FEDERAL RISK MANAGEMENT PLAN

Environmental Management Los Alamos Field Office (EM-LA)

Los Alamos, New Mexico 87544

Approved: _____
Christine Gelles, Acting Manager

TITLE: FEDERAL RISK MANAGEMENT PLAN

1.0 PURPOSE AND OBJECTIVE:

This Risk Management Plan (RMP) identifies the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office's (EM-LA) processes and procedures necessary for effective management of the federal risks for EM-LA work being performed at the Los Alamos National Laboratory (LANL)). This document excludes the prime environmental cleanup contractor's risk management processes and procedures. Note: the term "risk" used throughout this document includes positive risks, otherwise known as opportunities.

EM-LA provides direction, oversight of and funding to the laboratory's Environmental Management (EM) Program to characterize and remediate contaminants in the environment, decontaminate and decommission (D&D) process-contaminated facilities, and manages the disposition of transuranic (TRU) waste. The contractor is required to ensure proper development and execution of a lifecycle baseline that reflects the integrated mission objectives and strategic goals of EM-LA, New Mexico Environment Department (NMED), and the laboratory's Management & Operating (M&O) contractor.

The laboratory's primary mission objectives are on behalf of the National Nuclear Security Administration (NNSA); however, EM-LA's primary mission objectives include managing the environmental cleanup programs, ensuring delivery of activities, projects, and programs on schedule, within budget, and fully capable of meeting mission performance, safeguards and security, and environment, safety, and health standards. EM-LA provides programmatic and project oversight of the contractor-directed EM-LA Program and Field Office-directed contracted work for government furnished services and items (GFS&I) associated with the EM-LA Program.

The EM-LA Program encompasses LANL's environmental restoration, legacy waste disposition, and D&D projects. The EM-LA Program's primary goal is to ensure that past DOE operations do not threaten human or environmental health and safety in and around Los Alamos and surrounding northern New Mexico communities.

This RMP is a component of the overall Earned Value Management System (EVMS) required by EM. The EM policy and guidance outlines an EVMS, which includes:

- An integrated project execution plan;
- A project baseline;
- A change control process, including the establishment of a baseline change control board;
- Monthly reporting including the use of earned-value analysis;
- Risk analysis; and
- A RMP.

This RMP is valid for the life cycle of the EM-LA Program and is under configuration control with approved revisions made in accordance with DOE Office of Environmental Management (EM) and EM-LA established policies and procedures.

2.0 SCOPE:

The *Integrated Project Execution Plan* (LANL 2007) provides a detailed overview of the EM-LA Program and the DOE acquisition strategy for the EM-LA Program. The EM-LA Program's mission is to identify and remedy environmental hazards associated with past laboratory operations, and manage and dispose of legacy TRU waste. Integral to the EM-LA Program is D&D of excess facilities associated with legacy sites that must be removed prior to characterization and remediation activities. DOE Headquarters (HQ) and EM fund the EM-LA Program at LANL. The EM-LA Program at LANL is comprised of the following project baseline summary (PBS) components:

- **PBS VL-LANL-0013**, Solid Waste Stabilization and Disposition (Legacy Waste Disposition);
- **PBS VL-LANL-0030**, Soil and Water Remediation (Environmental Restoration); and
- **PBS VL-LANL-0040-D**, Nuclear Facility-LANL D&D (Defense);

Projects are at different levels of maturity within the EM-LA Program at LANL. Environmental restoration and legacy waste disposition have been ongoing since the 1990s and are mature projects. The EM mission at LANL includes completing the following activities:

- Disposal of Legacy TRU Waste;
- D&D of Technical Area (TA) 21 and TA-54 facilities in the path of environmental restoration sites; and
- Completion of environmental restoration activities.

Achievement of this mission increases LANL's operational efficiency and effectiveness and reduces risk to the public.

3.0 APPLICABILITY:

This RMP meets the requirements set forth in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets* (11-29-2010). The processes described herein are consistent with the guidance provided in DOE Guide 413.3-7A*, Risk Management Guide* (1-18-2011).

4.0 PLAN:

This section describes the EM-LA risk management process and provides an overview of the risk management approach for the EM-LA Program at LANL. DOE defines risk management as the act or practice of controlling risk. It includes planning, assessment, developing handling strategies, monitoring to determine how risks have changed, and documenting the overall risk management program.

The overall objective of EM-LA Program risk management is:

Objectively identify, assess, communicate, and manage risks through all phases of planning and execution to support the environmental cleanup contractor's overall goal of delivering the LANL EM cleanup work on schedule, within budget, and fully capable of meeting mission performance, safeguards and security, and environmental safety and health standards.

This over-arching objective is further broken down into the following eight supporting EM-LA Program objectives:

1. Develop and maintain a risk management plan with appropriate approvals and distribution.
2. Identify and document new risks as new projects are initiated and as changes occur within existing projects.

3. Implement, track, and update/revise risk handling strategies as necessary to ensure effective management of risks.
4. Actively and continuously monitor risks with updates to the risk register made as appropriate.
5. Report the status of risk management.
6. Implement risk management as an integrated element of the larger project management effort.
7. Management will provide emphasis and direction on risk management.
8. Risk Assessment Reports (RAR) will be developed for each individual Capital Asset Project (CAP) and maintained on an as needed basis. Updates to the Program RAR will be prepared for submittal to DOE HQ on an annual basis (during the third and fourth Quarters of each FY).

Appendix A provides the primary objective of risk management and specific criteria that EM-LA must meet in order to achieve each of these supporting objectives.

The Risk Management Coordinators (RMCs – federal team lead and PBS specific risk SME support team), facilitate risk management. The RMCs, risk owners, and EM-LA Program stakeholders use a structured assessment approach to identify and analyze those processes and products that are critical to meeting EM-LA Program objectives. They develop risk handling strategies to avoid and/or mitigate the threats and monitor the effectiveness of the selected handling strategies. Strategies for exploiting and/or enhancing opportunities are also developed. All data is collected and maintained in a risk register.

Risk information is included in all program reviews. As new information becomes available, the contractor conducts additional reviews to ascertain if new risks exist. The goal is to continuously look to the future for areas that may severely impact the program.

The Risk Management Process Model (Figure 1) provides the basis for the EM-LA Program's risk management process. The EM-LA Program risk owners identify and qualitatively analyze risks, both threats and opportunities, for their probability of occurrence and potential impact (consequence) to the performance baseline. Risk scores (i.e., high, moderate, or low) are assigned based on probability and consequence. Handling strategies are formulated for each threat scored as high or moderate to prevent (avoid) or mitigate the threat. Likewise, handling strategies for exploiting or enhancing opportunities are derived.

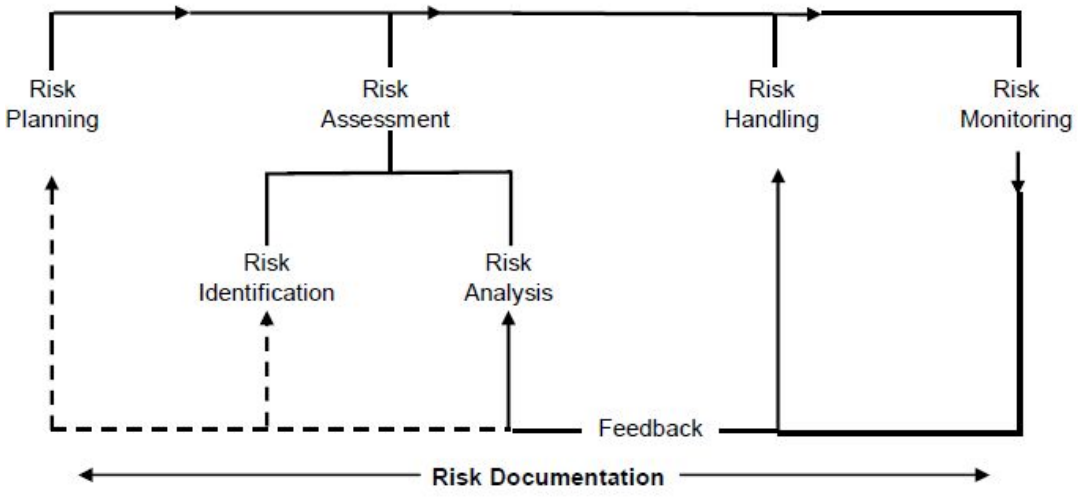


Figure 1. Risk Management Process Model

Following qualitative risk analysis, risk owners quantitatively assess risk handling strategies for risks scored as high or moderate. The potential cost impact of the risk handling strategy, as well as the potential schedule impact, is estimated. Optimistic, most likely, and pessimistic values of each risk handling strategy are determined. The optimistic, most likely, and pessimistic costs and schedule values for each risk handling strategy are analyzed using a Monte Carlo simulation model to determine the EM contingency values for CAPs as well as operational activities. The expected value (EV) of each risk is subsequently determined based on the probability of occurrence as qualitatively assessed. Cost and schedule impacts of identified residual and secondary risks that were scored as high or moderate are similarly quantified and analyzed to determine their contribution to EM contingency, as applicable. Programmatic uncertainties associated with EM projects are accounted for by performing an uncertainty analysis to determine the cost and schedule estimate at a 50 % confidence level. Programmatic risk values are carried at the DOE HQ level. EM-LA is not responsible for determining the contingency associated with EM-LA Programmatic risks.

Risk information is recorded in the federal risk register and maintained by the RMCs under the direction of the Federal Project Director (FPD) in conjunction with the IPT. The risk register is a living database that is regularly assessed and revised as necessary to ensure the effective management of risks throughout the life cycle of the EM-LA Program.

Each step in the risk management process is discussed in detail in following sections.

4.1 Risk Planning

Risk planning is the process of developing and documenting an organized, interactive strategy and method for identifying and tracking risks, developing risk handling strategies, and performing regular risk assessments to determine risks' status. Risk planning has the following specific objectives:

- Establish risk identification and analysis methodologies;
- Establish a structured methodology for selecting risk handling strategies;
- Establish roles and responsibilities of the RMCs and other parties to the risk planning effort; and
- Establish the risk products to be produced and the schedule by which those products will be updated.

This RMP is the output of the risk planning step. The processes and procedures outlined in this RMP are reviewed and revised, as necessary.

4.2 Risk Assessment

The EM-LA Program risk assessment process consists of identifying risks, including threats and opportunities, which could have an impact on the program's success, and analyzing of those risks to determine the probability of occurrence and consequences.

Risk assessment is an iterative process, with each assessment building on the results of previous assessments. The RMCs, in conjunction with risk owners, SMEs, and EM-LA Program stakeholders, regularly assess risks, reviewing risk handling strategies and the high risk areas whenever necessary to assess progress.

Results of the risk assessment process are documented in the federal and contractor risk assessment reports.

4.3 Risk Identification

The risk identification's purpose is to discern areas that pose threats to the EM-LA Program life cycle cost, scope, and schedule as well as those areas that provide opportunities to improve these same project elements. Risk identification is one of the most important phases of the risk

management process. Project managers cannot effectively measure, mitigate, or manage a risk if it remains unidentified. The EM-LA Program Risk Management Process requires that risk identification be performed and documented as new projects are initiated and as changes occur with existing projects. Risk identification is an ongoing process that will continue throughout the life cycle of the cleanup program.

4.4 Categories of Risk

Development and management of risks and project cost and schedule contingency requires clearly defined risk ownership and risk characterization.

Environmental Management Program risks are potential threats or opportunities categorized as:

- Contractor execution risks (including programmatic and project risks);
- EM-LA project risks; or
- EM-LA Programmatic risk.

The prime cleanup contractor for the Los Alamos site owns the contractor execution risks and includes its quantification in the management reserve (MR) estimate which is documented and recorded separately from the federal contingency. EM-LA owns EM-LA Programmatic and project risks; however, only EM project risks are included in the quantification of project contingency. Programmatic risks are tracked but have been documented as transferred to headquarters by formal memorandum to Barry Gaffney from Peter Maggiore, date July 3, 2014 (detailed in Section 5.2 of this document).
.

4.4.1 EM-LA Project Risks

Environmental Management project risks are within the project baseline but are generally beyond the contractor's control and are managed at the project level. Risks that EM and the contractor share can be handled by partitioning them into separate risks or treating them collectively in the risk register. Examples of EM project risks are:

- Major technological failures;
- Coordination across site programs;
- Changes due to direction from agency senior management;
- Unusual weather delays;
- Interpretation of and revisions to state/local regulatory and statutory requirements (how clean is clean);
- Design (one-of-a-kind, maturity);
- Procurement (GFS&I); and
- Contractor performance (based on work history).

4.4.2 EM-LA Programmatic Risks

Environmental Management programmatic risks are those risks that affect project execution at a program level. The cost and schedule impacts of EM-LA Programmatic risks are not and should not be included in a project's contingency calculation, such as:

- Closure of the Waste Isolation Pilot Plant (WIPP);
- Congressional funding reductions;
- Unknown-unknowns;
- EM funding reductions;
- Stakeholder changes;
- Site mission changes;
- Contractor transitions;
- Federal regulatory and statutory changes;
- DOE and EM directives;

- Cross-project risks that involve interrelationships between different mission objectives and projects at the same site; and
- co-dependent project risks that are generated when intermediate deliverables interlock in such a way that if both projects are not successfully completed, neither can be successfully completed.

4.5 Risk Identification Process

Participants in the risk identification process include risk owners, SMEs, and other EM-LA Program stakeholders. The EM-LA Program conducts risk identification using a structured approach for determining which events are likely to affect a program or project and documenting the characteristics of the events that may happen. Risk types include both threats and opportunities. Risk identification, facilitated by the RMCs, may include review of program documentation (e.g., work breakdown structure [WBS], schedule, planning assumptions), historical documentation, lessons learned, expert interviews, brainstorming, and scenario-based interviews with program managers and SMEs, cause-and-effect evaluation, and other techniques designed to encourage identification of a comprehensive set of risks. DOE Guide 413.3-7A (1-28-2011) recommends the use of a risk breakdown structure (RBS) to allow for a hierarchical structuring of risks and to facilitate brainstorming of new risks. Appendix B provides an example of an RBS that risk identification participants may use. Appendix C provides a list of common risks that participants should also consider during the brainstorming process. Risk identification should not be limited by these examples, however, and additional resources should be utilized as necessary to ensure complete identification of all risks.

The risk identification process should consider potential impacts to PBS life cycle cost, schedule, and scope of work. The initial process of risk identification continues until there is a high level of confidence, commensurate with the perceived level of risk of the program, that as many risks as possible have been identified. The RMCs record all identified risks and any pertinent assumptions in the appropriate risk register. Risks are stated clearly in the risk register in terms of both the risk event and the consequences to the program/project. Each risk statement includes cause/risk/effect.

4.6 Risk Analysis

Once the EM-LA Program has identified risks, they are evaluated to determine their potential impact to the program. The objective of the analysis process is to focus attention on the areas of greatest consequence and impact. Risk analysis employs both qualitative and quantitative methods. The EM-LA Program subjectively evaluates identified risks to determine the probability and consequence of each risk. The top risks are selected for further quantification and response planning.

4.7 Qualitative Risk Analysis Process

Risk is a measure of the potential ability (opportunity) or inability (threat) to achieve overall program objectives within defined cost, schedule, technical, and regulatory constraints. Risk has two components: (1) the probability of succeeding (opportunity) or failing (threat) to achieve a particular outcome, and (2) the consequences of succeeding (opportunity) or failing (threat) to achieve that outcome.

The EM-LA Program follows an established methodology of considering the probability of occurrence of a risk along with the consequences to determine whether the risk is ranked as high, moderate, or low. These probability and consequence components are assessed using a probability factor and a consequence factor.

The RMCs, risk owners, SMEs, and EM-LA Program stakeholders collaborate to determine the appropriate probability factor and consequence factor for each risk identified. Criteria related to operations projects for these factors are defined in Tables 2 and 3 below and can be tailored for

each CAP on an as needed basis. Tailored risk criteria must be reported in the project specific RAR.

In the definitions below, the probability of occurrence for a risk is considered for the duration of the program. Probability and consequence factors are monitored and updated as necessary during the program's life cycle.

Table 2
Definition of Risk Probability

Probability	Definition
Very Likely	Risk is likely to occur with a probability greater than or equal to 75%. *(Note: Risks likely to occur with a probability greater than or equal to 90% should be added to the baseline and removed from the risk register.)*
Likely	Risk is likely to occur with a probability greater than or equal to 50%.
Unlikely	There is less than 50% chance that this risk will occur.

Table 3
Definition of Risk Consequence

Type of Risk	Marginal	Significant	Critical
Cost: Impact on Project Contingency	< 1% of the Performance Measurement Baseline (PMB)	1% to < 3% of the PMB	> 3% of the PMB
Schedule: Impact on Project Schedule	Minor slip in schedule with some schedule potential adjustment to milestones required. SCHEDULE change < 1% of the original schedule duration.	Significant slip in schedule with resulting milestones changes that may affect facility mission. SCHEDULE change in the range of 1% to < 3% of the original schedule duration.	Significant slip in schedule with resulting milestones changes that may affect facility mission. SCHEDULE change > 3% of the original schedule duration.

The matrix shown in Table 4 (next page) combines the probability and consequence to determine a ranking (or score) for each risk. The purpose of the matrix is to focus attention and resources on issues that have the highest probability of occurrence or the highest consequence. The probability, consequence, and assigned risk level are documented in the appropriate Risk Analysis Forms and the Risk Register.

Table 4
Risk Level Matrix

		Consequence		
		Marginal	**Significant**	**Critical**
Probability	**Very Likely**	Moderate	High	High
	Likely	Low	Moderate	High
	Unlikely	Low	Low	Moderate

4.8 Quantitative Risk Analysis Process

For budgeting of capital asset projects, it is DOE policy to establish one or more funding reserves above the target value as a means of providing for costs not anticipated in the initial estimate. The EM-LA Program has two levels of reserve funding: the contractor MR and EM funded contingency. Figure 2 depicts the relationship of MR and EM contingency to each other and to the total project cost (TPC).

The EM policy on contingency requires quantitative risk analysis to determine contingency (Golan 2005). Quantitative risk analysis involves the numerical evaluation of the risk handling strategy identified for each risk qualitatively scored as high, moderate or low, including specific EM-LA Program PBS life cycle cost and schedule impacts. Quantitative risk analysis also includes determining the probability of achieving specific cost or schedule objectives. The results of quantitative risk analysis can be used to determine the level of risk planning that is required to successfully achieve cost and schedule objectives. The ultimate objective of this quantitative risk analysis is the development of EM funded contingency for capital asset projects and the identification of the potential risk associated with operations projects. The results of the quantitative risk analysis process are documented in the federal risk assessment reports.

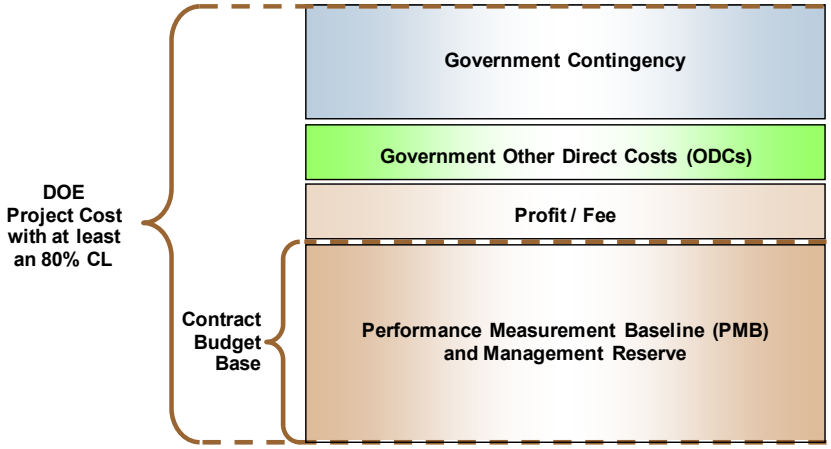


Figure 2. Contingency Model

4.9 Identifying Cost and Schedule Impacts

Department of Energy policy (Anderson 2006) requires that contingency be composed of the costs associated with mitigating identified risks and the costs associated with accommodating risk handling strategies into the schedule. Cost and schedule impacts associated with mitigating identified risks are therefore estimated following the identification of avoidance and/or mitigation strategies (discussed in detail later in this RMP). Avoidance/mitigation strategies may have the effect of reducing the probability of occurrence and/or the consequences of the risk.

The EM-LA Program assesses cost uncertainty, quantitative cost and schedule impacts for risk handling strategies identified for each risk qualitatively scored as high or moderate. Additionally, the costs and schedule impacts of identified residual and secondary risks scored as high or moderate are quantified. Cost impacts include the costs associated with the risk handling strategy and residual and secondary risks, such as the cost of additional effort necessary to carry out the response, additional work scope, and any related material expenses. Schedule impacts are estimated and assigned a monetary value based on the associated hotel load (program management and infrastructure) per day of delay. Optimistic, most likely and pessimistic values are identified. These values may represent a range of potential costs (e.g., if a different remedy is required) or they may include a “most likely” cost with optimistic and pessimistic values based on the potential error band or accuracy range of the cost estimate.

Cost and schedule impacts are estimated based on the best available information. Assumptions made are based on information gathered from risk owners, SMEs, EM-LA Program stakeholders, historical documentation, lessons learned, and similar projects, in an effort to assign a meaningful cost and schedule impact to each risk. Appendix D provides a list of common assumptions that are used to quantify risks. As previously stated, risk assessment is an iterative process, and these assumptions are continuously assessed and revised as the program progresses through its life cycle. The RMCs document assumptions and estimated cost and schedule impacts in the risk register.

4.9.1 Cost Risk (or Cost Uncertainty) Analysis Process

Uncertainty is a part of all projects. The amount of uncertainty directly correlates to how much is known about the project. As a project advances through its life cycle phases, more information becomes available, fewer questions are unanswered, and cost uncertainty (and therefore cost risk) diminishes. Uncertainty can be modeled as variables to which Monte Carlo analysis is applied, resulting in a probability distribution. The Monte Carlo model effectively analyzes the distribution of values within the range of estimate such that the confidence level of point estimates can be determined. Additionally, confidence levels can be established for calculating contingency values for capital asset projects. Programmatic uncertainties associated with operations projects are accounted for by performing an uncertainty analysis of the cost and schedule to determine the cost and schedule estimate at a 50 % confidence level.

The EM-LA Program typically creates estimates for projects during a planning phase and refines those estimates as the project progresses through its life cycle phases. Early estimates provide a rough order of magnitude of the possible costs and later, with more project definition available, a more accurate estimate can be established.

The EM-LA Program applies the life cycle phases defined for Environmental Restoration Cleanup Phases in Chapter 4, Types of Cost Estimates, of DOE Guide 430.1-1 (DOE 1997). Table 5 summarizes the purpose and accuracy range used for each phase. The guide establishes an accuracy range for cost estimates within each life cycle phase. For example, if the estimate in question is for conducting a Corrective Measures Study (CMS), and the project is currently in the midst of characterization efforts, then the CMS estimate will be a planning estimate with an accuracy range of -50% to +100%. This accuracy range is used as a starting point for discussions with the contractor Project Team Leader (PTL) / risk owner and SMEs to determine the range of

estimate required to build a Monte Carlo simulation model. The PTL and SMEs can apply their knowledge of specific activities to refine the range for the final model. Level of effort activities, or activities with fairly certain costs, are excluded from this analysis. The results of Monte Carlo analysis are used to quantify uncertainty and calculate confidence levels for the baseline budget submittal process.

Table 5
Definition of Life Cycle Phases for Environmental Restoration

Life Cycle Phase	Purpose	Estimating Accuracy Range
Planning	Assist in preliminary planning and budgeting for cleanup	-50% to +100%
Feasibility	Used to evaluate the numerous technical solutions developed to remediate a site	-30% to +80%
Preliminary	A more detailed cost estimate that is developed after a remediation alternative is selected	-30% to +60%
Detailed	Used to verify the contractor's figures in both lump sum and negotiated fee projects	-10% to +25%

4.9.2 Contractor Execution Risk Analysis

In addition to the cost uncertainty risk analysis described above, quantitative analysis is performed on the contractor execution risks to determine cost and schedule impacts for the purpose of calculating contingency for capital asset projects. Risks that are considered beyond the control of the contractor have been transferred to DOE for inclusion in the federal risk register and EM funded contingency.

The EM-LA Program recognizes potential overlap from the cost risk (uncertainty) quantification and the contractor execution risk quantification. For example, the uncertainty (or cost range) of waste disposal costs over the life of the project is a potential overlap with a contractor execution risk associated with disposal of low-level waste versus industrial waste reflected in the baseline. Where these potential overlaps exist, the EM-LA Program uses only the optimistic (lowest) value in the contractor execution Monte Carlo simulations to avoid overstating the cost impact.

4.10 Calculating EM Contingency for Capital Asset Projects

Environmental Management funded contingency is calculated for use by the FPD and is "the portion of the project budget that is available for managing risk within the funded project baseline" (DOE Guide 413.3-7A). EM policy establishes project contingency for capital asset projects at a level that provides at least an 80 percent confidence level for completing the baseline for EM cleanup projects. EM funded contingency is calculated by performing a Monte Carlo analysis of the project schedule activities and the contractor and federal risks to determine the 80 percent confidence level for completing the baseline.

Environmental Management schedule contingency is additionally for use by the FPD and is "the portion of the overall project schedule duration that is estimated to allow for the time impacts of risks" (DOE Guide 413.3-7A). EM policy establishes schedule contingency to provide at least an 80 percent confidence level for EM cleanup projects.

Contingency values are related to the program's defined scope. Should an event occur that fundamentally changes the program's scope, such as a change in remedial remedy, a new baseline will be developed along with recalculated EM contingency values.

The optimistic, most likely, and pessimistic costs and schedule values are analyzed using a Monte Carlo simulation model to determine the EM funded contingency with an 80 percent level of confidence for capital asset projects. The use of a Monte Carlo simulation model allows the determination of the probability of achieving cost and schedule objectives for the EM-LA Program within a specified confidence level. For most risks, the cost and schedule impact estimate is uncertain and could be within a range of values. Probabilistic methods determine distributions to represent entire judgments about the outcomes of uncertainties. Optimistic, most likely and pessimistic values for both cost and schedule are provided as inputs to a triangular distribution function. The Monte Carlo simulation model is used to calculate the level of confidence cost and schedule estimate or impact for each individual schedule item and risk.

Expected Value (EV) is additionally used to determine the final cost value of each risk for the calculation of EM funded contingency. EV is "a probability weighted average of all possible outcomes." (DOE Guide 413.3-7A). EV is useful in determining which risks should receive more attention or more resources during the risk management process. The EV of each risk is determined by multiplying the probability of the risk by its cost value determined through Monte Carlo simulation. Quantitative probability factors are defined for each of the three qualitative probability factors identified previously in Table 2. Quantitative probability factors are conservatively chosen to prevent underestimation of the magnitude of a given risk. Table 6 provides the quantitative probability factors used in the determination of EV.

Table 6
Quantitative Probability Factors

Probability of Occurrence	Quantitative Probability Factor
Unlikely	0.40
Likely	0.60
Very Likely	0.80

4.11 Risk Handling

After risks have been identified and qualitatively analyzed, an appropriate risk handling strategy is developed. The risk handling strategy identifies strategies for reducing the overall risk to the program by decreasing the probability and impact of threats and increasing the probability and impact of opportunities.

Four fundamental strategies are available to respond to threats:

1. **Avoidance** - This strategy seeks to prevent or eliminate the source of risk, generally through a fundamental change in requirements or specifications. This strategy decreases the likelihood of occurrence of the risk event(s).
2. **Mitigation** - This strategy mitigates the consequences should the risk be realized.
3. **Acceptance** - This strategy is an acknowledgement that the risk exists and represents a conscious decision to assume the consequences should it be realized. Risk acceptance is an appropriate strategy for risks that remain after application of the first two strategies and for low-level risks where formal response actions would not be cost-effective.
4. **Partial Transference** - This strategy involves the partial reallocation (i.e., the risk mitigation is shared) of all or part of the risk to another party.

The following two strategies may be used to respond to opportunities (Mulcahy 2003):

1. **Exploit** - This strategy increases the opportunity by making the cause more probable.
2. **Enhance** - This strategy increases the expected time, quality, or monetary value of a risk by increasing its consequences.

For all identified risks, the various handling strategies are evaluated in terms of feasibility, expected effectiveness, cost and schedule implications, and the effect on the system's technical performance, with the most suitable strategy selected. Avoidance and exploitation are the preferred risk handling strategies.

4.11.1 Risk Handling Process

A risk handling strategy is developed for every risk that is scored as high or moderate. Risk handling strategies for risks that are ranked as low are developed at the discretion of the RMCs and the risk owner. The risk handling strategy for a risk includes details on what must be accomplished, a monitoring trigger to alert the risk owner that an event has occurred to trigger the risk handling strategy actions, and a monitoring trigger date for tracking and reporting. The risk handling strategy also includes start and completion dates for planned activities related to the risk handling strategy. The RMCs capture these strategies, along with strategies to capitalize on opportunities, in the risk register database. The risk handling strategy is used to manage individual risks, set a schedule for accomplishing the related tasks, and assign responsibility for the tasks. The assigned risk owner is responsible for ensuring that the response plans are carried out.

Figure 3 presents a simplified depiction of the risk handling process. As previously stated, the preferred risk handling strategy for threats is risk avoidance (Step 1 in the figure). Risk avoidance may be included in the baseline as an activity.

Should risk avoidance prove unsuccessful in full or in part, risk mitigation (Step 2) is attempted. It may be necessary to accept the risk if a mitigation strategy is not available or if the cost and/or schedule impact of the risk mitigation strategy is greater than the cost and/or schedule impact of risk realization. Should the mitigation strategy prove unsuccessful in full or in part, a residual risk remains. The residual risk may be the original risk (if the mitigation strategy was completely unsuccessful) or a subset of the original risk (if the mitigation strategy was partially successful). A new mitigation strategy may be formulated (Step 3) to deal with the residual risk, or the residual risk is accepted if no further mitigation is possible or additional mitigation is not cost (or schedule) effective. If residual risk mitigation is unsuccessful, it is assumed that the risk is realized. Success is assumed if the initial mitigation strategy results in minimal or no impact to cost and/or schedule. It is further assumed that success of residual risk mitigation has a greater impact to the cost and/or schedule of the project than the initial risk mitigation alone, but not as severe as full realization of the risk with no successful mitigation.

Secondary risks may be identified as fallout of implementing risk handling strategies. Risk handling strategies may be developed for secondary risks (Steps 4 and 5). As with the original risk, it assumes success if the initial mitigation strategy results are minimal or have no impact to cost and/or schedule. It is further assumed that success of secondary residual risk mitigation has a greater impact to the cost and/or schedule of the project than the initial risk mitigation alone, but not as severe as full realization of the secondary risk with no successful mitigation.

An identified risk may be partially transferred to a second party (e.g., DOE HQ) if the risk cannot be effectively managed by Los Alamos Field Office alone, but can be effectively managed by a second party. The second party must agree to accept partial responsibility of the risk and take actions necessary to avoid or mitigate the risk. It remains the Field Office's responsibility to monitor the risk and address any residual and/or secondary risks that may arise following avoidance and/or mitigation strategies taken by the second party.

If a risk handling strategy is not included in the baseline (i.e., it is part of the EM contingency estimate), a Baseline Change Proposal (BCP) may be necessary prior to risk realization.

4.11.2 Residual and Secondary Risks

Residual risks, or risks that remain after the risk handling strategies have been implemented, are also identified, scored, and quantified (if moderate or high) in the risk register databases.

Secondary risks (new risks that are introduced by a response) are identified, scored, and quantified (if moderate or high) in the risk register databases.

4.11.3 Risk Monitoring

"Risk monitoring involves the systematic, continuous tracking and evaluating of the effectiveness and appropriateness of the risk handling strategy, techniques, and actions established within the risk management plan" (DOE Guide 413.3-7A, 1-28-2011). EM-LA performs risk monitoring through self-assessment to ensure:

- Risk owners are current and performing their roles and responsibilities as outlined by this RMP;
- Risk identification is performed as changes to the program are identified and that ongoing risk identification is both encouraged and managed;
- Accepted risks and low risks are reviewed regularly for changes in status;
- Avoidance strategies are implemented according to schedule and are proving successful;
- Risk handling strategies are being successfully implemented and executed;
- Any back-up plans are reviewed for applicability and if any others need to be put into place based upon performance of the current handling strategies;
- Cost and schedule contingency calculations for the current handling strategies that are being implemented and those that will be implemented in the near future are based upon recent performance for projected accuracy;
- Risk management communication that may be necessary for any current or near-term risks for management, customers, stakeholders, or others is consistent with the risk management communication plan; and
- The risk register and other risk-related documentation are up-to-date.

4.11.4 Risk Feedback

Risk monitoring ultimately provides feedback to the preliminary planning step and in some instances can initiate a review of the process steps again. EM-LA accomplishes risk feedback with the risk register. As previously described, the risk register is a living database that is maintained throughout the life cycle of the EM-LA Program. The EM-LA Program reviews the risk register annually as part of the baseline submittal process. In addition, this RMP requires that the risk register be regularly (at least monthly) assessed and revised to ensure assumptions remain correct and to update the status of risk management. The RMCs maintain the risk register under change control as described further in Section 2.5.1.

Risk feedback is also accomplished through risk reporting. EM-LA risk reporting is described further in Section 3, "Risk Documentation and Communication Plan," of this RMP.

4.11.5 Risk Register Change Control

As previously stated, the risk register is maintained under change control. Risk owners are responsible for keeping risks current through the change control process. Two types of changes are made through the risk management change control process:

1. **Major changes** – Those changes that involve modification of the qualitative score (i.e., low, moderate, high) for cost impacts, schedule impacts, status of risk (i.e., open, closed, transferred), and addition of new risks.
2. **Minor changes** – All other changes that do not fall under the category of major changes.

The RMCs, acting at the request of a risk owner, will make both major changes and minor changes to risks within the risk register. All major changes are recorded in a change control log within the risk register. The change control log is used, as necessary (e.g., when the RMP is updated), to report major changes and to report on trends, such as total number of risks per project, number of risks added since the last reporting period, number of risks closed since the last reporting period, number of risks realized since the last reporting period, etc.

4.11.6 Risk Documentation and Communication Plan

This RMP and reports generated from the risk register are the primary forms of documentation and communication associated with EM-LA Program risk management. The RMCs provide risk owners with a monthly monitoring report detailing risks with a monitoring trigger or risk handling date within a specified period (e.g., 30 days out or less). Risk owners review and update the risks on this report at least quarterly.

Progress and status of the risk register, including any additions or closure of risks, is reported to EM as required by DOE EM policies and procedures. The reporting format is such that it will convey information to decision-makers and team members on the status of the program risks as well as the effectiveness of the handling strategies. Any *ad hoc* reports are created following a written request by a FPD to an RMC who is responsible for generating and tracking the reports.

Environmental Management program stakeholders are additionally apprised of the status of risks, as applicable, through written communication (e.g., with the New Mexico Environment Department [NMED]), meetings with EM-LA Program stakeholders, including public meetings, and any other communication deemed necessary to appropriately inform stakeholders of the status of the EM-LA Program.

A *Federal Risk Management Communication Plan* (June 2013) was prepared by EM-LA and includes greater detail regarding the process for communication of risk information.

5.0 REQUIREMENTS AND REFERENCES:

5.1 Requirements

Reserved

5.2 References

Maggiore, Peter, July 3, 2014. Site-based Recommended to be Added to a Risk Register Managed by Headquarters Environmental Management, U.S. Department of Energy Memorandum for Barry Gaffney, Director, Office of Strategic Planning and Analysis. (Official transfer of Programmatic Risks to EM HQ)

Anderson, C.E., July 10, 2006. Policies for Environmental Management Operating Project Performance Baselines, Contingency and Federal Risk Management Plans, and Configuration Control, U.S. Department of Energy Memorandum for Distribution from Charles E. Anderson, Principal Deputy Assistant Secretary for Environmental Management. (Anderson 2006)

U.S. Department of Energy, Cost Estimating Guide, DOE Guide 430.1-1. (03-28-97)

U.S. Department of Energy, Risk Management Guide, DOE Guide 413.3-7A. (1-18-2011)

U.S. Department of Energy, Program and Project Management for the Acquisition of Capital Assets, DOE Order 413.3B. (Approved: 11-29-2010)

Mustin, Tracy P., March 15, 2012. Policy and Protocol for Office of Environmental Management Operations Activities, U.S. Department of Energy Memorandum to Distribution, Principal Deputy Assistant Secretary for Environmental Management. (Mustin, 2012)

Golan, P.M., February 3, 2005. Environmental Management Contingency Policy, U.S. Department of Energy Memorandum to Distribution from Paul M. Golan, Acting Assistant Secretary for Environmental Management. (Golan 2005)

Los Alamos National Laboratory, December 2007. Integrated Project Execution Plan, Rev. 1, Los Alamos National Laboratory document LA-UR-07-6683. (LANL 2007)

Mulcahy, R., PMP, 2003. Risk Management, Tricks of the Trade for Project Managers, RMC Publications, Inc. (Mulcahy 2003)

U.S. Department of Energy, Los Alamos Field Office, Environmental Projects Office, Federal Risk Management Communication Plan (June 2013)

Other Useful References/Recommended Reading

Root Cause Analysis Contract and Project Management, April 2008, http://science.energy.gov/~/media/opa/pdf/processes-and-procedures/doe/Final_RCA_Rpt.pdf

National Research Council, The Owner's Role in Project Risk Management, 2005, http://www.nap.edu/catalog.php?record_id=11183

GAO-09-3SP, GAO Cost Estimating and Assessment Guide, Chapter 14 – "Cost Risk and Uncertainty," March 2009, http://www.gao.gov/products/GAO-09-3SP

November 4-6, 2009 Risk Management Workshop (Oak Ridge, TN) Briefings, http://energy.gov/sites/prod/files/maprod/documents/Gruber_-_PMI_and_AACEI.pdf

6.0 DEFINITIONS AND ACRONYMS:

6.1 Definitions

Assumptions and Constraints: Assumptions and constraints relevant in the evaluation of risks and associated contingency are identified in the related Risk Assessment Reports (RAR).

Opportunities: Risks with positive benefits. (Example: Authorized release limits are approved allowing waste that was previously estimated as low level to be disposed of as industrial reducing waste disposal costs.)

Risk: Factor, element, constraint, or course of action that introduces an uncertainty of outcome, either positively or negatively that could impact program or project objectives. This definition for risk is strictly limited as it pertains to program or project management applications in the development of the overall RMP and its related documentation and reports.

Risk Assessment: Identification and analysis of project and program risks to ensure an understanding of each risk in terms of probability and consequence.

Risk Assumptions: An assumed action or decision that would cause the risk to occur or any project assumptions pertaining to the risk itself. (Example: Public stakeholders influence regulator decision on final remedy. Impact Reclassification process will provide sufficient data to support remedy selection.)

Risk Handling Strategy: Process that identifies, evaluates, selects, and implements options in order to set risk at acceptable levels given program or project constraints and objectives. Typical strategies include avoidance, mitigation, acceptance, and transference, specific actions, when they should be accomplished, the risk owner, and the cost and schedule.

Risk Management: The handling of risks through specific methods and techniques; includes planning for risk, assessing (identifying and analyzing) risk issues, developing risk handling strategies, monitoring risks to determine how risks have changed, and documenting the overall risk management program.

Risk Monitoring and Tracking: Process of systematically watching over time the evolution of the program and project risks and evaluating the effectiveness of risk strategies against established metrics.

Risk Planning: Process of developing and documenting an organized, comprehensive, and interactive strategy and methods for identifying and tracking risk, performing continuous risk assessments to determine how risks have changed, developing risk handling plans, monitoring the performance of risk handling actions, and the assignment of adequate resources.

Threats: Risks with negative consequences. (Example: Waste volumes are greater than estimated increasing waste disposal costs.)

6.2 Acronyms

BCP	Baseline Change Proposal
CAP	Capital Asset Project
CH	Contact-Handled
CMS	Corrective Measures Study
CPM	Contractor Project Manager
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EM	Office of Environmental Management
EM-LA	Environmental Management Los Alamos
EPO	Environmental Projects Office
EV	Expected Value
EVMS	Earned Value Management System
FOM	Field Office Manager
FPD	Federal Project Director
GFS&I	Government-Furnished Services and Items
HQ	Headquarters
LANL	Los Alamos National Laboratory
M&O	Management & Operating
MR	Management Reserve
NMED	New Mexico Environment Department
ODC	Other Direct Costs
OPS	Operations Project
PBS	Project Baseline Summary
PMB	Performance Measurement Baseline
PSR	Project Status Review
PTL	Project Team Leader
RAM	Responsibility Assignment Matrix
RBS	Risk Breakdown Structure
RH	Remote-Handled

RMC	Risk Management Coordinator
RMP	Risk Management Plan
SME	Subject Matter Expert
TA	Technical Area
TPC	Total Project Cost
TRU	Transuranic
WBS	Work Breakdown Structure
WIPP	Waste Isolation Pilot Plant

7.0 RESPONSIBILITIES:

RMCs are appointed by the EM-LA Field Office Manager (FOM) in coordination with the overall Risk Program Manager and the appointed FPDs to facilitate and manage the risk management process. The roles and responsibilities of the RMCs, as well as other key participants in the risk management process are outlined in following subsections. Table 1 provides the responsibility assignment matrix (RAM) for EM-LA's management of the federal EM risk Program.

Table 7
Risk Management Responsibility Assignment Matrix

	FPD	RMC	Risk Owner	SME	Other Stakeholders
Risk Planning	X	X			
Risk Identification		X	X	X	X
Qualitative Analysis		X	X	X	X
Quantitative Analysis		X	X	X	X
Risk Handling Strategy		X	X	X	X
Monitoring and Control		X	X		
Risk Communication	X	X	X		

7.1 Federal Project Director (FPD)

The FPD directs the risk planning process and has joint approval authority over the resulting RMP and any risk communication associated with the risk management process. It is the FPD's responsibility to ensure that risk identification is both encouraged and managed within EM-LA.

The FPD has oversight of the performing contractor's risk management process. The contractor reports on the status of contractor execution risks during the monthly Project Status Review (PSR). Additionally, the FPD may require additional risk assessment in conjunction with reported variances or BCPs.

7.2 Risk Management Coordinators (RMC)

The RMCs (Federal team lead and PBS specific risk SME support team), are the overall coordinators of the risk management process for the EM-LA Program. The RMCs are responsible for:

- Maintaining this RMP;
- Maintaining the risk registers;

- Briefing the FPD on the status of EM-LA Program risks;
- Tracking efforts to reduce moderate and high risk to acceptable levels;
- Providing risk management training;
- Facilitating risk assessments;
- Preparing risk briefings, reports, and documents required for program reviews and the acquisition milestone decision processes; and
- Coordinating with the M&O contractor's risk management program.

7.3 Risk Owners

Risk owners are those stakeholders that are assigned to manage specific risks, including facilitating the risk handling strategy as necessary and appropriate, and monitoring the risk through closure. Risk owners are ultimately responsible for their assigned risks and are involved in the risk management process from risk identification through closure. Risk owners are assigned during the risk identification process and are typically those responsible for managing the project scope, cost, and schedule (i.e., federal project managers or leadership who oversee or manage certain program risk).

7.4 EM-LA Federal Project & Program Managers

The federal project and program managers are responsible for EM project and program risk management, and implementing this RMP for their projects.

The federal project and program manager's responsibilities include:

- Assume ownership of the EM-LA Programmatic and project risks and subsequent handling strategies;
- Actively participate in the project's implementation of risk management, particularly in the mitigation of EM project and programmatic risks when the project's scope, budget, or schedules are affected;
- Work with the RMCs to maintain and update the risk register database with all identified risks and risk elements (e.g., assumptions, cost estimates, monitoring triggers, etc.,) associated with the project;
- Ensure risk handling results are documented and risks are marked closed when the risk is no longer applicable to the project; and
- Oversee the contractor's risk management efforts.

7.5 Subject Matter Experts (SME)

SMEs collaborate with the RMCs and risk owners as appropriate to identify, assess, and quantify potential risks. SMEs have knowledge about the technical aspects of individual projects and their respective risks. SMEs apply technical knowledge and experience to identify the risks, assess the risks within certain scenarios, and determine the probability and consequence of risk realization. SMEs additionally assist with the quantification of the potential cost and schedule impacts for calculating cost and schedule contingency.

7.6 Stakeholders

Stakeholders include those individuals and organizations that are actively involved in the program or may be affected by the program, including contractor personnel, the customer or end-user, suppliers and vendors, public relations, quality assurance/quality control, legal advisors, and the public. Stakeholders will likely identify risks that other participants may not otherwise consider and can be a valuable asset to the risk management process. The FPD invites stakeholders to be involved in the risk management process as applicable and appropriate.

8.0 ATTACHMENTS:

- Appendix A – Risk Management Objectives and Criteria, Rev. 0
- Appendix B – Risk Breakdown Structure

- Appendix C – Common Risks
- Appendix D - Risk Quantification Estimating Assumptions

9.0 RECORDS:

Records packages generated by this instruction shall be maintained as QA records and shall be handled in compliance with the requirements identified in the *EM-LA Records Management* procedure.

10.0 REVISION HISTORY:

Rev. No.	Rev. Date	Affected Section(s)	Description of Revision
0	mm/dd/yyyy	All	Initial release

END OF DOCUMENT

APPENDIX A

Risk Management Objectives and Criteria

EM-LA Program Overall Objectives for Risk Management

Objectively identify, assess, communicate, and manage risks through all phases of planning and execution to support LANL's overall goal of delivering the EM-LA Program on schedule, within budget, and fully capable of meeting mission performance, safeguards and security and environment, safety, and health standards.

EM-LA Program Risk Management Supporting Objectives and Criteria

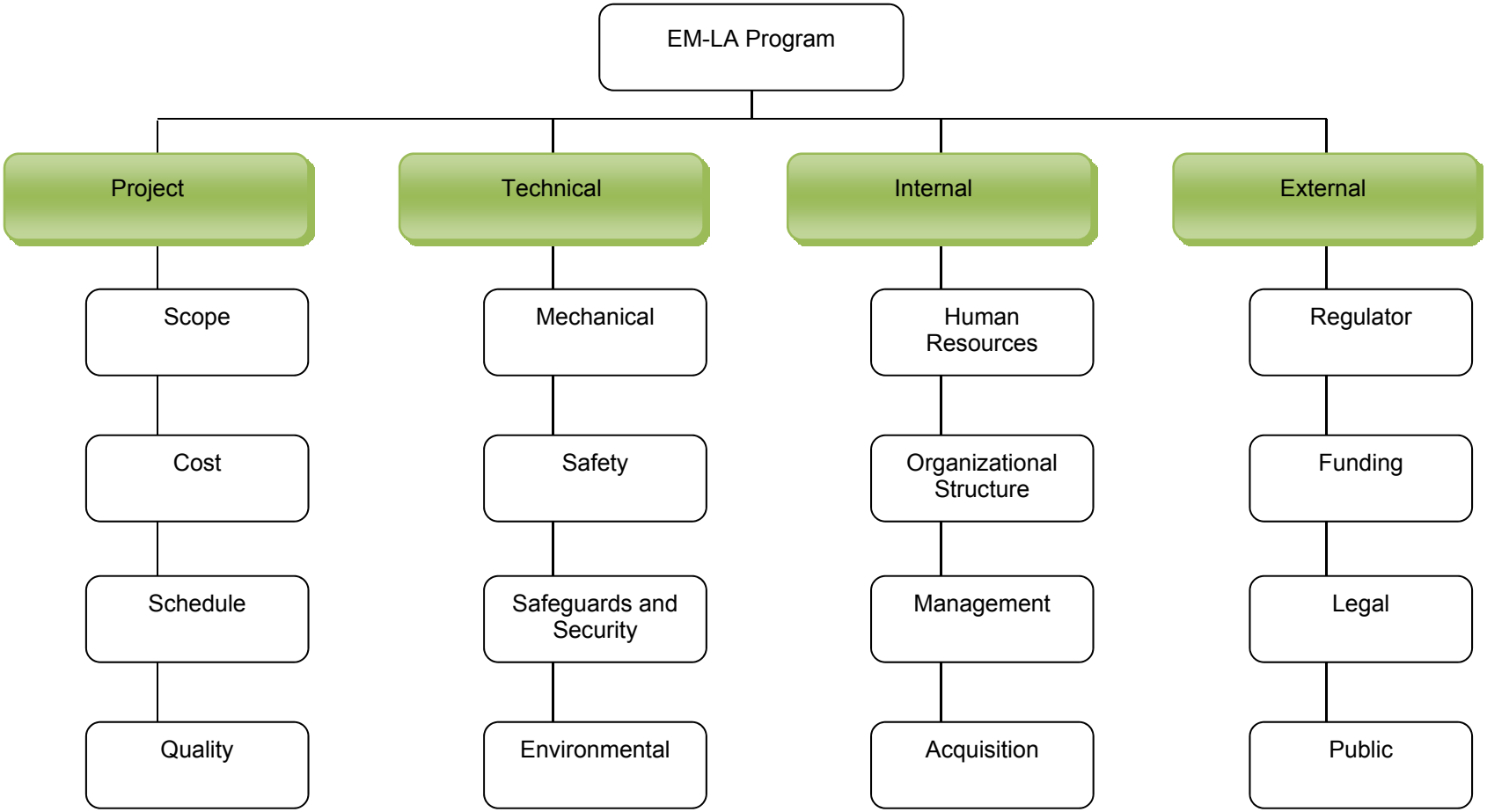
No	Objective	Criteria
1	The EM-LA Program develops and maintains a risk management plan with appropriate approvals and distribution.	The RMP is reviewed, revised, and approved on a periodic basis consistent with RMP and DOE requirements.
		The approved RMP is available for review in a known and accessible location (e.g., electronic library).
		Changes to the RMP are communicated to all EM-LA Program personnel with responsibility for risk management.
2	The EM-LA Program identifies and documents new risks as new projects are initiated and as changes occur within existing projects.	Risk identification is performed when new projects are initiated.
		Risk identification is performed when assumptions (e.g., addition of scope, change in approach) change on existing projects.
		In addition to threats, opportunities for reducing cost and improving schedule are identified.
		Risk triggers are identified for each new risk.
		A risk handling strategy is developed for each new risk (if they are moderate or high risks).
		Probability of risk occurrence and consequence of risk impact are identified qualitatively.
		Quantitative cost and schedule impact estimates (including optimistic, most likely, and pessimistic) are identified for each new risk.
		Monte Carlo analysis is used to establish the cost and schedule uncertainty as well as the DOE contingency in accordance with DOE policy.

No	Objective	Criteria
		Residual and secondary (as applicable) risks are identified and consider the effect of implementation of the risk handling strategy.
		Newly identified risks are documented in the federal and contractor risk registers, as appropriate.
3	The EM-LA Program implements, tracks, and updates/revises risk handling strategies as necessary to ensure effective management of risks.	Risk handling strategies are implemented as planned.
		The effectiveness of risk handling strategies is monitored/tracked to evaluate effectiveness of avoiding or mitigating risk.
		Risk handling strategies are revised when they do not appear to be effective at avoiding or mitigating risk.
		When risk handling strategies are revised, residual and secondary risks are re-evaluated.
		When risk handling strategies are revised, cost and schedule impacts are re-evaluated.
		The risk register is updated to reflect status of and/or changes to risk handling strategies.
4	The EM-LA Program actively and continuously monitors risks with updates to the risk register made as appropriate.	Risks are monitored with status provided for input into the risk register at least monthly.
		Previously identified “low” risks are reviewed periodically to ensure that their ranking and status has not changed.
		Risks that are realized are closed with appropriate explanation made in the risk register.
		Risks that have been overcome are closed with appropriate explanation made in the risk register.
		Risk triggers, probabilities, and consequences are reviewed and revised as necessary.
		DOE contingency is reevaluated when risks are added, revised, or closed.
5	The EM-LA Program reports the status of risk management.	Periodic risk management status meetings are held between the contractor and the federal project managers.
		Periodic risk management status meetings are held among the federal project managers.

No	Objective	Criteria
6	The EM-LA Program implements risk management as an integrated element of the larger project management effort.	Earned value data is evaluated and used as a risk indicator or risk trigger.
		Risk updates are provided as part of project status reviews (e.g., quarterly project review).
		Risk is considered in planning and decision-making associated with projects.
		Project lessons learned are documented and used to identify risks and handling strategies on other similar projects.
7	EM-LA Program management provides emphasis and direction on risk management.	Management clearly identifies expectations for risk management.
		Management provides training and other learning opportunities for risk management.
		Management provides the tools to effectively perform risk management.

APPENDIX B

Risk Breakdown Structure


EM-LA Program
Project
Technical
Internal
External
Scope
Cost
Schedule
Quality
Mechanical
Safety
Safeguards and Security
Environmental
Human Resources
Organizational Structure
Management
Acquisition
Regulator
Funding
Legal
Public

APPENDIX C

Common Risks

The following lists can be used for brainstorming of EM-LA Program risks that may be applicable to individual projects. This list is very generic in nature and should be used as one tool to ensure all potential risks have been identified.

Design Risks

- Design incomplete.
- Unexpected geotechnical or groundwater issues.
- Inaccurate assumptions on technical issues in planning stage.
- Incomplete quantity estimates.
- New or revised standard.

External Risks

- Local communities pose objections.
- Public hearing/comment process takes longer than expected.
- Unreasonably high expectations from stakeholders.
- Political factors or support for project changes.
- Stakeholders request late changes.
- New stakeholders emerge and request changes.
- Regulator requires implementation of an unplanned remedy.
- Threat of lawsuits.
- Increase in material cost due to market forces.
- Water quality regulations change.
- New permits or additional information required.
- Reviewing agency requires longer than expected review time.
- Changes to storm-water requirements.
- Permits or agency actions delayed or take longer than expected.
- New information required for permits.
- Environmental regulations change.
- Labor shortage or strike.

Environmental Risks

- Environmental analysis incomplete.
- New information after environmental document is completed may require re-evaluation or a new document.
- Design changes require additional environmental analysis.

Organizational Risks

- Inexperienced staff assigned.
- Losing critical staff at crucial point of the project.
- Insufficient time to plan.
- Unanticipated project manager workload.
- Internal “red tape” causes delay getting approvals, decisions.
- Functional units not available, overloaded.
- Priorities change on existing program.
- Inconsistent cost, time, scope and quality objectives.
- Overlapping of one or more project limits, scope of work or schedule.
- Funding changes for fiscal year.

Project Management Risks

- Project purpose and need is not well-defined.
- Project scope definition is incomplete.
- Project scope, schedule, objectives, cost, and deliverables are not clearly defined or understood.
- No control over staff priorities.
- Consultant or contractor delays.
- Estimating and/or scheduling errors.
- Unplanned work that must be accommodated.
- Lack of coordination/communication.
- Underestimated support resources or overly optimistic delivery schedule.
- Scope creep.
- Unresolved project conflicts not escalated in a timely manner.
- Delay in earlier project phases jeopardizes ability to meet programmed delivery commitment.
- Added workload or time requirements because of new direction, policy, or statute.
- Local agency support not attained.
- Unforeseen agreements required.
- Priorities change on existing program.
- Inconsistent cost, time, scope, and quality objectives.

Remediation Risks

- Inaccurate contract time estimates.
- Change requests due to differing site conditions.
- Temporary excavation and shoring system design is not adequate.
- Unidentified utilities.
- Buried man-made objects/unidentified hazardous waste.
- Dewatering is required due to change in water table.
- Electrical power lines not seen and in conflict with construction.
- Insufficient or limited construction or staging areas.
- Delay in demolition due to sensitive habitat requirements or other reasons.
- Long procurement lead time.

APPENDIX D

Risk Quantification Estimating Assumptions

Base estimates on historical project information when available. For example, if the risk is NMED requires additional monitoring wells, base the cost of additional wells on the current average cost for drilling a well. Only defer to the following general estimating assumptions/methodology when historical project information is not available:

1. Assume 250 working days per year, or 21 working days per month.
2. Assume $800 per day or $200,000 per year per FTE.
3. Refer to http://energy.gov/node/28939/cf70/escalation.pdf for DOE escalation rate assumptions when estimating escalation for work deferred to out years.
4. Refer to DOE Guide 430.1-1, *Cost Estimating Guide* (03-28-97), Chapter -11, when an uncertainty range is required to determine optimistic and pessimistic estimates. Use uncertainty ranges when a most likely estimate is developed and no reasonable alternatives are available to develop the optimistic and pessimistic estimates.
5. Use alternatives analysis provided in CME reports to quantify the risk of NMED selecting a different remedy than that base-lined, when available.
6. Use the following percent increase when quantifying risks associated with uncertainty in waste volume:
   a. Optimistic – 10%
   b. Most Likely – 20%
   c. Pessimistic – 30%
7. Use the following days delayed when quantifying the risk of the public hearing process taking longer than base-lined (pessimistic estimate is based on experience from the SNL Mixed Waste Landfill):
   a. Optimistic – 63 days (3 months)
   b. Most Likely – 125 days (6 months)
   c. Pessimistic – 375 days (18 months)
8. Calculate cost impact (in addition to hotel load associated with schedule impact) by escalating work delayed. Cost impact is the escalation applied due to the delay. No cost impact due to escalation should be assumed for the optimistic estimate. Assume a one year delay for the most likely estimate and a two year delay for the pessimistic estimate when calculating escalation.
9. Assume the average depth of a groundwater well is 1050 feet. Assume completion of a groundwater well requires 300 hours or 25 12-hour shifts.