

**MAINTENANCE GUIDE**  
**FOR U.S. DEPARTMENT OF ENERGY LOW-LEVEL WASTE**  
**DISPOSAL FACILITY PERFORMANCE ASSESSMENTS**  
**AND COMPOSITE ANALYSES**



**November 10, 1999**

(This page intentionally left blank.)

## CONTENTS

1.	INTRODUCTION .....	1 - 1
1.1	Purpose .....	1 - 1
1.2	Organization .....	1 - 2
1.3	Background .....	1 - 2
1.3.1	Objectives .....	1 - 3
1.3.2	Performance Assessment/Composite Analysis Process .....	1 - 3
1.3.3	Integration of Maintenance Process with Research and Development .....	1 - 6
2.	PERFORMANCE ASSESSMENT MAINTENANCE .....	2 - 1
2.1	Annual Determinations .....	2 - 2
2.1.1	Waste Receipts .....	2 - 4
2.1.2	Monitoring and Research and Development .....	2 - 5
2.1.3	Other Relevant Factors .....	2 - 7
2.2	Annual Summaries .....	2 - 7
2.2.1	Adequacy of Performance Assessment .....	2 - 8
2.2.2	Waste Receipts .....	2 - 9
2.2.3	Monitoring and Research and Development Results .....	2 - 10
2.2.4	Summary of Changes .....	2 - 11
2.2.5	Recommended Changes .....	2 - 11
2.3	Performance Assessment Revisions .....	2 - 12
2.4	Special Analyses and Reviews .....	2 - 13
3.	COMPOSITE ANALYSIS REVIEWS AND REVISION .....	3 - 1
3.1	Annual Determinations .....	3 - 1
3.1.1	Sources of Residual Radioactive Material .....	3 - 3
3.1.2	Land Use .....	3 - 4
3.1.3	Monitoring and Research and Development Activities .....	3 - 4
3.2	Annual Summaries .....	3 - 6
3.2.1	Assessment of Composite Analysis Adequacy .....	3 - 6
3.2.2	Source Terms .....	3 - 7
3.2.3	Monitoring and Research and Development Results .....	3 - 7
3.2.4	Summary of Changes .....	3 - 8
3.2.5	Recommended Changes .....	3 - 9
3.3	Composite Analysis Revisions .....	3 - 9
3.4	Special Analyses and Reviews .....	3 - 10
4.	REFERENCES .....	4 - 1

## **LIST OF TABLES**

Table 2-1. Summary of Facility-Specific Factors That May be Considered in Annual Determination .....	2 - 8
--	-------

## **LIST OF FIGURES**

Figure 2-1. Performance Assessment Review and Revision Process .....	2 - 3
Figure 3-1. Composite Analysis Review and Revision Process .....	3 - 2

## LIST OF ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act
CA	composite analysis
Center	Low-Level and Mixed Low-Level Waste Center of Excellence
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Department	U.S. Department of Energy
DOE	U.S. Department of Energy
DOE M 435.1-1	DOE Manual 435.1-1, <i>Radioactive Waste Management Manual</i>
DOE O 435.1	DOE Order 435.1, <i>Radioactive Waste Management</i>
ER	environmental restoration
LLW	low-level radioactive waste
NEPA	National Environmental Policy Act
PA	performance assessment
RCRA	Resource Conservation and Recovery Act
R&D	research and development
ROD	Record of Decision
WAC	waste acceptance criteria

(This page intentionally left blank.)

# 1. INTRODUCTION

## 1.1 Purpose

This document provides guidance for maintenance of U.S. Department of Energy (DOE or Department) low-level radioactive waste (LLW) disposal facility performance assessments (PA) and composite analyses (CA), as required by DOE Order 435.1, *Radioactive Waste Management* (DOE O 435.1) and Manual 435.1-1, *Radioactive Waste Management Manual* (DOE M 435.1-1) (Refs. 1, 2). Performance assessments are used to provide the Department with a reasonable expectation that LLW disposal will meet the radiological performance objectives for long-term protection of the public established in DOE M 435.1-1. Composite analyses are used by the Department as planning tools in efforts to ensure that the combined effect of all sources of residual radioactive material that could contribute to the dose calculated from disposal facilities will not compromise the requirements for future radiological protection of the public. The performance assessment and composite analysis must be maintained over the operational life of the LLW disposal facility and post-closure institutional control period.

Conduct of a performance assessment and/or composite analysis is not a static process. Rather, these analyses are initially prepared before the start of disposal facility operations and then reviewed, revised, and updated throughout the lifetime of the facility, up until the time of unrestricted release of the site. It will often be necessary to initiate this process using uncertain or incomplete data, thus yielding uncertain results. As the facility is operated and better data are obtained, the analyses will be refined and the uncertainty of results reduced. The process of reviewing and, as new information becomes available, updating the performance assessment and composite analysis comprises the maintenance activities described in this guidance document.

This *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses* is intended to provide guidance to assure that performance assessments and composite analyses are maintained on a consistent basis across the DOE complex. As will be described in more detail later, this *Maintenance Guide* is also intended to facilitate the Department's planning and implementation of research and development (R&D) activities related to the long-term safety of LLW disposal.

Companion documents, *Format and Content Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses* (Ref. 3) and *Format and Content Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Closure Plans* (Ref. 4), have been prepared to complement this document. The *PA/CA Format and Content Guide* provides guidance to preparers of performance assessments and composite analyses to enhance consistency in the content of performance assessments and composite analyses and to ensure a technically sound review and decision making process. The *PA/CA Format and Content Guide* is also intended to assure that information needed for performance assessment and composite analysis maintenance is presented in a manner that facilitates maintenance. The *Closure Plan Format and Content Guide* is intended to assure that closure plans are properly prepared and maintained over the life of the LLW disposal facility. This requires close coordination with the performance assessment/composite analysis maintenance process. The three documents together provide a structured basis for the preparation, review, and maintenance of DOE LLW performance assessments and composite analyses and closure plans.

Guidance related to implementation of the requirements of DOE M 435.1-1, including those related to performance assessments and composite analyses, is provided in *Implementation Guide for use with DOE M 435.1-1*, DOE G 435.1-1 (Ref. 5). Elements of the *Implementation Guide* applicable to maintenance have been incorporated into this *Maintenance Guide*. Other documents have previously been prepared that provide guidance on the maintenance of performance assessments and composite analyses (Refs. 6 and 7). This previous guidance is superseded by this *Maintenance Guide*. The Department has also prepared two other strategic documents related to maintenance of performance assessments and composite analyses. These documents are the *Complex-Wide Strategy for Maintenance of Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses* (Ref. 8) and *Low-Level Waste Management Program Research and Development Implementation Plan* (Ref. 9). These documents remain valid and various elements of them have been incorporated into this *Maintenance Guide*.

This *Maintenance Guide* does not supersede statutory or regulatory requirements, or other DOE orders or policies issued under the DOE directives system. Modifications and additions to this guidance will be made periodically. These changes will be formally made under the DOE directives system and will be distributed to recipients of this original guidance.

## **1.2 Organization**

This document is divided into four chapters. This first chapter is an introduction that provides an overall context of the performance assessment and composite analysis maintenance process described in later chapters of the document. The second chapter describes specific activities to be conducted as part of the process of maintaining performance assessments, and provides guidance on conducting these activities. Similar information related to composite analyses is provided in Chapter 3. Finally, Chapter 4 lists references used in the development of this guidance.

## **1.3 Background**

This section provides background information on the performance assessment and composite analysis process, with emphasis on those elements of the process related to maintenance. Section 1.3.1 describes the overall objective of the performance assessment and composite analysis process and its relationship to other types of assessments performed by the Department. Section 1.3.2 presents a general overview of the performance assessment, composite analysis, and maintenance processes. Finally, Section 1.3.3 describes the relationship between performance assessment and composite analysis maintenance and LLW disposal research and development activities.

### **1.3.1 Objectives**

The Department conducts activities, including disposal of LLW and remediation of radioactive contamination, that could potentially result in long-term radiological exposure to future members of the public. These activities must be conducted in a manner that is not only protective of the public during facility operations, but also ensures that future members of the public will be protected from the aggregate of all residual radioactive material on a DOE site. Performance



assessments and composite analyses are conducted as part of the process employed by DOE to ensure radiological protection of the public now and in the future.

The Department's approach to ensuring that its activities will not compromise future radiological protection of the public uses a combination of assessments, depending on regulatory requirements applicable to specific facilities or activities. Some activities, including current and future LLW disposal, are conducted by DOE under the direct authority of the Atomic Energy Act (AEA). These activities are subject to the performance assessment and composite analysis requirements of DOE O 435.1. Other activities, such as remediation of past radioactive releases, are being conducted pursuant to other laws, such as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA). Assessments of these activities are conducted in accordance with specific requirements under CERCLA and RCRA to assure future protection of public health and the environment. In some cases, multiple requirements apply. For example, if residual radioactivity at a CERCLA site has the potential to interact in the future with radioactivity at a LLW disposal site, the radioactive inventory of the CERCLA site must be considered in the composite analysis for the LLW disposal site. The Department's intent is to use the same combination of assessments and composite analyses for future disposal facilities until the comprehensive environmental management systems approach is in place.

#### 1.3.2 Performance Assessment/Composite Analysis Process

DOE M 435.1-1 IV.P.(2) states that "A site-specific radiological performance assessment shall be prepared and maintained for DOE low-level waste disposed of after September 26, 1988. The performance assessment shall include calculations for a 1,000 year period after closure of potential doses to representative future members of the public and potential releases from the facility to provide a reasonable expectation that the performance objectives identified in this Chapter are not exceeded as a result of operation and closure of the facility." Detailed guidance on the format and content of performance assessments is provided in the *PA/CA Format and Content Guide* (Ref. 3). Conduct of the performance assessment essentially involves estimating future radiological exposure to the public due to disposed waste, and comparing these predicted exposures to performance measures for various pathways. Major elements of the performance assessment include:

- determining the inventory of radionuclides in disposed wastes;
- developing a conceptual model of facility performance, including source term, radionuclide transport, and exposure pathways and scenarios;
- evaluating the release of radionuclides from the disposal site to the environment;
- evaluating the transport of radionuclides in the environment from the disposal facility to points of exposure;
- determining the dose resulting from exposure by various pathways;
- performing a sensitivity and uncertainty analysis; and

- comparing results to performance measures.

For DOE LLW disposal facilities in existence prior to the effective date of DOE O 435.1, the performance assessment process has already been initiated. For these facilities, the initial performance assessments have been based on the existing inventory of wastes disposed of after September 26, 1988, and the inventory of wastes expected to be disposed of in the future. For all new DOE LLW disposal facilities, the performance assessment must be completed and approved prior to construction and operation of the facility. Thus, the performance assessment must be based on expected future waste inventories and site conditions. In either case (existing facility or new facility) the performance assessment results are based on technically uncertain data, conservative parameters, or both.

DOE M 435.1-1 IV.P.(3) states that “For disposal facilities which received waste after September 26, 1988, a site-specific radiological composite analysis shall be prepared and maintained that accounts for all sources of radioactive material that may be left at the DOE site and may interact with the low-level waste disposal facility, contributing to the dose projected to a hypothetical future member of the public from the existing or future disposal facilities. Performance measures shall be consistent with DOE requirements for protection of the public and environment and evaluated for a 1,000 year period following disposal facility closure.” Detailed guidance on the format and content of composite analyses is also provided in the *PA/CA Format and Content Guide* (Ref. 3). Conduct of the composite analysis is very similar to conduct of the performance assessment, except that additional source terms are considered. That is, while the performance assessment only considers the radioactive waste placed in the disposal facility, the composite analysis considers all other sources of radioactive material at the site that could interact with the facility inventory. The composite analysis also considers fewer exposure pathways and different points of exposure. The sources of uncertainties in composite analysis results are similar to those for the performance assessment.

DOE M 435.1-1 IV.P.(4) states that “The performance assessment and composite analysis shall be maintained to evaluate changes that could affect the performance, design, and operating bases for the facility. Performance assessment and composite analysis maintenance shall include conduct of research, field studies, and monitoring needed to address uncertainties or gaps in existing data. The performance assessment shall be updated to support the final facility closure. Additional iterations of the performance assessment and composite analysis shall be conducted as necessary during the post-closure period.”

Maintenance comprises a critical element of the overall process for assuring long-term safety from LLW disposal. For example, the performance assessment is a tool to direct and evaluate LLW disposal facility design features (e.g., engineered barriers), as well as operational practices (e.g., depth of disposal). In addition, the performance assessment is key to developing waste acceptance criteria (WAC) and disposal facility radionuclide limits. Performance assessment maintenance, therefore, has significant implications with respect to facility design, facility operations, WAC, and other controlling documents (e.g., procedures). The composite analysis is a tool to evaluate and plan site cleanup (e.g., CERCLA and RCRA remediation and closure, facility decommissioning), land-use, and long-term stewardship activities within the perspective

of public radiological protection, considering the operation and closure of a LLW disposal facility. Maintenance of the composite analysis, therefore, has implications on these activities.

The need for maintenance is partly derived from the dynamic nature of the performance assessment and composite analysis process, which must be continued over the entire lifetime of the disposal facility, up to the time of unrestricted release of the site. To date, DOE has focused on completing performance assessments and composite analyses for existing LLW disposal facilities and sites that have received waste since September 26, 1988. These assessments and analyses have been developed using existing information on past activities and expected future activities, including closure, recognizing that uncertainty exists in this information. As part of the maintenance process, the performance assessments and composite analyses are refined and updated as new information becomes available that reduces uncertainty. At the time of closure, the performance assessment and composite analysis will be updated to reflect actual conditions at closure (e.g., actual waste inventory), the final closure design, and expected conditions during the post-closure period. Finally, during the post-closure period, the performance assessment and composite analysis will be updated to reflect actual conditions.

In the future, performance assessments for new facilities will be prepared prior to construction of the facility. For new facilities that have yet to be constructed, the initial performance assessment will be directed at determining waste characteristics and design features that will provide a reasonable expectation of meeting performance objectives. After the facility is constructed, the performance assessment and composite analysis will be maintained and updated as described above.

The process for preparing and maintaining performance assessments and composite analyses recognizes that there will be uncertainty in the information used to perform the analyses and in the results of the analyses, but that this uncertainty will be reduced over time through maintenance, monitoring, and companion research and development activities<sup>1</sup>. Reduction of uncertainty will provide greater confidence in the results of the analyses and in the long-term plans for protecting public health and safety and the environment.

This *Maintenance Guide* recognizes three elements of a successful maintenance program: 1) reviews and revisions of the performance assessment and composite analysis, 2) monitoring, and 3) research and development activities related to the performance assessment and composite analysis. Reviews and revisions provide a means for updating the analyses to replace projected or estimated data values with actual values. For example, most performance assessments will be based on projected inventories of wastes to be disposed of in the future. Through the maintenance process, the assessment is updated as data on actual disposed inventories becomes available. Similarly, performance assessments and composite analyses are typically based on expected future land use. At the time of facility closure, the analyses must be updated with data related to actual land use.

---

<sup>1</sup> Within the context of LLW disposal, the term “research and development” is used to refer to a variety of data collection activities (e.g., studies, testing) in addition to those activities traditionally identified as research and development.

Monitoring programs are closely tied to the maintenance process as monitoring data can be used to update and/or verify analyses. For example, a performance assessment may be based on a rate of moisture infiltration through a cover that was theoretically developed during the facility design process. Once the cover is installed, the actual rate of infiltration through the cover can be monitored and used to update the analysis.

The maintenance process also provides a means for incorporating results of research and development. For example, a performance assessment may be based on assumed radionuclide release rates from the waste form associated with a new treatment process under development. Testing of the waste treatment process can provide data on the actual release rates from the waste, which can then be used to update the performance assessment. The relationship between maintenance and research and development is described in more detail in Section 1.3.3.

### 1.3.3 Integration of Maintenance Process with Research and Development

Key elements of the Department's LLW disposal research and development program are: 1) identification of data/information needs; 2) prioritization of needs that can be met through research and development; 3) implementation of research and development to meet priority needs; and 4) integration of research and development results into the performance assessment and composite analysis process to reduce uncertainty and increase confidence in results. These elements are closely connected with the conduct and maintenance of performance assessments and composite analyses.

The performance assessment and composite analysis process provides the primary technical framework with which to identify site-specific research and development needs related to long-term safety of LLW disposal. Important research and development needs can be identified as the initial performance assessment and composite analysis are performed, after the initial performance assessment and composite analysis are completed and results are available, and during maintenance of the performance assessment and composite analysis, as described in more detail below.

Facility- and site-specific research and development gaps will first be identified during the formulation and development of the performance assessments and composite analyses. The conceptual site model identifies the radionuclide release, transport, and exposure processes that need to be considered in the performance assessment and composite analysis, and generally identifies the data required to simulate these processes. Specific analytical modeling tools are then used to evaluate those processes identified as important. Application of analytical modeling tools requires that input data values be provided; thus, data gaps associated with model parameters are readily identified during this model formulation step. For example, a process considered at many sites is radionuclide transport in groundwater. Specific data needed to model the process may include those describing the rate of groundwater movement (aquifer thickness, hydraulic conductivity, gradient, and porosity), those describing the contaminant source (dimensions, release rate, inventory, and concentration), and those describing contaminant interactions (decay rates, distribution coefficients). The process of applying a groundwater model requires the analyst to evaluate the adequacy of existing data in each of these categories and select the most appropriate values. The wider the range of potential values, the greater the uncertainty and, hence, the greater the effect on assessment results. In assessing the adequacy of

existing data, both on-site and off-site (e.g., other DOE sites, universities, private sector) sources are considered.

The analytical tools and available data are then used to conduct the performance assessment and composite analysis. The results, in particular the results of required sensitivity/uncertainty analyses, can then be used to refine the understanding of data gaps. The results of the performance assessment and composite analysis can then be used to assess the significance of these data gaps by determining how much each data gap contributes to the overall uncertainty of the results and how significant that uncertainty is. This evaluation is then used to identify and prioritize data gaps that need to be addressed through research and development.

After research and development activities have been implemented, the results are used to update the performance assessment and composite analysis as part of the maintenance process. The updated results can then be used to re-evaluate the status of the data gaps and update plans for further research and development.

(This page intentionally left blank.)

## 2. PERFORMANCE ASSESSMENT MAINTENANCE

Requirements for performance assessment maintenance are contained in DOE M 435.1-1 IV.P.(4), which states that:

- “(a) Performance assessments and composite analyses shall be reviewed and revised when changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or the improved understanding of the performance of the waste disposal facility in combination with the features of the site on which it is located alter the conclusions or the conceptual model(s) of the existing performance assessment or composite analysis.
- (b) A determination of the continued adequacy of the performance assessment and composite analysis shall be made on an annual basis, and shall consider the results of data collection and analysis from research, field studies, and monitoring.
- (c) Annual summaries of low-level waste disposal operations shall be prepared with respect to the conclusions and recommendations of the performance assessment and composite analysis and a determination of the need to revise the performance assessment or composite analysis.”

This section describes the performance assessment review and revision process that should be conducted by DOE Field Element Managers to meet the above requirements.

As required by DOE M 435.1-1, performance assessment maintenance includes the routine review and revision of the performance assessment. Reviews provide a mechanism for routine assessment of the performance assessment-derived controls on waste disposal so that potential problems are identified and managed. The performance assessment revisions ensure that there is cohesive documentation providing a reasonable expectation of meeting the DOE M 435.1-1 performance objectives. This use of a performance assessment is similar to the use of a safety analysis report. That is, the assumptions and analyses in the performance assessment are used to establish a performance envelope and are translated into administrative and engineering controls in procedures, WAC, and designs. Reviews are then used to determine whether disposal activities are being conducted or will be conducted in accordance with the controls. Revisions and special analyses provide a mechanism for evaluating conditions not originally included in the performance assessment to determine if they can be accommodated without changing the conclusions of the performance assessment.

The following sections address annual reviews to be conducted by the Field Element Managers, the annual summary to be submitted to Headquarters, revision of the performance assessment, and special analyses and reviews. The process of conducting annual reviews, advising Headquarters through annual summaries, and revising the performance assessment continues as necessary throughout the operational life of the disposal facility. At the time when the facility is to be closed, a final performance assessment is prepared, submitted to Headquarters for approval, and, with the final closure plan, provides the basis for approving facility closure. Maintenance of the performance assessment continues through the institutional control period, but additional revisions of the performance assessment after closure should only be necessary if monitoring

results indicate that additional analyses are needed. However, additional actions could be needed as a result of reviews required by other regulatory programs (e.g., CERCLA).

The overall performance assessment review and revision process is shown in Figure 2-1.

## **2.1 Annual Determinations**

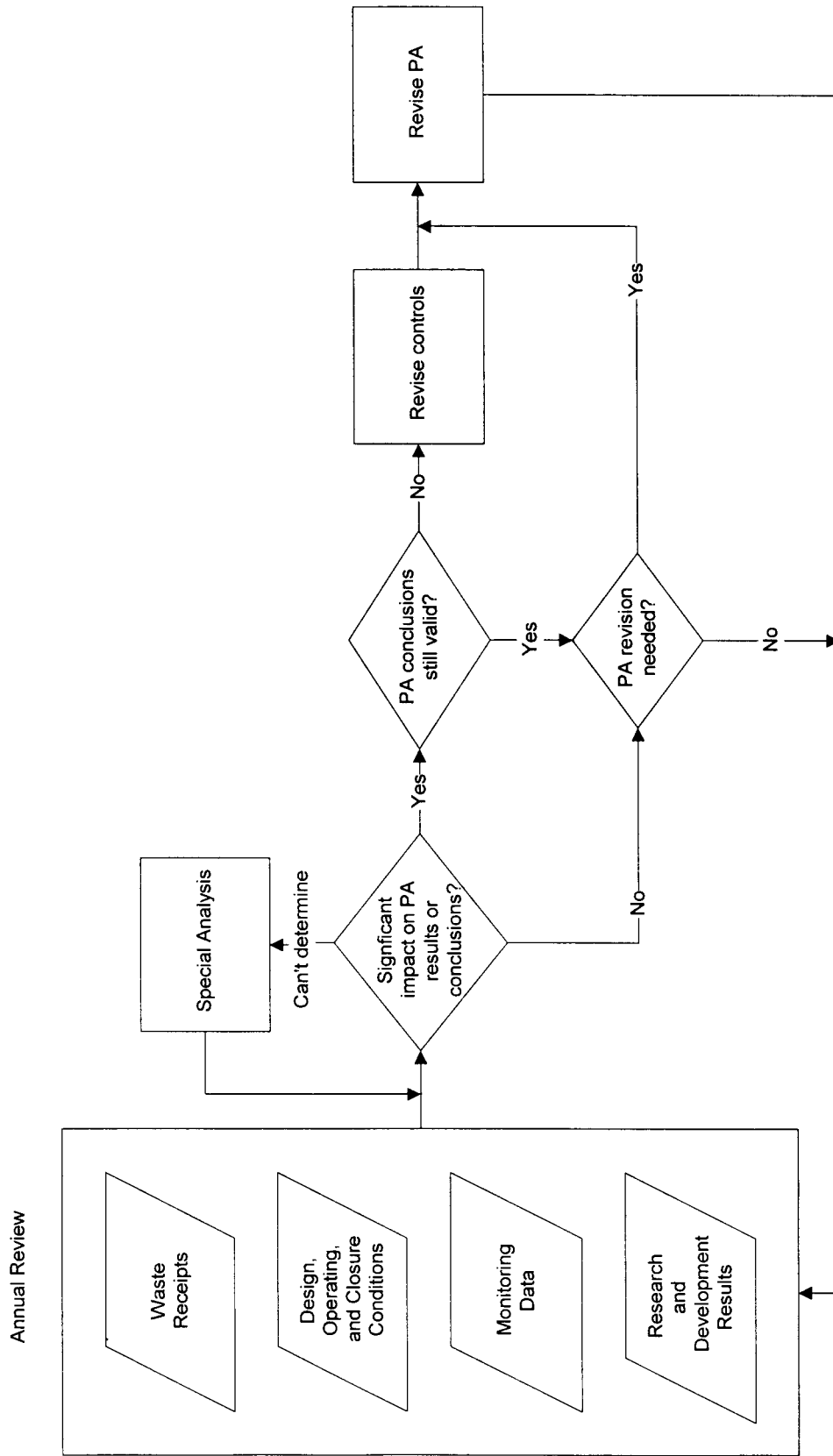
In accordance with DOE M 435.1-1 requirements, the Field Element Manager is responsible for making an annual determination of the continued adequacy of the performance assessment. The annual determination is to be documented and retrievable.

The annual determination provides the mechanism by which the Field Element Manager confirms that existing controls continue to be effective in ensuring that the performance assessment and its conclusions are valid. The annual determination also allows the Field Element Manager to identify potential problems so that they can be managed before they develop into situations affecting disposal operations. Thus, the review conducted to support the annual determination must be both retrospective and prospective. The Field Element Manager should review activities that occurred over the last year with respect to their effects on disposal operations and the continued adequacy of the performance assessment in representing facility effectiveness relative to performance objectives. The review should also consider expected future events in terms of their significance to disposal operations and the adequacy of the performance assessment. In some cases, a special analysis may be needed to determine the significance of new data or changes in conditions with respect to the results of the performance assessment. Conduct of special analyses is described in Section 2.4.

The *R&D Implementation Plan* (Ref. 9) requires the Field Office Low-Level Waste Program Office to make and document an annual determination of research and development needs related to LLW disposal. This process should be coordinated with the annual determinations required for each LLW disposal facility as part of the performance assessment maintenance process. The annual determination for each disposal facility should identify research and development needs that have been met during the past year, new needs that have arisen as a result of changes in operations or expected future conditions, and the effects of these changes on research and development priorities.

The result of the annual review should be documented in a memorandum that indicates the determination that was made, the basis for the determination, and any specific actions to be taken as a result of the review. As described in the following sections, the review should include consideration of waste receipts, results of monitoring and research and development activities, and other relevant factors.





**Figure 2-1. Performance Assessment Review and Revision Process.**

### 2.1.1 Waste Receipts

The review of waste receipts consists of several activities, including:

- updating inventory estimates on the basis of incremental changes since the last revision;
- adjusting inventories according to results of analysis of past waste receipts;
- adjusting inventories on the basis of any improvements in waste characterization that enhance estimates of waste in place;
- verification or modification of waste projections based on best available data; and
- determining consistency of waste forms with WAC.

Conduct of these activities is described in more detail in the following paragraphs.

The review of past and future waste receipts is to be based on a review of documentation such as quality records (e.g., receipt records, audits/surveillances), waste projections, and controlling documents (e.g., procedures, WAC). The review should be designed to confirm that the controls on waste receipts are consistent with the limitations derived from the performance assessment. Consequently, reviews should be designed to assess both the radionuclides contained in the waste and the waste form. The reviewer should consider the need to review past waste receipts, revised inventory estimates, projected waste receipts, and total inventory. In most cases, the review would be based on the increment of waste received beyond the known inventory that was included in the most recent revision of the performance assessment. However, if the site has conducted an historical evaluation of waste receipts (e.g., past waste receipts within the time frame analyzed in the performance assessment) that has resulted in a revision to the site's existing inventory, then the review should also include these data.

The review of waste receipts should also consider improvements to waste characterization methods that may have occurred. For example, the performance assessment may have used conservative estimates of significant radionuclide inventories based on gross activity. Use of improved methods that allow actual measurements of significant radionuclides may indicate that previous estimates were overly conservative, and that WAC should be revised in light of reduced uncertainty.

Waste disposed before September 26, 1988, need not be included (unless included in the performance assessment); such waste is to be included in the composite analysis. The waste projected to be received at the site in the future should also be considered to determine whether currently projected waste receipts are nominally the same as those anticipated at the time the performance assessment was prepared. For example, programmatic changes at a site could affect the wastes expected to be generated in the future. For facilities that will receive environmental restoration (ER) wastes, new ER site characterization data may allow reduced uncertainty in estimates of radionuclide inventories in wastes to be received. A confirmation should be made that the radionuclide concentrations and total inventories being used to control disposal operations are current.

The review of waste forms should be designed to confirm that the actual disposed waste forms are consistent with WAC derived from the performance assessment. For example, if the performance assessment was based on a critical radionuclide being contained in activated metal with a low release rate, then the review would be designed to determine if the critical radionuclide was actually contained in activated metal and could reasonably be expected to exhibit the low release rate. Similarly, the performance assessment may have been based on expected waste form characteristics from a treatment process that was not yet operational. Once the treatment process is operational, the actual waste form characteristics must be reviewed to determine whether they are consistent with those used in the performance assessment.

The overall result of the review of waste receipts will be a determination of whether any changes are needed to ensure the continued adequacy of the performance assessment with respect to radionuclide limits and waste form requirements.

#### 2.1.2 Monitoring and Research and Development

The review of monitoring and research and development results consists of several activities, including:

- comparing facility monitoring results to expected performance and determining consistency with conceptual model(s);
- evaluating other monitoring activities for significant results;
- evaluating research and development results to determine impacts on performance assessment results and conclusions and consistency with conceptual model(s);
- determining if better methodologies or technologies are available; and
- evaluating the results of special studies.

The review should be designed to determine if data collected during monitoring or research and development activities indicate that the disposal facility is performing as postulated in the performance assessment, and to determine if the conceptual models are still applicable (i.e., still adequately represent the disposal facility). Additionally, the review should provide information needed by the Field Element Manager to update the status of research and development needs related to LLW disposal safety.

Specific requirements for monitoring at LLW disposal facilities are contained in DOE M 435.1-1 IV.R.(3). These requirements include using the results of the performance assessment and composite analysis to develop monitoring plans, including determining the media, locations, radionuclides, and other substances to be sampled. In addition, the monitoring program must be capable of detecting changes in disposal facility parameters that may affect **long-term** performance. Thus, the facility monitoring program should be designed to directly interface with the performance assessment maintenance process.

Data collected as part of the facility's monitoring plan should be reviewed to determine whether they indicate that the facility is functioning within the performance envelope (i.e., results indicate that parameter values are conservative in terms of projected dose). If so, the information should be noted as confirming the adequacy of the current analysis. However, if monitoring results indicate that a particular parameter used in the performance assessment may not be as conservative as assumed and the impact would be a significant increase in projected dose or releases, additional analyses may be necessary. Conversely, if monitoring results indicate that a particular parameter used in the performance assessment was overly conservative, these data may provide the basis for special analyses to raise disposal facility radionuclide limits. The monitoring data should also be evaluated to identify any necessary or suggested changes to the monitoring plan. In addition, monitoring data should be reviewed to evaluate whether they are consistent with the conceptual model(s) upon which the performance assessment is based.

In addition to the monitoring specified in the facility's monitoring plan, results of other monitoring relevant to facility performance should also be reviewed. This monitoring can include environmental monitoring in the vicinity of the disposal facility, as well as nonroutine monitoring, such as sampling of liquids collected from the facility. These monitoring results should be evaluated in the same manner as the facility monitoring data (i.e., to determine if they indicate the need for any special analyses due to over- or under-estimation of a parameter value and to determine consistency with the conceptual model).

The review of research and development results should include those available from on-site or facility-specific activities, as well as those from activities conducted at other sites. Facility-specific research and development requirements should be identified in the disposal authorization statement for the facility. These and other site-specific research and development activities should be identified in the Site-Wide Radioactive Waste Management Program required by DOE M 435.1-1. These documents should be reviewed to identify potential on-site sources of research and development results. As described in the *R&D Implementation Plan* (Ref. 9), the Low-Level and Mixed Low-Level Waste Center of Excellence (the Center) is responsible for developing a centralized database of practices, research results, and technologies applicable to the needs of the complex's low-level waste management activities. Once this database is operational, it should be reviewed quarterly by the site to identify potential sources of research and development results applicable to data needs associated with on-site disposal facilities. These reviews are to be documented annually by the Field Office Low-Level Waste Program Office.

Once applicable research and development results have been identified using the above sources, they should be reviewed with respect to facility performance. If they indicate that the facility is functioning within the performance envelope (i.e., results indicate that parameter values are conservative in terms of projected dose), then the information should be noted as confirming the adequacy of the current performance assessment analysis. However, if research and development results indicate that a particular parameter used in the performance assessment may not be as conservative as assumed and the impact would be a significant increase in projected dose or releases, additional analyses may be necessary. Conversely, if research and development results indicate that a particular parameter used in the performance assessment was overly conservative, these data may provide the basis for special analyses to raise disposal facility radionuclide limits.

In some cases, instead of data, research and development results will consist of improved analytical methods (e.g., computer codes). In these cases, the review should determine whether application of these improved methods to the performance assessment would reduce the uncertainty associated with the results of the assessment. If so, the significance of the reduced uncertainty should be discussed (e.g., WAC could be revised). In some cases, it may be appropriate to conduct a special analysis to quantitatively evaluate impact of the method on performance assessment results.

The review of research and development results should also assess the status of research and development with respect to previously-identified data needs and uncertainties. As described in Section 2.2.3, this information will be used to update the research and development planning and implementation process.

### **2.1.3 Other Relevant Factors**

The purpose of the annual determination is to routinely assess the adequacy of the performance assessment in light of information made available since the last annual determination. As discussed above, a review of past and expected waste receipts, and an evaluation of the results of monitoring and research and development programs are important to determining the continuing adequacy of the performance assessment. In addition, there are other operational and design considerations that may be relevant to the determination of performance assessment adequacy. Factors that may be considered in conducting the annual determination are summarized in Table 2-1. Other factors should also be included if they are relevant to the disposal facility being considered and may have a significant impact on performance assessment results. The performance assessment sensitivity/uncertainty analysis should be reviewed to identify factors that may have a significant impact on facility performance (i.e., factors to which the results are sensitive or which have a high uncertainty). The review or evaluation of these additional factors will be based principally on available documentation rather than collection of new data.

## **2.2 Annual Summaries**

DOE M 435.1-1 IV.P.3(c) states that "Annual summaries of low-level waste disposal operations shall be prepared with respect to the conclusions and recommendations of the performance assessment and composite analysis and a determination of the need to revise the performance assessment or composite analysis." To comply with this requirement, the Field Element Manager shall prepare an annual summary for each LLW disposal facility and submit the summary to Headquarters. The annual summary should be prepared by summarizing the information and conclusions from the annual determination for the previous year. The annual summary should include the information described in the following sections.

**Table 2-1. Summary of Facility-Specific Factors That May be Considered in Annual Determination.**

Category	Subject	Factors
Operations	Disposal geometry	<ul style="list-style-type: none"> <li>• depth of trench</li> <li>• depth of waste profile</li> <li>• thickness of backfill/cover</li> <li>• trench orientation (compared to assumption in PA)</li> </ul>
	Waste form and packaging	<ul style="list-style-type: none"> <li>• special waste forms</li> <li>• containers used vs. PA assumptions</li> </ul>
	Waste acceptance criteria	<ul style="list-style-type: none"> <li>• radionuclide limits consistent with analyses</li> <li>• reporting of PA-significant radionuclides</li> <li>• waste form and packaging requirements</li> </ul>
	Procedures and systems	<ul style="list-style-type: none"> <li>• verification of waste characteristics (e.g., the radionuclide content)</li> <li>• tracking inventories against total limits</li> </ul>
Facility/Closure Design	Disposal technology	<ul style="list-style-type: none"> <li>• technologies being used or planned vs. those analyzed in the PA</li> </ul>
	Engineered barriers	<ul style="list-style-type: none"> <li>• engineered barriers employed vs. those analyzed in the PA</li> <li>• closure cover design consistent with PA assumption</li> <li>• threats to cover integrity and viability</li> </ul>
	Other design features	<ul style="list-style-type: none"> <li>• provisions for performance monitoring</li> </ul>
	Structural stability	<ul style="list-style-type: none"> <li>• operational controls to enhance stability being employed</li> <li>• unexpected subsidence</li> </ul>
	Future land use	<ul style="list-style-type: none"> <li>• assumptions and analyses in the PA consistent with site future use plans</li> </ul>

### 2.2.1 Adequacy of Performance Assessment

The annual summary report should present conclusions drawn from the annual determination made by the Field Element Manager for the review period (generally the previous year). The

summary should include a discussion or description of relevant factors, if any, that may have challenged or supported the determination of performance assessment adequacy.

The annual summary report should contain a summary statement as to whether the information reviewed as part of the annual determination resulted in any change to the conclusions of the performance assessment (i.e., whether, in light of the new information reviewed, there is still a reasonable expectation that the performance objectives of DOE M 435.1-1 will be met). This statement should reflect one of four possible scenarios based on the annual review:

- 1) there is no change to the conclusions of the performance assessment;
- 2) the conclusions remain valid (i.e., there is still a reasonable expectation of meeting performance objectives) but the new information indicates less conservatism in the results than previously believed;
- 3) the conclusions remain valid but the new information indicates more conservatism in the results than previously believed; or
- 4) the conclusions are no longer valid (i.e., there is no longer a reasonable expectation of meeting performance objectives).

The general basis for the statement concerning changes to the performance assessment conclusions should be presented. The basis may include a summary of supporting data, but should not include a detailed presentation of data.

This section of the annual summary should indicate whether, based on the above information, it will be necessary to revise the performance assessment.

### 2.2.2 Waste Receipts

The Field Element Manager should include an assessment of waste receipts in the annual summary. The assessment should summarize the waste receipt information reviewed during the annual determination. The primary purpose of this section of the annual summary is to inform Headquarters how the wastes received over the past year compare with what was analyzed in the performance assessment. The inventory and concentration of critical radionuclides in the waste (i.e., those having a significant contribution to total dose) should be compared to projections and/or facility limits. Similarly, the disposal of radionuclides that require special waste forms should be summarized.

If there is a substantial variance between actual waste receipts and the waste characteristics used in the performance assessment, the significance of this variance on the results of the performance assessment should be discussed.

### 2.2.3 Monitoring and Research and Development Results

The results of monitoring conducted under the monitoring plan required by DOE M 435.1-1 IV.R.(3) should be summarized and interpreted. The interpretation should address whether the

results indicate that the performance of the facility is as expected based on the performance assessment. The interpretation should also address the consistency of the monitoring results with the conceptual model(s) that form the basis of the performance assessment. Any variance of actual performance from that indicated by the performance assessment, and the significance of this variance, should be described. Any changes to the conceptual model(s) indicated by the monitoring results should be identified. If changes to the conceptual model(s) are indicated, the significance of these changes to the results and conclusions of the performance assessment should be discussed.

Any other monitoring results that were reviewed as part of the annual determination (see Section 2.1.2) should similarly be summarized and interpreted. Environmental monitoring results can be included by reference to other reports (e.g., site-wide annual environmental monitoring reports), but their significance, if any, to the performance of the disposal facility should be discussed.

The annual summary should similarly present a summary of the research and development efforts that were conducted, the research and development results that were evaluated, and an interpretation of the significance of these results. To assist Headquarters with tracking the status of LLW research and development implementation efforts, the research and development efforts that were reviewed should be categorized as follows:

- 1) research and development required by the facility's disposal authorization statement;
- 2) research and development contained in the Site-Wide Radioactive Waste Management Plan, but not required by the disposal authorization statement;
- 3) on-site research and development not contained in the Site-Wide Radioactive Waste Management Plan;
- 4) off-site research and development contained in the Center database; or
- 5) other off-site research and development efforts.

The annual summary should contain an evaluation of the significance of the research and development results with respect to the conclusions of the performance assessment. The evaluation should indicate whether the results indicate a change to the conclusions of the performance assessment, and whether the results indicate more or less conservatism in the performance assessment results.

The summary of results should be presented in such a manner as to facilitate updating the research and development planning process. Specifically, the presentation should allow easy comparison of the results reviewed with the data gaps and uncertainties previously identified during preparation and review of the performance assessment. The degree to which identified data gaps and uncertainties have been addressed by the research and development activities completed to date should be identified. The annual summary should also present the status of on-site research and development efforts associated with the LLW facility. The status should identify those research and development efforts completed during the previous year, those that are ongoing, those that will be started during the next year, and future efforts that will be



included in Project Baseline Summaries to be submitted to Headquarters. Research and development that is required by the disposal authorization statement should be identified.

#### 2.2.4 Summary of Changes

This section is to summarize changes affecting the performance assessment that have occurred over the past year. This would include changes to the disposal facility design, operations, or maintenance program, as well as expected changes to future conditions, such as site land-use plans. The annual summary should describe changes to the disposal facility configuration or operational controls as compared to those described in the performance assessment, including changes that have been made as a result of special analyses (see section 2.4).

This section should also discuss changes related to monitoring and research and development. Specifically, this discussion should include the status of information needs (e.g., data gaps, uncertainties) identified in the performance assessment and previous annual reviews. The status of information needs should be categorized as follows:

- 1) previously existing information needs that have been satisfied by monitoring and research and development efforts completed during the previous year;
- 2) previously existing information needs that are no longer relevant due to changes in facility design, operations, or expected future conditions; and
- 3) new information needs identified as a result of the annual review, including those resulting from changes in facility design, operation, or expected future conditions.

#### 2.2.5 Recommended Changes

This section of the annual summary is to advise Headquarters of planned or contemplated changes in disposal facility design or operations or in the performance assessment maintenance program. The subjects should be the same as covered above in Summary of Changes (Section 2.2.4), but should be forward-looking. Implementation of these recommended changes does not require Headquarters approval unless changes affect conditions specified in the disposal authorization statement.

The discussion of recommended changes should include the expected significance of the changes with respect to the performance assessment results and conclusions. If needed to illustrate the impacts of specific changes on performance assessment results, the discussion should reference the results of the performance assessment sensitivity/uncertainty analysis. If significant changes to the results or conclusions are expected, the summary should recommend whether or not the performance assessment should be revised.

This section should also address recommended changes to monitoring and research and development activities associated with the LLW disposal facility and performance assessment. This should include expected changes in information needs and the resulting changes in activities needed to meet information needs. Any recommended changes to monitoring or research and

development activities required by the disposal authorization statement should be highlighted as these will require Headquarters approval.

## **2.3 Performance Assessment Revisions**

DOE M 435.1-1 IV.P.(3)(a) requires revision of the performance assessments when changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or improved understanding of the performance of the waste disposal facility in combination with the features of the site on which it is located alter the conclusions or the conceptual model(s) of the existing performance assessment. The annual determination described in Section 2.1 is designed to identify conditions that would necessitate revision of the performance assessment. The annual summary described in Section 2.2 will identify specific conditions expected to result in changes to the conclusions or conceptual model(s).

A performance assessment revision is to include updated information (e.g., land-use plans, results from monitoring and research and development), revised analyses, new models, changes in expected radionuclide inventories, or other items affecting calculations of results. Consistent with use of a graded approach, the form of the performance assessment revision may range from a simple amendment to the performance assessment to reissuance of the performance assessment document. If an amendment to the performance assessment is used, there must be a clear interpretation of how the information in the amendment relates to the original performance assessment analyses and what it means relative to the conclusions reached in the performance assessment. In addition to submitting the performance assessment revision to the Deputy Assistant Secretary for Waste Management (or to the Deputy Assistant Secretary for Environmental Restoration for LLW disposal facilities that are CERCLA sites), the Field Element Manager is also responsible for ensuring the revision is distributed to all other parties on the official distribution list for the performance assessment.

In determining how best to revise the performance assessment, the Field Element Manager should consider how cohesive and readily understood the performance assessment is or will be following the revision. For example, the revision may involve redoing source term, transport, and dose assessment calculations using new waste characteristic data. There would be no changes to descriptive information about the site and facility, and no changes to the conceptual models. In this case, it would be appropriate to prepare an amendment that presents the new data, the results of the revised analysis, and comparison of the new results to the performance objectives. In another case, however, there could be substantial changes to site or facility characteristics that result in significant changes to the conceptual model(s). In this case, it would probably be appropriate to revise and reissue the entire performance assessment document. If a full revision of the performance assessment document is made, the annual determination (Section 2.1) is not necessary in the year the revision is made.

Upon receipt of a revised performance assessment, Headquarters staff must conduct a review and determine a course of action. Actions resulting from the Headquarters review may range from a memorandum to file acknowledging the receipt and acceptability of the performance assessment revision, to the initiation of a more thorough and detailed review. Headquarters staff may request additional information from the Field Element Manager as needed to conduct the review.

## 2.4 Special Analyses and Reviews

Special analyses are expected to be needed as part of the routine maintenance of the performance assessment. As used here, special analyses are analyses performed to evaluate the significance of new information or new analytical methods to the results of the performance assessment, or to supplement or amend the analyses performed in the original performance assessment. A special analysis is not the same as a revision to the performance assessment, but the results of the special analysis may be used to determine whether a performance assessment revision is needed. As described below, a number of different factors may prompt a special analysis.

As part of the annual review, the Field Element Manager may identify a concern or potential problem that needs to be evaluated. Resolution of the concern may require the acquisition of data through monitoring or research and development, or the use of existing data in a special analysis. Additionally, the performance assessment analyst may determine the need for special analyses due to errors found in the prior analyses. Also, ongoing research and development may yield results (e.g., new data or new analytical methods) that warrant evaluation to determine their significance to the conclusions of the performance assessment.

From an operating program standpoint, special analyses may be necessary to evaluate whether certain actions or changes can be made. This guidance cannot anticipate all of the changes that a LLW disposal site might consider, but the following indicate the types of changes that could necessitate a special analysis in support of operations:

- disposal of radionuclides not analyzed in the performance assessment;
- disposal of waste streams not analyzed in the performance assessment;
- changes in waste forms that could increase release rates for critical radionuclides;
- wastes that exceed the concentrations analyzed for performance assessment-significant radionuclides;
- wastes that cause the site to exceed the total inventory analyzed for performance assessment-significant radionuclides; and
- changes in the disposal facility design or operations from those described in the performance assessment.

It should be noted that the above factors are included in the information reviewed as part of the annual determination described in Section 2.1. The need for a special analysis is not derived from the specific type of information reviewed, but rather from whether it is possible to assess the significance of the information with respect to the results of the performance assessment.

The purpose of conducting special analyses can be thought of as similar to the process for resolving unreviewed safety questions described in DOE Order 5480.21, *Unreviewed Safety Questions*. The intent of the process is to provide flexibility in day-to-day operations and to require those issues with a significant impact on the performance assessment's conclusions, and

therefore the projected compliance with performance objectives, to be brought to the proper level for attention.

The performance assessment is an important element of the authorization basis to operate a DOE LLW disposal facility. The performance assessment identifies those aspects of design and operations that are important to long-term performance and, therefore, those aspects that DOE relies upon to allow initial and continued operations. Any changes that could directly or indirectly affect the facility authorization basis, and, therefore, its performance, should be analyzed to determine the significance of their affect on the analyzed performance.

Special analyses evaluating proposed changes to the design or operation of the disposal facility, or those analyzing new information with the potential to affect the conclusions of the performance assessment, should be reviewed and approved by the Field Element Manager. If the special analysis indicates that the performance measures used in the performance assessment would be exceeded, appropriate action must be taken. That action may be as simple as not implementing a proposed change. Depending on the reason for initiating the analysis, the appropriate action may be further analysis, collection of additional data, and/or corrective actions to limit disposal facility operations. Headquarters should be notified unless the action pertains to a change that is considered, but not implemented. A proposed change that does not cause the performance measures to be exceeded must be evaluated to determine whether Headquarters' approval has been dictated elsewhere. For instance, changes in the basic disposal concept (e.g., from vault disposal to shallow land burial) requires review and approval by Headquarters, as would changing specifications in the disposal authorization statement that lead to a significant change in projected dose.

If neither of the above conditions apply, the decision on approval of a special analysis and the actions it implies depends on the significance of the results. A rule-of-thumb is that if the results of the original performance assessment and the results of the special analyses are small relative to the corresponding performance measure, then the Field Element Manager need only document his/her review and approval. The Field Element Manager should summarize or reference the approval of these special analyses in the annual review documentation and the annual summary to Headquarters. As used here, about 10% is considered to be small relative to the performance measure (e.g., the results of the all-pathways dose in the original performance assessment and special analysis are both less than 2.5 mrem/yr). The Field Element Manager should also adopt a similar process for special analyses and related changes that are not small relative to the performance measure if the analysis indicates the change in dose (or concentration depending on the performance measure) is relatively insignificant. Again, as a rule-of-thumb, changes less than a 10% increase in the dose (or concentration) in the original performance assessment are considered insignificant (e.g., the all pathways dose in the original performance assessment is 15 mrem/yr and the all-pathways dose from the special analysis is 16 mrem/yr). Special analyses causing changes to the performance assessment results larger than those discussed above are to be submitted to the Deputy Assistant Secretary for Waste Management (or to the Deputy Assistant Secretary for Environmental Restoration for LLW disposal facilities that are CERCLA sites) after review and approval by the Field Element Manager. The submittal should address whether a change to the disposal authorization statement should be implemented or is required.

(This page intentionally left blank.)

### **3. COMPOSITE ANALYSIS REVIEWS AND REVISION**

Requirements for composite analysis maintenance under DOE M 435.1-1 are the same as those for performance assessment maintenance previously identified in Chapter 2. This chapter describes the composite analysis review and revision process that should be conducted by DOE Field Element Managers to meet these requirements.

As required by DOE M 435.1-1, composite analysis maintenance includes the routine review and revision of the composite analysis. Reviews provide a mechanism for routine assessment of the site plans (e.g., remediation, closure, decommissioning, land-use) developed from the results of the composite analysis. This review process allows potential problems to be identified and managed at an early stage. The revisions ensure that there is cohesive documentation providing a reasonable basis to conclude that DOE requirements for radiological protection of the public and the environment will be met in the future. The composite analysis is a planning tool that allows Field Element Managers to evaluate the cumulative effects of all sources of radioactive materials that may interact with those in the LLW disposal facility. The impact of future activities on the dose to hypothetical future members of the public can be evaluated using the composite analysis, and the results used to develop land-use plans, remediation plans, long-term stewardship documents, etc. The annual review of the composite analysis is used to determine whether actual and planned conditions are consistent with those contained in the composite analysis. Revisions and special analyses provide a mechanism for evaluating conditions not originally included in the composite analysis to determine if they can be accommodated without violating the conclusions of the composite analysis.

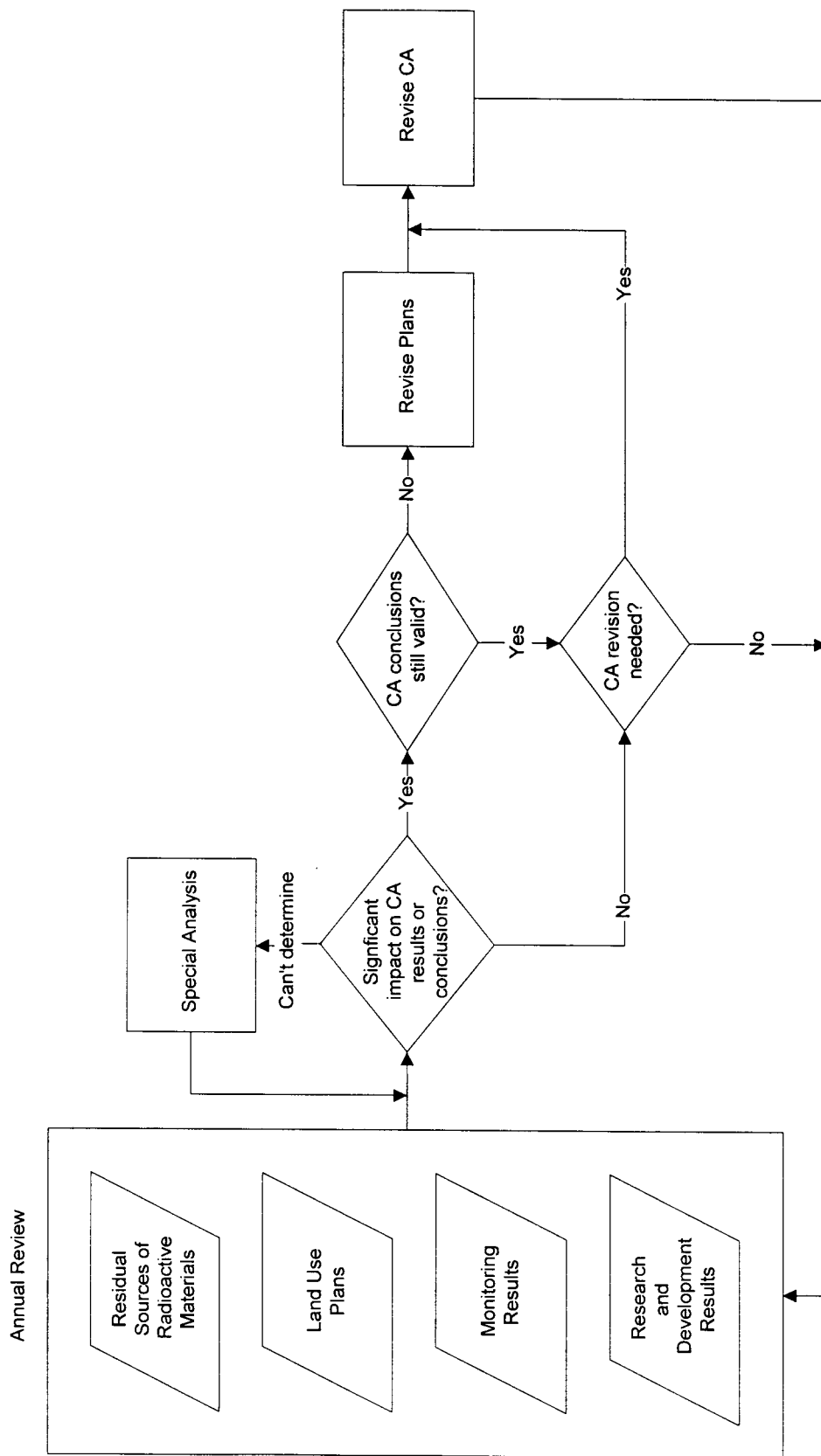
The following sections address annual reviews to be conducted by the Field Element Manager, the annual summary to be submitted to Headquarters, revision of the composite analysis, and special analyses. The process of conducting annual reviews, advising Headquarters through annual summaries, and revising the composite analysis continues as necessary throughout the operational life of the disposal facility and during the institutional control period following closure.

The overall composite analysis review and revision process is shown in Figure 3-1.

#### **3.1 Annual Determinations**

In accordance with DOE M 435.1-1 requirements, the Field Element Manager is responsible for making an annual determination of the continued adequacy of the composite analysis. A frequency other than annual may be specified in the disposal authorization statement, or may be requested by Headquarters. The annual determination is to be documented and retrievable.

The annual determination provides the mechanism by which the Field Element Manager evaluates whether current and planned site activities are consistent with the composite analysis and, therefore, whether the conclusions of the composite analysis remain valid. This allows potential problems to be identified and managed before they affect site operations. Therefore, the review conducted to support the annual determination must be both retrospective and prospective. The



**Figure 3-1. Composite Analysis Review and Revision Process.**

Field Element Manager should review changes to actual or planned activities that have occurred over the last year with respect to the continued adequacy of the composite analysis in representing radiation dose to hypothetical future members of the public. The review should also consider new information that has become available and the significance of this new information with respect to the conclusions of the composite analysis. In some cases, a special analysis may be necessary to determine the significance of changes or new information. Conduct of special analyses is described in Section 3.4.

The *R&D Implementation Plan* (Ref. 9) requires the Field Office Low-Level Waste Program Office to make and document an annual determination of research and development needs related to LLW disposal. This process should be coordinated with the annual determinations required for each composite analysis as part of the maintenance process. The annual determination for each composite analysis should identify research and development needs that have been met during the past year, new needs that have arisen as a result of changes in actual or expected future conditions, and revised research and development priorities.

The result of the review should be documented in a memorandum that indicates the determination was made, the basis for the determination, and any specific actions to be taken as a result of the review. As described below, the review should include consideration of sources of residual radioactive material, land-use, results of monitoring and research and development activities, and other relevant factors.

#### 3.1.1 Sources of Residual Radioactive Material

The sources of residual radioactive material considered in the composite analysis form a key element of the basis for estimating dose to hypothetical future members of the public. The review of sources of residual radioactive material is to be based on a review of site documentation such as CERCLA records of decision (RODs), other CERCLA documents, RCRA documentation, plans for facility closure or decommissioning, plans for new facilities, long-term stewardship documents, etc. The review should consider the following:

- 1) Is each source considered in the composite analysis still valid (i.e., have potential sources been eliminated due to changes in site plans)?
- 2) Has new information become available concerning the radiological, chemical, and/or physical characteristics of the source?
- 3) Have new sources been identified?
- 4) Have new sources been characterized?

The review should be designed to determine whether the sources of residual radioactive material considered in the composite analysis are representative of expected future conditions.

The overall result of the review will be a determination of whether any changes are needed to ensure the continued adequacy of the composite analysis with respect to radionuclide releases from sources of residual radioactive materials other than the active or planned LLW disposal



facility. The review should also identify data gaps and uncertainties associated with sources of residual radioactive materials that should be addressed through research and development.

### 3.1.2 Land Use

Future land use is another key element of the basis for estimating dose to hypothetical future members of the public. The review of land use is to be based on a review of documentation such as land-use plans or planning documents, National Environmental Policy Act (NEPA) documents (e.g., environmental assessments, environmental impact statements), long-term stewardship documents, surveys of land use (past, present, and projected) adjacent to the DOE site, and other relevant documents. The review should focus on determining whether the future land use identified in the composite analysis is representative of the most current land-use plans for the site. The overall result of the review will be a determination of whether any changes are needed to ensure the continued adequacy of the composite analysis with respect to land use assumptions.

### 3.1.3 Monitoring and Research and Development Activities

The review of monitoring and research and development results consists of several activities, including:

- evaluating monitoring results for consistency with composite analysis and conceptual model(s);
- evaluating research and development results to determine impacts on composite analysis results and conclusions;
- determining if better methodologies or technologies are available; and
- evaluating the results of special studies.

The review should be designed to determine if data collected during monitoring or research and development activities indicate that the conceptual model(s) and data used for the composite analysis are still applicable. Additionally, the review should provide information needed by the Field Element Manager to update the status of research and development needs related to LLW disposal safety.

A variety of monitoring efforts may be applicable to the sources considered in the composite analysis. As described in Section 2.1.2, monitoring is required for the LLW disposal facility and the results of the composite analysis must be considered in developing the monitoring plan. Sources of radioactive material that are CERCLA or RCRA sites should have monitoring programs based on applicable requirements under CERCLA or RCRA. Monitoring of other sources, as well as site-wide environmental monitoring, may be required under DOE Order 5400.1, *General Environmental Protection Program*.

Data collected as part of the above monitoring programs should be reviewed to determine whether they are consistent with the conceptual model(s) and data used for the composite analysis. For example, if the composite analysis includes a source that is a CERCLA site that

will undergo future *in-situ* remediation, the composite analysis may be based on the assumed performance of the remediation. Monitoring data collected after completion of the remedial action would then be used to determine the validity of the assumptions used in the composite analysis. Similarly, the composite analysis may be based on assumed future values of residual radioactivity that will remain after facilities are decommissioned. Monitoring performed after decommissioning is completed would be used to determine actual values of residual radioactivity.

When monitoring data are compared to data used in the composite analysis, the significance of the monitoring data to the results of the composite analysis should be assessed. Specifically, the reviewer should evaluate whether the monitoring data indicate that the results of the composite analysis are more or less conservative than expected. In some cases, a special analysis may be needed to assess the significance of the data (see Section 3.4). Monitoring results from the LLW disposal site monitoring program will be discussed in the annual summary for the performance assessment. For composite analysis maintenance, these data should only be reviewed to determine if they have implications with respect to sources other than the LLW disposal facility.

The review of research and development results should include those available from on-site studies, as well as those from studies conducted at other sites. The former should be identified in the Site-Wide Radioactive Waste Management Program required by DOE M 435.1-1, while the latter should be identified in the database to be developed and maintained by the Center (see Section 2.1.2). This database should be reviewed to identify potential sources of research and development results applicable to data needs associated with the composite analysis. These database reviews are to be documented annually by the Field Office Low-Level Waste Program Office.

Once applicable research and development results have been identified using the above sources, they should be reviewed with respect to the data and conceptual model(s) used in the composite analysis. The review should specifically address data gaps and uncertainties identified during preparation and review of the composite analysis. Research and development results that address these data gaps and uncertainties should be evaluated with respect to their impact on the results and conclusions of the composite analysis. This evaluation should address whether the results of the composite analysis are more or less conservative than expected and whether the conclusions of the composite analysis are still valid. In some cases, a special analysis may be required to make these evaluations (see Section 3.4).

In some cases, instead of data, research and development results will consist of improved analytical methods (e.g., computer codes). In these cases, the review should determine whether application of these improved methods to the composite analysis would reduce the uncertainty associated with the results of the analysis. If so, the significance of the reduced uncertainty should be discussed. In some cases, it may be appropriate to conduct a special analysis to quantitatively evaluate impact of the method on composite analysis results.

The review of research and development results should also assess the status of research and development with respect to previously-identified data needs and uncertainties. As described in Section 3.2.3, this information will be used to update the research and development planning and implementation process.

## 3.2 Annual Summaries

DOE M 435.1-1 IV.P.3(c) states that "Annual summaries of low-level waste disposal operations shall be prepared with respect to the conclusions and recommendations of the performance assessment and composite analysis and a determination of the need to revise the performance assessment or composite analysis." To comply with this requirement, the Field Element Manager shall prepare an annual summary for each composite analysis and submit the summary to Headquarters. The annual summary should be prepared by summarizing the information and conclusions from the annual determination for the previous year. The annual summary should include the information described in the following sections.

### 3.2.1. Assessment of Composite Analysis Adequacy

The annual summary report is to provide a summary of the conclusions drawn from the annual determination made by the Field Element Manager for the review period (generally the previous year). The summary should include a discussion or description of relevant factors, if any, that may have challenged or supported the determination of composite analysis adequacy.

The annual summary report should contain a summary statement as to whether the information reviewed as part of the annual determination resulted in any change to the conclusions of the composite analysis (i.e., whether, in light of the new information reviewed, dose to hypothetical future members of the public is expected to be below applicable limits and constraints). This statement should reflect one of four possible scenarios based on the annual review:

- 1) there is no change to the conclusions of the composite analysis;
- 2) the conclusions remain valid but the new information indicates less conservatism in the results than previously believed;
- 3) the conclusions remain valid but the new information indicates more conservatism in the results than previously believed; or
- 4) the conclusions are no longer valid (i.e., doses to hypothetical future members of the public may exceed applicable limits and constraints).

The general basis for the statement concerning changes to the composite analysis conclusions should be presented. The basis may include a summary of supporting data, but should not include a detailed presentation of data.

This section of the annual summary should indicate whether, based on the above information, it will be necessary to revise the composite analysis.

### 3.2.2. Source Terms

The Field Element Manager should include an assessment of the potential sources of radioactive material, other than the LLW disposal facility (the LLW disposal facility will have been addressed in the performance assessment annual summary). The assessment should summarize

the source term information reviewed during the annual determination. The primary purpose of this section of the annual summary is to inform Headquarters of changes to the sources of radioactive materials considered in the composite analysis. These changes could include:

- deletion of sources considered in the composite analysis;
- addition of new sources not considered in the composite analysis;
- changes to existing sources (e.g., completion of remedial activities at source that is CERCLA site); or
- availability of new information that reduces uncertainty in characteristics of existing sources.

The annual summary report should present these changes and describe their significance with respect to the results and conclusions of the composite analysis.

### 3.2.3. Monitoring and Research and Development Results

The monitoring results reviewed as part of the annual determination (see Section 3.1.3) should be identified, summarized, and interpreted. The interpretation should address whether the results indicate that the conceptual model(s) and data used for the composite analysis are still applicable. Any changes to the conceptual model(s) indicated by the monitoring results should be identified and their significance with respect to the results and conclusions of the composite analysis should be discussed. Monitoring results that are significantly different than data used in the composite analysis should also be identified and the significance of the differences discussed.

The annual summary should similarly present a summary of the research and development efforts that were conducted, the research and development results that were evaluated, and an interpretation of the significance of these results. Results that are specifically directed toward the LLW disposal facility will be evaluated in the annual summary for the performance assessment, and should not be addressed in this section. To assist Headquarters with tracking the status of LLW research and development implementation efforts, the research and development that was reviewed should be categorized as follows:

- research and development contained in the Site-Wide Radioactive Waste Management Plan;
- on-site research and development not contained in the Site-Wide Radioactive Waste Management Plan;
- off-site research and development contained in the Center database; or
- other off-site research and development efforts.

The annual summary should contain an evaluation of the significance of the research and development results with respect to the conclusions of the composite analysis. The evaluation

should indicate whether the results indicate a change to the conclusions of the composite analysis, and whether the results indicate more or less conservatism in the composite analysis results.

The summary of results should be presented in such a manner as to facilitate updating the research and development planning process. Specifically, the presentation should allow easy comparison of the results with the data gaps and uncertainties previously identified during preparation and review of the composite analysis. The degree to which identified data gaps and uncertainties have been addressed by research and development activities completed to date should be identified. The annual summary should also provide a summary of the status of on-site research and development efforts associated with the composite analysis. The status should identify those research and development efforts completed during the previous year, those that are ongoing, those that will be started during the next year, revised priorities for research and development, and future efforts that will be included in Project Baseline Summaries to be submitted to Headquarters.

#### 3.2.4. Summary of Changes

This section is to summarize changes affecting the composite analysis that have occurred over the past year. This would include changes to expected future conditions, such as site land-use plans or remediation plans. The annual summary should also describe changes made as a result of special analyses (see section 3.4).

This section should also discuss changes related to monitoring and research and development. Specifically, this discussion should include the status of information needs (e.g., data gaps, uncertainties) identified in the composite analysis and previous annual reviews. The status of information needs should be categorized as follows:

- 1) previously existing information needs that have been satisfied by monitoring and research and development efforts completed during the previous year;
- 2) previously existing information needs that are no longer relevant due to changes in source terms, land use, site plans, or other conditions; or
- 3) new information needs identified as a result of the annual review, including those resulting from changes in site conditions.

#### 3.2.5. Recommended Changes

This section of the annual summary is to advise Headquarters of planned or contemplated changes in relevant site programs that could affect the composite analysis and changes in the composite analysis maintenance program. The subjects should be the same as covered above in Summary of Changes (Section 3.2.4), but should be forward-looking. Implementation of these recommended changes does not require Headquarters approval unless the changes affect areas that are conditions for approval of the composite analysis.

The discussion of recommended changes should include the expected significance of the changes with respect to the composite analysis results and conclusions. If needed to illustrate the impacts of specific changes on composite analysis results, the discussion should reference the results of the composite analysis sensitivity/uncertainty analysis. If significant changes to the results or conclusions are expected, the summary should recommend whether or not the composite analysis should be revised.

This section should also address recommended changes to monitoring and research and development activities associated with the composite analysis. This should include expected changes in information needs and the resulting changes in activities needed to meet information needs. Any recommended changes to monitoring or research and development activities that are conditions of approval of the composite analysis should be highlighted as these will require Headquarters approval.

### **3.3 Composite Analysis Revisions**

DOE M 435.1-1 IV.P.(3)(a) requires revision of the composite analysis when changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or improved understanding of the performance of the waste disposal facility in combination with the features of the site on which it is located alter the conclusions or the conceptual model(s) of the existing composite analysis. The annual determination described in Section 3.1 is designed to identify conditions that would necessitate revision of the composite analysis. The annual summary described in Section 3.2 will identify specific conditions expected to result in changes to the conclusions or conceptual model(s).

A composite analysis revision is to include updated information (e.g., land use plans, results from monitoring and research and development), revised analyses, new models, changes in expected radionuclide inventories, or other items affecting calculation of results. Consistent with the use of a graded approach, the form of the composite analysis revision can range from a simple amendment to the composite analysis to a reissuance of the composite analysis document. If an amendment to the composite analysis is used, there must be a clear interpretation of how the information in the amendment relates to the original composite analysis and what it means relative to the conclusions reached in the composite analysis. In addition to submitting the composite analysis revision to the Deputy Assistant Secretary for Waste Management (or the Deputy Assistant Secretary for Environmental Restoration for LLW disposal facilities that are CERCLA sites), the Field Element Manager is also responsible for ensuring the revision is distributed to other parties, as appropriate. Other appropriate parties include interested stakeholders, and selected Field Office and Headquarters staff.

In determining how best to revise the composite analysis, the Field Element Manager should consider how cohesive and readily understood the composite analysis is or will be following the revision. For example, the revision may involve redoing transport and dose assessment calculations based on new land use data (i.e., a new point of assessment). There would be no change to the conceptual models. In this case, it would be appropriate to prepare an amendment that presents the new data, the results of the revised analysis, and comparison of the new results to the dose limits and constraints. In another case, however, there could be substantial changes to site or facility characteristics that result in significant changes to the conceptual models. In

this case, it would probably be appropriate to revise and reissue the entire composite analysis document. If a full revision of the composite analysis document is made, the annual determination (section 3.1) is not necessary for the year the revision is made.

Upon receipt of a revised composite analysis, Headquarters staff must conduct a review and determine a course of action. Actions resulting from the Headquarters review may range from a memorandum to file acknowledging the receipt and acceptability of the composite analysis revision to the initiation of a more thorough and detailed review. Headquarters staff may request additional information from the Field Element Manager as needed to conduct the review.

### **3.4 Special Analyses and Reviews**

Special analyses are expected to be needed as part of the routine maintenance of the composite analysis. As used here, special analyses are analyses performed to evaluate the significance of new information to the results of the composite analysis, or to supplement or amend the analyses performed in the original composite analysis. A special analysis is not the same as revision to the composite analysis, but the results of the special analysis may be used to determine whether a composite analysis revision is needed. As described below, a number of different factors may prompt a special analysis.

As part of the annual review, the Field Element Manager may identify a concern or potential problem that should be evaluated. Resolution of the concern may require the acquisition of data through monitoring or research and development, or the use of existing data in a special analysis. Additionally, the composite analysis preparer may determine the need for special analyses due to errors found in the prior analyses. New information that is likely to change the results of the composite analysis, such as potential new sources of residual radioactive material or potential changes in land-use plans will generally require special analyses to quantify the changes in results. Also, ongoing research and development may yield results that warrant quantitative evaluation to determine their significance to the conclusions of the composite analysis.

From the perspective of site-wide planning, special analyses may be necessary to evaluate whether certain actions or changes can be made. This guidance cannot anticipate all of the changes that a site might consider, but the following indicate the types of changes that could necessitate a special analysis:

- change in disposition of a potential source (e.g., *in-situ* rather than *ex-situ* remediation of a CERCLA site);
- addition of sources not analyzed in the composite analysis;
- deletion of sources analyzed in the composite analysis (e.g., as a result of programmatic changes); and
- changes in land-use plans.

It should be noted that the above factors are included in the information reviewed as part of the annual determination described in Section 3.1. The need for a special analysis is not derived

from the specific type of change identified, but rather from whether it is possible to assess the significance of the change with respect to the results of the composite analysis.

The purpose of conducting special analyses can be thought of as similar to the process for resolving unreviewed safety questions described in Order DOE 5480.21, *Unresolved Safety Questions*. The intent of the process is to provide flexibility in site-wide planning and to require those issues with a significant impact on the conclusions of the composite analysis, and therefore the projected compliance with radiological protection requirements, to be brought to the proper level for attention.

The composite analysis is an important element of the authorization basis to operate a DOE disposal facility. The composite analysis identifies those aspects of the site that are important to long-term performance and therefore those aspects that DOE relies upon to allow initial and continued operations. Any change that could directly or indirectly affect the facility authorization basis, and therefore its performance, should be analyzed to determine the significance of their affect on the analyzed performance.

Special analyses evaluating proposed changes in the composite analysis bases (e.g., sources of radioactive material, land-use plans) or those analyzing new information with the potential to affect the conclusions of the composite analysis should be reviewed and approved by the Field Element Manager. If the special analysis indicates that the doses to future hypothetical members of the public would exceed dose limits or constraints, appropriate action must be taken. That action may be as simple as not implementing a proposed change. Depending on the reason for initiating the analysis, the appropriate action may be further analysis, collection of additional data, and/or corrective actions. Headquarters should be notified unless the action pertains to a change that is considered, but not implemented.

The decision on approval of a special analysis and the actions it implies depends on the significance of the results. A rule-of-thumb is that if the results in the original composite analysis and the results in the special analyses are small relative to the dose limit and constraint, then the Field Office need only document its review and approval. The Field Office should summarize or reference the approval of these special analyses in the annual review documentation and the annual summary to Headquarters. As used here, about 10% is considered to be small relative to the dose limit and constraint (e.g., the results of the all-pathways dose in the original composite analysis and special analysis are both less than 3 mrem/yr). The Field Office should also adopt a similar process for special analyses when the results of the special analyses are not small relative to the dose limit and constraint, but the change in dose is relatively insignificant. Again, as a rule-of-thumb, changes less than a 10% increase in the dose in the original composite analysis are considered insignificant (e.g., the all pathways dose in the original composite analysis is 24 mrem/yr and the all-pathways dose from the special analysis is 25 mrem/yr). Special analyses causing changes to the composite analysis results larger than those discussed above are to be submitted to the Deputy Assistant Secretary for Waste Management (or Deputy Assistant Secretary for Environmental Restoration for LLW disposal facilities that are CERCLA sites) after review and approval by the Field Element Manager.



#### 4. REFERENCES

1. U.S. Department of Energy, *Radioactive Waste Management*, DOE Order 435.1, July 9, 1999.
2. U.S. Department of Energy, *Radioactive Waste Management Manual*, DOE M 435.1-1, July 9, 1999.
3. U.S. Department of Energy, *Format and Content Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses*, (in preparation).
4. U.S. Department of Energy, *Format and Content Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Closure Plans*, (in preparation).
5. U.S. Department of Energy, *Implementation Guide for use with DOE M 435.1-1*, DOE G 435.1-1, July 9, 1999.
6. U.S. Department of Energy, *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses*, January 9, 1998.
7. U.S. Department of Energy, *Maintenance of U.S. Department of Energy Low-Level Waste Performance Assessments*, September, 1996.
8. U.S. Department of Energy, *Complex-Wide Strategy for Maintenance of Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analyses*, September 30, 1998.
9. U.S. Department of Energy, *Low-Level Waste Management Program Research and Development Implementation Plan*, April 1999.

(This page intentionally left blank.)