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**DOE-STD-1241-2023
March 2023**

DOE TECHNICAL STANDARD

IMPLEMENTING RELEASE AND CLEARANCE OF PROPERTY REQUIREMENTS



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

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FOREWORD

The Department of Energy (DOE) has developed this Technical Standard (STD) to assist DOE Field Element Managers and DOE contractors in meeting release and clearance of property requirements provided in DOE Order (O) 458.1, *Radiation Protection of the Public and the Environment*, Chg. 4 (2020), to consolidate all previously published pre-approved Authorized Limits and include newly approved volumetric pre-approved Authorized Limits. The volumetric pre-approved Authorized Limits were authorized under the Associate Under Secretary for Environment, Health, Safety and Security (AU-1) Memorandum: *Pre-Approved Limits for Release and Clearance of Volumetric Radioactivity of Personal Property at Department of Energy Field Elements* on March 16, 2021. The Director, Office of Environmental Protection and ES&H Reporting issued supporting Operating Experience Level 3: *Implementation of Pre-Approved Authorized Limits for Release and Clearance of Volumetric Radioactivity of Personal Property at DOE Field Elements* in March 2021 which may be useful in implementing clearance of personal property in a manner compliant with DOE O 458.1.

DOE previously issued for use and comment draft DOE Guide (G) 441.1-xx, *Control and Release of Property with Residual Radioactive Materials*, in 2002, and DOE Handbook (HDBK)-xxxx-97, *Draft Handbook for Controlling Release for Reuse or Recycling of Non-Real Property Containing Residual Radioactive Material*, in 1997, to serve as clearance of property guidance supporting DOE O 5400.5 requirements. These documents have been incorporated into this technical standard, intended to provide updated guidance for implementing DOE O 458.1 release and clearance of property requirements.

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ACRONYMS

ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
ASER	Annual Site Environmental Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DoD	Department of Defense
DOE	Department of Energy
DPM	disintegrations per minute
EPA	Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
G	Guide
HDBK	Handbook
HPS	Health Physics Society
ICRP	International Commission on Radiological Protection
LM	Legacy Management
MARLAP	<i>Multi-Agency Radiological Laboratory Analytical Protocols Manual</i>
MARSAME	<i>Multi-Agency Radiation Survey and Assessment of Material and Equipment Manual</i>
MARSSIM	<i>Multi-Agency Radiation Survey and Site Investigation Manual</i>
MEI	Maximally exposed individual
NCRP	National Council on Radiation Protection and Measurements
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
NUREG	NRC Nuclear Regulatory Guide
O	Order

OE-3	Operating Experience Level 3
RCRA	Resource Conservation and Recovery Act
RESRAD	RESidual RADioactivity code
SFMP	Surplus Facilities Management Program
SI	International System
STD	Standard
TED	Total Effective Dose
WL	working level

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1 PURPOSE, SCOPE, AND ORGANIZATION

1.1 Purpose and Scope

The U.S. Department of Energy (DOE) operates a variety of sites, including nuclear facilities, accelerators, and weapons test facilities. As the missions of DOE continue to evolve, many of these facilities are undergoing remediation and decommissioning. Through these efforts, real property or personal property is routinely available for release and clearance from DOE control. This Standard provides guidance, consistent with DOE requirements, for implementing the release and clearance of property that may contain residual radioactive material. The guidance is provided for Department and contractor personnel who oversee and perform release and clearance of property that may be contaminated with residual radioactive material and who must determine the disposition of property under the requirements in DOE O 458.1, Chg. 4, *Radiation Protection of the Public and the Environment* (DOE, 2020). This Standard is applicable to decommissioning, deactivation, decontamination, and remedial action of property with the potential for residual radioactive contamination. This Standard, unless invoked by Rule, DOE Directive or contract, is not a requirements document, and shall not modify or otherwise add any contractual or regulatory obligations established in Directives or Rules.

Guidance for implementing DOE O 458.1 requirements for the release and clearance of property has been provided by the Office of Public Radiation Protection (formerly Office of Environmental Policy and Assistance) over the past 2 decades through Orders, individual memorandums, guidance documents, and modeling and analysis tools. A principal objective of this Standard is to integrate the key elements of these individual guidance documents and tools into one document as a central resource for DOE and contractor personnel.

1.2 Organization

The Standard presents the principal requirements for release and clearance of property (Section 2); provides implementation guidance on essential elements of the authorized release options analysis process (Section 3); and follows with guidance on the authorized release and clearance process for specific applications (Section 4). Posting and property control for unrestricted and restricted release of property is presented in Section 5. Section 6 reviews the organizational approvals required and the conditions that must be met for DOE Cognizant Secretarial and Field Element Manager approval of the release and clearance of property. References are provided in Section 7. Definitions of key terms used are provided in Section 8. Appendix A provides an excerpt from an issued Office of Environmental Management Memorandum on expected elements of an Authorized Limits package for potential use by other program offices. Appendix B summarizes a brief history of DOE's establishment of release and clearance criteria.

1.3 Enhancements and Improvements to DOE's Monitoring and Release Practices

DOE continually seeks ways to improve its management of materials that might be released from Departmental control. Several Secretarial memorandums describing policy changes and guidance relative to the release and clearance of DOE surplus and scrap materials have been issued to improve and standardize procedures. This Standard does not alter the January 12, 2000, moratorium on the release of volumetrically contaminated metals and the Secretary's direction contained in the July 13, 2000, suspension on the unrestricted release of scrap metal from radiation areas with DOE facilities.

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 (Department of Energy Press Release: *Energy Secretary Richardson Blocks Nickel Recycling at*

Oak Ridge; Press Release R-00-008). The guidance was also issued internally on February 14, 2000 (DOE Secretarial Memorandum: *Release of Materials for Re-use and Recycle*; Memorandum from Bill Richardson to Heads of All Departmental Elements). The NRC has not issued a national standard.

On July 13, 2000, DOE suspended “the unrestricted release for recycling of scrap metal from radiological areas within DOE facilities” (DOE Secretarial Memorandum: *Release of Surplus and Scrap Materials*; Memorandum from Bill Richardson to Heads of Departmental Elements). 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’s Order on radiation protection of the public and the environment. DOE has since developed and published DOE O 458.1.

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 Secretarial Memorandum: *Managing the Release of Surplus and Scrap Materials*; Memorandum from Bill Richardson to Departmental Elements). Details of the Department’s guidance for improvements to its monitoring and release practices are presented and emphasized in the appropriate sections of this Standard. A summary of the key elements of the guidance from the January 19, 2001, memorandum 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 considered for release from DOE radiological control. It is necessary for DOE to establish and document clear process-knowledge-based procedures incorporating records and operating history for those releases that have no potential to contain residual radioactive material.
- 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 evaluated and appropriately monitored or surveyed to determine that any residual radioactive material meets authorized limit-based release procedures consistent with DOE O 458.1 and associated guidance. All such property must be appropriately surveyed based on the types and quantities of residual radioactive material that may be present to ensure compliance with DOE approved Authorized Limits.
- Ensure that released property meets DOE requirements. DOE has both the authority and responsibility for regulating the release of property under DOE radiological control and must ensure that long-term stewardship and institutional controls for protection meet the requirements of DOE O 458.1. Field Element Managers are responsible for ensuring contractors and DOE personnel comply with DOE requirements. DOE encourages Field Element Managers to internally review property release and clearance procedures to ensure they are compliant with DOE directives. DOE sites must have the capabilities, consistent with the types of radiological activities conducted, to monitor routine and non-routine radiological releases and to assess the radiation dose to members of the public. 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 Element Managers should incorporate information on property control and release programs, including information on Authorized Limits, certification and independent 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. Notification of applicable Federal, State or local regulatory agencies or Tribal governments is required. Field Element Managers should ensure information on Authorized Limits and surveys and independent verification program results are included in the annual site environmental reporting (ASER).

This Standard is responsive to the requirements contained in DOE O 458.1 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 can be downloaded from the Department's website for the moratorium and suspension of the release of metals from DOE Sites, <https://www.energy.gov/ehss/articles/moratorium-and-suspension-release-metals-doe-sites>. 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, Fact Sheet: *Frequently Asked Questions on the Suspension on Release for Recycling of Metals from Radiation Areas*, Office of Environmental Policy and Guidance; Air, Water and Radiation Division.), and can be downloaded from the website referenced above.

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2 PRINCIPAL REQUIREMENTS

The principal requirements relating to the release and clearance of property with the potential to contain residual radioactive material are presented in DOE O 458.1, section 4.k, Release and Clearance of Property. Releases must also comply 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 for any actual, likely, or plausible use, radiologically characterized through monitoring and surveys, 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 As Low As Reasonably Achievable (ALARA) process requirements, and meets DOE dose constraints.
- All property releases are appropriately documented, verified, approved, and reported; public notification is addressed; and processes are in place to appropriately maintain records.

The Standard is consistent with DOE Policy (P) 420.1, *Department of Energy Nuclear Safety Policy* (DOE, 2011), and DOE P 450.4A, Chg. 1, *Integrated Safety Management Policy*, (DOE, 2018). The Standard also reflects, as appropriate, recommendations and guidance on radiological safety from various national and international standards and scientific organizations, including the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurement (NCRP), and the American National Standards Institute (ANSI).

2.1 Dose Limits and Constraints

2.1.1 Dose Limit

The primary dose limit for any member of the general public is 100 mrem (1 mSv) total effective dose (TED) 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 dose from radon and its decay products, dose received as a patient from medical sources, dose from background radiation, and dose from occupational exposure [DOE O 458.1, paragraph 4.b.(1) (a)]. Compliance may be demonstrated by calculating dose to the representative person or the maximally exposed individual (MEI). Determination of the representative person or the MEI must include members of the public both on DOE sites outside of controlled areas and off DOE sites.

2.1.2 Dose Constraints

While the public dose limit is for all sources, a dose constraint of 25 mrem/yr (0.25 mSv) is applied for release and clearance of real property. Authorized Limits for annual dose from the release and clearance of real property should be as far below 25 mrem (0.25 mSv) as is practicable. A more stringent dose constraint for annual dose from the release and clearance of personal property is 1 mrem (0.01 mSv). These dose constraints represent an upper bound or "cap" for ALARA based Authorized Limits for release and clearance of real and personal property containing residual radioactive material. The dose constraints ensure DOE property release and clearance are generally consistent with those dose requirements imposed

on NRC licensees in 10 Code of Federal Regulations (CFR) 20, “Standards for Protection Against Radiation,” subpart E, “Radiological Criteria for License Termination.” Additionally, depending on circumstances, DOE O 458.1 either permits or requires the use of concentration based constraints as well to demonstrate compliance with the dose constraints. Real property is defined by DOE as 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 is property of any kind, except for real property. For the purposes of DOE O 458.1 and this Standard, examples of personal property include consumable items (e.g., wood, containers, lab equipment and paper); personal items (e.g., clothing, brief cases, respirators and gloves); office items (e.g., computers, unused office supplies, and furniture); tools and equipment (e.g. hand tools, power tools, construction machinery, vehicles, tool boxes, ladders, and scales); and debris (e.g. removed soil, rubble, sludge, wood, tanks, scrap metal, concrete, wiring, doors, and windows).

2.2 ALARA Process

Management commitment to ALARA is a critical element in ensuring a successful ALARA program. An ALARA analysis is to be conducted in the assessment of potential release options and to support the final authorized release disposition 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 below the applicable dose limits and ALARA. Releases should be assessed in a manner consistent with the DOE ALARA process for protection of the public and environment (DOE HDBK 1215-2014, Chg. 1, *Optimizing Radiation Protection of the Public and the Environment for use with DOE O 458.1, ALARA Requirements*) based on optimization and dose limits. Optimization considers the collective dose to the exposed population from radiation sources to be proportional to the number of radiation-induced health effects and evaluates the cost or detriment of measures that would reduce the dose below applicable dose limits or dose constraints. Optimization provides a basis for judging the reasonableness of the selection of a particular radiological protection system after considering several alternatives. Optimization is not minimization and is the result of an evaluation that carefully balances the benefits from exposure reduction with the cost (the best option is not necessarily the one with the lowest cost). The ALARA process uses a graded approach to ensure that doses to the public are low and any decisions made as a result of the process to be both beneficial and cost-effective. Compliance with dose limit to any member of the public is necessary, regardless of the cost. Description of the ALARA process must be documented in approved plans, procedures, or other documentation. The level of detail should be commensurate with the magnitude of the radiological hazard associated with the DOE activity. For additional information, refer to Section 3.1.

2.3 Radiological Surveys

Any property known or suspected to have residual radioactive material must be appropriately surveyed or characterized (DOE O 458.1 4.k.(8)) for determining final disposition options. 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 measurement and data quality objectives, use approved sampling and analysis techniques, and as appropriate, include an evaluation of non-uniformly distributed residual radioactive material for radiological screening, characterization, certification, or verification, to ensure the Authorized Limits for release and clearance have been met. The surveys should identify proxy radionuclides for hard to detect radionuclides and ensure that activity concentrations are evaluated. The surveys should be supported by measurement procedures and technical basis documents. 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 and guidance contained in the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (DOD-DOE-EPA-NRC, 2000) or *Multi-Agency Radiation Survey and Assessment of Material and Equipment Manual (MARSAME)* (DOD-DOE-EPA-NRC, 2009). MARSSIM addresses the survey of surface soil (top 15 cm (6 in.)) and surfaces (e.g., real property). MARSAME addresses the survey of materials and equipment (e.g., 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. Surveys for the discharge of air or liquid effluent releases are discussed in DOE HDBK 1216-2015, Chg. 1, *Environmental Radiological Effluent Monitoring and Environmental Surveillance*. Guidance on effluent release limits are provided in DOE STD-1196-2022, *Derived Concentration Technical Standard*. Individuals responsible for release and clearance actions for ensuring compliance with the requirements of DOE O 458.1 should have the appropriate education, training, and skills to discharge these responsibilities based upon DOE O 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*.

2.4 Public Involvement and Notification

Public and stakeholder participation is a fundamental component of program operations, planning activities, and decision making within the Department. DOE Field Element Managers must, as appropriate, incorporate information on property control and site clearance policies and protocols, process knowledge decisions, and processes for evaluating and setting Authorized Limits. They must also provide information concerning any newly approved or revised Authorized Limits and the use of pre-approved Authorized Limits into effective site public notification and communication programs. DOE Field Element Managers need to ensure written notification of Authorized Limits to applicable Federal, State, local regulatory agencies, or Tribal governments.

Property clearance activities must be summarized in the ASER according to DOE O 231.1 B, *Environmental Safety and Health Reporting*. The ASER serves as a key component of the Department's commitment to openness and public understanding of DOE operations. DOE sites should use their ASERs, along with other public information tools, to keep the public informed about environmental monitoring and performance. The ASER should include approved Authorized Limits, results of radiological monitoring and surveys of cleared property, and quantities of property cleared. Timely collection, reporting, analysis, and dissemination of data pertaining to the environment and safety supports public notification. When sites maintain other publicly accessible information portals that contain environmental data, these should be identified in the ASER, particularly if these sources present data that is more current than what is collected and calculated in the ASER. Documentation on all releases must be made available to the public and the property owner or recipient, as appropriate. Successful good practices include site-specific web-based information, an executive summary in the ASER, and a summary pamphlet targeted for the general public or non-technical reader.

2.5 Independent Verification and Quality Assurance

2.5.1 Independent Verification

In accordance with DOE O 458.1, paragraph 4(k)(9), DOE Field Element Managers shall establish independent verification programs to confirm that survey and evaluation processes are in place and are appropriately implemented. Independent verification programs must ensure that property released from DOE radiological control meets Authorized Limits and implements the ALARA process. A graded approach to independent verification should be implemented which is commensurate with the scope, complexity, and hazard associated with the action. Personnel involved in verification must be

independent of the operating contractor and DOE personnel directly involved in the specific clearance action for certifying the release or releasing the property and must report directly to DOE. It may be accomplished by DOE or independent contractor review of survey protocols and post-remedial-action data. Consultation with the Cognizant Secretarial Officer or the Office of Public Radiation Protection is available to assist in determining the appropriate level of independent verification required to meet DOE O 458.1 requirements. The independent verification must include, at a minimum, review of the radiological characterization report or data, but, as appropriate, may include independent surveys or sample analysis to verify compliance. In more complex situations, a more formal verification process should be considered such as peer review or third-party support. 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. For real property that is to be transferred to the public or managed by another agency/entity other than DOE or a new facility constructed, an independent verification plan will be prepared and independent verification surveys and sample analysis will be conducted to verify compliance, unless determined to be unneeded by DOE because, for example, the transferred property will be under a license. The results of the verification should also be part of the permanent record of the release and should be included in the ASER.

2.5.2 Quality Assurance

DOE activities are subject to the Department's quality assurance requirements contained in 10 CFR 830, "Nuclear Safety Management," subpart A, "Quality Assurance Requirements" and DOE O 414.1D, *Quality Assurance* with the exceptions of equivalencies and exemptions noted in these documents. These requirements apply to the release and clearance processes for property containing residual radioactive material.

DOE elements and DOE contractors or subcontractors involved in radiochemical sampling and analysis should refer to guidance found in NRC technical report designation (NUREG) 1576, EPA 402-B-04-001A, *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)*, Vol. 1-3. To ensure the defensibility of data generated through proper analysis, all laboratory analysis of radionuclides should be performed by DOECAP-Accreditation Program certified laboratories. Participation and performance in this program should be documented as part of the radiological characterization record.

2.6 Process and Historical Knowledge Clearance of Property

It is important to evaluate and clearly define areas and activities that potentially can contaminate real and personal property. DOE activities and areas should be evaluated for radiological contamination before property is released from them, using a graded approach, and documenting historical knowledge of operating history. Consultation with the Cognizant Secretarial Officer or the Office of Public Radiation Protection is available to assist in determining the appropriate level of graded approach required to meet DOE O 458.1 requirements. 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. Screening surveys consistent with established procedures may be used to verify no contamination of residual radioactive material. 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 evaluated using DOE's authorized limit-based release procedures consistent with DOE O 458.1 4(k) 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 independent verification program to ensure historical and process knowledge clearance is being effectively implemented.

Depending upon the complexity of the activities and based upon a graded approach, a MARSSIM historical site assessment could be considered an acceptable means to show compliance with the requirements of DOE O 458.1 4(k).

MARSSIM has six survey objectives for a historic site assessment:

- identify potential sources of contamination,
- determine whether or not sites pose a threat to human health and the environment,
- differentiate impacted from non-impacted areas,
- provide input to scoping and characterization survey designs,
- provide an assessment of the likelihood of contaminant migration, and
- identify additional potential radiation sites related to the site being investigated.

This is accomplished in three phases: identification of site, preliminary investigation of the facility or site, and site visits or inspections.

2.7 Final Documentation and Availability

Final documentation supporting the release and clearance of property [per DOE O 458.1, paragraph 4.(k)(9) through 4.(k)(11)] must be made part of the Department's permanent record and must be publicly available. Successful good practices include site-specific web-based information, reading rooms, and public information centers. Documentation should indicate the approved release and clearance criteria (e.g. Authorized Limits) and include other data supporting the release and clearance of property, such as radiological certification and independent verification results.

2.7.1 Specific Elements of the Final Documentation

The final clearance documentation for real and personal property clearance:

- shall ensure that final radiological monitoring or surveys are conducted and that documentation shows the clearance requirements meets Authorized Limits,
- shall document oversight duties to verify that the contractor assurance program ensures that the applicable radiological clearance requirements have been met,
- shall ensure that oversight uses a graded approach commensurate with requirements of DOE oversight functions in DOE O 226.1B, *Implementation of Department of Energy Oversight Policy*,
- shall include graded approach to the independent verification activities commensurate with the scope, complexity, and risk associated with the clearance action,
- shall include information and data supporting independent verification results,
- shall ensure procedures, analytical models, instruments, data and analyses, and documentation used

for the clearance are adequate to comply with the requirements of DOE O 458.1,

- shall include information and data supporting the clearance of property such as radiological certification,
- shall indicate criteria use for clearance in approved Authorized Limits, including any revised Authorized Limits, or pre-approved Authorized Limits,
- shall identify the property's destination or disposition,
- shall estimate a date for when the property will be cleared and an estimate of when the property will be released from DOE control,
- shall describe the property being released and its radiological history,
- shall include potential collective dose to the exposed population and the potential dose to a member of the public most likely to receive the highest dose (MEI),
- shall describe the ALARA options analysis and the application of its results in decision making relative to the property being released,
- shall indicate the actual or likely use scenarios and final radiological condition of the property,
- shall provide assurance to other interested parties that the public and the environment are being protected by effective public notification programs,
- shall document evidence of written notification to applicable Federal, State, or local regulatory agencies or Tribal governments,
- shall summarize the annual types and quantities of residual radioactive material cleared in the Annual Site Environmental Report, and
- shall identify effective site public notification and communications program such as websites to inform the public of releases of property.

The final documentation for real property clearance:

- shall identify any restrictions or conditions on the future use of the property such as institutional controls,
- may include independent surveys or sample analysis to verify compliance,
- shall prepare independent verification plan and conduct independent verification surveys for real property transferred to the public or managed by another agency/entity other than DOE unless the transferred property will be under a license, and
- shall ensure independent verification is performed as described in section 2.5.

The final documentation for personal property clearance:

- shall include Field Element Manager operational awareness of radiological monitoring and survey instrumentation ensuring that survey techniques and instruments utilized are appropriate for the clearance action,
- shall include radiological survey procedures,
- shall include recordkeeping,
- shall include methodologies and techniques used for the clearance of property, and
- may include as deemed appropriate a more formal independent verification process in cases of high technical complexity or poor historical performance.

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

2.7.2 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 and clearance 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 or site-specific web-based information.

2.8 Records Maintenance and Reporting

All records relating to the release and clearance of property from a controlled area are to be maintained in compliance with DOE O 200.1A, *Information Technology Management* (DOE, 2017), and DOE O 243.1C, *Records Management Program* (DOE, 2022). DOE sites and facilities must report property clearance activities in their ASER as required by DOE O 231.1B. The ASER should include a summary of approved Authorized Limits, results of radiological monitoring and surveys of cleared property, types and quantities of property cleared, and independent verification program results.

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3 THE RELEASE AND CLEARANCE PROCESS

3.1 DOE ALARA Principles and Process for Release and Clearance of Property

3.1.1 ALARA Principles

The ALARA process must be documented to demonstrate the implementation of optimization control and management of radiological activities so that doses to members of the public (both individual and collective) and releases to the environment are kept ALARA. DOE O 458.1, paragraph 4.(d) requires that all release and clearance of property be assessed and the ALARA process applied no matter how small the potential dose from residual radioactive material.

3.1.2 ALARA Process

DOE has established a graded level of ALARA analysis using qualitative, semi-quantitative, and quantitative analyses to provide control and oversight to ensure doses to the public are low and meet dose constraints. The degree of control, treatment, processing, and remedial action or other method of limiting doses to workers and to members of the public should be determined by implementing a process that identifies and considers all factors important to decision making. The process must consider sources, modes of exposure, and all pathways which potentially could result in the release of radioactive materials into the environment, or exposure to the public.

ALARA Process, as implemented in DOE O 458.1 and DOE-HDBK-1215-2014, is:

A graded process for evaluating alternative operations, processes, and other measures, for optimizing releases of radioactive material to the environment, and exposure to the work force and to members of the public taking into account societal, environmental, technical, economic, and public policy considerations to make a decision concerning the optimum level of public health and environmental protection. A graded approach provides the flexibility to perform qualitative or quantitative ALARA analyses. For low doses, qualitative evaluations normally will suffice.

3.1.3 Guidance for Implementing the ALARA Process

Guidance has been developed for applying the ALARA process to environmental releases in DOE-HDBK-1215-2014. The guidance:

- provides additional information on the ALARA requirements in DOE O 458.1,
- elaborates on the necessary elements of an ALARA process,
- assists DOE program and field offices in understanding what is necessary and acceptable for implementing the ALARA process for DOE activities that are conducted under DOE O 458.1, and

- aids decision makers by identifying acceptable approaches and methods for identifying and selecting the optimum radiation protection alternative from among several candidate radiation protection alternatives.

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 while ensuring public dose limits meet requirements in DOE O 458.1.

3.2 Use Scenarios and Limits for Release and Clearance of Property

3.2.1 Doses Under Likely Use Scenario

As stated in DOE O 458.1, 4.k.(6), Authorized Limits must be established and approved for clearance of any property with residual radioactive material to provide reasonable assurance that the requirements of DOE O 458.1, 4.k.(1) and 4.k.(2) are met. The limits should be selected to ensure doses to individuals using the property under “actual” or “likely use” scenarios will be well below the primary dose limit and at a level that provides a reasonable expectation dose will be less than the dose constraint of 25 mrem (0.25 mSv) in a year for real property and a dose constraint of 1 mrem (0.01 mSv) a year for personal property. “Actual” or “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. Based on DOE experience gained in applying these requirements under DOE O 458.1, it is expected doses will be on the order of a few mrem or less in a year for real property.

3.2.2 Doses Under Plausible Use Scenarios

The evaluation to support establishment of a specific authorized limit should consider the plausible use¹ of the property over the long term. As stated in DOE 4.e.(2), the estimated individual dose to the MEI or representative person that is representative of the persons or group likely to receive the most dose and is based on pathway and exposure parameters that are not likely to underestimate or substantially overestimate the dose, and, the collective dose (population dose) that is a realistic as practicable estimate of the sum of the doses to all members of the actual exposed population. Dose estimates for release and clearance of the property calculated under this type of scenario may be a relatively large fraction of the public dose limit if the probability of the scenario occurring is relatively low. It is not expected that the 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 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 different. 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 plausible use scenario is high and reasonably certain, the 25 mrem/yr (0.25 mSv/yr) dose constraint should be applied, ensuring doses associated with the potential release would be limited to a very small fraction of the 100 mrem/yr (1 mSv/yr) dose limit. In such instances, the plausible use may be considered the likely use. No

¹ The 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.

assessment of plausible use scenario dose is required where radioactivity in released material is present above background levels and applicable dose constraints are demonstrated to be met.

3.3 Evaluation of Individual Dose in the Release and Clearance Process

Within the release and clearance of property process, it is required that no action will cause individual doses to a member of the public in excess of the public dose limit. Given the fact that the public 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 or clear property that is likely to cause an individual to receive a dose at or near the public dose limit.

On this basis, DOE requires that Authorized Limits for real property derived through the ALARA process (DOE-HDBK-1215-2014) be constrained at 25 mrem (0.25 mSv) in a year to the maximum exposed individual, considering actual or likely future use. The ALARA process should assess the benefits, costs, and other considerations associated with estimated doses at several levels below the dose constraint. The selected release and clearance criteria should be based on the optimum level of public health and environmental protection while taking into account societal, environmental, technical, economical, and public policy considerations.

ALARA Analysis to Demonstrate a Release Option Meets the 25 mrem/yr (0.25 mSv/yr) Dose Constraint for Real Property

- Analysis should be completed for several dose levels, with at least two dose levels below the 25 mrem/yr (0.25 mSv/yr) dose constraint.
- 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 (0.03 mSv) or less should be evaluated. (Note: For personal property at least one alternative below 1 mrem/yr (0.01 mSv/yr) should be considered.)
- This *quantitative* ALARA analysis is recommended for a dose-based process. (Note: If DOE pre-approved surface or volumetric Authorized Limits are used, a more *qualitative* ALARA analysis can be conducted.)

3.4 Evaluation of Collective Dose in the Release and Clearance Process

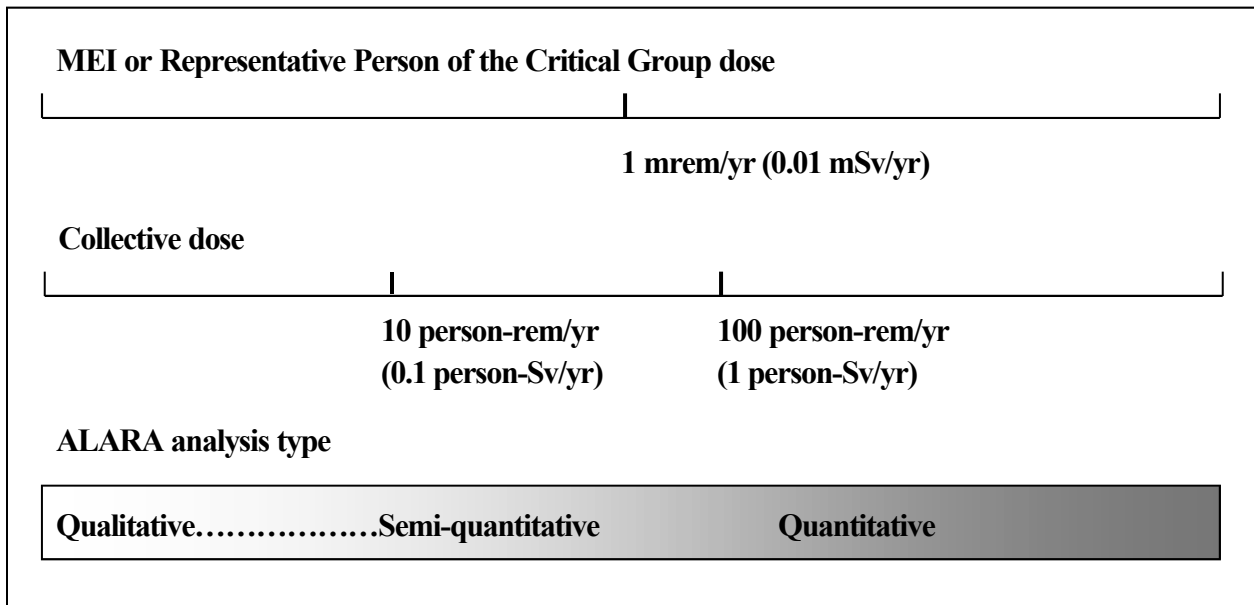
Although the individual dose constraint is used to ensure an individual or group of individuals does not receive an inordinate fraction of a potential dose, in general, it is the collective dose averted that should be compared to costs and other factors when conducting the release and clearance options 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.

3.4.1 Collective Dose

Collective dose is the term used to describe the TED to all persons in a specified population received in a specific period of time. The collective dose refers to the population potentially exposed to the cleared

property for clearance of property actions. The unit of collective dose is expressed in units of person-rem. The collective dose is important because it impacts the decision-making process ensuring that collective dose estimates be representative so that comparison of alternative release and clearance options can be compared without bias. The collective dose is assumed to be indicative of the potential number of radiation-induced health effects to the population from the disposition 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. Guidance on collective dose evaluation is provided in DOE HDBK-1215-2014.

Collective-dose estimates should be provided for actual or likely use scenarios, and plausible future use of the property. In most cases, collective doses relating to actual or likely 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 (1 person-Sv) 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/yr (0.1 person-Sv/yr), 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. When the collective dose is between 10 person-rem/yr (0.1 person-Sv/yr) and 100 person-rem/yr (1 person-Sv/yr), a semi-quantitative analysis should be considered. It is recommended that ALARA analyses of one or more alternatives that reduce collective doses to less than 10 person-rem/yr (0.1 person-Sv/yr) and individual doses to less than a few mrem in a year be considered.



3.4.2 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 and clearance 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 and clearance 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 typically 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.

Ultimate disposition 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. DOE O 458.1, e.(1)(d) states, consistent with the graded approach, collective dose estimates may be truncated by distance (e.g., 50 miles) or individual dose level (e.g. 10 microrem) when integration of doses beyond such thresholds does not significantly affect data quality objectives.

In most cases, collective doses relating to actual or likely 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. 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. DOE HDBK-1215-2014 contains several 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.

3.5 Evaluation of Other Factors in the Release and Clearance Process

Assessments of potential doses associated with release and clearance should be specific to the particular release being considered. Although this Standard is limited to release and clearance 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 worker dose, public health risk, environmental protection and cost that may be important in establishing Authorized Limits. Societal concerns and public policy, 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.

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4 SPECIFIC APPLICATIONS OF THE RELEASE AND CLEARANCE PROCESS

4.1 Accelerator-Produced Radioactive Material

DOE regulates the use of accelerator-produced radioactive material at its facilities under the authority and responsibilities provided through the Atomic Energy Act of 1954, as amended (AEA). Personal property affected by accelerator-produced radioactive material should be evaluated and Authorized Limits determined consistent with the goals and recommendations provided in this Standard and DOE STD-6004-2016, *Clearance and Release of Personal Property from Accelerator Facilities*. Pre-approved surface and volumetric Authorized Limits can be applied directly to accelerator produced radioactivity. This Standard and the DOE O 458.1 requirements are applicable to residual radioactive material above background levels. These background levels include radiation from: naturally occurring radioactive materials which have not been technologically enhanced, cosmic sources, global fallout as it exists in the environment, radon and its decay products in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities, and consumer products containing nominal amounts of radioactive material or producing nominal amounts or radiation. Background does not include materials containing natural radionuclides whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the natural state by 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 release and clearance. 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.

4.2 Radium and Radon

4.2.1 Radium

DOE O 458.1 4.k.(6)(f) provides specific pre-approved Authorized Limits for radium. Authorized Limits for radium-226 and radium-228 in soil is 5 pCi/gram in excess of background levels, averaged over 100 m², in the first 15 cm depth of the surface layer of soil; and 15 pCi/gram in excess of background levels, averaged over any subsequent 15 cm subsurface layer of soil plus an ALARA assessment. If both thorium-230 and radium-226 or both thorium-232 and radium-228 are present and not in secular equilibrium, the appropriate pre-approved limit must be applied to the radionuclide with the higher concentration. 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 assessment 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.

4.2.2 Radon

Buildings released or cleared from DOE control are required by DOE O 458.1 4.f.(4) to not cause the radon-220 and radon-222 decay product concentration to exceed 0.03 Working Level (WL), including

background. A reasonable effort must be made to meet a 0.02 WL for average radon decay product concentration. 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. Radon-222 doses are exempted from the DOE primary dose limits in buildings or the environment which have not been elevated as a result of current or prior DOE activities. If measurements of radon are made, it may generally be assumed that 4 pCi/L radon is equivalent to the 0.02 WL limit. The limits are largely based on EPA emission standards in 40 CFR 61, “National Emission Standards for Hazardous Air Pollutants”. 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.

4.3 Release and Clearance of Personal Property Including Equipment

When the Department releases or clears personal property (described in section 2.1.2) from DOE radiological control or transfers ownership (either by sale or other means) to members of the public, the limits for equipment are the same as for those applied to personal 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 O 458.1 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 (1 mSv) 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 and clearance 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. The ALARA analysis should be consistent with DOE HDBK-1215-2014.

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 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 consistent with DOE HDBK-1215-2014, paragraph 4.2.

4.4 Surface Activity on Personal Property

The guidelines for surface activity on property released or cleared from DOE control are provided in section 4.4.1., and derived from previous guidance in the following:

- March 15, 1984: Memorandum from Joseph R. Maher, DOE Office of Nuclear Safety, to field elements, *Unrestricted Release of Radioactively Contaminated Personal Property* (DOE, 1984).
- June 1989: DOE/CH-8901, *Manual for Implementing Residual Radioactive Material Guidelines*

(DOE, 1989).

- November 17, 1995: Memorandum from Raymond F. Pelletier, DOE Office of Environmental Policy and Assistance, *Application of DOE 5400.5 Requirements for Release and Control of Property Containing Residual Radioactive Material* (DOE, 1995).

These surface activity guidelines are equivalent to existing NRC guidelines originally published in Regulatory Guide 1.86 (withdrawn) and now contained in NUREG-1556, Volume 9, Rev.3, *Consolidated Guidance About Materials Licenses*, September 2019.

4.4.1 Surface Activity Guidelines

DOE total residual surface activity guidelines, which provide release and clearance criteria for allowable total residual surface activity in disintegrations per minute per hundred square centimeters (dpm/100 cm²), are in the references above and Table 1 of this Standard. When more than one radionuclide is present, the unity rule (sum of fractions) presented in MARSSIM should be used to determine release and clearance criteria. The pre-approved surface Authorized Limits in Table 1 are applicable to personal property.

The surface pre-approved Authorized Limits were originally defined based on the measurement capabilities of the instrumentation. Release and clearance of personal property consistent with these surface pre-approved Authorized Limits will provide reasonable assurance that doses are well below the personal property dose constraint.

**Table 1. DOE Total Residual Surface Activity Guidelines:
Allowable Total Residual Surface Activity (dpm/100 cm²)^{a, b}**
(From: NUREG 1556, Vol 9, Rev. 3 and documents discussed in section 4.4)

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

^a

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. Authorized Limits for residual radioactive material in volume must be approved separately or meet DOE Total Residual Volumetric Activity Guidelines: Allowable Total Residual Volumetric Activity.

^b

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.

^c

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.

^d

Measurements of average contamination should not be averaged over an area of more than 1 m². 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 cm².

^e

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) (0.002 mGy/hr) and 1.0 mrad/h (0.01 mGy/hr), respectively, at 1 cm.

^f

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

^g

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

^h

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.

4.4.2 Surface Activity Guidelines for Tritium

The Department has reviewed the analysis conducted by the former DOE Tritium Surface Contamination Limits Committee and the Standard developed from the analysis, DOE STD-1129-2015, *Tritium Handling and Safe Storage* regarding potential doses associated with the release and clearance of property containing residual tritium. The Department has established the use of 10,000 dpm/100 cm² as a pre-approved Authorized Limit for removable tritium. This pre-approved Authorized Limit for removable surface contamination ensures nonremovable fractions will not cause exposures that approach the DOE dose constraints for personal property.

4.4.3 Surveys and Measurements

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. 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 practical 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 status survey documentation for the release and clearance 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, which may be either a wet or dry smear, or a piece of polystyrene foam (DOE STD-1129-2015). 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 1 are extremely difficult to detect but have low radiotoxicity (e.g., ¹²⁵I and ¹²⁹I from Group 1) and pose low dose and risk of exposure to levels in Table 1. For these radionuclides, measurement confidence of 67 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.

4.5 Volumetric Activity in Personal Property

4.5.1 Volumetric Activity Guidelines

DOE total residual volumetric activity guidelines, which provide release and clearance criteria for allowable total residual volumetric activity in becquerels per gram (Bq/g) (or pCi/g), are in Table 2 of this Standard. When more than one radionuclide is present, the unity rule (sum of fractions) presented in MARSSIM should be used to determine release and clearance criteria. The pre-approved volumetric Authorized Limits in Table 2 are applicable to personal property only (described in section 2.1.2), including disposal, recycling or reuse of process gases, liquids and residue, but not the discharge of air or liquid effluent releases that are controlled by other requirements. The pre-approved volumetric Authorized Limits should not be used regarding release of land or soil intended for agricultural purposes. The volumetric activity guidelines were established under procedures in DOE O 458.1 (4.k.6.(f) 2.) with the issuance of memorandum, *Pre-Approved Authorized Limits for Release and Clearance of Volumetric*

Radioactivity of Personal Property at DOE Field Elements (March 16, 2021) by the Chief Health, Safety and Security Officer. DOE O 458.1 provides for the use of pre-approved Authorized Limits, instead of developing site-specific Authorized Limits, if their use is documented in the environmental radiological protection program and the specific application² is approved through the responsible DOE Field Element Manager. The volumetric activity guidelines are based upon screening levels published in the national consensus standard, ANSI/ Health Physics Society (HPS) N13.12-2013. An Operating Experience Level 3 (OE-3) was issued by the Director, Office of Environmental Protection and ES&H Reporting entitled: OE-3:2021-01, *Implementation of Pre-Approved Authorized Limits for Release and Clearance of Volumetric Radioactivity of Personal Property at DOE Field Elements* (March 2021) which may be useful in implementing clearance of personal property.

Although Table 2 values are conservative and may be too restrictive or inappropriate for certain radionuclides in certain situations, sites may continue to seek site-specific Authorized Limits using site-specific values. Sites may utilize site-specific Authorized Limits or use pre-approved Authorized Limits with Field Element Manager approval.

² 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. Volumetric contaminated metals may only be released for recycle when the volumetric contamination decays, the metal is treated to remove detectable contamination, or controls (restrictions) are placed on its use.

**Table 2. DOE Total Residual Volumetric Activity Guidelines:
Allowable Total Residual Volumetric Activity^a
(From: ANSI/HPS N13.12-2013)**

Radionuclide Groups ^b	SI units Volume (Bq/g)	Conventional units Volume (pCi/g)
Group 0 Special Case: ¹²⁹ I ^c	0.01	0.3
Group 1 High-energy gamma, radium, thorium, transuranics, and mobile beta-gamma emitters: ²² Na, ⁴⁶ Sc, ⁵⁴ Mn, ⁵⁶ Co, ⁶⁰ Co, ⁶⁵ Zn, ⁹⁴ Nb, ¹⁰⁶ Ru, ^{110m} Ag, ¹²⁵ Sb, ¹³⁴ Cs, ¹³⁷ Cs, ¹⁵² Eu, ¹⁵⁴ Eu, ¹⁸² Ta, ²⁰⁷ Pb, ²¹⁰ Po, ²¹⁰ Pb, ²²⁶ Ra, ²²⁸ Ra, ²²⁸ Th, ²²⁹ Th, ²³⁰ Th, ²³² Th, ²³² U, ²³⁸ U, ²³⁹ Pu, ²⁴⁰ Pu, ²⁴² Pu, ²⁴⁴ Pu, ²⁴¹ Am, ²⁴³ Am, ²⁴⁵ Cm, ²⁴⁶ Cm, ²⁴⁷ Cm, ²⁴⁸ Cm, ²⁴⁹ Cf, ²⁵¹ Cf, ²⁵⁴ Es, and associated decay chains ^d , and others ^b	0.1	3
Group 2 Uranium and selected beta-gamma emitters: ¹⁴ C, ³⁶ Cl, ⁵⁹ Fe, ⁵⁷ Co, ⁵⁸ Co, ⁷⁵ Se, ⁸⁵ Sr, ⁹⁰ Sr, ⁹⁵ Zr, ⁹⁹ Tc, ¹⁰⁵ Ag, ¹⁰⁹ Cd, ¹¹³ Sn, ¹²⁴ Sb, ^{123m} Te, ¹³⁹ Ce, ¹⁴⁰ Ba, ¹⁵⁵ Eu, ¹⁶⁰ Tb, ¹⁸¹ Hf, ¹⁸⁵ Os, ¹⁹⁰ Ir, ¹⁹² Ir, ²⁰⁴ Tl, ²⁰⁶ Pb, ²³³ U, ²³⁴ U, ²³⁵ U, ²³⁸ U, natural uranium ^e , ²³⁷ Np, ²³⁶ Pu, ²⁴³ Cm, ²⁴⁴ Cm, ²⁴⁸ Cf, ²⁵⁰ Cf, ²⁵² Cf, ²⁵⁴ Cf, and associated decay chains ^d , and others ^b	1	30
Group 3 General beta-gamma emitters: ⁷ Be, ⁷⁴ As, ^{93m} Nb, ⁹³ Mo, ⁹³ Zr, ⁹⁷ Tc, ¹⁰³ Ru, ^{114m} In, ¹²⁵ Sn, ^{127m} Te, ^{129m} Te, ¹³¹ I, ¹³¹ Ba, ¹⁴⁴ Ce, ¹⁵³ Gd, ¹⁸¹ W, ²⁰³ Hg, ²⁰² Tl, ²²⁵ Ra, ²³⁰ Pa, ²³³ Pa, ²³⁶ U, ²⁴¹ Pu, ²⁴² Cm, and others ^b	10	300
Group 4 Low-energy beta-gamma emitters: ³ H, ³⁵ S, ⁴⁵ Ca, ⁵¹ Cr, ⁵³ Mn, ⁵⁹ Ni, ⁶³ Ni, ⁸⁶ Rb, ⁹¹ Y, ^{97m} Tc, ^{115m} Cd, ^{115m} In, ¹²⁵ I, ¹³⁵ I, ¹⁴¹ Cs, ¹⁴⁷ Ce, ¹⁷⁰ Tm, ¹⁹¹ Os, ²³⁷ Pu, ²⁴⁹ Bk, ²⁵³ Cf, and others ^b	100	3,000
Group 5 Low-energy beta emitters: ⁵⁵ Fe, ⁷³ As, ⁸⁹ Sr, ^{125m} Te, ¹⁴⁷ Pm, ¹⁵¹ Sm, ¹⁷¹ Tm, ¹⁸⁵ W, and others ^b	1,000	30,000

^aThe screening levels for clearance have been rounded to one significant figure and are assigned for volume radioactivity.

^bTo determine the specific group for radionuclides not shown, a comparison of the screening factors, by exposure scenario, listed in Tables B.1, C.1, and D.1 of NCRP Report No. 123I (NCRP 1996) for the radionuclides in question and the radionuclides in the general groups above will be performed and a determination of the proper group made, as described in ANSI/HPS N13.12-2013, Annex A.

^cBecause of potential ground-water concerns, the volume radioactivity values for ¹²⁹I when disposal to landfills or direct disposal to soil is anticipated is assigned to Group 0.

^dFor decay chains, the screening levels represent the total activity (i.e., the activity of the parent plus the activity of all progeny) present.

^eThe natural uranium screening levels for clearance *shall* be lowered from Group 2 to Group 1 if decay-chain progeny are present (i.e., uranium ore versus process or separated uranium, for example, in the form of yellowcake). The natural uranium activity equals the activity from uranium isotopes (48.9% from ²³⁸U, plus 48.9% from ²³⁴U, plus 2.2% from ²³⁵U). This approach is consistent with summing radionuclide fractions discussed in ANSI/HPS N13.12-2013, Section 4.4.

4.5.2 Volumetric Activity Guidelines for Tritium

The Department has established the use of 100 Bq/g (3,000 pCi/g) as a pre-approved Authorized Limit for the release and clearance of personal property containing volumetric tritium. This pre-approved Authorized Limit for volumetric contamination is appropriate to demonstrate compliance when evaluating liquids and gases containing tritium. For solids with tritium contamination, using the surface pre-approved Authorized Limit of 10,000 dpm/100 cm² or the volumetric pre-approved Authorized Limit is valid to demonstrate compliance. Release of solids using the pre-approved surface Authorized Limit or pre-approved volumetric Authorized Limit will not cause exposures that approach the DOE dose constraints for personal property.

4.6 Release of Metals

Scrap metals cleared directly from a radiologically area posted under 10 CFR 835 are currently suspended from the unrestricted release for recycle based upon Secretarial Memorandums described in Section 1.3. The Secretarial Memorandums also placed a moratorium on the release of volumetrically contaminated metals. The suspension applies to the recycle of all scrap metal types. Recycle means the metal will be melted and new product made for use outside of DOE. Metals in a posted radiological area that are cleared under 10 CFR 835 criteria is routinely retained for possible reuse. The release of contaminated metal property for reuse for their intended purpose (e.g. chair, desk, equipment) is not suspended and should not be considered as “scrap” metal. Reuse and recycle are critical to the Department meeting its pollution prevention and waste minimization goals.

Historically, some sites conservatively over posted areas based upon 10 CFR 835 requirements. This has led to situations where a substantial volume of metals with no potential for radiological contamination being encumbered under the moratorium or suspension. Establishing radiological area boundaries that meet the requirements of 10 CFR 835, without introducing excessive conservatism, ensures the correct materials are encumbered as originally intended under the Secretarial Memorandums.

4.7 Release of Real Property

Release of real property requires specific analysis to ensure release and clearance meet the dose constraint of 25 mrem/yr (0.25 mSv/yr). Authorized Limits must be established and approved for real property under the requirements in DOE O 458.1, 4.k.(6). The Authorized Limits must be supported by a complete exposure pathway analysis using RESidual RADioactivity (RESRAD) family of codes or other approved methodologies, techniques, parameters, and models that meet DOE quality assurance requirements under DOE O 414.1D. Application of the ALARA process to determine that levels are as low as is reasonably achievable is required and the effort should be commensurate with the risks from the residual radioactive material. The analysis should be quantitative for doses near the dose constraint and should include several candidate radiation protection alternatives.

Release of buildings as real property are subject to the dose constraint of 25 mrem/yr (0.25 mSv/yr). Disposition options may conclude the actual or likely use is demolition of the building for disposal, the dose constraint of 25 mrem/yr (0.25 mSv/yr) is still applied. The building and contents attached to the building, cleared under site specific Authorized Limits for real property may be approved for disposal by the Field Element Manager.

Prior to a building released under an Authorized Limit, contents previously but no longer attached to the building are considered personal property and are required to meet the dose constraint of 1 mrem/yr (0.01 mSv/yr) consistent with Sections 4.4 and 4.5.

The pre-approved Authorized Limits for surface activity and volumetric activity were issued to ensure that the release and clearance of personal property meets the dose constraint of 1 mrem/yr (0.01 mSv/yr). Real property has a dose constraint of 25 mrem/yr (0.25 mSv/yr). Using the pre-approved Authorized Limits for real property would be overly conservative.

4.8 Release of Soils

Authorized Limits³ for release or control of residual radioactive material in surface soils⁴ and subsurface soils should be developed consistent with the requirements, goals, and recommendations in DOE O 458.1 and this Standard. The RESRAD family of codes 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 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, current RESRAD family of codes should be used in such assessments. DOE Field Element Managers should ensure there is appropriate justification for use of alternative models and that such models meet DOE quality assurance and quality control requirements in DOE O 414.1D. Clearance of property with residual radioactive material under activities using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) may be considered equivalent to Authorized Limits if the Field Element Manager has determined that the criteria meet the requirements of DOE O 458.1, and provided that the use of the criteria is documented and approved as would be an Authorized Limit. DOE recommends implementing the guidance provided in the consensus MARSSIM manual as a standard approach for release and clearance of real property under DOE O 458.1.

4.9 Real Property Previously Cleared

Real property consisting of buildings and soil cleared under a real property site-specific Authorized Limit for unrestricted release remain cleared from radiological concerns. Actions that involve the removal of the building, foundation, or soil subsequent to the clearance do not require another clearance action based upon personal property dose constraints. However, if the building or soil were radiologically impacted after the initial clearance, another clearance action is required based upon potential use of the property. Real property cleared with institutional controls as part of a site-specific Authorized Limit should be reevaluated by the site when a change of real property use no longer meets previously approved institutional controls. Technology improvements of detection instrumentation do not warrant a reevaluation of previously cleared property.

³ Authorized limits are typically expressed as concentration limits in picocuries per gram (pCi/g) or becquerels per kilogram (Bq/kg).

⁴ Surface soils is typically the top 15 cm (6 in.) of soil (40 CFR 192).

4.9.1 MARSSIM Survey Design

MARSSIM provides information on planning, conducting, evaluating, and documenting building surface and surface soil final status surveys for demonstrating compliance with dose or risk-based regulations or standards. Field Element Managers should utilize processes in MARSSIM to develop appropriate survey designs using the Data Quality Objectives Process to ensure that the survey results are of sufficient quality and quantity to support the final release and clearance of property decisions.

Preliminary Survey Considerations are discussed in MARSSIM Manual, Chapter 4. Final Status surveys are discussed in Chapter 5. Determining the release criteria for soil includes a survey design including application of decommissioning criteria, determining number of data points for statistical tests (based on potential presence of contaminant as a background radionuclide), and determining any areas of elevated activity.

4.9.2 Small Areas of Elevated Activity

Small areas of elevated activity may exist at sites. These areas of elevated activity have also been referred to as hot spots. MARSSIM addresses the concern for small areas of elevated activity by comparison to the investigation level. Scanning surveys are typically used to identify small areas of elevated activity. The size of the area of elevated activity that the survey is designed to detect will determine the scanning technique to detect these areas. Determining the number of survey data points is detailed in MARSSIM Section 5.5.2.4.

4.10 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 O 458.1 and DOE O 435.1, *Radioactive Waste Management* (DOE, 2021) 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 O 458.1 as is practicable. This is determined on the basis of the ALARA analysis. The criteria should be such that disposal of materials into the landfill will not result in a future need to remediate the landfill to meet the requirements of DOE O 458.1, unless the landfill is authorized to receive radioactive waste under DOE O 435.1 procedures. In making this determination, consideration should also be given to radionuclide limits established in the 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 (0.25 mSv) in a year with a goal of a few mrem in a year or less;
- evaluated to ensure groundwater will be protected in a manner consistent with requirements in DOE O 458.1, 4.i. and other applicable State regulations and guidelines;
- evaluated to verify release of the landfill property would not be expected to require remediation under DOE O 458.1 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:

- estimated concentrations in waste,
- total activity (source term) likely to be disposed in the landfill,
- fraction of total waste containing residual radioactivity,
- estimated individual doses from expected or likely use scenarios,
- estimate or assessment of collective doses in relation to other alternatives, and
- 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.

4.11 Offsite Landfills

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 used for materials to be disposed of in a non-DOE landfill 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 (0.25 mSv) in a year, with a goal of a few mrem 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 O 458.1 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.

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5 POSTING AND PROPERTY CONTROL

5.1 Unrestricted and Restricted Release of Property

DOE material with residual radioactivity control requirements addressed in this Standard relate to unrestricted and restricted release of real and personal property. This includes transfer of the property through sale, lease, gift, or otherwise. Restrictions associated with any of these actions may be considered in assessing and evaluating potential doses through the ALARA process and making determinations for disposition.

DOE HDBK-1240-2021, *Institutional Controls Implementation Handbook for Use with Use of Institutional Controls* (2021) provides information to assist program and field offices in implementing institutional controls. Management implementation of institutional controls should ensure there is 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. Institutional controls are used when necessary to control potential doses to the public. DOE may choose to implement defense-in-depth using multiple layers of protection to ensure that safety is not dependent solely on any single element of design, construction, maintenance, or operation. Legacy Management (LM) Guide-3-20-2.0-0.0, *Guidance for Institutional Controls for Long Term Surveillance and Maintenance at DOE Legacy Management Sites*, provides guidance that monitoring programs should include a process for periodic review and evaluation (at least every 5 years for CERCLA sites) of implemented institutional controls to ensure restrictions are being maintained. DOE must have sufficient authority to take corrective actions should they be needed to ensure the safety of the public.

5.2 DOE-Owned Property

DOE may choose to continue to own and actively control access or use of property not cleared and this guidance and DOE O 458.1 4.k. requirements do not specifically apply. Rather, the radiation protection requirements for the public in the other sections of DOE O 458.1 apply to DOE-owned and maintained facilities. DOE property not meeting DOE O 458.1 release requirements should be posted and controlled as required in 10 CFR 835. Where these requirements are being applied, it is not necessary to develop Authorized Limits for unrestricted release to establish posting criteria. Posting criteria should be in accordance with the requirements set forth in 10 CFR 835.

5.3 Noteworthy Difference Between 10 CFR 835 and DOE O 458.1 Posting Requirements

DOE recognizes some differences in 10 CFR 835, “Occupational Radiation Protection,” posting requirements compared to DOE O 458.1 requirements for release and clearance of property containing residual radioactive material. DOE 10 CFR 835, appendix D provides the requirements for posting of surface contaminated material and areas and as such, the requirements for releasing areas or material from a 10 CFR 835 defined radiological area to a 10 CFR 835 defined DOE Controlled area. DOE O 458.1 release and clearance of property section is utilized for: 1) moving personal property from a DOE controlled area for clearance and 2) real property from posting and DOE radiological control for clearance. The 10 CFR 835 regulation has promulgated a set of surface concentration guidelines that constitute the basis for continued radiological control under that rule, but excludes material, equipment, and real property approved for release when the radiological conditions of the material, equipment, and real property have been documented to comply with the criteria for release set forth in a DOE Authorized Limit (10 CFR 835.1(b) (6)). There may be some situations where DOE or DOE contractors prepare personal and real property for release under DOE O 458.1 but choose to maintain control of the property for some undetermined period of time. If this personal or real property remains in a DOE Controlled Area, the requirements of 10 CFR 835 still apply.

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6 ORGANIZATIONAL APPROVALS

Field Element Managers are responsible for implementation of the release and clearance requirements for property containing residual radioactive material under DOE O 458.1. Table 3 summarizes responsibilities and authorities. Field Element Managers are responsible for oversight and documentation. They must ensure all property released conforms to DOE requirements and is released consistent with DOE approved Authorized Limits. Approval of release and clearance actions must be in writing by the appropriate approval authority. Field Element Managers are also responsible for coordination with the Cognizant Secretarial Officer and, where necessary, with the Director for Environment, Health, Safety and Security in the implementation of the requirements.

- Field Element Managers are empowered to implement pre-approved Authorized Limits for personal property to the extent such limits conform to the surface and volumetric concentration guidelines in Table 1 and Table 2 (DOE O 458.1 4.k.6(f)(3)).
- Field Element Managers are empowered to review and, as appropriate, approve Authorized Limits for real property (buildings and soil) in consultation with the Cognizant Secretarial Officer (DOE O 458.1 4.k.6(d)(1)).
- Field Element Managers are empowered to approve Authorized Limits for personal property (including any restrictions or conditions for future use) when clearance of the property is below 1 mrem/yr (0.01 mSv/yr) TED to a member of the public and 10 person-rem/yr (0.1 person-Sv/yr) collective dose. Supporting documentation must be provided to the Cognizant Secretarial Officer at least 45 working days prior to implementation of the Authorized Limits. The Cognizant Secretarial Officer in consultation with the Director for Environment, Health, Safety and Security must notify the Field Element Manager within 30 working days if the application document is incomplete or the stated Authorized Limits are not acceptable (DOE O 458.1 4.k.6(d)(2)).
- Authorized dose limits (in excess of 1 mrem/yr (0.01 mSv/yr) public or 10 person-rem/yr (0.1 person-Sv/yr) for personal property must be approved by the Cognizant Secretarial Officer in consultation with the Director for Environment, Health, Safety and Security (DOE O 458.1 4.k.6(d)(2)).
- Field Element Managers may request approval of temporary dose limits (higher than 100 mrem (1 mSv)) from the appropriate program office Cognizant Secretarial Officer in consultation with the Director for Environment, Health, Safety and Security. Cognizant Secretarial Officers must limit approval of temporary dose limits to no more than 500 mrem (5 mSv) TED, provided the average TED over any 5 contiguous years does not exceed 100 mrem/yr (1 mSv/yr) (DOE O 458.1 4.c.(3)). However, it is recommended that such limits be coordinated with the Director for Environment, Health, Safety and Security in a manner similar to the approval process for alternative surface and volume limits for personal property discussed in Section 6.1.
- Field Element Managers are empowered to approve clearance of real or personal property with residual radioactive material at CERCLA sites if remediation criteria are equivalent to Authorized Limits specified in DOE O 458.1 and procedures in this Standard. Field Element Managers performing environmental restoration activities under CERCLA analysis and documentation must submit certification to the Cognizant Secretarial Officer that compliance with the requirements of DOE O 458.1 have been met. A copy of the relevant CERCLA documentation should be provided to the Director for Environment, Health, Safety and Security (DOE O 458.1 4.k.7).

Neither DOE O 458.1 nor this guidance establishes time limits for reviews (except as noted above for personal property) of Authorized Limits or temporary dose 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 Director for Environment, Health, Safety and Security approval or consultation is required, the staff will strive to complete timely and responsive reviews. To aid in this process, the Director for Environment, Health, Safety and Security has established a graded approach to its review process that enables staff to respond to requests within 90 working days, under normal circumstances. Early involvement of the Director for Environment, Health, Safety and Security in the process is recommended and can help reduce these time periods.

6.1 Conditions for Field Element Manager Approval of Authorized Limits for Personal Property

Authorized Limits and survey protocols for residual radioactive material on surface or in volume of personal property in lieu of surface and volume activity guidelines (Table 1 and Table 2) may be derived and approved by DOE Field Element Managers without written approval of the Director for Environment, Health, Safety and Security if all of the following conditions are met:

- The applicable criteria described in this Standard are appropriately addressed,
- The release or releases of the subject material will not cause a maximum individual TED dose to a member of the public in excess of 1 mrem/yr (0.01 mSv/yr) or a collective dose of more than 10 person-rem/yr (0.1 person-Sv/yr),
- A procedure is in place to ensure records of the releases are maintained consistent with DOE O 458.1 requirements and survey or measurement results are reported consistent with the data reporting guidance in DOE HDBK-1216-2015, and
- 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 Cognizant Secretarial Office at least 45 working days before the Authorized Limits become effective. The Cognizant Secretarial Officer in consultation with the Director for Environment, Health, Safety and Security will provide written notification to the field office within 30 working days of receipt if the Authorized Limits or supporting material are incomplete or not acceptable. In cases where it is determined 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 notification and review cycle. A new notification and review cycle, using the same time frames identified above, would be conducted by the Cognizant Secretarial Office and the Director for Environment, Health, Safety and Security on the revised submission of Authorized Limits and supporting material. Otherwise, the Authorized Limits (including any conditions or limitations set forth by the approving Field Element Manager) may be considered approved without written approval from the Cognizant Secretarial Officer and the Director for Environment, Health, Safety and Security.

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 Director for Environment, Health, Safety and Security.

6.2 Request for Technical Assistance

Field Element Managers may request technical assistance from the Office of Environment, Health, Safety and Security 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 Standard 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 on surface or in volume that do not meet the criteria for approval by the Field Element Manager as stated above must be approved in writing by the Cognizant Secretarial Officer in consultation with the Director for Environment, Health, Safety and Security.

6.3 Authorized Limited Applications

Applications for approval by the Cognizant Secretarial Officer and consultation with the Director for Environment, Health, Safety and Security must contain the following information:

- A description of the property,
- Specific limits proposed for each radionuclide or group of radionuclides and/or external radiation exposure, surrogate measurements, or conditions used to limit radionuclides,
- Potential collective dose to the exposed population and the potential dose to a member of the public most likely to receive the highest dose for both actual or likely future use, and plausible future use of the property,
- ALARA assessments (section 2.2) conducted for the proposed clearance action to include, at a minimum, the effects of: 1) Implementing the proposed Authorized Limits; 2) Implementing alternative levels of residual radioactive material instead of the proposed Authorized Limits; and 3) Not implementing the proposed Authorized Limits, i.e., not proceeding with the proposed clearance action,
- A description of the procedures and radiological monitoring or surveys to be used to demonstrate compliance with the proposed limits,
- A description of the applicable dose constraint, supported by a complete exposure pathway analysis using appropriate methodologies, techniques, parameters and models (such as the current RESRAD family of codes) that meet DOE quality assurance requirements (DOE O 414.1),
- Authorized limits expressed in terms of concentration or radioactivity per unit surface area (e.g., dpm per 100 cm²), radioactivity per unit mass (e.g., pCi per gram) or volume (e.g., pCi per ml), total radioactivity, or DOE controls and restrictions, if applicable,
- A description of independent verification activities commensurate with the scope, complexity, and risk associated with the clearance action,
- Identification of any restrictions or conditions on the future use of the property upon which the proposed limits are based, and the means by which the restrictions or conditions will be implemented and maintained,

- Include written evidence of notification of applicable Federal, State or local regulatory agencies or Tribal governments, and
- An estimated date for when the property will be cleared and an estimate of when the property will be released from DOE control.

The Office of Environmental Management released a memorandum, subject: Office of Environmental Management Desk Reference for Implementing the Property Clearance Process Portion of the Department of Energy Order 458.1, Radiation Protection for the Public and Environment (April 2019) to assist Environment Management sites with the release and clearance of real and personal property. Appendix C of the memorandum discusses expected elements of an Authorized Limits package and this is included as Appendix A of this document. This guidance was issued only for Environmental Management sites but may be useful as a reference for submitting information to other program offices.

Table 3. Approval Responsibilities for the Authorized Release Process

Action and Condition	Organizational Functions
Approval of Authorized Limits for the release and clearance of real and personal property containing residual radioactivity and for disposal of wastes.	See Sections 4.3, 4.4, 4.5, 4.7, 4.8, 4.10 and 4.11 of this Standard
1. Authorized Limits consistent with surface or volumetric activity guidelines or other DOE-approved Authorized Limits.	1. Request reviewed and approved by DOE Field Element Managers consistent with Sections 4.4 and 4.5.
2. Alternate dose-based derived Authorized Limits for real property where potential doses are less than the 25 mrem/yr (0.25 mSv/yr) dose constraint but in excess of 1 mrem/yr (0.01 mSv/yr) to a member of the public or 10 person-rem/yr (0.1 person-Sv/yr) collective dose.	2. Request reviewed and approved by DOE Field Element Manager in coordination with program office.
3. Alternate dose-based derived Authorized Limits for personal property where potential doses are less than 1 mrem/yr (0.01 mSv/yr) to a member of the public and less than 10 mrem/yr (0.1 mSv/yr) collective dose.	3. Request reviewed and approved by DOE Field Element Manager. Authorized Limit documentation must be sent to the program office 45 working day prior to implementation. The Authorized Limits may be considered approved if the program office does not notify the site within 30 working days of incompleteness or not acceptable.
4. Alternate dose-based derived Authorized Limits for personal property where potential doses are greater than 1 mrem/yr (0.01 mSv/yr) to a member of the public.	4. Request reviewed and approved by DOE Program Office in consult with the Director for Environment, Health, Safety, and Security.
5. Alternate dose-based derived Authorized Limits where a temporary public dose limit is higher than 100 mrem/yr (1 mSv/yr), but less than 500 mrem/yr (5 mSv/yr) TED, provided the average TED over any 5 contiguous years is less than 100 mrem/yr (1 mSv/yr) TED.	5. Request reviewed and approved by DOE Program Office in consult with the Director for Environment, Health, Safety, and Security.
6. CERCLA sites where remediation criteria are equivalent to DOE approved Authorized Limits.	6. Request reviewed and approved by DOE Field Element Manager with certification of meeting requirements sent to program office.

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7 REFERENCES

1. 10 Code of Federal Regulations (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 835, “Occupational Radiation Protection;” Washington, D.C.
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8 DEFINITIONS

Actual or Likely Use Scenarios — The current uses and reasonably anticipated uses in the foreseeable future of real and personal property considering the history of use; use restrictions, designations or controls; affected populations, ecosystems, or natural resources; and the property’s historic or cultural significance. For real property considerations also include Federal and State use designations; local zoning and future land use plans; and proximity to residences, commercial or industrial areas, or areas of cultural or historic significance.

ALARA (As Low As Reasonably Achievable) — An approach to radiation protection to manage and control releases of radioactive material to the environment, and exposure to the work force and to members of the public so that the levels are as low as is reasonably achievable, taking into account societal, environmental, technical, economic, and other public policy considerations. As used in DOE O 458.1, ALARA is not a specific release or dose limit but a process which has the goal of optimizing control and management of releases of radioactive material to the environment and doses so that they are as far below the applicable limits of DOE O 458.1 as reasonably achievable.

ALARA Process—A graded process for evaluating alternative operations, processes, and other measures, for optimizing releases of radioactive material to the environment, and exposure to the work force and to members of the public taking into account societal, environmental, technical, economic, and public policy considerations to make a decision concerning the optimum level of public health and environmental protection. A graded approach provides the flexibility to perform qualitative or quantitative ALARA analyses. For low doses, qualitative evaluation normally will suffice.

Authorized Limit — A limit on the concentration or quantity of residual radioactive material on the surfaces or within property that has been derived consistent with DOE directives including the ALARA process requirements. An authorized limit may also include conditions or measures that limit or control the disposition of property.

Background Radiation — Radiation from: (1) naturally occurring radioactive materials which have not been technologically enhanced (i.e., background radiation does not include TENORM); (2) cosmic sources; (3) global fallout as it exists in the environment (such as from the testing of nuclear explosive devices); (4) radon and its decay products in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities; and (5) consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation.

Clearance of Property — The removal of property that contains or may contain residual radioactive material from DOE radiological control under 10 CFR 835 and DOE O 458.1, current version.

Collective Dose — The sum of the total effective dose to all persons in a specified population received in a specified period of time. For clearance of property the collective dose refers to the population potentially exposed to the cleared property. Collective dose is expressed in units of person-rem (or person-sievert).

Dose — A general term for absorbed dose, equivalent dose, effective dose, committed equivalent dose, committed effective dose, or total effective dose as defined in DOE O 458.1.

Maximally Exposed Individual — A hypothetical individual who, because of realistically assumed proximity, activities, and living habits, would receive the highest radiation dose, taking into account all pathways, from a given event, process, or facility.

Personal Property — Property of any kind, except for real property. For the purposes of DOE O 458.1 and this Standard, examples of personal property include consumable items (e.g., wood, containers, lab equipment and paper); personal items (e.g., clothing, brief cases, respirators and gloves); office items (e.g., computers, unused office supplies, and furniture); tools and equipment (e.g. hand tools, power tools, construction machinery, vehicles, tool boxes, ladders, and scales); and debris (e.g. removed soil, rubble, sludge, wood, tanks, scrap metal, concrete, wiring, doors, and windows).

Plausible Use – 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.

Quality assurance program—The overall program or management system established to assign responsibilities and authorities, define policies and requirements, and provide for the performance and assessment of work.

Real Property—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.

Reference Person — A hypothetical aggregation of human (male and female) physical and physiological characteristics arrived at by international consensus for the purpose of standardizing radiation dose calculations.

Release of Property— Real or personal property that has no known historical contamination is not under AEC control and disposition is not regulated under DOE O 458.1. Property can be released from DOE control.

Representative Person — An individual receiving a dose that is representative of the more highly exposed individuals in the population. This term is the equivalent of, and replaces, ‘average member of the critical group’ as defined in ICRP Publication 103.

Residual Radioactive Material — Any radioactive material which is in or on soil, air, water, equipment, or structures as a consequence of past operations or activities of the Department or its predecessors.

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.

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.

Total Effective Dose (TED) — Sum of the effective dose (for external exposures) and the committed effective dose (for internal exposures).

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.

Working Level (WL) – The potential alpha energy concentration of radon decay products in 1 liter of air, without regard to the degree of equilibrium, that will result in the emission of 1.3×10^5 MeV of alpha particle energy.

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APPENDIX A
ENVIRONMENTAL MANAGEMENT MEMORANDUM, 2019: APPENDIX C, EXPECTED
ELEMENTS OF AN AUTHORIZED LIMITS PACKAGE

EXPECTED ELEMENTS OF AN AUTHORIZED LIMITS PACKAGE (NOTE: From Appendix C of memorandum, subject: Office of Environmental Management Desk Reference for Implementing the Property Clearance Process Portion of the Department of Energy Order 458.1, Radiation Protection for the Public and Environment (April 2019).)

Authorized Limits documentation should include:

- A property description and process knowledge documentation.
 - o Physical description and radiological history including:
 - Property location and physical description of the property
 - Types/forms and general quantities of residual radioactive material within the property
 - Radionuclides of concern: clearly all radionuclides the authorized limit pertains to

- Current and likely future property use, use restrictions and means for maintaining those restrictions, and anticipated dates of property clearance and release.
 - o Describe current and likely future human receptors including the more highly exposed representative person and a MEI.
 - The dose to the more highly exposed representative person and the MEI is not meant to underestimate or substantially overestimate the actual dose.

 - o Evaluation of real property against the need for maintaining institutional controls and impacting long-term stewardship of adjacent DOE real property. The impact of the property clearance must not create a noncompliance for the adjacent property in the near or long-term.

 - o Explicitly state any restrictions or conditions for future use of the property to ensure the basic dose limit and applicable dose constraints are not exceeded (e.g., recycling restrictions at landfill).

- A conceptual site model (CSM) that describes the local environment and links sources, impacted media, potential migration pathways, and likely routes of exposure. The physical description and receptor information from the property description and process knowledge documentation will be inputs to the CSM.
 - o The CSM must include site-specific information on the radiation source, dispersion patterns, location and demography of members of the public in the vicinity of DOE radiological activities, land use, food supplies, and exposure pathway information.

- Specific Authorized Limits and derivation method.
 - o Dose modeling methods, techniques, parameters, and model meet DOE O 414.1D quality requirements (e.g., RESRAD family of codes and CAP-88). Dose models are appropriate for their purpose and dose model inputs consider actual and likely future use, and plausible use scenarios.
 - Analytical models must consider likely and complete exposure pathways including:
 - Direct external radiation from sources located on-site
 - External radiation from airborne material
 - External radiation from material deposited on surfaces off-site
 - Internal radiation from inhaled airborne material
 - Internal radiation from material ingested with water, and with food

- from terrestrial crops or animal products
 - Internal radiation from material ingested with aquatic food products
 - External or internal radiation due to residual material on, or in, cleared real property
 - Any other pathway unique to the DOE site or activity
 - Input parameters are clearly presented and input values are justified.
 - DOE-approved dose coefficients are used.
 - Values of assumed default or site-specific parameters used in calculations must be presented with respective references and derivation methods, as appropriate.
 - If an applicant chooses to use a dose modeling code other than the most recent version of the code, then the applicant should explain why the older version of the code was used, and describe the how the calculation is affected.
- o Collective dose to the potentially exposed population.
- The collective dose is calculated for all members of the actual exposed populations for the actual and likely future use of the property and is consistent with the realistic and practicable CSM.
 - The collective dose calculation excludes radon or, if radon is a result of DOE activities, the dose for radon and its decay products is calculated separately.
 - Collective dose for members of the public must be representative of the total dose and of adequate quality for supported comparisons, trending, or decisions. Collective dose estimates may be truncated by distance (e.g., 50 miles), or individual dose level (e.g., 10 microrem (0.1 microSv) when integration of doses beyond such thresholds does not significantly affect data quality objectives.
- o Authorized Limits are expressed in terms of total and removable radioactivity per unit surface area (e.g., dpm/100 cm²), or radioactivity per unit mass (e.g., pCi/g) or volume (e.g., pCi/ml), or total radioactivity.
- Specific limits for each radionuclide or group of radionuclides and/or external radiation exposure, surrogate metrics, or conditions that limit radionuclides are stated.
- Appropriate dose-based and concentration-based constraints.
- o Dose constraint by property type:
 - Personal property –TED of 1 mrem/yr (0.01 mSv/yr)
 - Collective dose – 10 person-rem/yr (0.1 person-Sv/yr)
 - Real property – TED of 25 mrem/yr (0.25 mSv/yr)
 - o The addition of the authorized limit must not cause the dose to the public from DOE activities to exceed 100 mrem/yr (1 mSv/yr).
 - Dose estimates exclude background radiation, radon and radon decay products in air (except as noted above), medical applications, other non-DOE sources.
 - o The baseline dose is presented.
 - Based on the representative person or MEI receptor exposed to mean (or upper estimate of the mean) radionuclide concentrations.
 - o Authorized Limits must be protective of private or public drinking water systems (See Drinking water maximum contaminant levels in 40 CFR Part 141, National Primary Drinking Water Regulations, if analytical pathways include private or public drinking water systems). Consistent with the graded approach, if an exposure pathway could impact a drinking water system, then this calculation should be completed. If there is

no possibility of impacting a drinking water system as a result of the authorized limit, then this calculation does not need to be completed.

- ALARA assessments for the proposed clearance action to include the effects of implementing:
 - o The proposed Authorized Limits
 - o Alternative levels instead of the proposed Authorized Limits
 - o Not proceeding with the proposed clearance action (i.e., a baseline dose)

- Stakeholder communications - Written notification to applicable federal, state, or local regulatory agencies, or Tribal government stakeholders.

- Implementation plan - The plan should describe how Authorized Limits requirements will be implemented including, but not limited to:
 - o A MARSSIM-based design including data quality objectives
 - o A description of survey and monitoring procedures and the instruments to be used
 - o Basic analytical laboratory methods and reporting requirements (e.g., analytical methods and detection limits)
 - o For difficult to access surfaces on potentially contaminated property, an evaluation of residual radioactive material is performed which is sufficient to demonstrate that specific or pre-approved Authorized Limits will not be exceeded.
 - The evaluation process and historical knowledge should be documented.
 - The process should include procedures for evaluating operational records and operating history.
 - For real property, the process should address specific property individually. (If several parcels of land are contiguous, or if several structures are located in the same area and have a common operational history, a single evaluation for all of the properties may be acceptable.)
 - The types and quantities of residual radioactive material and the sources and pathways by which the property became contaminated should be included in the process and historical knowledge evaluation.
 - o If available process and historical knowledge cannot demonstrate that the property does not contain residual radioactive materials, then radiological monitoring or surveys must be conducted to supplement process and historical knowledge evaluations.
 - o If not supplemented by radiological surveys, process knowledge and historical knowledge evaluations must be adequate to demonstrate:
 - Whether the property was ever used for radiological activities or in areas that could result in the presence of residual radioactive material.
 - Whether property that formerly contained residual radioactive material was decontaminated to meet DOE Authorized Limits and has not been used in a manner that could re-contaminate the property.
 - o Independent verification plan.
 - o For personal property, limits should be based on the:
 - Expected annual quantity of property to be cleared, or
 - Expected total amount to be cleared over the life of the project, and
 - Options for metal reuse or recycle, if applicable.

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APPENDIX B

DOE HISTORY OF RELEASE AND CLEARANCE

DOE began release and clearance of radiological contaminated material at Formerly Utilized Sites Remedial Action Program (FUSRAP) and the Surplus Facilities Management Program (SFMP) in the late 1970s and early 1980s. These sites became radiologically contaminated as a result of previous activities for government nuclear programs. Criteria for cleanup of these sites were proposed on a site-by-site basis by the field offices responsible for the specific remedial actions. The criteria and even the approaches to the development of cleanup varied. In reviewing the proposed criteria, DOE Headquarters realized that general guidelines were needed for these activities. The major requirement identified was the need for criteria for residual radioactive material in soil. At the request of DOE Headquarters, the national laboratories made several attempts to develop soil criteria applicable to remedial actions. In 1983, DOE began to consolidate these criteria and associated procedures in order to identify generic soil criteria for all DOE remedial actions.

DOE Headquarters established a working group comprised of representatives from the concerned headquarters program offices; the Office of Environment, Safety, and Health; DOE operations offices; and the national laboratories involved in the development of specific criteria for decontamination efforts. The working group activities were also coordinated with representatives of the EPA and the NRC. These representatives attended several meetings of the working group in an advisory capacity.

The initial charter of the working group was to develop an acceptable set of generic soil criteria. However, recommendations from the first meeting to the group resulted in DOE expanding the charter to include all aspects of cleanup operations. Also, recognizing that soil criteria are significantly affected by many site-specific factors, the working group recommended that a generic procedure for deriving soil criteria should be included in the guidelines rather than generic soil concentration limits.

For residual radioactivity guidelines, DOE used the recommendation and system of standards and models provided in the ICRP Publications 26 and 30. This included the use of the concept of effective dose equivalent rather than critical organ dose (ICRP 2) for defining dose limits for the general public and adoption of the lifetime average limit of 100 mrem/yr (1 mSv/yr) effective dose equivalent. DOE guidelines for residual radioactive material were developed and first issued in February 1985. The methodology for deriving soil guidelines was coded by Argonne National Laboratory (ANL) in RESRAD. ANL currently supports a family of codes including RESRAD-ONSITE, RESRAD-OFFSITE, RESRAD-BUILD, RESRAD-RDD, and RESRAD-BIOTA.

DOE has long-standing pre-approved Authorized Limits for surface contamination, approved under guidance memorandum and published with DOE Order (O) 5400.5. Current requirements to protect the public and the environment against undue risk from radiation associated with DOE radiological activities are published in DOE O 458.1.

DOE previously considered establishing volumetric pre-approved Authorized Limits in line with national consensus standard, ANSI/HPS N13.12 (1999) *Surface and Volume Radioactivity Standards for Clearance*, criteria. However, it was determined the available criteria did not adequately meet DOE needs at the time. ANSI/HPS N13.12 was revised and published in 2013. A majority of the recommendations and values were carried forward to the new standard, but certain important volumetric criteria were revised from the previous standard.

Over the past few years, several DOE sites have received DOE program office approval for use of volumetric Authorized Limits for a variety of personal property utilizing the values and technical

justification provided in ANSI/HPS N13.12-2013. In each case, the supporting analyses demonstrated a reasonable expectation that the DOE O 458.1 dose constraints (1 mrem/yr (0.01 mSv/yr)) for release and clearance of personal property would be achieved. DOE issued pre-approved Authorized Limits for volumetric contamination by memorandum from the Associate Under Secretary for Environment, Health, Safety and Security, subject: *Pre-Approved Authorized Limits for Release and Clearance of Volumetric Radioactivity of Personal Property at Department of Energy Field Elements*, in 2021.

Additionally, DOE STD 6004-2016, *Clearance and Release of Personal Property from Accelerator Facilities*, was developed to support the control, clearance, and release of personal property from accelerator, accelerator facilities, and modules thereof. This standard used ANSI/HPS N13.12-2013 to derive and establish the screening levels for the clearance of materials that contain, or may contain, residual volume radioactivity from radiological control which generally satisfies the criteria set forth in DOE O 458.1.

DOE previously issued for use and comment draft DOE Guide (G) 441.1-xx, *Control and Release of Property with Residual Radioactive Materials*, in 2002, and DOE HDBK-xxxx-97, *Draft Handbook for Controlling Release for Reuse or Recycling of Non-Real Property Containing Residual Radioactive Material*, in 1997, to serve as clearance of property guidance supporting DOE O 5400.5 requirements. These documents have been incorporated into this technical standard, intended to provide updated guidance for implementing DOE O 458.1 clearance of property requirements.