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MEMORANDUM FOR DISTRIBUTION

FROM: ANNE MARIE WHITE
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A handwritten signature in blue ink, appearing to read "Anne Marie White".

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*

The Department of Energy Order 458.1, *Radiation Protection for the Public and Environment*, includes specific requirements for the property clearance process. This includes a review and consultation process for supporting clearance through the use of authorized limits and independent verification criteria. Differing interpretations of guidance for the required approval package which sites prepare and submit to the Office of Environmental Management (EM) Headquarters has led to inefficiencies at the sites. In an effort to improve and clarify the process, to minimize rework, and to improve standardization across EM, the attached EM desk reference was developed.

The desk reference's clarifying procedures describe the expected elements of an authorized limits package, the consultation process, the independent verification process, and roles and responsibilities of those who develop and approve the clearance package. Site use of the desk reference will simplify and improve EM property clearance actions as well as resource management planning for authorized limits technical reviews.

If you have any questions, please contact Mr. Andrew Szilagyi, Director for Infrastructure and Deactivation and Decommissioning, at (301) 903-4278.

Attachment



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**DESK REFERENCE:
IMPLEMENTING DOE ORDER 458.1
PROPERTY CLEARANCE PROCESS
(AUTHORIZED LIMITS AND INDEPENDENT
VERIFICATION)**

**U.S. Department of Energy
Office of Environmental Management
April 2019**

FOREWORD

The U.S. Department of Energy (DOE) Office of Environmental Management (EM) is issuing this desk reference to clarify expectations associated with the review and approval of authorized limits and independent verification for the clearance of property for DOE EM activities. DOE Order 458.1, *Radiation Protection of the Public and the Environment*, contains specific requirements for the elements of authorized limits packages and clarifies requirements for independent verification. The information within this desk reference is meant to help the field in developing authorized limits packages and independent verification plans and improve the consultation process with Headquarters elements.

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1. INTRODUCTION

The radiological clearance of property involves removal of property that contains or may contain residual radioactive material from radiological controls as specified by U.S. Department of Energy (DOE) requirements. The DOE is responsible for verifying that radiological clearance actions meet applicable DOE authorized limits (ALs), or other applicable requirements including associated restrictions or institutional controls. DOE Order (O) 458.1, *Radiation Protection of the Public and the Environment*, integrated independent verification (IV) into the requirements for the radiological clearance (i.e., radiological release) of real and personal property (DOE 2011). This desk reference provides guidance for EM sites on development of AL packages and IV plans and the associated approval processes.

2. BACKGROUND

ALs are developed to ensure compliance with dose limits for property clearance activities as specified in DOE O 458.1 for situations that do not meet pre-approved AL criteria. Pre-approved ALs are specified in DOE O 458.1, Section 4.k(6)(f) and further described in Section 4 of this document. Expected elements of an AL are defined in Appendix C of this document. Included in the expected elements is the requirement for an IV plan. IV consists of an independent evaluation of property, clearance documentation, and field surveys/sampling to fully assess the final site or facility conditions and provide assurance that DOE O 458.1 radiological clearance requirements have been met.

The IV process ensures that the:

- Cleanup contractor's radiological clearance program survey plans, procedures, and instrumentation are adequate to meet applicable ALs or other applicable requirements and guidance,
- Cleanup contractor properly executes the radiological clearance program, and
- Data and documentation generated during the clearance action are adequate to demonstrate compliance with DOE O 458.1 and the applicable ALs.

Because much of the data for verification efforts are obtained during the execution phase of a remedial action or deactivation and decommissioning (D&D) projects, it is essential that the IV requirements be considered at the beginning of all property clearance projects. Further, these requirements must be integrated into the overall project budget and schedule. This will ensure timely completion of all IV activities prior to site restoration and project closeout. Lessons learned have demonstrated that many of the issues associated with a site's radiological remedial action or D&D program were identified late in the process and could have been avoided with the early engagement of IV personnel.

There are significant economic, stakeholder, and long-term risk mitigation benefits that result from the proper and timely implementation of IV. Major benefits include:

- Avoiding schedule delays and cost increases by identifying issues early in the cleanup process
- Ensuring the cleanup contractor's plans, procedures, and reports are technically sound

- Providing real-time corrective actions if areas of concern are identified
- Issuing accurate and defensible documentation to validate compliance with cleanup requirements and avoid possible future litigation
- Preventing an improper release of property

Perhaps most importantly, IV enhances credibility and builds stakeholder trust in property clearance action by providing the assurance that buildings, lands, materials, and equipment released to the public pose minimal risk - a paramount concern for the Office of Environmental Management (EM) and other stakeholders.

3. IMPLEMENTATION OF AUTHORIZED LIMITS.

As specified by Section 4.k(6) of DOE O 458.1, ALs must be established and approved for the clearance of any property with residual radioactive material to provide reasonable assurance that dose constraint and as low as reasonably achievable (ALARA) requirements are met. ALs (for both real and personal property) may be preapproved under certain provisions of DOE O 458.1; be developed for a specific site and clearance pathway; and/or be Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-process approved (for real property) provided those remediation criteria meet the requirements of DOE O 458.1.

3.1 PRE-APPROVED AUTHORIZED LIMITS

Pre-approved ALs are specified in DOE O 458.1, Section 4.k(6). Preapproved ALs considered acceptable per DOE O 458.1 include:

- Real property: For radium-226 and radium-228 in soil 5 pCi/gram (0.2 Bq/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 (0.56 Bq/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 preapproved limit must be applied to the radionuclide with the higher concentration.
- Real or personal property: Guidelines and limits previously derived from DOE O 5400.5, *Radiation Protection of the Public and the Environment*, and associated guidance (such as the surface activity guidelines in draft Implementation Guide for the Control and Release of Property with Residual Radioactive Material for use with DOE O 5400.5, Table 2).
- Real or personal property: Other pre-approved ALs that may be used by sites (e.g., American National Standards Institute (ANSI) standards) must be approved by the Assistant Secretary for Environmental Management (EM-1) in consultation with the Associate Under Secretary for Environment, Health, Safety, and Security (EHSS) (AU-1). The approval may be made through a DOE memorandum but must be incorporated into a DOE directive or a technical standard within eighteen months of issuance.

3.2 DEVELOPMENT OF AUTHORIZED LIMITS

Property clearance actions that do not meet pre-approved AL criteria must be developed in accordance with DOE O 458.1. While the main elements for an AL package can be found in DOE O 458.1, Section 4.k (6), the details of those elements require demonstration of compliance with other sections of the Order. To streamline the AL development and review process, EM created a checklist-style review guide in Appendix C which includes all the pertinent information required by the Order.

3.3 AUTHORIZED LIMITS APPROVAL PROCESS

Use of pre-approved ALs must be approved in writing by the relevant Field Manager (FM). Other site-specific ALs require consultation with EM-1 and AU-1. Documentation supporting the ALs must be provided to EM-1 and AU-1 at least 45 working days prior to the intended implementation date. EM-1 and AU-1 must notify the FM within 30 working days of receipt of the AL package if any issues are identified. The 30-day review period begins with the confirmed receipt of the AL package by HQ. The field office should verify with the Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs that the package was received by HQ.

Appendix B summarizes the AL approval processes for preapproved ALs, site-specific ALs, and CERCLA remediation criteria. A summary of property clearance documentation requirements is provided in Table A-1 of this document.

4. INDEPENDENT VERIFICATION IMPLEMENTATION

IV activities are performed to provide reasonable assurance that real or personal property clearance actions meet DOE O 458.1 requirements. It is expected that IV activities will be conducted with a graded approach. As such, efforts will vary by site and for projects within a given site. Such efforts should be commensurate with the scope, complexity, and risk associated with the clearance action. At minimum, IV must ensure that the radiological cleanup contractor's procedures, instruments, field and analytical data, and documentation are adequate for demonstrating compliance with ALs and other applicable requirements and guidance.

DOE O 458.1, Section 4.k(9)(b), specifies IV requirements for the clearance of property from radiological controls, including remedial action, D&D projects, and transfers to non-DOE entities. Appendix D of this document includes guidance to the FM on how to implement oversight of IV activities.

4.1 CLEARANCE DOCUMENTATION

DOE O 458.1, Section 4.k(9)(b), requires DOE site personnel to independently assess documentation associated with the clearance action. Clearance documentation may include the cleanup contractor's operational awareness, process and historical knowledge reports/historical site assessments, D&D or remedial action plans, characterization plans and reports, clearance

survey plans and reports, radiological survey instrumentation calibration and use procedures, survey and sampling procedures, analytical techniques, qualifications of IV personnel, ALs calculations and supporting information, and other documents that support release decisions. Table D-2 of this document provides the requirements from DOE O 458.1 and an explanation of those requirements for IV documentation.

4.2 GRADED APPROACH AND INDEPENDENT VERIFICATION

DOE O 458.1 requires use of the graded approach for IV activities in order to scale the effort commensurate with the scope, complexity, and risk associated with the clearance action. DOE staff may refer to DOE-STD-1153-2019, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, for general guidance on application of the graded approach.

There are many inherent risks in a clearance action that are monitored and, to some level, controlled by integrated IV. Properly assessing the level of risk and controls needed may determine the required data quantity and quality for clearance decisions, increase stakeholder confidence in decisions, reduce potential for uncertainties regarding unknowns or future data gaps, and ultimately lower project and financial risk, thereby providing assurance that DOE EM does not release property that presents radiological risk to the public, workers and, the environment. The graded approach applies to two types of work relative to IV activities, the clearance of personal (i.e., non-real) property under DOE O 458.1, Section 4.k(9)(b)3, or the clearance of real property under DOE O 458.1, Section 4.k(9)(b)4.

Appendix F provides example approaches for IV. Table F-1 presents an approach for IV of non-real/personal property and Table F-2 presents an approach for IV of real property. Key factors to consider include, but are not limited to: the availability and reliability of a detailed conceptual site model, process knowledge, characterization data, the accessibility of contaminated media, and the detectability of contaminants. If, for example, the site has been well characterized, the contaminants are contained and immobile, and the risk of exceeding clearance requirements is small, the IV may be limited to document and data reviews. However, multi-media contamination, complex fate and transport mechanisms, the presence of hard-to-detect radionuclides, limited process knowledge or historical documentation, high (external) stakeholder sensitivities, and other factors requires a more robust IV approach. Early project involvement by qualified and experienced IV personnel will shape the IV requirements and graded approach.

4.3 DATA LIFECYCLE

IV data should be managed from the onset of clearance activities through DOE or project-required retention periods (e.g., per DOE Order 243.1A, *Records Management Program*) as part of the data life cycle. This data lifecycle typically includes four phases, as described in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and the Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME) (DOE 2000 and 2009): plan, implement, assess, and decide (or plan, execute, report, and close depending upon the project). Regardless of the terminology, the flow diagram presented in Appendix G shows the phase-specific data lifecycle for IV activities. Each phase of the IV data

lifecycle is summarized in the following discussion. The checklist presented in Appendix H contains phase-specific instructions that may guide IV-related activities from project inception to completion.

4.3.1 Plan

The planning phase of the IV data life cycle begins with procurement of IV resources. IV procurement may follow cleanup contractor procurement, but IV qualified staff should be in place with sufficient time to review and comment on the cleanup contractor's plans, procedures, and support documentation, prior to implementation. While IV qualified staff reviews cleanup contractor planning documents, the cognizant DOE site personnel are responsible for the IV plan.

DOE O 458.1 does not specify the content or organization of the IV plan, however it does state the requirements for an IV plan for release of real property. As a best practice an IV project-specific or program plan for both personal and real property releases should be developed. This is especially the case when survey or analytical laboratory data for decision are used as inputs, but is also prudent for detailing the type, depth, frequency, integration points, and scope of IV activities.

The foundation of the IV plan should be project-specific data quality objectives (DQOs) that are developed to validate the cleanup contractor's results and conclusions, rather than duplicating the clearance survey. Development of DQOs is described in the MARSSIM and the MARSAME using a graded approach (DOE 2000 and 2009). Commensurate with the graded approach required by DOE O 458.1, Section 4.k(9)(b)1, the level of detail required is dependent on the complexity of the project, access to historical data or process knowledge.

An IV plan should contain four major components: introductory and background material, DQOs, IV responsibilities, and additional topics that may need to be developed during IV planning. The suggested content is presented in Appendix E of this document. This outline represents a general guideline for the IV plan, and includes the minimum information that should be included. Note that the IV plan for any particular site may include additional information due to the site-specific variables and the complexity of the clearance project.

4.3.2 Implementation

The implementation phase of the IV data lifecycle includes the clearance action (characterization, remediation, etc.) and execution of the IV plan. During implementation, adjustments may need to be made, including small-scale adjustments that do not require significant documentation or larger scale adjustments requiring a change control process, based on observations or new information uncovered during this phase. The output of the implementation phase is the data needed to assess and report on IV findings.

4.3.3 Assess

The assessment phase of the IV data lifecycle includes the data quality assessment, verification that the cleanup contractor executed their plan and met DQOs, and the overall evaluation of clearance actions relative to DOE and project requirements.

4.3.4 Decide

The decision phase of the IV data lifecycle includes a determination of whether the clearance action has met DOE and project requirements. If the clearance action has not met DOE and project requirements, the cleanup contractor may be required to repeat certain phases of work. If this occurs, IV personnel may also be required to re-evaluate both IV and cleanup contractor plans, practices, and reports. Only after the clearance objectives have been met should the project proceed to closure. Closure includes the receipt and retention/archiving of critical project records from both the closure contractor and IV personnel.

4.4 Qualifications

DOE O 458.1, Section 4.k(9)(b)4 states IV personnel must “be qualified or have sufficient knowledge and experience to oversee radiological clearance activities”. Quantifying this qualification is subjective and FMs may wish to consult with EM-HQ. This consultation could prevent the appearance of bias when making inter-departmental selections, and could expedite the IV Contractor (IVC) selection process.

In general, IV personnel should demonstrate the capability to successfully perform the necessary verification activities associated with the following:

- 1) Establishing and implementing protocols for multi-media sampling
- 2) Managing and operating radiation instrumentation
- 3) Collecting radiation measurements and radiological samples
- 4) Interpreting radiation measurement and laboratory analytical data
- 5) Reviewing and preparing clearance documents
- 6) Demonstrating knowledge of the DOE health and safety requirements

The selected IV personnel should not only be able to perform the work safely and competently, but should also help secure public and stakeholder confidence that the clearance action was or will be performed consistent with DOE O 458.1 and project requirements. The IVC may be asked to assist with the development of site-specific ALs; this does not present a conflict of interest or preclude the IVC from performing IV. DOE O 458.1, Section 1.1.4, also acknowledges that IV personnel may be required to procure laboratory services for sample analysis. It is important to note, however, that the FM is ultimately responsible to assure that the procured analytical laboratories meet the standards of the project DQOs and independently support clearance decisions.

The selected internal and/or external IV laboratory should meet the requirements specified in NUREG-1576, EPA 402-B-04-001A, *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)*, Vol. 1-3, which provides guidance for the planning, implementation, and assessment phases of projects involving laboratory analysis of radionuclides to ensure the generation of consistent and comparable data and to ensure that laboratory data meet project-specific data quality objectives. Currently approved DOE Consolidated Audit Program (DOECAP) commercial radiological laboratories are generally acceptable if they have been reviewed for the analyses being required by the IV plan.

5. SUMMARY

This EM desk reference summarizes DOE O 458.1 property clearance requirements and provides additional guidance for the development of AL package and IV plans, along with the EM consultation and approval process. This guidance is meant to provide upfront expectations for the elements of an AL package and an IV plan, thus streamlining the review and approval process.

The Appendices cover the following:

- Appendix A, summarizes the property clearance documentation requirements and provides specific guidance on the consultation process.
- Appendix B, outlines the EM AL review and approval process.
- Appendix C provides the expected elements of an AL package. This is the guide used by EM-HQ technical reviews to review AL packages. The EM-HQ review is documented on this guide.
- Appendix D contains a crosswalk of IV-related requirements in DOE 458.1 with guidance in MARSSIM along with minimum and discretionary IV requirements from DOE O 458.1.
- Appendix E provides an IV plan outline.
- Appendix F provides examples of the graded approach for the clearance of personal property in Table F-1 and real property in Table F-2.
- Appendix G provides an outline of the IV data life-cycle.
- Appendix H provides an IV activities checklist.

6. REFERENCES

DOE 1993. *Radiation Protection of the Public and the Environment*. Order 5400.5, Change 2. U.S. Department of Energy. Washington, DC. January 7.

DOE 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Revision 1. DOE/EH-0624, U.S. Department of Energy. Washington, DC. August.

DOE 2008. *Office of Environmental Management Plan for the Approval and Independent Verification of ALs*, Office of Engineering and Technology Office. Washington, DC. May.

DOE 2009. *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME)*. DOE/EH-0004, Washington, DC. January.

DOE 2011. Order 458.1, *Radiation Protection of the Public and the Environment* [specifically Sect. 4.k(9)(b)]. U.S. Department of Energy. Washington, DC. February.

NRC 2004. *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)*. NUREG-1576, EPA 402-B-04-001A. U.S. Nuclear Regulatory Commission. Washington, DC. July.

APPENDIX A
SUMMARY OF PROPERTY CLEARANCE DOCUMENTATION REQUIREMENTS

Table A-1. Summary of property clearance documentation requirements for EM activities

| Document | Recommended Completion By Project Stage ¹ | Prepared By | Reviewed By | Consultation With | HQ Review Period ² | Approved By | Timing |
|--|--|-----------------------------|-------------|--|-------------------------------|---|--|
| ALs for Real Property – Application | CD-2 | Contractor or DOE personnel | FM | EM-1 (EM-1 may opt to consult with AU-1) | 30 working days | FM in writing | At least 45 days prior to implementation |
| ALs for Personal Property – Application | CD-2 | Contractor or DOE personnel | FM | EM-1 and AU-1 | 30 working days | FM in writing | At least 45 days prior to implementation |
| Pre-approved ALs specified in DOE O 458.1 – Application | CD-2 | Specified in DOE O 458.1 | FM | N/A | N/A | FM in writing | N/A |
| Other Pre-approved ALs – Application ³ | | Contractor or DOE personnel | EM-1 | AU-1 | NA | EM-1 in writing | NA |
| Certification of Compliance with DOE O 458.1 (for CERCLA remediation criteria) | CD-2 | FM | EM-1 | AU-1 | 30 working days | Approved by default unless document is deemed to be not in compliance with DOE O 458.1 by EM-1 or AU-1 after 30 day review period | At least 45 days prior to implementation |
| Site Radiological Clearance Program | CD-3 | Contractor or DOE personnel | FM | EM-1 and IVC personnel | 30 working days | FM | At least 45 days prior to implementation |
| Site IV Program (large sites if umbrella IV program exists) | CD-3 | IVC Personnel | FM | EM-1 | 30 working days | FM | At least 30 days prior to implementation |
| Building/Parcel-Specific IV Project Plans (small sites) | CD-3 | IVC Personnel | FM | EM-1 | 30 working days | FM | At least 30 days prior to implementation |

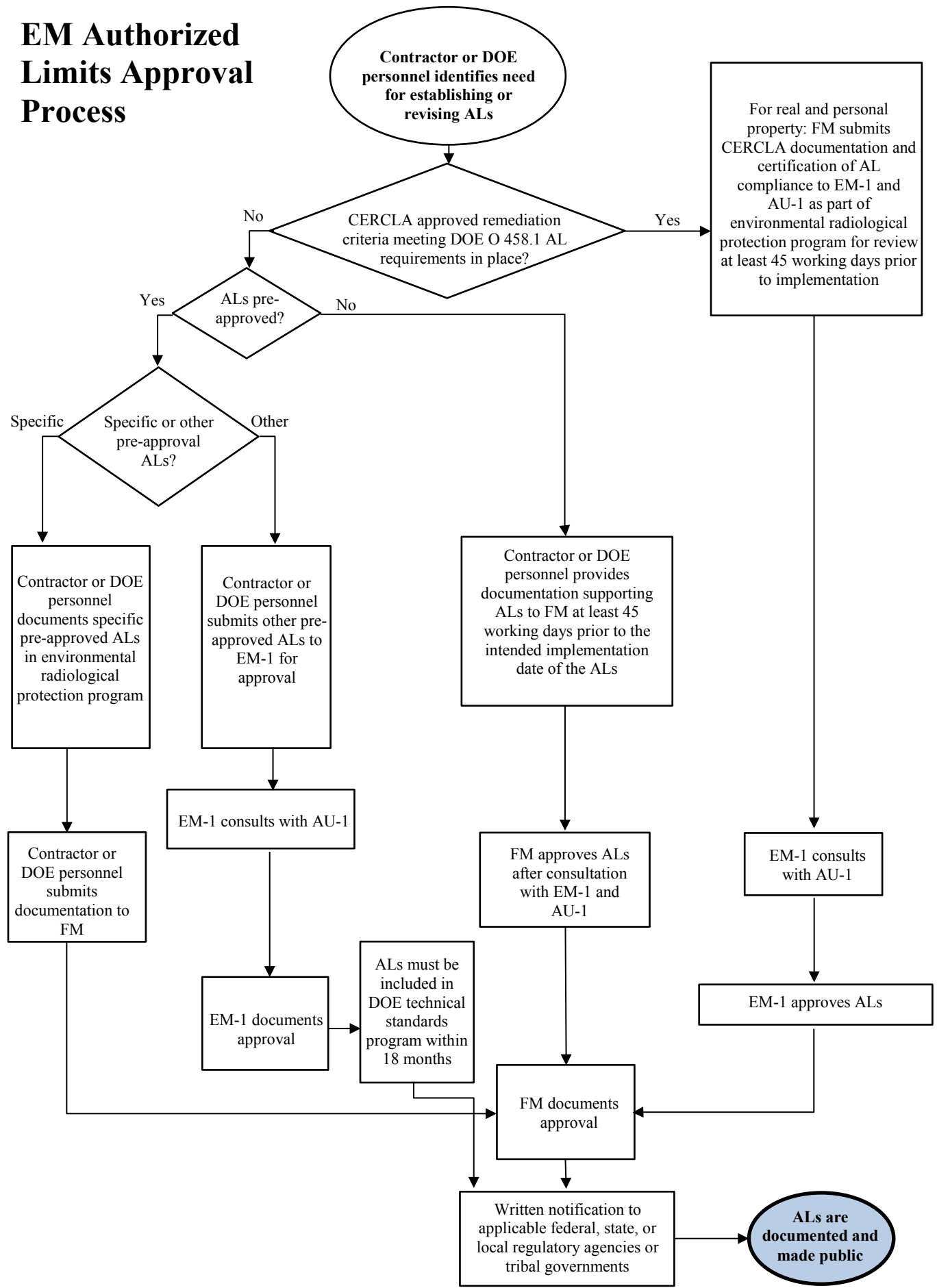
¹ This is a recommended schedule for consideration. It is understood that not all AL and IV activities follow this type of project schedule

² The 30 day review period begins when receipt is confirmed by the appropriate HQ offices.

³ Other per-approved ALs may be made through DOE memorandum but must be included in the DOE technical standards program within 18 months of issuance

APPENDIX B
EM AUTHORIZED LIMITS APPROVAL PROCESS

EM Authorized Limits Approval Process



APPENDIX C
EXPECTED ELEMENTS OF AN AUTHORIZED LIMITS PACKAGE

EXPECTED ELEMENTS OF AN AUTHORIZED LIMITS PACKAGE

Authorized limits documentation should include:

- A property description and process knowledge documentation.
 - 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 y 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.
 - Describe current and likely future human receptors including the more highly exposed representative person and a maximum exposed individual (MEI).
 - The dose to the more highly exposed representative person and the MEI is not meant to underestimate or substantially overestimate the actual dose.

 - 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.

 - 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.
 - 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.
 - Dose modeling methods, techniques, parameters, and model meet DOE O 414.1D quality requirements (e.g., RESidual RADIOactive material (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.
- 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) when integration of doses beyond such thresholds does not significantly affect data quality objectives.
 - 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.
 - Dose constraint by property type:
 - Personal property – Total effective dose (TED) of 1 mrem/yr (0.01 mSv/yr)
 - Collective dose – 10 person-rem/year (0.1 person-Sv/year)
 - Real property – TED of 25 mrem/yr (0.25 mSv/yr)

- The addition of the authorized limit must not cause the dose to the public from DOE activities to exceed 100 mrem/yr.
 - Dose estimates exclude background radiation, radon and radon decay products in air (except as noted above), medical applications, other non-DOE sources.
 - The baseline dose is presented.
 - Based on the representative person or maximally exposed individual (MEI) receptor exposed to mean (or upper estimate of the mean) radionuclide concentrations.
 - 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:
- The proposed authorized limits
 - Alternative levels instead of the proposed authorized limits
 - 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:
- A MARSSIM-based design including data quality objectives
 - A description of survey and monitoring procedures and the instruments to be used
 - Basic analytical laboratory methods and reporting requirements (e.g., analytical methods and detection limits)
 - 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.

- 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.
- 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.
- Independent verification plan.
- 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.

APPENDIX D
INDEPENDENT VERIFICATION-RELATED REQUIREMENTS AND GUIDANCE

Table D-1. Summary of IV-related Requirements and Guidance

| DOE Order 458.1 Requirement | MARSSIM |
|--|---|
| Graded Approach. Graded approach to IV activities is commensurate with the scope, complexity, and risk associated with the clearance action | Sect. 1.2. MARSSIM is based on a graded approach. Sect. 9.2. The IV plan(described in MARSSIM as the QAPP). should be developed using a graded approach. Sect. 9.3. ...the assessment of survey data should be consistent with the objectives of the survey (i.e., a graded approach). |
| Property Release. IV plan to review the remediation contractor's characterization data, operational awareness of radiological monitoring and survey procedures, recordkeeping, methodologies, and techniques; complete IV surveys and analyze samples, as required. | Sect. 9.3.1. Data verification activities should be planned and documented in the IV plan (described in MARSSIM as the QAPP). These assessments may include but are not limited to inspections, QC checks, surveillance, technical reviews, performance evaluations, and audits. |
| Independence. Independent of the clearance action contractor; reports to and is given authority by DOE; qualified, knowledgeable, and experienced in overseeing radiological clearance activities. | Sect. 9.3.1. A technical review is an independent assessment that provides an in-depth analysis and evaluation... to ensure that established requirements are satisfied. |
| Timeliness. No specific requirement, though FEMs are required to "verify that the contractor assurance program is ensuring that the applicable radiological clearance requirements have been met." | Sect. 9.3.1. Verification activities should be initiated as part of data collection during the implementation phase of the survey. Activities performed during the implementation phase are assessed regularly with findings documented and reported to management. |

Table D-2. Minimum and discretionary IV requirements from DOE O 458.1

| Citation | Category | Minimally (Always) Required | Responsibility of DOE FMs | Documentation Expectations |
|-----------------|---|--|--|--|
| 4.k(9)(b)1 | Graded approach | Oversight must ensure that clearance contactor procedures, instruments, data and analysis, and documentation used for clearance comply with the Order. | A graded approach to IV activities should be commensurate with the scope, complexity, and risk associated with the clearance action | Memo to file documenting review of contractor documentation |
| 4.k(9)(b)2 | Personal property | Oversight must ensure operational awareness of radiological monitoring and survey procedures, recordkeeping, methodologies, and techniques used for clearance comply with the Order. | More formal IV process may be instituted if, for example, the clearance action is highly complex or there is a history of poor performance | Memo to file documenting review of field implementation of contractor clearance procedures |
| 4.k(9)(b)3 | Real property to be retained by under DOE control | IV personnel will review the radiological characterization report or data. | IV surveys or sample analysis | Report generated by IV personnel documenting review and/or field surveys/sampling results ⁴ |
| | Real property to be cleared from DOE control | IV personnel will prepare IV plan and will conduct IV surveys and sample analysis. | DOE may not require IV plans or data collection in some cases, such as if the real property will be managed under a license | Report generated by IV personnel documenting review and/or field surveys/sampling results ⁴ |

⁴ IV results must also be summarized in the annual site environmental report (ASER)

| Citation | Category | Minimally (Always) Required | Responsibility of DOE FMs | Documentation Expectations |
|-----------------|-------------------------------------|---|---|---|
| 4.k(9)(b)4 | Independence – DOE personnel | Independent of the contractor conducting the clearance action; reports to DOE; authority and freedom to report issues to FEMs; qualified, knowledgeable, and experienced in overseeing radiological clearance activities. | Not applicable | Minimally, a memo to file documenting evaluation of the selected IV personnel |
| | Independence – contractor | Independent of the contractor conducting the clearance action; reports to DOE; authority and freedom to report issues to FEMs; qualified, knowledgeable, and experienced in overseeing radiological clearance activities. | Not applicable | |
| 4.k(11) | Final clearance documentation | Must describe the clearance process(es) and property being cleared | Documentation must demonstrate that property being sold or otherwise cleared from DOE radiological control meets all DOE radiological protection requirements, is not required to be controlled for national security reasons, and meets DOE property control requirements. | Contents and mechanism may be tailored to the need, situation, and type of property being cleared |

APPENDIX E
INDEPENDENT VERIFICATION PLAN OUTLINE

Independent Verification (IV) Plan Annotated Outline

1. Introductory and background material may include:
 - An introduction section that broadly defines the project and organizational roles
 - A historical summary of the site or area and other background information
 - Contaminant information and cleanup criteria
 - Site or area location maps
2. Data Quality Objectives (DQOs):
 - The seven steps in the DQO process that clarifies IV scope and decisions, the types of data needs, limits on decision errors, and the quantity and quality of data needs
3. IV Responsibilities:
 - Key project individuals/positions and responsibilities of each
4. Procedures:
 - Field and analytical procedures, analytical and measurement methods and equipment, and other topics that require agreement for successful completion of IV activities
5. Additional topics may include, but are not limited to:
 - Requirements related to worker or environmental health and safety
 - Training and health and safety requirements
 - Waste management plans
 - Data management and sample management plans
 - IV reporting and archiving requirements

APPENDIX F
EXAMPLE APPROACHES FOR INDEPENDENT VERIFICATION OF PROPERTY

Table F-1. Example graded approach for the clearance of personal property

| Characteristics | Complexity | Example of IV Team Actions |
|--|--|---|
| Fixed surface contamination only | <ul style="list-style-type: none"> • Extent of contamination well-defined • Contaminants easily detected and quantified • Cleanup or cleanup contractor has previously demonstrated high-level, quality performance | <ul style="list-style-type: none"> • Review data and historical and program documents • Thoroughly evaluate clearance plans, procedures, and instrumentation used • No or limited field surveys |
| Fixed surface and volumetric contamination | <ul style="list-style-type: none"> • Extent of contamination well-defined • Possible hard-to-detect nuclides (HTDNs) • Known contamination present • Cleanup contractor has previously demonstrated quality performance or high technical competence | <ul style="list-style-type: none"> • Review data and historical and program documents • Thoroughly evaluate clearance plans, procedures and instrumentation used • Limited (up to 10% coverage) field surveys/soil sampling of randomly and/or judgmentally selected clearance areas |
| Fixed and removable surface, plus volumetric contamination | <ul style="list-style-type: none"> • More extensive areas of contamination • Contamination may migrate to other areas (is dispersible) • Significant stakeholder concern • Cleanup contractor has minimal prior independent assessment experience or minimal prior demonstration of quality performance | <ul style="list-style-type: none"> • Review data and historical and program documents • Thoroughly evaluate clearance plans, procedures and instrumentation used • Field surveys/sampling of 10% or more of the total clearance areas selected randomly and/or judgmentally |
| Fixed and removable surface, plus volumetric contamination | <ul style="list-style-type: none"> • Complex site • Multiple contaminants • Presence of HTDNs • Contamination may migrate to other areas (is dispersible) • Significant stakeholder concern • Cleanup contractor has minimal prior independent assessment experience or minimal prior demonstration of quality performance | <ul style="list-style-type: none"> • Review data and historical and program documents • Evaluate instruments and techniques • Extensive field surveys/sampling at >10% of clearance areas selected randomly and/or judgmentally |

Table F-2. Example graded approach for the clearance of real property

| Characteristics | Complexity | Example IV approach |
|--|--|--|
| Surface soil contamination only | <ul style="list-style-type: none"> • Extent of contamination well-defined • Contaminants easily detected and quantified • Cleanup or cleanup contractor has previously demonstrated high-level, quality performance | <ul style="list-style-type: none"> • Review data and historical and program documents • Thoroughly evaluate clearance plans, procedures, and instrumentation used • No or limited field surveys |
| Surface and subsurface soil contamination | <ul style="list-style-type: none"> • Extent of contamination well-defined • Possible HTDNs • Known soil contamination present • Cleanup contractor has previously demonstrated quality performance or high technical competence | <ul style="list-style-type: none"> • Review data and historical and program documents • Thoroughly evaluate clearance plans, procedures and instrumentation used • Limited (up to 10% coverage) field surveys/soil sampling of randomly and judgmentally selected clearance areas |
| Surface soil, subsurface soil, and groundwater contamination | <ul style="list-style-type: none"> • More extensive areas of contamination • Contamination has migrated to groundwater • Significant stakeholder concern • Cleanup contractor has minimal prior independent assessment experience or minimal prior demonstration of quality performance | <ul style="list-style-type: none"> • Review data and historical and program documents • Thoroughly evaluate clearance plans, procedures, and instrumentation used • Field surveys/sampling of 10% or more of the total clearance areas selected randomly and/or judgmentally |
| Surface soil, subsurface soil, and groundwater contamination | <ul style="list-style-type: none"> • Complex site • Multiple contaminants • Presence of HTDNs • Contamination has migrated to groundwater • Significant stakeholder concern • Cleanup contractor has minimal prior independent assessment experience or minimal prior demonstration of quality performance | <ul style="list-style-type: none"> • Review data and historical and program documents • Evaluate instruments and techniques • Extensive field surveys/sampling at >10% of clearance areas selected randomly and/or judgmentally |

APPENDIX G
INDEPENDENT VERIFICATION DATA LIFECYCLE

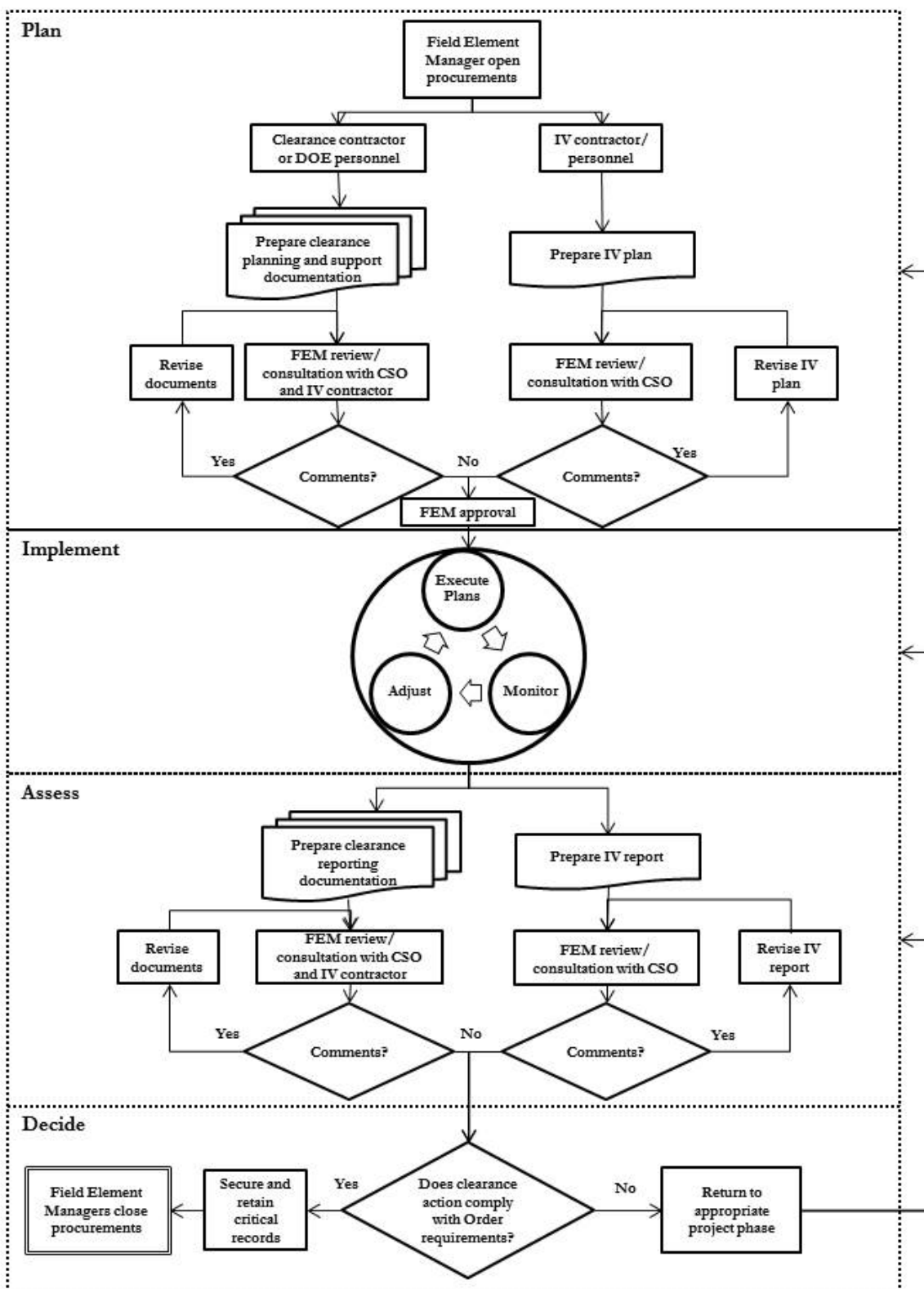


Figure G-1. Data lifecycle for IV activities

APPENDIX H
INDEPENDENT VERIFICATION ACTIVITIES CHECKLIST

V activities checklist

| Planning phase | |
|-----------------------------|---|
| <input type="checkbox"/> | Determine scope and scale of IV involvement based on the graded approach. |
| <input type="checkbox"/> | Plan for IV costs concurrent with the cleanup contractor procurement. |
| <input type="checkbox"/> | Consult the Cognizant Secretarial Officer or designee on selection of IV personnel and resource decisions. |
| <input type="checkbox"/> | Create the IVC statement of work, if required, and complete contractual agreements. |
| <input type="checkbox"/> | Provide IV personnel with historical and conceptual model documentation. |
| <input type="checkbox"/> | Coordinate interactions between cleanup contractor and IV personnel to create respective draft plans. |
| <input type="checkbox"/> | Provide the cleanup contractor's Site Radiological Clearance Program to the IV personnel and the CSO for review and comment (allow 30 days). Provide CSO and IV comments, as needed, to the cleanup contractor for consideration. |
| <input type="checkbox"/> | Initiate the development of the IV Program Plan (performed by the IVC). |
| <input type="checkbox"/> | Review and approve Site Radiological Clearance Program. |
| <input type="checkbox"/> | Review and approve the IV Program Plan. |
| <input type="checkbox"/> | Assure that all required planning documents have been approved prior to moving to the next phase of work. |
| Implementation phase | |
| <input type="checkbox"/> | Coordinate interactions between cleanup contractor and IV personnel to optimize efficiency of the on-site IV activities, as appropriate. |
| <input type="checkbox"/> | Communicate issues identified by IV personnel so that appropriate adjustments may be made in a timely manner. |
| <input type="checkbox"/> | Monitor IV progress for consistency with the IV Plan and Order requirements. |
| <input type="checkbox"/> | Assure that sufficient IV data has been collected prior to moving to the next phase of work. |
| Assessment phase | |
| <input type="checkbox"/> | Coordinate interactions between cleanup contractor and IV personnel to create respective draft data reviews and reports. |
| <input type="checkbox"/> | Provide the cleanup contractor's data and reports to the IV personnel for review and comment. Provide IV comments, as needed, to the cleanup contractor for consideration. |
| <input type="checkbox"/> | Review both the cleanup contractor and IV data and reports and provide comments. |
| Decision phase | |
| <input type="checkbox"/> | Decide if IV results alter cleanup contractor decisions and adjust the clearance action accordingly - this may include repeating phases of work or alternate actions. |
| <input type="checkbox"/> | If IV requirements have been met, secure IV certification that the clearance action was concluded per the cleanup contractor plan and Order 458.1 requirements. |
| <input type="checkbox"/> | Secure and retain critical IV records. |
| <input type="checkbox"/> | Close IV procurements. |