1 INTRODUCTION

This document describes the proposed site-wide goal for environmental remediation at the Los Alamos National Laboratory (LANL). The proposed goal is described as a "vision" of how the LANL campus will look when the Department of Energy (DOE) Environmental Management (EM) program cleanup mission is complete and the National Nuclear Security Administration (NNSA) assumes full responsibility for environmental management at LANL. The vision juxtaposes land-use, program, and facility plans with remediation requirements, establishing a conceptual completion goal (or end state) that is both realistic and protective. The purpose of the vision is to identify where and how potentially harmful exposures to hazardous contaminants might occur under projected future conditions, and to determine what actions will be necessary and sufficient to minimize the potential for harm under those condition. Consistent with the objectives of cleanup, the vision conceptualizes specific end-state conditions that will minimize the potential for harm in the future. Because this paradigm is consistent with the federal government's definition of risk as the probability that a substance or situation will produce harm under specified conditions, the vision is referred to as a *risk-based end state*.

The April 2003 DOE Policy 455, *Use of Risk-Based End States*, requires DOE EM sites to define and document a risk-based end-state vision that is acceptable to regulators and stakeholders, and then to revise cleanup program plans as necessary to achieve that end-state in the most efficient manner (ref DOE Policy 455.1). The policy is a formal mandate for EM sites to implement risk-based corrective action programs as described in numerous DOE, Environmental Protection Agency (EPA) publications, ASTM Standard Guides, and National Research Council recommendations (refs including DOE Expedited Site Characterization and SAFER).

Risk-based corrective action is an application of standard scientific, engineering, and mathematical principles, enabling steady progress in solving even very complex cleanup problems. The complexities of cleanup at a typical EM site are generally similar: Multiple contaminants distributed in multiple environmental media, released over long periods of time and large areas of land. Uncertainties in source(s), nature, extent, transport, and fate of contaminants are very large and can never be absolutely eliminated. Risk-based corrective action provides an objective means of managing uncertainties to the degree necessary and sufficient to make defensible decisions about effective cleanup actions.

Risk-based corrective action is a defining element of LANL's integrated technical strategy, which was formally submitted to the New Mexico Environment Department (NMED) in 2000 as Revision 8 of the LANL *Installation Work Plan* (ref). The LANL technical strategy also incorporates guidance developed by EPA Region VI, which maximizes the benefits of risk-based planning by applying it first on a site-wide scale to rank and prioritize among multiple corrective action sites, then on a site-specific scale to optimize the corrective actions to achieve cleanup goals for sites both individually and collectively (ref EPA R6 CAS).

The risk-based end-state vision describes cleanup goals that would be protective under the planned future uses described in two planning documents. The first is LANL's *Ten-Year Comprehensive Site Plan*, which describes NNSA's facility and operations over a 10-year planning window; the second is *Land Transfer Report to Congress under Public Law 105-119, A Preliminary Identification of Parcels of Land in Los Alamos, New Mexico for Conveyance or Transfer*, which identifies specific parcels of land that are planned for transfer from DOE ownership. In addition, the future end-state vision makes use of other LANL documents, including those that forecast the environmental impacts of planned activities, in compliance with the National Environmental Policy Act.

The DOE's risk-based end-state initiative is fully consistent with the EPA's recent endorsement of "systematic planning," which uses risk-based decision methods to ensure objectivity, defensibility, and cost-effectiveness in corrective action programs. (ref TRIAD) "Systematic planning is the scaffold around which defensible site decisions are constructed… First and foremost, planning requires that key decision-makers collaborate with stakeholders to resolve clear goals for a project." LANL will collaborate with its stakeholders to revise the proposed risk-based end-state vision as needed to define clear goals for completion of its EM-sponsored cleanup work. Once the final end-state goal is resolved with public and regulatory stakeholders, LANL will use risk-based decision analysis to objectively, defensibly, and cost-effectively align its remediation project plans to achieve that goal.

1.1 Organization of the Report

The format and content of this report strictly adheres to DOE's *Guidance for Developing a Risk-Based, Site-Specific End State Vision*.

The remainder of this section provides background and programmatic context for the descriptive information in Sections 2, 3, and 4. The descriptive information in Sections 2, 3, and 4 focuses on attributes that relate to risk on three spatial scales: Regional, site-wide, and hazard-specific. The attributes of risk are natural and man-made features, events, and processes that impact the potential for harm to living systems from exposures to environmental hazards. Major risk attributes include the type and amount of contamination in environmental; the current distribution and potential migration of contamination in the environment; and the conditions and situations that may result in contact between living organisms and contamination at specific locations. These attributes will change over time, as remediation actions are completed and LANL operations continue amid evolving Federal, Tribal, state, and municipal conditions and constraints.

To differentiate between the present state and the planned end-state, the three spatial descriptions in Sections 2, 3, and 4 depict two time frames, present-day and end-state. As prescribed by the DOE, the end-state vision represents a snapshot of conditions anticipated 20 years after completion of the EM-sponsored cleanup mission. For LANL, the risk-based end-state vision conceptualizes the year 2035, consistent with a planned EM completion in 2015.

Section 2 depicts LANL in its regional context under current and planned conditions. The current conditions reflect factual knowledge in 2003, while the planned conditions reflect objective goals to be achieved through 2035. Section 3 depicts the current and planned conditions at a slightly smaller scale that encompasses the LANL boundary and directly adjacent environs. Finally, Section 4 describes the current- and end-state at the scale of watersheds, within which one or more contaminant sources coexist. The site- and hazard-scale descriptions in Sections 3 and 4, respectively, are both graphical and narrative.

1.2 Site Mission

Since World War II, scientific research and technology development have been conducted at the Los Alamos National Laboratory in support of national security. That mission endures today: To develop and apply science and technology to

- Ensure the safety and reliability of the U.S. nuclear deterrent.
- Reduce the threat of weapons of mass destruction, proliferation, and terrorism.
- Solve national problems in defense, energy, environment, and infrastructure.

The concepts of risk and the constructs of risk management are fundamental to the accomplishment of every element of the LANL mission.

1.2.1 Management of National Security Risks

Under the current structure of the federal government, the National Nuclear Security Administration (NNSA) sponsors the core national security mission work conducted at LANL. It is expected that LANL will remain a center of research and development in support of national security into the foreseeable future.

The goal of the national security mission is to develop countermeasures to threats posed by weapons and tactics of modern warfare and terrorism. These countermeasures include surveillance and monitoring of existing and emerging weapons and tactics and developing and maintaining a deterrent arsenal. The development of technologies to understand threats and develop deterrents and countermeasures requires a significant level of research in nearly every branch and specialty of science, from the most fundamental to the most esoteric. The general technical capabilities required by the LANL mission are:

- Atomic-to-global scale sensor and detector research and development to acquire information about threats.
- Data storage technologies, data display capabilities, and computational methods to assemble and interpret an ever-growing body of information.

- Research, engineering, fabrication, storage, testing, treatment, and disposal of chemical, biological, and radiological materials.

1.2.2 Management of Operational Risks

The achievement of the LANL mission requires the use and disposal of radioactive materials, chemicals, and pathogens. As evidenced by their use in terrorism and warfare, these substances are harmful under specific conditions. Their use and disposal at LANL is carefully controlled at every stage through safe operating procedures developed to prevent known conditions of harm. These procedures reflect federal laws, state and federal regulations, and DOE directives. Safe operating procedures limit the doses, exposure frequencies, and exposure durations to protect workers. The limits are typically 10- to 1000-times lower than thresholds known to cause harm.

Since 1996, all LANL operations have been performed within an integrated safety and security management system, which ensures that associated hazards are identified and procedures are developed to mitigate the risks from hazards as a routine part of the work authorization process. Elements of the integrated safety and security management system include radiation protection of workers, non-nuclear authorization basis, and management of nuclear facilities.

The risks associated with operations involving radioactive materials are controlled primarily through procedures that implement the requirements of DOE Orders. These Orders reflect the state of knowledge about radiological doses as defined, refined, and maintained by national and international scientific organizations. (ref NCRP, ICRP, IAEA, etc.) Procedures are followed through every phase of LANL operations involving radioactive materials to prevent against harmful conditions of exposure. These procedures are implemented to protect both LANL workers and other members of the public.

Analogous procedures are followed to manage the risks associated with toxic chemicals. These procedures comply with standards and regulations administered primarily through the Occupational Safety and Health Administration (OSHA) and the EPA. These regulations and implementing procedures reflect the state of scientific knowledge about the toxicity of various chemicals, and the preventive measures that will ensure against harmful exposures.

Different regulations and policies apply to ensure against harmful exposures under different conditions, including individual work-spaces to facility effluent stacks. In general, compliance with OSHA regulations prevents workers from being exposed to harmful amounts of toxic chemicals, and compliance with EPA regulations and DOE Orders likewise protects other members of the public.

1.2.3 Management of Environmental Risks

There are several facilities and operations at LANL that release radioactive and chemical substances into the environment. All releases are monitored, reported, and audited in accordance applicable laws, regulations, and requirements. Monitoring ensures that releases of potentially harmful substances are below amounts that are known to cause harm under potential conditions of exposure in the environment.

Liquid and air-borne releases are monitored at the point of discharge, and at locations either down-stream or down-wind from the discharge. The monitoring results are reported to the EPA, NMED and/or the DOE to independently validate compliance with applicable regulations. Environmental risks from LANL operations are managed in accordance with the following primary requirements:

- DOE Order 435.1 *Radioactive Waste Management* (formerly DOE Order 5820.2A): Addresses risk of radioactive waste disposals sites.
- DOE Order 450.1 *Environmental Protection Program* (formerly DOE Order 5400.5): Addresses risk from radioactivity released into the environment from all sites and facilities, through the post-closure period.
- RCRA Hazardous Waste Facility Permit

The National Environmental Policy Act requires that LANL analyze and report potential environmental risks associated with planned facilities and operations prior to initiating work. Together, these directives ensure that LANL is complying with environmental protection laws, including but not limited to:

- Clean Air Act

- New Mexico Air Quality Control Act
- Clean Water Act
- Safe Drinking Water Act
- Toxic Substances Control Act
- Hazardous and Solid Waste Act
- Resource Conservation and Recovery Act

Operations using toxic substances at LANL were conducted for many years before laws were enacted to prevent unintentional harm to people and the environment. Still, LANL began sampling studies and voluntary cleanups in 1946, after the successful completion of their initial mission. These efforts continued through the 1960s. Throughout the 1970s, LANL implemented more formal practices to identify and assess contamination in the environment. In the 1980s, a program was funded by DOE EM to conduct corrective actions at LANL sites where contamination was found to present a potential risk to human health and the environment. The specific requirements for corrective actions for radiological contamination in the environment are found in DOE Order 5820.2A (superseded by DOE Order 435.1), which incorporates by reference corrective actions under the RCRA for hazardous chemical contamination in the environment. The goals of the LANL environmental cleanup program are to

- protect human health and the environment from exposure to hazardous chemical or radioactive materials resulting from past treatment, storage and disposal practices, and
- meet or exceed the environmental cleanup requirements of the LANL RCRA permit to operate hazardous waste facilities.

1.3 Status of Cleanup Program

The EM mission at LANL was initiated in 1989 and is scheduled to be complete in 2015 on the basis of its 2003 performance management plan (ref). In its initial RCRA facilities assessment, LANL identified over 2,000 individual "potential release sites" across its 43-square-mile area that would be further evaluated through its EM-sponsored remediation program. Potential release sites include such things as septic tanks and associated drain lines, chemical storage areas, wastewater discharge areas, material disposal areas, high-explosive firing sites, storage tanks, and spills. Potential release sites are located on mesa tops, canyon walls, and canyon bottoms. No two are exactly alike, varying in terms of contaminant type (or "nature," such as chemical solvents, radioactive substances, and explosives), distribution (or "extent," either localized or broadly distributed), mobility (or "transport," in air or water), and transformation (or "fate," such as radioactive decay or biodegradation).

In 1999, LANL updated its remediation approach from one focused on individual sites and their potential to impact human health to one focused on aggregates of sites and their cumulative potential to impact human health and/or the broader ecosystem. The revised approach is documented in the facility-wide *Installation Work Plan*, which was approved by the NMED in 2002. While the corrective-action Order issued to DOE and LANL by NMED is pending, LANL intends that its EM-sponsored cleanup activities will be completed in accordance with the risk-based process described in the approved work plan. The following subsections describe the key elements of the LANL cleanup program.

1.3.1 General Technical Strategy and Cleanup Goals

Although not an official pilot site, LANL is following the technical framework endorsed by EPA Region VI in its *Corrective Action Strategy Guidance for Pilot Projects* (ref).[1] EPA Region VI developed its risk-based corrective action strategy to accelerate corrective action at RCRA sites, a goal that is consistent with DOE's risk-based end-states policy. Moreover, the EPA Region VI corrective action strategy begins with the clarification of a final risk goal, which, like DOE's risk-based end-state vision, is the level of

[1] The EPA Region VI corrective action strategy addresses the primary basis of the NMED order, which is reducing risk to human health and the environment. What is more, the Region VI strategy requires the early determination of performance standards as an objective basis of EM completion, which would remedy one of the primary objections to the order, namely the lack of completion criteria.

protection to be achieved and maintained by the facility based on future land use, real receptors, and known releases.

The final risk goal is one of three categories of performance standards recommended by Region VI, the other two being source control and applicable statutes and regulations. Table 1.3-1 lists Region VI's descriptions of, and LANL's proposals for meeting, performance standards.

Table 1.3-1
Proposed performance standards comprising the risk-based end state to be achieved at EM completion

Performance Standard	EPA Region VI Definition	LANL Proposal
Source Control	Control of materials that include or contain hazardous wastes or hazardous constituents, that act as a reservoir for migration of contamination to soil, sediment, ground water, surface water, or air, or as a source for direct exposure. Contaminated ground water plumes are not generally considered a source material.	Eliminating, reducing or stabilizing primary sources (e.g., storage tanks, outfalls, MDAs) Eliminating, reducing or stabilizing secondary sources (e.g., contaminated soils, sediments, alluvial water)
Statutory/ Regulatory	Media-specific contaminant levels that must be achieved, such as maximum contaminant levels (MCLs) in drinking water. These requirements may be specified in Federal, state, and local laws and regulations.	Achieving MCLs and DCGs within water supply system by achieving site- and source-specific ACLs at designated monitoring wells
Final Risk Goal	The level of protection to be achieved and maintained by the facility based on land use and acceptable risk at specific locations and times	Providing 95% confidence that the probability of exceeding applicable thresholds is not greater than 10^{-5} for a period of 20 years under exposures consistent with future land use

Performance standards provide an objective basis for determining the priority of corrective actions and optimizing remedies according to their ability to achieve and maintain the standards. By focusing on known and realistic goals, the Region VI corrective-action strategy emphasizes progress over process. In completing its EM mission, LANL will achieve a risk-based end state vision that integrates Region VI performance standards to protect both human receptors and the environment from all sources of contamination across the entire LANL campus. To accomplish this, LANL has developed a systematic risk-based decision analysis process.

Risk-based decision analysis provides many benefits:

- Facilitates prioritization of contaminated sites at individual installations.
- Provides a consistent mechanism for addressing both simple low-risk sites and complex high-risk sites, establishing a systematic approach for sites of differing complexity.
- Guides data collection to support the development of site-specific cleanup goals, ensuring that data collected are demonstrably linked to ensuring protection of human health and the environment.
- Assesses cumulative risks from all sources affecting the same human or ecological receptor, quantifying the overall, facility-wide risk encountered by potential target receptors.
- Encourages early action at sites where the risk is imminent and at sites where the risk is low but remediation is rapid and inexpensive.
- Considers relevant uncertainties explicitly using stochastic modeling approaches, and considers options for reducing relevant uncertainties.
- Integrates the selection of cleanup options with the cleanup goals, evaluating multiple options in a quantitative framework.

- Provides a means of revisiting remedies over the long term through repeated risk evaluations if site conditions change over time.
- Takes place in a public forum, explicitly presenting all relevant science, assumptions, and judgments.
- Undergoes external, public and independent scientific peer review before decisions are implemented.
- Complies with relevant state and federal statutory programs, being flexible enough to incorporate applicable state and EPA regulations.

The risk-assessment methods used to provide input to the decision analysis is itself graded to ensure that the level of technical rigor matches the level of information needed for a particular decision in the cleanup process. LANL follows EPA's *Process for Conducting Probabilistic Risk Assessment* (ref).

1.3.2 Investigation and Assessment Strategy

Investigations and assessments are conducted iteratively to support cleanup decisions that ensure progress toward achieving performance standards. Since the source-control performance standard applies to individual release sites, site-specific investigations are tailored to provide information necessary and sufficient to assess the site-specific practicability of alternative source-control measures. Since the final risk goal applies to all releases collectively, site-wide investigations are tailored to provide information necessary and sufficient to assess the potential for harm from exposures to environmental media that may be directly or indirectly contaminated from one or more release sites. To the extent possible, the site-wide investigations are also designed to provide information necessary and sufficient to assess releases in the context of regulatory performance standards.

1.3.2.1 Source Specific

Before the integrated technical strategy was implemented, site-specific investigations generally followed the traditional RCRA Facilities Investigation approach. Since then, LANL has made substantial progress in streamlining site-specific investigations by identifying feasible site-specific source-control alternatives, and designing investigations to provide information to either confirm or deny the practicability of those alternatives.

According to EPA Region VI, the source-control performance standard applies to "materials that contain hazardous wastes or hazardous constituents, that act as a reservoir for migration of contamination to soil, sediment, ground water, surface water, or air, or as a source for direct exposure." This implies that the source-control performance standard applies to contained or confined hazards (including storage tanks and associated plumbing, landfills, surface impoundments, and evaporation lagoons), but does not apply to media contaminated indirectly as a result of these sources (including air, surface soil, sediment, surface water, groundwater, and biota). Therefore, investigations and assessments designed to support source-control decisions are limited to sites that meet EPA Region VI's applicability criteria.

For sources including septic tanks, shallow-subsurface landfills, surface impoundments and evaporation lagoons, LANL plans to achieve source control by excavation, offsite disposal, and remediation. Accordingly, site-specific investigations are designed to support excavation, waste disposition, and site remediation decisions. These investigations are often based on the results of contaminant transport models developed and implemented to assess the likely nature and extent of contaminated media.

For the majority of the deeper subsurface material disposal areas (MDAs), excavation is dangerous and/or impracticable, and off-site disposal is unlikely or virtually impossible due to the large volumes of deeply buried heterogeneous materials contaminated with a variety of constituents. Source control at MDAs is limited primarily to stabilization of existing caps. To streamline MDA investigations to support stabilization decisions, LANL developed a risk-based characterization process (ref MDA Core Document submitted to NMED).

To design investigations for MDAs, baseline quantitative risk assessments are conducted to evaluate the stability of MDA sources assuming no enhancement of the existing caps. Stability is judged in the context of applicable regulatory standards, including the Safe Drinking Water Act. To further streamline characterization process, models developed for the performance assessment and composite analysis for LANL's operating on-site radioactive waste disposal facility have been modified to account for release

and transport of both hazardous and radioactive constituents. (ref PA/CA and TA-54 RFI Report) (Note that the "inadvertent site intruder" exposure scenario included in the PA/CA is excluded from the risk assessment applications.)

Probabilistic (EPA's "Tier 3") methods are implemented because they provide an efficient but rigorous way to 1) simulate the performance of multiple MDAs within a single numerical framework, 2) determine what modeled characteristics of a given MDA are most important in terms of source stability, 3) evaluate alternative stabilization methods, 4) design appropriate monitoring programs.

(Sections 3 and 4 provide additional detail on baseline risk assessments and risk-based remedy selection for MDAs.)

1.3.2.2 Site-Wide

For contaminated media to which the source-control performance measure does not directly apply, LANL's investigations are designed to provide information needed to evaluate the need for actions to meet media-specific regulatory standards and site-wide risk goals. A quantitative risk-based decision-analysis process is especially valuable for these investigations, since contamination resulting from operations as far back as 1943 has had time to migrate within and between environmental media, resulting in broad spatial distributions and cross-media contamination.

Baseline risk assessments are conducted to understand the impacts of contaminants in environmental media, where impacts are evaluated in the context of applicable regulatory performance standards and cumulative risk. To the extent possible, risk assessments are designed to incorporate media-specific standards. Contaminant transport is simulated at scales that account for physical features and processes that may cause multiple contaminants to be transported in air or water to a single point, resulting in coincident exposures. Exposures are modeled consistent with current and reasonably foreseeable land use.

There are eight major watersheds that traverse the 43 square mile LANL campus. These watersheds play a significant role investigations and assessments conducted to support decisions related to the attainment of regulatory performance standards and site-wide risk goal. All of the watersheds are impacted to some extent by contaminants associated with current and/or historic LANL operations. Some of the watersheds are directly impacted by contaminated liquid effluents, and most were indirectly impacted by contaminants carried from other locations into watersheds, primarily in runoff of rainwater and snowmelt. Contamination deposited in canyon sediments are then subject to further transport by perennial and ephemeral stream-flow, and also by winds that are dramatically channeled within some of the steeper, deeper canyons. To account for these physical attributes and processes related to contaminant transport, baseline risk assessments are conducted for each watershed to inform decisions related to the attainment of applicable regulatory performance standards for surface water and air, as well as the final risk goal.

The watersheds also play a major role in assessing groundwater impacts, because the regional aquifer is partially recharged from surface-water infiltration within watersheds. LANL has developed a risk-based decision analysis application to streamline site-wide investigations and assessments for the purposes of achieving applicable drinking-water performance standards and the final risk goal. This systematic decision framework incorporates information collected through geologic, hydrologic, and environmental investigations conducted since the implementation of EM cleanup in 1989, including site-specific characterization studies and regional hydrogeology studies.(ref. Hydrogeologic Work Plan)

Over the last three years, LANL has developed the "infrastructure" needed to implement site-wide groundwater-pathway risk assessment, including:

- A site-wide enterprise GIS for geo-spatial data staging, storage, distribution, analysis and visualization (ref),
- A site-wide three-dimensional hydrogeology data model (ref),
- A site-wide empirical infiltration model (ref),
- A site-wide quasi-three-dimensional vadose zone groundwater flow model (ref), and
- A regional three-dimensional regional-aquifer flow model (ref).

(Section 3 provides detailed descriptions of the site-wide hydrogeology.)

(Sections 3 and 4 provide additional detail on site-wide hydrogeology, and the baseline risk assessment for groundwater.)

1.3.3 Prioritization Strategy

Consistent with the EPA Region VI corrective action strategy, LANL prioritizes work on the basis of risk. An initial prioritization was accomplished by DOE, LANL, and NMED based on semi-quantitative risk attributes, including

- Nature and extent of contamination,
- Potential for on-site exposures, and
- Potential for offsite migration.

Table 1.3-2 lists the watersheds in order of priority as initially determined, along with the compelling rationale for each watershed's rank. This ranking was used to develop the lifecycle baseline for the cleanup project. Specific work elements were planned for each watershed. Annually at the fiscal-year boundary, the baseline is constrained according to the anticipated budget. Work within specific watersheds is aligned to accomplish the greatest progress with the available resources. Consequently, on an annual basis, not all work will be within the highest-priority watershed. The current prioritization listed in Table 1.3-3 may be reconsidered if indicated by the results of the quantitative baseline groundwater pathway risk assessment.

1.3.4 Remedy Selection

LANL has identified likely remedies for cleanup sites. Each remedy will be optimized using risk-based decision analysis to compare the effectiveness of alternative remedy designs at achieving applicable performance standards under the conditions of planned land use.

Table 1.3-2
Initial priority ranking of watersheds as a basis for planning

Watershed Name	Priority	Risk-Based Rationale for Priority Rank
Los Alamos/Pueblo	1	Mobile contaminants; land-transfer parcel; recreational use
Mortandad	2	Mobile contaminants; land transfer; proximity to Pueblo land; recreational use.
Water/ Cañon de Valle	3	Mobile contaminants; and recreational use.
Pajarito	4	Potentially mobile contaminants, and recreational accessibility
Sandia	5	Potential contamination, and recreational accessibility
Ancho	6	Potential contamination, and recreational accessibility
Chaquehui	7	Potential contamination
Frijoles	8	Recreational accessibility

Exposures scenarios have been developed to represent future land use according to existing plans. The vast majority of cleanup sites are on property that is expected to remain under DOE ownership. The risk-based remedy selection decision analysis for these sites will feature industrial-use exposure scenarios for mesa-tops and firing sites, and recreational-use scenarios for canyons. There are 10 parcels of DOE property that were designated for transfer to either Los Alamos County or the Pueblo of San Ildefonso (held in trust by the Department of the Interior). Cleanup goals for these land parcels will be determined

using risk-based decision analysis for residential-use scenarios. Finally, LANL plans to release a small section of land to either the National Park Service or the National Forest Service. In either case, contamination on that land will be remediated to levels consistent with a recreational-use scenario. Those levels will be calculated using risk-based decision analysis methods.

1.3.5 EM Completion

For cleanup sites located on DOE property, EM completion will coincide with the attainment of performance standards through remedies approved by the administrative authority. LANL intends for the final risk goal performance standard to meet the intent of the risk-based end state, which represents EM completion.

Long-term performance monitoring and response actions to maintain the risk-based end state will be integrated into the NNSA environmental management system consistent with the requirements of DOE Order 450.1. The location, frequency, and duration of monitoring will be established using systems-engineering design principles, and a logical exit strategy will be defined to ensure that resources are not wasted on unnecessary data collection and reporting.

Table 1.3-3
Planned schedule for task and watershed completion

Planned Completion	Task
FY03	Hydrogeologic characterization well R-02
	Hydrogeologic characterization well R-04
	Hydrogeologic characterization well R-11
FY04	Hydrogeologic characterization well R-03
	Hydrogeologic characterization well R-10
	Hydrogeologic characterization well R-17
FY05	Hydrogeologic characterization well R-27
	Hydrogeologic characterization well R-30
FY06	MDA-H
FY08	MDA-C
FY09	MDA-B
	MDA-T
FY10	MDA-A
	MDA-L
	LA/Pueblo Watershed
	MDA-U
	MDA-V
FY12	Sandia Watershed
	MD-AB
FY13	Frijoles Watershed
FY14	MDA-F
FY15	Mortandad Watershed
	Water/Canon de Valle Watershed
	Pajarito Watershed
	Ancho Watershed
	Chaquehui Watershed
	EM Work Complete by 2015, turnover to NNSA

1.3.6 Long-Term Risk Management

Consistent with the Atomic Energy Act, DOE retains responsibility for radioactive materials used in its programs. This includes responsibility for residual environmental contamination as long as it poses a threat to human health and/or the environment. At LANL, EM sites that cannot be remediated to contaminant levels allowing unrestricted use (either now or in the foreseeable future) will transition to the National Nuclear Security Administration (NNSA). As required by DOE Order 450.1 *Environmental Protection Program*, the Laboratory will explicitly incorporate long-term environmental stewardship activities into an integrated environmental management system supported by NNSA.

What is more, the basic risk-based decision analysis will be used as an adaptive management tool (as described the NAS/NRC in *Environmental Cleanup at Navy Facilities*) for long-term environmental stewardship planning. This approach addresses key issues faced by DOE sites by

- Allowing continuous evaluation, research and development toward innovative solutions to resolve long-term risks (i.e., uncertainties) while convention remedies are implemented to manage short-term risks.
- Periodically reevaluating previous remediation decisions that do not meet LTES goals, even if they are currently protective.
- Integrating public stakeholders in each decision phase.

1.3.7 Public Involvement

The senior managers at LANL have identified community partnerships as one of their top five performance priorities. The risk-based end states initiative and the long-term environmental stewardship initiative will be one of the pilot project for strategic community involvement this fiscal year. LANL's Citizen's Advisory Board and a local anti-nuclear activist organization have already requested copies of this draft document.