and submitted to EH-4 at least 45 working days prior to implementation. Submittal to EH-4 is mandatory.  The authorized limits may be considered approved by EH-1 if EH-4 does not notify the field as to the status of the review and potential concerns within 30 working days following receipt of request.
3. Alternate ALARA/dose-based derived authorized limits for surfaces or activity in mass or volume where potential doses are less than the 25-mrem dose constraint but in excess of 1 mrem or 10 person-rem in a year.	3. Request reviewed and approved by DOE field elements in coordination with program office.  It is mandatory that field elements provide authorized limits to EH-4 for review and approval prior to implementation.  EH-1 provides written approval if authorized limits are acceptable and field elements implement limits.
Approval of authorized limits for open land (soil criteria); does not include waste or soil-like wastes for disposal in a landfill or other disposition.	Request reviewed and approved by DOE field elements consistent with Sections 5.2 and 5.3.  Field elements coordinate with program offices.  EH provides technical assistance upon request.
Approval of authorized limits for structures.	See Sections 5.4 and 5.5 of this Guide. Organizational functions are the same as for 1-3 above under “personal property,” except that for surface activity on structures, submittal of authorized limits to EH-4 is voluntary and EH-1 approval is not required.
Exemptions for 10 CFR part 835 posting, access control.	Exemption requests submitted to EH-1 consistent with 10 CFR part 820. Request should use documentation for authorized limit to justify exemption and will be approved or rejected by EH-1 within 45 days of receipt.

EH – Office of Environment, Safety and Health

EH-1 – Assistant Secretary for Environment, Safety and Health

EH-4 – Office of Environment, Safety and Health, Office of Environment

## 8. REFERENCES

1. 10 CFR 20, “Standards for Protection Against Radiation,” subpart E, “Radiological Criteria for License Termination;” Washington, D.C.
2. 10 CFR 61, “Licensing Requirements for Land Disposal of Radioactive Waste;” Washington, D.C.
3. 10 CFR 830, “Nuclear Safety Management;” Washington, D.C.
4. 10 CFR 834, “Radiation Protection of the Public and the Environment” (proposed); Washington, D.C. Notice of availability published in the *Federal Register (FR)*, August 31, 1995 [*FR* 60, 45381]; proposed March 25, 1993, [*FR* 58, 16268].
5. 10 CFR 835, “Occupational Radiation Protection;” Washington, D.C.
6. 40 CFR 192, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings;” Washington, D.C.
7. ANSI (American National Standards Institute), 1999. *Surface and Volume Radioactivity Standards for Clearance*; ANSI/N13.12-1999; New York; August 31, 1999.
8. DoD-DOE-EPA-NRC (Department of Defense, Department of Energy, Environmental Protection Agency, Nuclear Regulatory Commission), 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Rev. 1; NUREG 1575; Washington, D.C.; August 2000.
9. DOE, 1984. Guidance Memorandum: *Unrestricted Release of Radioactively Contaminated Personal Property*; Washington, D.C.; DOE Office of Nuclear Safety; March 15, 1984.
10. DOE, 1988. *General Environmental Protection Program*; DOE 5400.1; Washington, D.C.; November 9, 1988.
11. DOE, 1989. *Manual for Implementing Residual Radioactive Material Guidelines—A Supplement to the U.S. Department of Energy Guidelines for Residual Radioactive Material at FUSRAP and SFMP Sites*; DOE/CH-8901; Washington, D.C.; June 1989.
12. DOE, 1990. *Radiation Protection of the Public and the Environment*; DOE 5400.5; Washington, D.C.; February 8, 1990.
13. DOE, 1991a. *DOE Guidance on the Procedures in Applying the ALARA Process for Compliance with DOE 5400.5*; Washington, D.C.; DOE Office of Environmental Policy and Assistance.

14. DOE, 1991b. *Recommended Tritium Surface Contamination Release Guides*; Washington, D.C.; DOE Tritium Surface Contamination Limits Committee.
15. DOE, 1991c. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*; DOE/EH-0173T; Washington, D.C.; January 1991.
16. DOE, 1992. *DOE Radiological Control Manual*; DOE/EH-0256T; Washington, D.C.
17. DOE, 1994. *Public Participation*; DOE P 1210.1; Washington, D.C.; July 29, 1994.
18. DOE, 1995. Guidance Memorandum: *Application of DOE 5400.5 Requirements for Release and Control of Property Containing Residual Radioactive Material*; Washington, D.C.; DOE Office of Environment; Air, Water and Radiation Division; November 17, 1995.
19. DOE, 1996a. *Information Management Program*; DOE O 200.1; Washington, D.C.; September 30, 1996.
20. DOE, 1996b. *Environment, Safety, and Health Reporting*; DOE O 231.1; Washington, D.C.; November 7, 1996.
21. DOE, 1997a. *Applying the ALARA Process for Radiation Protection of the Public and Environmental Compliance with 10 CFR Part 834 and DOE 5400.5 ALARA Program Requirements* (DOE draft ALARA standard); 2 vols.; Washington, D.C.; April 1997.
22. DOE, 1997b. *Environmental Implementation Guide for Radiological Survey Procedures* (draft report for comment); Washington, D.C.; February 1997.
23. DOE, 1997c. Guidance Memorandum: *Establishment and Coordination of Authorized Limits for Release of Hazardous Waste Containing Residual Radioactive Material*; Washington, D.C.; DOE Office of Waste Management; January 7, 1997.
24. DOE, 1999. *Radioactive Waste Management*; DOE O 435.1; Washington, D.C.; July 9, 1999.
25. DOE, 2000a. Department of Energy Press Release: *Energy Secretary Richardson Blocks Nickel Recycling at Oak Ridge*; Press Release R-00-008; Washington, D.C.; January 12, 2000.
26. DOE, 2000b. Secretarial Memorandum: *Release of Surplus and Scrap Materials*; memorandum from Bill Richardson to heads of all departmental elements; Washington, D.C.; July 13, 2000.



27. DOE, 2000c. Fact Sheet: *Frequently Asked Questions on the Suspension on Release for Recycling of Metal from Radiation Areas*. Office of Environmental Policy and Guidance. Air, Water and Radiation Division. July 2000.
28. DOE, 2000d. *Records Management Program*; DOE O 243.X (draft); Washington, D.C.
29. DOE, 2001. Secretarial Memorandum: *Managing the Release of Surplus and Scrap Materials*; memorandum from Bill Richardson to heads of departmental elements; Washington, D.C.; January 19, 2001.
30. NRC, 1974. *Termination of Operating Licenses for Nuclear Reactors*; Regulatory Guide 1.86; Washington, D.C.; June 1974.
31. NRC, 1987. *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material*, Washington, D.C., August 1987.
32. Pfingston, M., et al.; 1997. *TSD Dose: A Radiological Dose Assessment Model for Treatment, Storage, and Disposal Facilities*; ANL/EAD/LD-4; Argonne, IL; Argonne National Laboratory; March 1997.
33. Wang, Y., et al.; 1993. *A Compilation of Radionuclide Transfer Factors for the Plant, Meat, Milk, and Aquatic Food Pathways and the Suggested Default Values for the RESRAD Code*; ANL/EAIS/TM-103; Argonne, IL; Argonne National Laboratory; August 1993.
34. Yu, C., et al.; 1993. *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil*; ANL/EAIS-8; Argonne, IL; Argonne National Laboratory; April 1993.
35. Yu, C., et al.; 1994. *RESRAD-BUILD: A Computer Model for Analyzing the Radiological Doses resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material*; ANL/EAD/LD-3; Argonne, IL; Argonne National Laboratory; November 1994.
36. Yu, C., et al.; 2000. *RESRAD-RECYCLE: A Computer Model for Analyzing the Radiological Doses and Risks Resulting from the Recycling of Radioactive Scrap Metal and the Reuse of Surface-Contaminated Material and Equipment*; ANL/EAD-3; Argonne, IL; Argonne National Laboratory; November 2000.
37. Yu, C., et al.; 2001. *User's Manual for RESRAD Version 6*; ANL/EAD-4; Argonne, IL; Argonne National Laboratory; July 2001.

**This page intentionally left blank.**

**SECRETARIAL MEMORANDUMS REGARDING POLICY AND GUIDANCE FOR  
MANAGING THE RELEASE OF DOE SURPLUS AND SCRAP MATERIALS**

Priority & Security Notices



**FOR IMMEDIATE RELEASE**  
**January 12, 2000**

**NEWS MEDIA CONTACT:**  
**Stu Nagurka, 202/586-4940**

## **Energy Secretary Richardson Blocks Nickel Recycling at Oak Ridge**

### ***Secretary Supports NRC Establishment of National Standards***

Energy Secretary Bill Richardson announced today that he is blocking the release into commerce of volumetrically contaminated nickel from Department of Energy (DOE) facilities in Oak Ridge, Tennessee. The action will allow time for the evaluation of alternatives by DOE and for the Nuclear Regulatory Commission (NRC) to make a decision on national treatment standards. The Secretary also is directing expansion of the decision into a new, department-wide policy that would prevent the release of all volumetrically contaminated metals pending the NRC's decision and DOE's determination whether to release any such metals.

"The department will modify its contract with British Nuclear Fuels Inc. (BNFL) to prohibit release of the Oak Ridge nickel into the marketplace," said Secretary Richardson. "We are also establishing a new policy prohibiting the release of all volumetrically contaminated metals at other DOE facilities. This will give the Nuclear Regulatory Commission time to develop national standards for volumetrically contaminated materials, and allow the public an opportunity to weigh in on the development of a national policy. It also will allow DOE to examine alternatives to free release."

Volumetrically contaminated means contamination is present throughout the mass of the metal. While this decision covers some 6,000 tons of contaminated nickel at Oak Ridge, the new national policy will impact approximately 10,000 tons of additional volumetrically contaminated metal at DOE sites.

BNFL, a DOE contractor, is in the process of cleaning up several buildings at the former Oak Ridge uranium enrichment plant, and is removing equipment containing large amounts of nickel. Under the original contract, BNFL had the option of melting and decontaminating the nickel before releasing the material under a State of Tennessee license.

- DOE -

R-00-008



At a Glance ■ Press & Info ■ People & Pages  
Science Education ■ Content Map ■ Search




**The Secretary of Energy**

Washington, DC 20585

July 13, 2000

MEMORANDUM FOR HEADS OF DEPARTMENTAL ELEMENTS

FROM: BILL RICHARDSON   
SUBJECT: Release of Surplus and Scrap Materials

The Department of Energy's (DOE) management of surplus and scrap materials has evolved over many years. Effective management of these materials has become more complicated over the past decade because the Department has begun generating them in larger quantities as it closes many facilities and expands its environmental management activities. Moreover, since much of this material was once used in nuclear operations, our management of it must continue to take into account safety and security issues, but we also want to address recently voiced public concerns that are not faced by most other Federal Agencies or by private industry.

For several months, we have been actively reviewing ways to improve our management of materials which might be released from departmental control. My goal has been to identify ways to better ensure protection of public health and the environment, openness and public trust, and fiscal responsibility.

I thank the Reuse and Recycling Task Force I established last winter for their contribution to the Department's review. While the work of the task force is now complete, many of its members will be involved over the coming months further developing and implementing changes to our policies and procedures.

On January 12, 2000, I placed a moratorium on the Department's release of volumetrically contaminated metals pending a decision by the Nuclear Regulatory Commission (NRC) whether to establish national standards. The NRC continues to review the issue, and the moratorium remains in effect.

Today, I am hereby directing further action in four areas: improvement of the Department's release criteria and monitoring practices; expansion of efforts to promote reuse and recycling within the complex of DOE facilities; improvement of the Department's management of information about material inventories and releases; and the accelerated recovery of sealed sources. Also, I am suspending the unrestricted release for recycling of scrap metals from radiation areas within DOE facilities. This suspension will remain in effect until improvements in our release criteria and information management have been developed and implemented as described below.



Our existing release criteria, described in DOE Order 5400.5, limit the potential for radiation exposure to the public to levels well below applicable requirements. Our experience using these criteria, however, demonstrates that even this very low potential exposure is not fully acceptable to the public. Our experience with existing criteria also shows that most scrap metal released is either not contaminated at all or has residual levels of surface contamination well below the current DOE standard.

Henceforth, the Department will not allow the release of scrap metals for recycling if contamination from DOE operations is detected using appropriate, commercially available monitoring equipment and approved procedures. To implement this decision, I am directing the Assistant Secretary for Environment, Safety and Health, with appropriate resource support, to revise DOE directives and associated guidance documents applicable to scrap metal releases through a public process, as described below, by December 31, 2000.

The Department will publish proposed changes to DOE directives and guidance for at least sixty days of public review and comment. The changes will describe conditions whereby the Department uses appropriate, commercially available technology and the most appropriate monitoring and decontamination procedures to ensure that no detectable contamination from DOE operations remains on any scrap metal released into commerce for recycling from any portion of our facilities. The revised DOE directive will establish a review cycle to develop future updates to guidance consistent with lessons learned, advances in monitoring or decontamination technology and procedures, and new information such as any future rulemaking activity by the NRC.

Changes will also be made to DOE's requirements and guidance to improve the collection, maintenance, and reporting of information associated with releases of surplus equipment, scrap metals, and other excess personal property. We need better records on inventories of these materials; contamination, security, and other concerns associated with them; and the basis for decisions authorizing their release. This information needs to be maintained in a way that makes it easily accessible to the public (consistent with classification and other security requirements) and readily available to meet the needs of project and program managers.

Once the revised directives and guidance are in place, the Department will require each DOE site to have local public participation before the site may resume the unrestricted release for recycling of scrap metals from radiation areas. These public participation requirements must address each of the above mentioned elements associated with release criteria and information management. In addition, the Department will require individual sites to certify, through the responsible Program Secretarial Officer (PSO), that they have met all requirements of the revised order before the release of scrap metal from radiation areas for recycling can resume. In addition, each affected PSO will implement an

independent verification program to ensure that site activities continue to comply with the new requirements.

While updated release criteria and record keeping procedures are being developed and implemented, the Department will undertake several activities to promote internal reuse and recycling. All DOE programs and sites should expand their efforts to reuse and recycle materials within the Department. I direct the Assistant Secretary for Energy Efficiency and Renewable Energy to lead completion of a feasibility study on the potential use of a dedicated mill to recycle steel for reuse within the DOE complex. The study is to be completed within ninety days, after which I will receive the study's recommendations and determine if the Department will pursue the project further. Also, I direct the Chief Financial Officer to develop a set of proposed actions that will institutionalize incentives for internal reuse and recycling when such activities are cost-effective and protective of workers, the public, and the environment. The Chief Financial Officer will forward these recommended actions to me within 120 days for approval.

Finally, I direct the Assistant Secretary for Environmental Management to accelerate the Department's program to recover radioactive sources. The goal should be to recover over the next four years the backlog of commercial sources for which the Department has authority.



The Secretary of Energy  
Washington, DC 20585

January 19, 2001

MEMORANDUM FOR HEADS OF DEPARTMENT ELEMENTS

FROM: BILL RICHARDSON *Bill Richardson*

SUBJECT: Managing the Release of Surplus and Scrap Materials

Over the last year, the Department has grappled with how to improve its management and release of surplus and scrap material. Our reviews have not identified any evidence that the public might be harmed by releases from our sites, but we have determined that there is a need to improve radiation monitoring, independent verification, and record keeping and reporting. We must also better engage the public in our decision making and help them better understand our release practices.

There is clearly expressed public concern and interest regarding the procedures and requirements under which materials leave our sites for recycling, reuse, or other disposition. I have taken steps to address these concerns while we improve our release policies and procedures. Last January, I placed a moratorium on the unrestricted release of volumetrically contaminated metals pending a decision by the Nuclear Regulatory Commission whether to establish national standards. In July, I suspended the unrestricted release for recycling of all metals **from** radiation areas within Department of Energy (DOE) facilities until improvements in release criteria and related information management have been implemented. Both these prohibitions remain in effect.

The Department has, over the last several months, been developing procedures which, when implemented, would allow unrestricted releases for recycling of metals without detectable radioactive contamination. Internal and public comments on these proposed changes raised significant and substantive issues. Consequently, additional deliberation is necessary, and the new requirements are not complete.

Moreover, in light of these comments, I have determined that the Department should prepare an environmental impact statement (EIS). This will allow an open, healthy discussion of the broadest range of concerns associated with the unrestricted release of materials from our sites. The Office of Environmental Management, in coordination with other Departmental elements, should prepare a Notice of Intent to begin this EIS, to be published within 60 days.





Finally, I am forwarding the guidance below to help our sites improve their monitoring and release practices. These steps are consistent with existing provisions of DOE Order 5400.5 and should be incorporated into your existing release programs.

**1) Clearly define areas and activities that can potentially contaminate property:** I want to emphasize the importance of evaluating activities and areas for potential radiological contamination before property is released from them. DOE has both the authority and responsibility for regulating the radiological release of property under our radiological control. It is necessary that we establish and document clear process-knowledge-based procedures for those releases that have no potential to violate our radiological protection requirements. In addition, there should be opportunity for public participation in establishing and implementing these procedures.

**2) Clearly define release criteria, including measurement and survey protocols, for property released from areas or activities that have potential to contaminate:** Property that cannot be certified for release through process knowledge procedures must be reviewed using our authorized limit-based release procedures consistent with existing DOE Order 5400.5 requirements and associated guidance, as well as the prohibitions mentioned above. All such property must be appropriately surveyed, and its compliance with DOE-approved authorized limits **confirmed**.

Authorized limits you approve must be well documented. The documentation should address the rationale for selecting them (including as low as reasonably achievable, **ALARA**, considerations), the scope of their applicability, and measurement procedures and protocols for demonstrating compliance. Such documentation is necessary even if the surface activity guidelines from DOE Order 5400.5 or the Office of Environment, Safety and Health's (EH) November 17, 1995 guidance is being used. A complete understanding of the limits is needed to ensure that contractors understand the requirements and for DOE to **fulfill** its **regulatory** responsibility when evaluating contractor performance. It will also help in ensuring that our process to clear materials for release is open to public scrutiny. The approval process for authorized limits should be implemented consistent with the requirements of DOE Order 5400.5 and the EH guidance.

**3) Ensuring that released property meets DOE requirements:** As I have stated, DOE has both the authority and responsibility for regulating the radiological release of property under our radiological control. Line management, in particular the Field Offices, have the responsibility to ensure that contractors and DOE personnel comply with DOE requirements. As such, I encourage line management to internally review their property release and control systems to ensure they are compliant with DOE directives. It should be clear that DOE contractors or DOE elements are responsible for conducting final surveys and the preparation of documentation to demonstrate that property releases meet DOE requirements. In addition, DOE field offices, working with their lead program office should establish independent verification programs to further confirm that survey and evaluation processes are in place, being appropriately implemented and that property released from DOE radiological control meets authorized limits. The level and scope of the verification effort should be commensurate with the potential for contamination, as well as the complexity and hazard, and it should appropriately address real and personal property releases. If DOE personnel responsible for independent verification use contractors, the contractors must be independent of the operating contractor managing the property or responsible for the release survey or decontamination of the property.

**4) Better inform and involve the public and improve DOE reporting on releases:** All DOE sites are already responsible for having and implementing public involvement and communications programs. Field Office Managers should incorporate information on property control and release programs including information on authorized limits, certification and verification survey programs, and process knowledge decisions into site public involvement and communications programs. Site release policies and protocols shall be coordinated with the public, and public input considered in DOE's development and approval of site release programs. Responsible field offices must make the documentation on releases available to the public and those receiving the property.

In addition, field offices should report annually on their release programs. The Office of Management and Administration should work with EH and the program offices to develop a system that will allow headquarters to track releases by category. DOE Order 5400.5 and DOE M 43 1.1 already require annual site environmental reports to contain information on DOE releases of radioactive material and potential doses to the public. Therefore, I am directing Field Office Managers to ensure that they include information on the authorized limits being used at their facilities, and surveys and independent verification program results, in the site's annual environmental reports.

**This page intentionally left blank.**

## OVERVIEW OF SUPPORTING GUIDANCE AND TOOLS

This appendix lists many of the guidance documents and tools available for implementing the process for release and control of property with residual radioactive material. Many of these guidance documents and tools can be downloaded from the Office of Environmental Policy and Guidance's main Web site (<http://tis.eh.doe.gov/oepa>), from the Office's Dose and Risk Assessment Web site (<http://tis.eh.doe.gov/oepa/risk>), or from the RESRAD Web site (<http://web.ead.anl.gov/resrad/home2/>).

### B.1 DOSE MODELING TOOLS

1. DOE (Department of Energy), 1989. *Manual for Implementing Residual Radioactive Material Guidelines—A Supplement to the U.S. Department of Energy Guidelines for Residual Radioactive Material at FUSRAP and SFMP Sites*; DOE/CH-8901; Washington, D.C.; June 1989.
2. Pflingston, M., et al.; 1997. *TSD Dose: A Radiological Dose Assessment Model for Treatment, Storage, and Disposal Facilities*; ANL/EAD/LD-4; Argonne, IL; Argonne National Laboratory; March 1997.
3. Wang, Y., et al.; 1993. *A Compilation of Radionuclide Transfer Factors for the Plant, Meat, Milk, and Aquatic Food Pathways and the Suggested Default Values for the RESRAD Code*; ANL/EAIS/TM-103; Argonne, IL; Argonne National Laboratory; August 1993.
4. Yu, C., et al.; 1993. *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil*; ANL/EAIS-8; Argonne, IL; Argonne National Laboratory; April 1993.
5. Yu, C., et al.; 1994. *RESRAD-BUILD: A Computer Model for Analyzing the Radiological Doses resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material*; ANL/EAD/LD-3; Argonne, IL; Argonne National Laboratory; November 1994.
6. Yu, C., et al.; 2000. *RESRAD-RECYCLE: A Computer Model for Analyzing the Radiological Doses and Risks Resulting from the Recycling of Radioactive Scrap Metal and the Reuse of Surface-Contaminated Material and Equipment*; ANL/EAD-3; Argonne, IL; Argonne National Laboratory; November 2000.
7. Yu, C., et al.; 2001. *User's Manual for RESRAD Version 6*; ANL/EAD-4; Argonne, IL; Argonne National Laboratory; July 2001.

## **B.2 DOE ALARA GUIDANCE**

1. DOE, 1991a. *DOE Guidance on the Procedures in Applying the ALARA Process for Compliance with DOE 5400.5*; Washington, D.C.; DOE Office of Environmental Policy and Assistance.
2. DOE, 1997a. *Applying the ALARA Process for Radiation Protection of the Public and the Environmental Compliance with 10 CFR Part 834 and DOE 5400.5 ALARA Program Requirements* (DOE draft ALARA standard); 2 vols.; Washington, DC.; April 1997.

## **B.3 GUIDANCE MEMORANDUMS**

1. DOE, 1984. Guidance Memorandum: *Unrestricted Release of Radioactively Contaminated Personal Property*; Washington, D.C.; DOE Office of Nuclear Safety; March 15, 1984.
2. DOE, 1995. Guidance Memorandum: *Application of DOE 5400.5 Requirements for Release and Control of Property Containing Residual Radioactive Material*; Washington, D.C.; DOE Office of Environment; Air, Water and Radiation Division; November 17, 1995.
3. DOE, 1997c. Guidance Memorandum: *Establishment and Coordination of Authorized Limits for Release of Hazardous Waste Containing Residual Radioactive Material*; Washington, D.C.; DOE Office of Waste Management; January 7, 1997.

## **B.4 SURVEY, MEASUREMENT, ENVIRONMENTAL MONITORING, AND RADIOLOGICAL CONTROLS GUIDANCE**

1. DOD-DOE-EPA-NRC (Department of Defense, Department of Energy, Environmental Protection Agency, Nuclear Regulatory Commission), 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Rev. 1; NUREG 1575; Washington, D.C.; August 2000.
2. DOE, 1991c. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*; DOE/EH-0173T; Washington, D.C.; January 1991.
3. DOE, 1992. *DOE Radiological Control Manual*; DOE/EH-0256T; Washington, D.C.
4. DOE, 1997b. *Environmental Implementation Guide for Radiological Survey Procedures* (draft report for comment); Washington, D.C.; February 1997.