DOE/NV/11718--491-Rev. 1

Maintenance Plan for the Performance Assessments and Composite Analyses for the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada Test Site

Prepared by

Bechtel Nevada

Prepared for

U.S. Department of Energy
National Nuclear Security Administration
Nevada Operations Office
under Contract Number
DE-AC08-96NV11718

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DISCLAIMER NOTICE

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ACRONYMS and ABBREVIATIONS

BN	Bechtel Nevada
CA	Composite Analysis
CADD	Corrective Action Decision Document
CAU	Corrective Action Unit
CFR	Code of Federal Regulations
DAS	Disposal Authorization Statement
DOE	U.S. Department of Energy
DOE/HQ	U.S. Department of Energy Headquarters
EIS	Environmental Impact Statement
ER	Environmental Restoration
FFACO	Federal Facilities Agreement and Consent Order
FY	fiscal year
GCD	Greater Confinement Disposal
ICMP	Integrated Closure and Monitoring Plan
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LLW	low-level radioactive waste
MOP	member of the public
NNSA/NV	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
PA	Performance Assessment
R&D	Research and Development
RWAP	Radioactive Waste Acceptance Program
RWMS	Radioactive Waste Management Site
UGTA	Underground Test Area

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EXECUTIVE SUMMARY

U.S. Department of Energy (DOE) Order 435.1 requires that performance assessments (PAs) and composite analyses (CAs) for low-level waste (LLW) disposal facilities be maintained by the field offices. This plan describes the activities to be performed in maintaining the PA and the CA for the Area 3 and Area 5 Radioactive Waste Management Sites (RWMSs) at the Nevada Test Site (NTS). The plan is based on DOE Order 435.1 (DOE, 1999a) and Manual (M) 435.1-1 (DOE, 1999b), Implementation Guide (DOE, 1999c), and Maintenance Guide (DOE, 1999d).

Potential changes in conditions in disposal operations and site features, and new information gained through monitoring and research activities, may invalidate the conclusions of the PAs and CAs, upon which are based the conditions for the continuing operation of a LLW facility, as specified in the facility's Disposal Authorization Statement (DAS). The goal of the maintenance program is to assure that the conclusions of the PAs and CAs remain current and commensurate with the changes occurring, and protective of future health and safety of the people and the environment. The maintenance process is an iterative one in which changing conditions may result in revision of the PA and CA; the revised PA and CA may impose a different set of conditions for facility operation, closure, and post-closure.

The maintenance process includes managing uncertainty, performing annual reviews, submitting annual summary reports to DOE Headquarters (DOE/HQ), carrying out special analyses, and revising the PAs and CAs, if necessary. Management of uncertainty is an essential component of the maintenance program because the results of the original PAs and CAs are understood to be based on uncertain assumptions about the conceptual models; the mathematical models and parameters; and the future state of the lands, disposal facilities, and human activities. The annual reviews for the PAs include consideration of waste receipts, facility-specific factors, results of monitoring, and results of research and development (R&D) activities. Likewise, results of ongoing R&D, changes in land-use planning, new information on known sources of residual radioactive materials, and identification of new sources may warrant an evaluation to determine the impacts on the conclusions of the CA.

The following PA and CA maintenance program activities are included in the National Nuclear Security Administration Nevada Operations Office's (NNSA/NV's) Low-Level Waste Life Cycle Baseline (Bechtel Nevada [BN], 2002a):

- Development of assessment/decision tools
- Annual reviews
- Annual summary reporting
- PA/CA revisions
- Special studies
- Support to the NTS Radioactive Waste Acceptance Program (RWAP)

- The maintenance plan revision
- Task supervision

The maintenance process continues as necessary throughout the operational life of each RWMS. The development of the assessment/decision analytic tools, which is a continuous improvement process, is scheduled annually. The reviews and the preparation of summary reports are annual activities. The first annual summary report for the Area 3 RWMS (including the results of the 2001 annual review) was submitted to DOE/HQ in March 2002 (BN, 2002b). The annual summary report for the Area 5 RWMS for the 2001 review has been deferred to fiscal year (FY) 2003. The NNSA/NV decided that starting next FY, a single annual summary report will be issued covering the reviews of both the Area 3 and Area 5 RWMSs. The first such combined report is scheduled for submittal to the DOE/HQ at the end of January 2003. No annual reviews or summary reports will take place in years the PA or CA revisions take place.

Whether a PA or CA revision is necessary is a decision NNSA/NV has to make based on the results of reviews and special studies. A report revision includes a cycle of DOE/HQ review and approval. A revision may also lead to revision of the DAS because facility operational parameters would have changed. At the time a disposal facility is to be closed, a final PA and CA will be prepared and submitted to DOE/HQ for approval, together with the final monitoring and closure plans. During post-closure, PA and CA revisions may continue to be made if monitoring results indicate that additional analyses are warranted.

This plan does not include any scheduled PA revisions. However, CA revisions are scheduled because the requirement for CA revisions has been specified in the respective DASs for each of the facilities. The first scheduled Area 5 CA revision will incorporate the results of the Frenchman Flat Corrective Action Unit (CAU) Corrective Action Decision Document (CADD) currently scheduled for completion in FY 2009. Therefore, revision of the Area 5 CA is scheduled for FY 2010. The revised Area 3 CA will incorporate the results from the Yucca Flat CAU CADD currently scheduled for completion in FY 2020. A revision of the Area 3 RWMS CA is scheduled for FY 2021.

Special studies, including all modeling and evaluations that directly or indirectly impact the results of the PAs and CAs, are scheduled annually. NNSA/NV is continuing to develop dynamic probabilistic models of the performance assessment of the Area 3 and Area 5 facilities with the model for the latter facility scheduled for completion in FY 2003. These models will serve to quantify uncertainty and uncertainty reduction, and can be efficiently used to assess the impact of new monitoring data, and the importance of reviews and special studies. NNSA/NV will use the results of probabilistic PA/CA models as a decision tool for evaluating required decision objectives while managing their disposal facilities and to assess the need for and facilitate the completion of PA and CA revisions.

The support of the NTS RWAP, including the NTS Waste Acceptance Criteria, will be an ongoing activity during the operational life of each facility. The maintenance plan will be revised every other year to include the changes in activities and schedules. Task supervision, scheduled annually, includes continuous technical and administrative activities pertaining to the maintenance program execution.

1.0 INTRODUCTION

1.1 Purpose and Scope

U.S. Department of Energy (DOE) Order 435.1 requires that performance assessments (PAs) and composite analyses (CAs) for low-level waste (LLW) disposal facilities be maintained by the field offices. This plan describes the activities to be performed in maintaining the *Performance Assessment (PA) and Composite Analysis (CA) for the Area 3 and Area 5 Radioactive Waste Management Sites (RWMSs) at the Nevada Test Site (NTS)* (refer to Figure 1). The plan is based on DOE Order 435.1 (DOE, 1999a) and Manual (DOE M 435.1-1) (DOE, 1999b), Implementation Guide (DOE, 1999c), and Maintenance Guide (DOE, 1999d). It is noted that the DOE's National Nuclear Security Administration Nevada Operations Office (NNSA/NV) issued the Radioactive Waste Management Manual (NV M 435.1-1) on August 29, 2000, to implement the requirements of DOE Order 435.1 and DOE M 435.1-1.

The Disposal Authorization Statement (DAS) for the continuing operations of a LLW facility at the DOE complex specifies the conditions for operations based on approval of a PA and CA, and requires the facility to implement a maintenance program to assure that these conditions will remain protective of the public health and the environment in the future. The goal of the maintenance program is to provide that assurance. The maintenance process is an iterative one in which changing conditions may result in a revision of PA and CA; the revised PA and CA may impose a different set of conditions for facility operation, closure, and postclosure.

The maintenance process includes managing uncertainty, performing annual reviews, submitting annual summary reports to DOE Headquarters (DOE/HQ), carrying out special analyses, and revising the PAs and CAs, if necessary. Management of uncertainty is an essential component of the maintenance program because results of the original PAs and CAs are understood to be based on uncertain assumptions about the conceptual models; the mathematical models and parameters; and the future state of the lands, disposal facilities, and human activities. The annual reviews for the PAs include consideration of waste receipts, facility specific factors, results of monitoring, and results of research and development (R&D) activities.

Likewise, results of ongoing R&D, changes in land-use planning, new information on known sources of residual radioactive materials, and identification of new sources may warrant an evaluation to determine the impacts on the conclusions of the CAs.

1.2 Background

A PA was conducted for the Area 5 RWMS (Shott *et al*., 1995) and submitted to DOE/HQ for review in July 1995. After its review by the DOE PA Peer Review Panel, the Area 5 RWMS PA was accepted with conditions (DOE, 1996a). Subsequently, the document was revised, incorporating changes as directed by the reviewers, and published (Shott *et al*., 1998). A CA for the Area 5 RWMS was completed in February 2000 (BN, 2000). The DOE Low-Level Waste Disposal Facility Federal Review Group (LFRG) reviewed both the CA and the revised PA

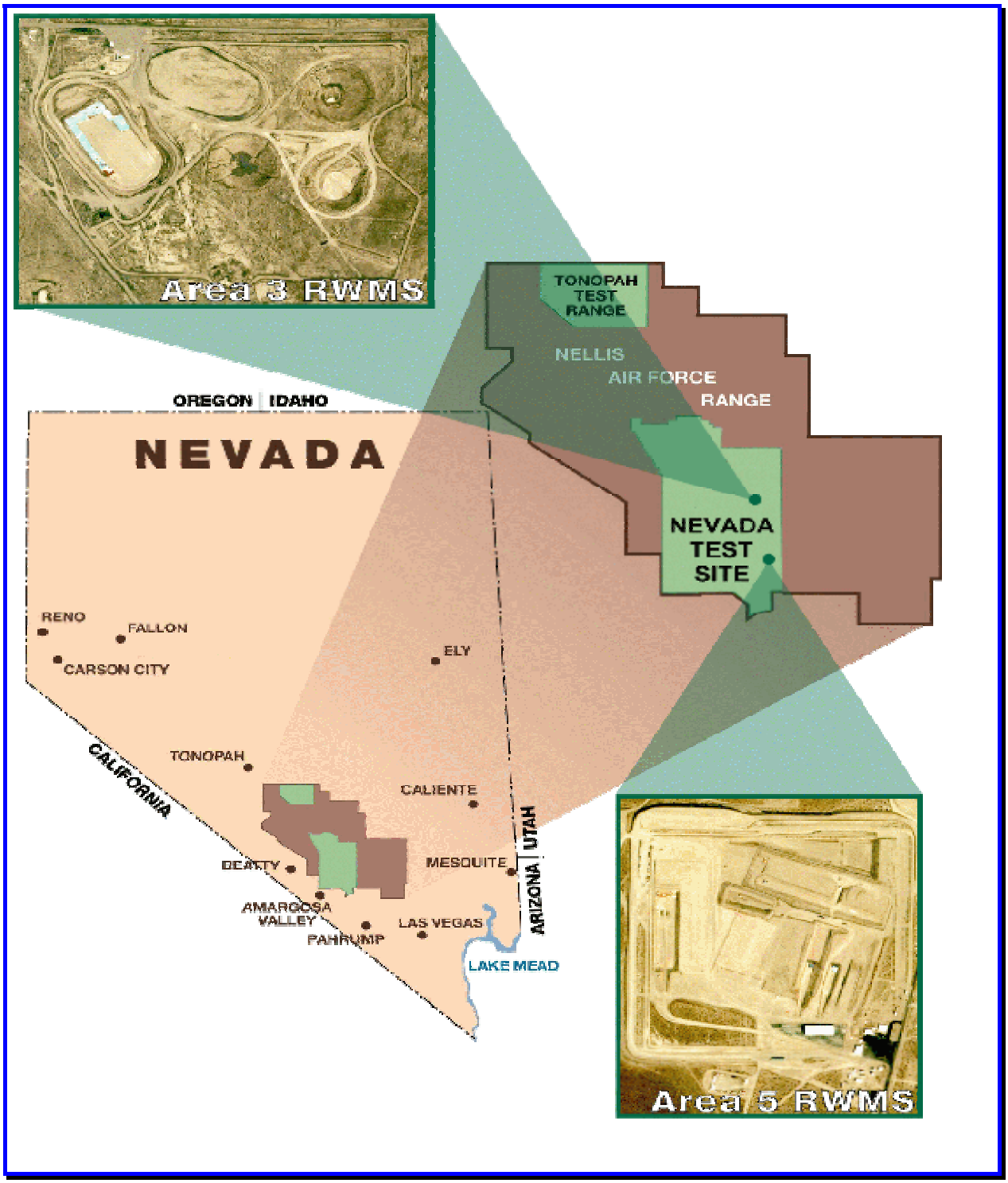

Figure 1 **Location map of the Area 3 and Area 5 Radioactive Waste Management Sites**

document in fiscal year (FY) 2000. Upon the LFRG's recommendation, DOE/HQ issued a conditional DAS for the Area 5 RWMS on December 5, 2000, and required that the specified conditions be addressed within one year of the DAS's issuance. To resolve these conditions, NNSA/NV submitted to the DOE/HQ in November 2001 two addendum reports (one for the PA and one for the CA) (BN, 2001 a,b). Both reports were approved in May 2002, with conditions met and issues closed. Other conditions remain in the DAS, including minor issues that are to be addressed as part of the PA maintenance, and the condition that NNSA/NV will incorporate in a future revision of the CA the dose from the Underground Test Areas (UGTAs) within Frenchman Flat.

A combined PA and CA document was prepared in 1997 for the Area 3 RWMS (Shott *et al*., 1997). The LFRG conducted a review of the document and recommended formal authorization for disposal operations with conditions. Following LFRG's recommendation, DOE/HQ issued the DAS for the Area 3 RWMS on October 20, 1999. The DAS for the Area 3 RWMS identified six secondary PA issues, one primary and one secondary CA issues, and requested that NNSA/NV resolve these specified issues and revise the PA and CA accordingly. The revised PA and CA document was submitted to DOE/HQ for review in FY 2001. On July 25, 2001, DOE/HQ informed NNSA/NV that while some conditions had been resolved, others remained; and that NNSA/NV provide appropriate documentation to close these outstanding conditions. In January 2002, NNSA/NV provided the DOE/HQ with a letter report addressing these outstanding conditions. In August 2002, DOE/HQ informed NNSA/NV that all unclosed DAS conditions have been closed, except that two topics should be addressed as part of the Maintenance Program. The Area 3 DAS calls for a future revision of the CA to incorporate the dose from the UGTAs within Yucca Flat.

A PA for the transuranic waste emplaced in four greater confinement disposal (GCD) boreholes at the Area 5 RWMS was prepared by Sandia National Laboratories (Cochran *et al*., 2000) to demonstrate consistency with the requirements of Title 40 Code of Federal Regulations (CFR) Part 191. The GCD PA was reviewed by the LFRG in FY 2001, and conditionally accepted. NNSA/NV will not revise the GCD PA. Any required changes in the GCD PA will be implemented through the maintenance program for the Area 5 RWMS, including annual summary reports and PA revisions.

1.2.1 Tracking of Minor Issues

As stated in the DASs, NNSA/NV will address all minor or secondary issues identified in the LFRG Review Reports for the Area 3 and Area 5 RWMS PAs and CAs as part of the maintenance program. The implementation of this plan will assure that these minor issues are addressed. Table 1 lists the issues that will be tracked and resolved through the maintenance program. The resolution pathway for each issue is included in the third column of *Table 1*.

1.3 Organization

Section 2.0 of this document presents the elements of the PA and CA Maintenance Plan for the Area 3 and Area 5 RWMSs at the NTS: the development of the maintenance tools, the annual

Table 1 Minor Issues

Identified Issue	Source Document for Issue	Resolution Pathway
The assurance requirements of EPA Title 40 CFR 191 must be met for the GCD boreholes.	GCD PA	The assurance requirements will be met at the time of closure of the Area 5 RWMS, as stated in the *Integrated Closure and Monitoring Plan for the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada Test Site* (ICMP) (BN, 2001d)
Inconsistencies between conceptual models for the Area 5 RWMS PA and CA, the Area 3 RWMS PA and CA, and the GCD PA	Area 5 RWMS PA; Area 3 RWMS PA/CA; GCD PA	The development of probabilistic performance assessment models using the GoldSim software system will integrate past performance assessments and eliminate inconsistencies and conceptual models. This work will be described in annual summary reports and in a probabilistic modeling report that will be submitted to the LFRG in January 2001.
Conduct site monitoring and site characterization studies as required to increase confidence in the results of the PAs.	Area 3 RWMS PA/CA	Monitoring programs at both Area 3 and Area 5 RWMSs are ongoing; data will be incorporated through Bayesian updating in the probabilistic models and combined with value of information studies; impact on the uncertainty and confidence in results will be presented in annual summary reports.
The maintenance program must include periodic assessment of changes to potentially interacting sources (UGTA, industrial sites) and impacts on the CAs	Area 5 RWMS CA; Area 3 RWMS PA/CA	Changes in potentially interacting sources will be evaluated through the maintenance and results presented in the annual summary reports.
The maintenance program must include periodic assessment of changes to land use restrictions and impacts on the CAs.	Area 5 RWMS CA; Area 3 RWMS PA/CA	Changes in land use restrictions will be reviewed through the maintenance program and results presented in the annual summary reports.
Monitoring systems need to be deployed and data gathered and evaluated to distinguish between interacting sources at the Area 3 RWMS.	Area 3 RWMS PA/CA	The monitoring systems deployed at the disposal facilities are described in the ICMP (BN, 2001d); monitoring results will be evaluated and presented in the annual summary reports.

reviews and summaries, special analyses, and revisions. Planned activities and schedules are provided in Section 3.0.

A discussion of the modeling effort currently underway towards an integrated assessment modeling and decision analysis framework is provided in Section 2.1. The annual reviews and summaries for the PA and CA including the discussions of the waste receipts, facility-specific factors, residual sources of radioactive materials at the NTS, land-use plans, and monitoring and R&D results are given in Section 2.2. Section 2.3 discusses the special studies; and Section 2.4, the revisions.

2.0 MAINTENANCE PROGRAM

All PAs and CAs have uncertainty in their analytical and numerical models, in their model assumptions, in their input parameters used in the models, and in the conceptual model assumptions and scenarios that underlie and support the models. The impact of uncertainty on the conclusions of the PA/CAs must be evaluated systematically over a 1,000-year compliance interval. These issues are assessed through bounding calculations in a PA/CA compliance evaluation leading to the issuance of a DAS for individual sites. Uncertainty in a disposal system should be quantified and examined during the PA and CA maintenance studies to aid the NNSA/NV in the efficient management of disposal facilities. Verification of the conclusions of a PA/CA can be viewed as a two-step process. The first requires demonstrating with reasonable expectation the compliance or safety of a disposal site with respect to the performance objectives. The second is an effort to quantify and reduce uncertainty, and use knowledge of uncertainty in decisions concerning management of the disposal facility.

The Area 5 and Area 3 RWMSs continue to receive and dispose LLW from cleanup activities on the NTS and from off-site generators across the DOE complex. The NTS LLW disposal sites are designated by DOE/HQ as a regional disposal center along with the Hanford site in Washington State (*Federal Register,* February 25, 2000) and serve the DOE complex through evaluation and acceptance when possible as the disposal option for higher-specific-activity LLW.

The impact of uncertainty on the conclusions of PA/CAs for the NTS facilities must be evaluated systematically during the post-compliance PA maintenance period to aid the NNSA/NV in the efficient management of their continuing disposal operations. Additionally, quantification of uncertainty provides information that can be used for more effective management of monitoring and closure programs.

Verification of the long-term safety of the Nevada LLW disposal sites is accomplished through the two-step process described above. The PA maintenance program includes the following groups of activities that are discussed in this section:

- Developing assessment and decision analyses tools,
- Performing annual reviews and developing annual summary reports,
- Performing special analyses, and
- Revising the PA and CA documents.

Quantifying uncertainty and assessing the potential for uncertainty reduction is the context for the above activities. The maintenance activities continue throughout the operational life of the disposal facility, as well as during the institutional control period. A schedule for these activities is provided in Section 3.0.

2.1 Development of Assessment and Decision Analyses Tools

The NNSA/NV initiated the conversion and integration of the approved Area 3 and Area 5 RWMSs PA and CA models into a probabilistic, dynamic modeling platform to increase programmatic efficiency, better assess uncertainty of the disposal systems, and facilitate

decisions concerned with the long-term operation and closure of the disposal sites. GoldSim probabilistic simulation software was selected for this purpose because it provides the required capability (Golder Associates, 2001). The primary strengths of GoldSim include the following:

- It was designed from inception as a fully probabilistic computer code,
- It is highly versatile for PA applications,
- The program contains modules designed for probabilistic modeling of the multiple components of a waste disposal system,
- The GoldSim computer code has been used for multiple national and international PA studies (it is used for the total system PA studies of underground disposal of high-level radioactive waste by the Yucca Mountain Project [DOE, 2001]), and
- The computer code has been verified and documented (McGrath and Beckham, 2001).

The current GoldSim modeling is focused on benchmark comparison of the results of the approved deterministic (Area 5 RWMS PA models) and newly developed probabilistic models (Area 3 RWMS PA and CA and Area 5 RWMS CA models). The following summarizes the process:

- Incorporate the existing PA structure in the probabilistic model and input fixed-point (deterministic) parameters into the GoldSim probabilistic computer program.
- Benchmark the GoldSim model results against the results of the approved PAs using the PA performance objectives as the main basis for comparison. Document and compare model outputs at a sufficient level of detail to allow a reviewer to readily compare the model results and assess model equivalency.
- Retain the model framework and systematically convert deterministic parameter inputs for the PA model into probability distributions.
- Re-run the GoldSim model with probability distributions for input parameters. Compare the revised results with the deterministic data runs to calibrate differences in output between the probabilistic and deterministic data sets.
- Conduct sensitivity analysis of the model output from the revised probabilistic computer output to identify the input parameters that most significantly impact the output results. Use the results of sensitivity analysis to assess the value of revising the model structure, gathering additional information, or refining parameter distributions, or both. Uncertainty and sensitivity analyses should be performed in tandem to assess uncertainty components that can be attributed to input parameters and to target future data collection on the most sensitive parameters.
- Use monitoring or characterization data, or both, to revise the input probability distributions in the GoldSim model using the new information. Continue iterative cycles of data assessment, model revision, and model runs to attempt to reduce uncertainty. The iterative cycles should not be open-ended. Completion of modeling efforts should be guided by the value of information studies using programmatic decision objectives established for the Area 3 and Area 5 RWMSs.

The Area 5 RWMS was selected for the initial transition to a fully probabilistic model because of higher yearly disposal volumes, higher activity waste, and greater expansion capability compared to the Area 3 RWMS. The PA and CA for the Area 3 RWMS will be transitioned to a probabilistic model after completion of the Area 5 RWMS model. The structural framework of the Area 5 RWMS PA and CA was implemented initially in the GoldSim code and the code was run deterministically. Resulting model output closely matched the results of the Area 5 RWMS PA and CA and provides benchmark verification of the GoldSim model.

After completion of benchmarking, a fully probabilistic GoldSim model was developed for the Area 5 RWMS PA and CA. The revised probabilistic model focused initially on three topics. The first is reduction in the conservatism of the original PA and CA. Conservative deterministic input parameters in the PA models were translated to probability density functions that better represent the information state and uncertainty of the parameters. Conservative bounding assumptions in the model were replaced wherever possible with probability density functions. For example, the rate of upward liquid advection was bounded by assumption in the Area 5 RWMS PA. It was converted to a beta distribution in the probabilistic model using abstracted modeling results from soil physics calculations, numerical models of water balance through time that incorporate climate change, and the results of stable isotopic studies. The inadvertent human intrusion was assumed to occur in the Area 5 RWMS PA (probability of 1). It was treated as a probability density function in the revised probabilistic model using the results of a subject matter expert elicitation (Black *et al*., 2001).

The second topic is examination of the technical justifications and model translations for model components shown to be significant in sensitivity analysis completed for the original Area 5 RWMS PA and CA. The Area 5 RWMS PA showed through sensitivity analysis that biotic processes (plant-root uptake and mammal and insect burrowing), inventory, and radon flux were highly sensitive parameters. A revised biotic-uptake model was developed and the results of this model were abstracted into the probabilistic model. Rates of upward liquid advection were re-examined and a revised beta distribution was developed for the probabilistic model. Inventory amounts for all radionuclides are treated as probability density functions in the revised probability model. Inventory updates to calendar year 2000 are now available. The inventory was not updated in the probabilistic model to preserve continuity with the previous model. The inventory will be updated in the next iteration of the probabilistic model.

Finally, a technical concern for the Area 5 and Area 3 RWMSs PA and CAs is consistency between models including model assumptions and parameter data used in the models. Multiple iterative changes in the successive facility PA and CA models were upgraded to the most recent state of knowledge in the probabilistic model. For example, the dose model in the probabilistic PA model was updated to the model parameters and model structure used in the Area 3 RWMS PA and CA. Model and parameter data for upward advection used in the Area 3 PA/CA and the GCD PA are now implemented consistently in the probabilistic model. The source-term model was not changed for the revised probabilistic model. For future model iterations, depending on results of sensitivity analysis, the probabilistic model will incorporate parameter and model structure for container degradation, source-term release by radionuclide, and full solubility limits.

The final stage of completion of the probabilistic model is implementation of a decision analysis structure and application of multiple approaches to sensitivity analysis using simulation results from the probabilistic model. The decision model incorporates multiple management options for institutional control, revision of waste concentration limits, closure, monitoring, and cost-benefit analysis.

2.2 Annual Review and Summary Report

The objectives of annual reviews can be summarized as the following:

- Confirmation of existing controls being effective in ensuring that PA and CA conclusions are valid;
- Consideration of expected future events in terms of their significance to disposal operations and the adequacy of the PA and CA;
- Review of new information and determining the significance of this new information to the PA and CA through special analysis, if found necessary; and
- Identification of R&D 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 R&D priorities.

The result of the review will be documented in a summary report that will include conclusions drawn from the review and discussions of relevant factors supporting the determination of the PA and CA adequacy and any specific actions recommended to be taken as a result of the review. A single report will be prepared, combining the PA and CA reviews for both the Area 3 and the Area 5 RWMSs, and submitted to DOE/HQ. No annual review or summary reporting will be carried out in years that a PA or CA revision is undertaken.

2.2.1 Waste Receipts

The review of waste receipts consists of several activities:

- Updating closure 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;
- Verifying or modifying waste projections based on best available data;
- Determining consistency of new waste forms with the Nevada Test Site Waste Acceptance Criteria (NTSWAC) (DOE, 2002); and
- Evaluating radionuclides existing in the waste not evaluated in the PAs.

During FY 2001, waste receipts through FY 2000 were reviewed and the closure inventory estimates used in the PAs were updated. This process will continue on an annual basis to determine whether the continued adequacy of the PA could be assured while the closure

inventory estimates change. Such inventory changes may also lead to revision of the waste concentration limits for future disposals at the Area 3 and Area 5 disposal facilities.

2.2.2 Facility-Specific Factors

The facility-specific factors that will be considered in the annual reviews are summarized in Table 2. Any changes in these operational and design factors will be evaluated as to their impacts on the performance assessment adequacy.

Table 2 Facility-Specific Factors

Category	Subject	Factors
Operations	Disposal Geometry	• depth of trench • depth of waste profile • thickness of backfill/cover
	Waste Form and Packaging	• special waste forms • containers
	Waste Acceptance Criteria	• radionuclide limits • reporting of PA-significant radionuclides • waste form and packaging requirements
	Procedures and Systems	• verification of waste characteristics (e.g., the radionuclide content)
Facility/Closure Design	Disposal Technology	• technologies being used or planned vs those analyzed in the PA
	Engineered Barriers	• engineered barriers employed vs those analyzed in the PA • closure cover design consistent with PA assumption • threats to cover integrity and viability
	Other Design Features	• provisions for performance monitoring
	Structural Stability	• operational controls to enhance stability being employed • unexpected subsidence
	Further Land Use	• assumptions and analyses in the PA consistent with future site use plans.

2.2.3 Sources of Residual Radioactive Material

The dose received in the future by a member of the public (MOP) from exposure to contaminated sites at the NTS will depend on future land-use policies, remediation, and closure activities. All environmental restoration (ER) activities at the NTS (remediation and closure of historically contaminated sites) are the sources of residual radioactive materials considered in the CAs for the Area 3 and Area 5 RWMSs. Remediation of ER sites at the NTS takes place under the Federal Facilities Agreement and Consent Order (FFACO) between the DOE, the state of Nevada, and the U.S. Department of Defense (FFACO, 1996). The FFACO defines a Resource Conservation and Recovery Act-like process for remediation and closure of these sites and requires state of Nevada review and approval of all corrective actions. The results of the restoration activities associated with the ER sites (including UGTA, Industrial, and Soil Sites) need to be reviewed annually and incorporated into the CA.

The review will consider the following:

- Is each source considered in the CA still valid (i.e., have potential sources been eliminated because of changes in site plans)?
- Has new information become available concerning the radiological, chemical, and physical characteristics of the source?
- Have new sources been identified and characterized?

The overall result of the review will be a determination of whether any changes are needed to ensure the continued adequacy of the CAs with respect to radionuclide releases from sources of residual radioactive materials other than the RWMSs. The review will also identify data gaps and uncertainties associated with sources of residual radioactive material that should be addressed through R&D.

2.2.4 Land-Use Plans

Future land use is another key element of the basis for estimating dose to a hypothetical future MOP, and changes in land use must be considered in annual determinations of the CA adequacy (DOE, 1999d). 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 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 overall result of the review will be a determination of whether any changes are needed to ensure the continued adequacy of the CA with respect to land-use assumptions.

The current and future land-use planning for the NTS is described in the *Final Environmental Impact Statement for the Nevada Test Site and Offsite Locations in the State of Nevada* [EIS] (DOE, 1996b). The EIS is implemented through the Nevada Test Site Resource Management Plan (DOE, 1998).

2.2.5 Monitoring and Research and Development

Results of both on-site and off-site R&D activities will be reviewed as part of the maintenance process. The Maintenance Guide (DOE, 1999d) refers to a variety of data collection activities as R&D activities, in addition to traditional R&D activities. Off-site R&D activities include those at the other DOE sites, the National Laboratories, the Desert Research Institute, and academic institutions.

The review of monitoring and R&D results consists of the following activities:

- Comparing facility monitoring results to expected performance and determining consistency with conceptual model(s);
- Using monitoring results to assess parameter uncertainty and changes in the PA releases;
- Evaluating R&D results to determine impacts on PA 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 will determine if data collected during monitoring or R&D activities support the disposal facility performance postulated in the PA, and will determine if the conceptual models are still reasonable representations of the disposal facility. The review will also allow NNSA/NV to identify data needs and uncertainties and update the status of R&D needs accordingly.

The results of the monitoring activities identified in the monitoring plan for the Area 3 and Area 5 RWMSs, as well as the results of NTS-wide routine environmental monitoring and surveillance activities, will also be reviewed. Routine radiological environmental monitoring and environmental surveillance on and off the NTS are described in the *Routine Radiological Environmental Monitoring Plan* (BN, 1998), which integrates all previous monitoring efforts at the NTS, and addresses compliance with DOE Orders 5400.1 and 5400.5, applicable federal and state regulations, and stakeholder issues.

2.3 Special Analyses

Special analyses are performed to evaluate the significance of new information to the results of the PAs and CAs, or to supplement or amend the analyses performed in the original PAs and CAs. The results of the special analysis may be used to determine whether a PA or CA revision is needed. The following operational and natural changes at the disposal sites at the NTS may necessitate a special analysis:

- Disposal of radionuclides not analyzed in the PA;
- Disposal of waste streams not analyzed in the PA;
- Changes in waste forms that could increase release rates for critical radionuclides;
- Wastes that exceed the concentrations of significant radionuclides analyzed in the PA;
- Wastes that cause the site to exceed the total inventory of significant radionuclides analyzed in the PA;

- Changes in the disposal facility design or operations from those described in the PA;
- changes in the physical setting (changes due to climate change or catastrophic events and changes in plants or animal species [or both]);
- Changes in the compliance period, the time of closures, the institutional control period from those described in the PA and CA; and
- Changes in future land-use and human activities from those described in the CA.

The special studies will be performed using the GoldSim assessment and decision models for the disposal facilities. The type of analyses to be performed will include the following:

- Evaluating the uncertainty in the estimated performance of the disposal sites for the multiple performance objectives of DOE Order 435.1,
- Assessing reduction in model conservatism and the resulting reduction in uncertainty in the PAs and CAs,
- The programmatic benefits of uncertainty reduction for the decision objectives of the disposal sites,
- Testing and verifying the conceptual models of the geohydrological setting of the disposal systems (including testing of alternative conceptual models which are consistent with site characterization data),
- Iteratively assessing the impacts of data gathered from site monitoring and additional site characterization studies on the PA and CA results,
- Streamlining the monitoring program based on the results of sensitivity and uncertainty analysis of the results of probabilistic modeling of system performance,
- Iteratively evaluating and refining waste concentration limits for the disposal sites,
- Continuing evaluations on a case-by-case basis of the acceptability of new waste streams for disposal at the NTS facilities,
- Applying the results of probabilistic modeling for refining and reducing the cost of strategies used for the monitoring program and to close disposal cells, and
- Using the results of iterative probabilistic modeling to establish decision objectives for transitioning the disposal sites to long-term stewardship.

2.4 Revisions

A PA or CA revision is necessary when annual reviews and special analyses indicate significant impacts (numerical criteria to measure the significance of impacts will be developed) on the results and conclusions of the original PA or CA, documented in the facility DASs. A PA revision includes updated information (e.g., results from monitoring and R&D), revised analyses, new models, changes in expected radionuclide inventories, or other items affecting the results. Likewise, a CA revision will include updated information (e.g., land-use plans, results from monitoring and R&D), revised analyses, new models, changes in expected radionuclide inventories, or other items affecting the results.

The NNSA/NV will use the probabilistic models for the Area 3 and Area 5 RWMSs to assess the need for a PA or CA revision. New results from annual reviews, special analysis, and/or site

monitoring can be incorporated into the probabilistic models and the models can be run using the new information. The model results can be used to efficiently establish the impact of changed information on the performance objectives of DOE Order 435.1.

The form of a revision can range from a simple amendment to the subject document to a reissuance of that document. The revised PA or CA will be submitted to DOE/HQ for review and approval. The submittal will address whether a change to the DAS should be implemented. In the year a PA or CA revision is made, an annual review and summary reporting will not be carried out. The NNSA/NV will reserve the option of negotiating with the LFRG whether a decrease greater than 10 percent in a performance objective will require a PA or CA revision.

2.4.1 Criteria for Revisions

The PA and CA results for performance objectives are compared with the respective regulatory dose and flux performance measures. If annual reviews show that changes in the PA or CA results are expected to exceed 10 percent of the respective performance measures, the PA or CA will be revised. The PAs for the Area 3 and Area 5 RWMSs meet all performance objectives with a large margin. If the evaluated changes indicate a decrease in the PA results (dose or flux), a PA revision can also be made because lowered PA results may increase the facility waste concentration limits, thus allowing a better utilization of the available disposal capacity at the facility.

Detailed criteria to measure the significance of impacts on the PA or CA, which are identified through annual determinations and special analyses, will be developed. However, this plan tentatively adopts a 10 percent change of the PA or CA performance measures (as suggested in the DOE Maintenance Guide) as the incremental change that will lead to a PA or CA revision.

3.0 ACTIVITIES AND SCHEDULE

The following PA and CA maintenance activities are included in NNSA/NV's Low-Level Waste Life Cycle Baseline (BN, 2002a):

- Development of assessment and decision tools
- Annual reviews
- Annual summary reporting
- PA and CA revisions
- Special studies
- Support to the NTS Radioactive Waste Acceptance Program (RWAP)
- Maintenance Plan revision
- Task supervision

The schedule of activities is summarized in Table 3. Maintenance activities will continue throughout the operational life of each RWMS and beyond, as necessary. Sensitivity analysis, decision analysis and value of information analysis are being built into the probabilistic performance assessment models and will be used as an integral part of the evaluations summarized in the annual summaries. Development of the assessment and decision tools, which is a continuous improvement process, is scheduled annually. Reviews and the preparation of summary reports are annual activities. The first annual summary report for the Area 3 RWMS (including the results of the 2001 annual review) was submitted to DOE/HQ in March 2002 (BN, 2002b). The annual summary report for the Area 5 RWMS for the 2001 review has been deferred to FY 2003. NNSA/NV decided that starting in FY 2003, a single annual summary report would be issued covering the reviews of both the Area 3 and Area 5 RWMSs. The first such report is scheduled for submittal to DOE/HQ at the end of January 2003. No annual reviews and summary report preparation will take place in years the PA or CA revisions take place.

Table 3 The Schedule of Maintenance Activities

Activity	Frequency or Fiscal Year
Development of Assessment/Decision Tools	Annual
Annual Reviews	Annual
Annual Summary Reporting	Annual
PA/CA Revisions	No PA revisions Area 5 RWMS CA: FY 2010 Area 3 RWMS CA: FY 2021
Special Studies	Annual
Support to NTS RWAP	Annual
Maintenance Plan Revision	Every two years
Task Supervision	Annual

Whether a PA or CA revision is necessary is a decision NNSA/NV has to make, following the results of reviews and special studies. The report revisions will require a cycle of DOE/HQ review and approval process. Such revisions may also lead to revisions of the DASs because facility operation parameters may change. At the time the disposal facility is to be closed, a final PA and CA will be prepared and submitted to DOE/HQ for approval, together with the final monitoring and closure plans. The current closure dates are FY 2010 for the 92-acre site of the Area 5 RWMS and FY 2021 for the Area 3 RWMS, as well as the disposal units located in the expansion area north of the Area 5 RWMS (BN, 2001d). During postclosure, PA and CA revisions may continue to be made if monitoring results indicate that additional analyses are warranted.

This plan does not include any scheduled PA revisions. However, CA revisions are scheduled because the requirement for CA revisions has been specified in the respective DASs for each of the facilities. The first scheduled Area 5 RWMS CA revision will incorporate the results of the Frenchman Flat Corrective Action Unit (CAU) Corrective Action Decision Document (CADD), currently scheduled for completion in FY 2006. Therefore, revision of the Area 5 RWMS CA is scheduled for FY 2007. The revised Area 3 RWMS CA will incorporate the results from the Yucca Flat CAU CADD currently scheduled for completion in FY 2012. Therefore, a CA revision for the Area 3 RWMS is scheduled for FY 2013.

Special studies are scheduled annually, which include all modeling and evaluations that directly or indirectly impact the results of the PAs and CAs and consequently lead NNSA/NV to revise the affected documents. The support of the NTS RWAP, including the NTSWAC, will be an ongoing activity during the operational life of each facility. The maintenance plan will be revised every other year to include the changes in activities and schedules. Task supervision, which includes continuous activities pertaining to the maintenance program execution, is scheduled annually.

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