4.5 Cost Review

The following is an outline of the organization of Section 4.5:

4.5.1 Nuclear and Facility Operations

- 4.5.1.1 Methodology
- 4.5.1.2 Summary Findings & Concerns
- 4.5.1.3 Detailed Assessment
  - *Facility Landlord Functions*
  - *PuSPS Operations*
  - *Nuclear Stabilization*
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4.5.2 Demolition and Disposal

- 4.5.2.1 Overview
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- 4.5.2.6 Top-Down Estimate Review
- 4.5.2.7 Basis of Estimate Software Tool (BEST) Interface

4.5.1 Nuclear and Facility Operations

The purpose of the confidence review of the operational activities corresponding to the 2006 Closure Project Baseline is to assess how effectively the following project implementation details have been addressed:

- Planning, process methodology and assumptions
- The basis of cost estimate
- Risk assessment and contingency planning
- Resource allocation
- Integration across functions.

Exclusive of general site operations (PBDs 23 through 36), we have sorted operational activities into two macro process categories: Facility Landlord Functions and Nuclear Operations. We segregated the work thus solely as an organizing principle – it has no correlation to K-H's work structure. Direct and indirect costs related to these Operations represent approximately 8.1% of the overall project costs or $419 million from 1997 to 2006.

The Facility Landlord Function is to provide safe, compliant facilities to allow mission and site activities to occur. This is comprised of the following responsibilities:

- Maintenance
- Surveillance
- Technical Support
- Facility Management
- Compliance or Authorization Management.

The Nuclear Operations Function is to provide the processing of nuclear contaminated material within the Protected Area building clusters. This operation is comprised of the following responsibilities:

- Stabilization of SNM material (metals, liquids, solid residue, uranium)
- Development and operation of the PuSPS equipment
- Building Deactivation
- SNM Shipping.

4.5.1.1 Methodology

The following discussion is the result of our review of the 2006 Closure Project Baseline for Facility and Nuclear Operations. The Operations function is one of many "cross-cutting" activities; that is, the success or failure of its implementation directly affects the critical path of closure.
In order to validate the effectiveness of the macro-processes described above, we identified and analyzed specific work activities that we deemed indicative of the highest risk, cost, or "integration" exposure. This approach required a focused and thorough scrutiny of specific WADlets and the schedule and estimating bases that support them. It was not intended to be a comprehensive review of all PBDs associated with these operations; instead, it is a representative review of a number of specifically identified PBDs, WADs, and WADlets within the operations project. These will be identified and discussed later in this report.

A detailed assessment of the WADlets is required to test the management processes because estimating, scheduling and integration assumptions and support reside only within the WADlets. The WADlets provide the most meaningful insight to project protocol and controls. The criteria for selecting WADlets for validation testing follows.

Criteria for Selection of Sample

Our baseline confidence review of operating activities targeted those PBDs, WADs, and WADlets that directly affect the critical path to closure. The level of risk criticality was assessed based on the level of risk or uncertainty that we subjectively assigned to each activity. The risk assessment is comprised of three basic components: cost, schedule, and technical difficulty.

Aside from risk and uncertainty, our sample selection was driven by process. The PBDs, WADs, and WADlets that we have selected all "crosscut" one another at different points throughout the

project lifecycle, thus allowing us to critique the integration of operating activities within the 2006 baseline. This approach also permits us to analyze methodology and the potential alteration of the critical path to closure due to risk and uncertainty in each operating activity.

By researching risk, process methodology, implementation and integration from a WADlet level, we are better able to analyze the logical composition of the 2006 CPB.

While Facility Landlord Functions comprise a significant contribution to project cost, and are an important component of mortgage milestone reductions, they were given lower risk priority. There are two primary reasons for this:

1. Costs, while substantial, are stable and have well-established historical bases. They are therefore relatively easier to estimate and forecast; and,
2. Technical and schedule risks are low in building operations. The technical capabilities and skills for building operations are less demanding than those for Nuclear Operations.

Nuclear Operations ("NucOps") on the other hand represent the essence of the RFCP and for that reason we applied a higher level of scrutiny in this area. Furthermore, NucOps exemplify all three components of risk and have a major bearing on the Project's closure critical path currently scheduled for 2006.

In consideration of the above, we selected the following PBD's:

PBD	Description
8	Plutonium Metals & Oxide Stabilization
9	Plutonium Solid Residue Stabilization
12	SNM Shipping
16	Closure Cluster 371
17	Closure Cluster 707/750
18	Closure Cluster 771/774

We note that selection of these PBDs does not suggest that the others are of less importance; the selection was intended to be indicative of the "cross cutting" operational functionality across the project. A complete list of the PBDs, WADs, and WADlets selected for our sample follows later in this report.

Each PBD was subject to a high-level review to determine which WAD within the PBD would be selected for analysis. Then we focused on WADs that represented the highest cost and most significant technical and schedule risk. The same essential selection criteria were applied to the selection of WADlets. Upon review of a broad pool of WADlets, we selected a sample that we believed would best demonstrate the following:

- Integration and crosscutting functionality. WADlets which most depended upon coordinated management across activities were selected;

- Management protocol and accountability. WADlets that were assigned the same manager were generally not reviewed. The reason for this was to test the application of policy and procedures. This is based upon the assumption that strong policy and procedures would be proved through implementation consistency across different projects.

Support Documentation Review

After selecting PBDs, WADs, and WADlets for review, we gathered support data pertaining to them which was available through the RFETS intranet network. These documents include the following:

- Project Baseline Descriptions ("PBDs") including Appendix A - Baseline Cost Detail, Appendix B - Change Control Logs, and Appendix C - Work Authorization Documents (by fiscal year);
- Basis of Estimates ("BOEs");
- Selected WAD Level Project Performance Reporting ("PPR");
- Selected P&I Reporting – Cost Performance Reports ("CPR")
- Selected WAD Spending Variance Reports ("SVR");
- Primavera Project Planner ("P3") scheduling data; and,
- Joshua, BEST, P&I Reporting database.

Interviews

Upon completion of the preliminary document review, we arranged interviews with key personnel from both the K-H project management team and the Department of Energy. The table that follows is a list of the PBDs, WADs, and WADlets that we selected and the corresponding personnel that we interviewed.

Among other things, the interviews were conducted to confirm the assumptions identified in the PBDs, allow explanation of project management reasoning, discover client perceptions of services delivered and to clarify project controls and protocol.

Selective Building Tours

We made guided tours of Buildings 707, 776/777, and 371. The purpose of the tours was to become familiar with the physical plant operations and to better appreciate constraints and encumbrances that are identified in the Bases of Estimate. Building 707 and Building 371 were selected based upon their relative status of completion in the closure work program. Building 776/777 was selected based on the complexity of operations in the building. From an operations standpoint, these buildings were selected because they will provide the majority of nuclear material processing throughout the project lifecycle. Furthermore, Building 371 will house the PuSPS and is on the critical path for closure by 2006.

Focus	PBD	PBD Description	WAD	WAD Description	WADlet	WADlet Description	K-H Representatives	DOE Representatives
Landlord	16	B371/374	31	371 Cluster Project	1.1.06.02.01.02	Cluster Maintenance	Kirk B. Foster-Manager James Floerke-PBD Manager	Kevin J. Keenan-D.O.E Lead
Nuclear Ops	8	Pu Metals & Oxide	13	Pu Processing & Packaging	1.1.04.08.01.05 1.1.04.09.06	PuSPS in B371 Op New Pu Metal/Oxide Process	Kurt Kehler-Manager Tina Meins-K-H Analyst	Kevin J. Keenan-D.O.E Lead
Nuclear Ops	9	Pu Solid Residue Stabilization	20	Dry Repack Residues Elimination	1.1.04.09.04.07	Operate Dry/ Shapes Repackaging	Jeffrey Higley-Manager John Lehew-PM for WAD Jeff Higley-WADlet Manager Mike Solano-Analyst Gary Scott-Project Randy Malloy-PM Ted Karas-PM	
Nuclear Ops	12	SNM Shipping Project	22	SNM Shipping Project	1.1.04.10.20	Shipment of SNM Metal & Oxide	Robert H. Dart- Manager	
Deactivation	16	B371/374	31	371 Cluster Project	1.1.06.02.03	371/374 Cluster Deactivation	Sheldon Anderson-Manager Joe Majestic-Deact. Leader Mary Nixon-Analyst Mike Hill-P&I	
Deactivation	17	B707/750	32	707/750 Cluster Closure Project	1.1.06.07.03.02/05	707 Cluster Deactivation	Interview pending with TJ Wirth	David A. Hicks-D.O.E. Lead
Misc.		P & I					Mike Hill Linda Pace	
Misc		Field and Performance Assessment						Mary Yants

Analysis

After all support documents were reviewed and interviews and inspections were completed, we compared K-H Project Management assumptions and planning to our fact-based findings and the perceptions of the K-H Project Team. We also used "Joshua," a proprietary K-H software package for budgeting and tracking costs, and the P3 reporting tools to analyze how cash flows and resources correlated to key milestones.

4.5.1.2 Summary Findings and Concerns

Based upon our interviews with various K-H team members and DOE representatives, assessment of printed project protocol and data, and analysis of data made available to us, we have a number of key concerns related to the viability of implementing the 2006 Plan.

A preponderance of the proposed work performed in the Nuclear Operations arena entails new technology and pioneering procedures. That is, K-H's work may be encumbered by unforeseen or hidden conditions; due to the nature of the site, it is a process of discovery. Nevertheless, K-H's tenure on site, and the lessons they have learned during that period, should help mitigate the uncertainty of Nuclear Operations in general.

It should be noted that our assessment of the viability of K-H's work plan assumes that all technical assertions regarding Nuclear Operations stated by K-H are true. This is not a technical review; rather, it is a confidence review of the processes and methodologies employed to implement the work.

Our summary findings and concerns follow.

Resource Allocation and Workflow

A consistent observation across all NucOps was that human resources are reported to be limited. An analysis of the correlation of standard time to overtime supported the observation: we noted instances where standard time was consistently below planned levels while overtime was consistently above planned levels. This suggests that either resources are poorly managed or they are constrained. In either case, a high incidence of overtime suggests inadequate planning. There is also an increased danger that accidents may occur due to less disciplined work activity and worker fatigue.

A number of WADlet managers indicated that staffing is becoming one of the single most challenging aspects of job management. The K-H Team acknowledges that screening for security clearances and training of new employees are both costly and cumbersome. The security clearance process may take as long as six to eight months. During this period, employees are on a job payroll. Therefore, it is more expedient for managers to share staff to meet incremental goals. P&I representatives told us that a labor resource committee has been established to

address this issue. Notwithstanding this, most of the operations managers did not appear to be aware of the role of this committee.

- ***Resource Limits*** - Limited Resources are evident throughout operations. In FY00 every operating project has estimated to increase their required resources. Management is expecting workers to be more efficient and work more overtime, yet workers have little incentive to do so. Given a strong national and local economy, untrained new hires are becoming more difficult to find. Further complicating the problem, new employees have a six-month mobilization period for security clearance and training.

  K-H has not established a structured, concise methodology or process for allocating human resources. If there is one, WAD managers appear to be unaware of it. As an example, we noted that WAD 21 intended to establish a two-shift operation for the resizing of plutonium materials. They have not been able to accommodate a two-shift operation due to limited resources. Instead, project managers are addressing the most pressing project needs, apparently as dictated by fee incentives.

- ***Attrition*** – KH management has also informed us that the level of employee attrition is increasing. We note that as tenured employees leave (possibly to seek more secure or lucrative job opportunities elsewhere), they take with them meaningful background knowledge inherent to operation protocol at RFETS. Should this practical operational knowledge become limited due to employee attrition, not only will resource levels deplete, but, efficiency levels will also be inversely effected.

- ***Incentives*** – Laborers who were employed on DOE sites prior to 1991 are eligible to participate in what was referred to as "article 3161," which provides an incentive/severance package to those laborers. When asked if K-H was providing any incentives to entice new process handlers (i.e., non-professionals) to enter the project, K-H responded that incentives are still being defined.

  We recognize that the Department of Energy established a Contractor Workforce Restructuring program. The local manifestation of this program was referred to as the Rocky Flats Local Impacts Initiative. However, the government's involvement terminated in 1993.

  Notwithstanding the above, given the urgency of the necessary increase in operations to successfully meet the 2006 closure, K-H should have a more proactive set of procedures for recruiting new employees (as discussed in the Resource Allocation section of this report).

These issues are discussed further in the Resource Leveling portion of this report.

Basis of Estimate

The Basis of Estimate ("BOE") is the key tool used in developing anticipated costs for implementation of the RFCP. The 2006 Plan is predicated on the notion that K-H has built a

body of knowledge during their tenure as Operating Manager that allows it to develop, with a relatively high level of certainty, a meaningful basis of estimate.

According to the K-H transmittal letter to DOE dated May 21, 1999, the President of K-H stated that basis of estimates for the 2006 Plan is a "ground-up" calculation. That is, K-H personnel who have intimate knowledge of operations develop costs with a high level of detail.

We have identified the following shortcomings in the BOE model:

Risk Factors

The risk factors related to cost, schedule and technological difficulty are inconsistently applied. In a number of interviews WADlet managers stated that they did not understand why risk was applied to what otherwise appeared to be non-risk issues. For example, we noticed inconsistencies where cost estimates based on historical cost data were given high risk factors that K-H could not substantiate.

In addition to this, we have found that estimators and/or analysts are already factoring cost and schedule contingency into their baseline costs. The BOEs were intended to represent "optimal" (i.e., standard) planning. Instead, they have come to represent something more indicative of "worst-case." If the sample-set is indicative of WADlet manager protocol, the risk factors may be redundant.

Logic vs. Protocol

It is our understanding that the BOEs are intended to be self-contained, that is, they are a "stand-alone" means of explaining the bases of estimates. In our view, the narrative description for the BOEs is not well substantiated, especially in light of K-H's long history at the Site. While activities are usually segregated in a rational manner, the support for the work flow is not clear, particularly where historical cost bases are provided. For example, sometimes the work narrative refers to an accounting charge code as the basis for cost. However, accounting charge codes are not recognized in the BEST system, as a result, the correlation between cost and associated work is weak.

Because the BOE is parsed to show activity year-on-year, the logic appears contrived. That is, we noted that the narrative and the quantitative bases were replicated (cut and pasted) year after year irrespective of level of activity. To affect a "level of effort" change, a factor is sometimes applied across all resources within an activity. While this is not inappropriate from a work-logic standpoint, the narrative support is weak and has little to do with the anticipated work flow.

This methodology appears to run counter to the "rolling wave" theory. One would expect limited narrative support for work in the out-years. Instead, the BOE appears to force resource loading, which would otherwise be considered highly dynamic. In other words, the evidence suggests that the extensive BOE inputs are required as a matter of protocol (or convenience via "cut and paste"), but are disassociated with the reality of anticipated or known workflow.

Finally, we saw little evidence of diminishing costs and associated risks as a result of "lessons learned." The BOEs that we reviewed did not appear to show any efficiency gains over time.

K-H management informed us that P&I have supplied guidelines for developing basis of estimate. Based on our review of selected WADlets we could not identify any consistency in estimate development among the different projects. K-H management told us that while the guidelines exist, they are not strictly followed and actual estimate development is left to the discretion of the estimator.

For instance, there is not a specific definition as to the composition of project management labor. From a controls standpoint, it is extremely onerous to extract these costs from the reporting system. Different estimators define project management differently.

Project Management

In our review of selected WADlets, we encountered project management costs that ranged from 10% to 70% of direct costs. These costs do not include PBDs 30 and 34. In light of K-H's "Project Management" and "Management Project," this burden seems excessive. As previously stated, we were told that the characterization of project management activities was left in large part to the discretion of the estimators. Due to variable coding, project management costs are cumbersome to track (it should be noted that P&I declined to assist us in identifying these costs).

PuSPS

PuSPS Functionality

Successful implementation of the PuSPS system is crucial to timely completion of the 2006 Plan. The K-H team's concern about the Government Furnished Equipment (GFE) provided by British Nuclear Fuels Limited (BNFL) is well known. The nuclear packaging portion of the BNFL equipment was approved as GFE, the stabilization portion was not. K-H was contracted by DOE to design, fabricate, and construct new stabilization machinery. Additional testing performed at the request of K-H on the nuclear packaging system appears to have demonstrated that the system is less dependable than planned and would likely be prone to frequent breakdown requiring high maintenance.

K-H has proactively initiated design modifications that incorporate new methodologies to address potential contamination problems. We believe that K-H has taken appropriate and prudent action with respect to modifying or improving the PuSPS; however, in light of the acknowledged problems, the level of confidence in the system is very low.

DOE STD – 3013 Containers

The 3013 containers are not approved for plutonium weight less than 50%. K-H has based their schedule and BOE assumptions on the presumption that the containers will be allowed to accommodate plutonium weight greater than 30%. We have been told by K-H that they fully

expect this to be approved, but here again, this is beyond their control. In the event that it is not approved, delays can be expected.

Special Nuclear Material (SNM) Shipping

9975 Containers

One of the single most pressing issue related to shipping of SNM is that the 9975 containers have not been certified for use by Environmental Management 70 ("EM70") a division of DOE. K-H informed us that the 9975 shipping container is in its eighth design review with results expected in October 1999. The container was originally scheduled to be approved in August 1998.

We have been told by K-H that they have a high level of confidence that the containers will be approved in FY00, but this is well beyond their control. In the event that it is not approved, delays can be expected.

Deactivation

While RFCA explicitly states what deactivation does **not** include, there does not appear to be a written protocol to diminish the "gray area" between deactivation and decommissioning within the PBDs or BOEs.

Characterizations

K-H concedes that it did not fully characterize all areas within the contaminated building clusters. However, we were unable to identify any contingency planning and assumptions for highly contaminated areas (such as the X-Y Retriever in Building 707 and the Central Storage Vault in Building 371).

4.5.1.3 Detailed Assessment

Facility Landlord Functions

As indicated above, Facility Landlord Functions are comprised of five primary responsibilities. The responsibilities are enumerated below with a concise description of the tasks entailed in them:

1. ***Surveillance***: to ensure the compliance with the authorization basis, radiological controls, and compliance to State and Federal environmental regulations;
2. ***Maintenance***: to perform standard routine, preventative and corrective maintenance as well as major equipment repairs related to the buildings. We note that enhancements through this activity is considered low priority due to a relatively high cost to benefit ratio;

3. ***Technical Support***: to satisfy the need for specialized technical expertise primarily in the field of health and safety. Also, activities related to the development and corroboration of baseline activities;
4. ***Operations Management***:the largest portion of this is dedicated to the operation and continuous monitoring of the utilities/ventilation systems necessary to control radioactive material and associated contamination safely. Workforce resource allocation is also undressed under this assignment; and,
5. ***Authorization Basis Development:*** these activities ensure there are adequate controls for hazards associated with storage of material and operations to be performed in the buildings. It also includes the Annual Update and maintenance of the DOE Order 5480.23 compliant authorization basis document for various clusters.

Approach

To focus the assessment of performance, we subjectively allocated degrees of importance to these functions based upon our perception of relative "criticality" associated with the success of the RFCP. Criticality was deemed to be either low, medium or high depending upon the functions' interdependence with other processes of the Project in terms of cost, schedule, overall perceived risk, and technical sophistication. (These distinguishing characteristics are discribed further below.)

A summary of the functions' cost contribution and a criticality rating for them follows:

Function	Nominal Cost (x 000)	Cost as a % of Total Prime Cost	Cost Criticality	Schedule	Risk Criticality	Technical Criticality
Surveillance	37,819	0.7%	Low	Medium	Low	Low
Maintenance	137,183	2.7%	High	Low	Low	Low
Technical Support	82,078	1.6%	Medium	Medium	Low	Low
Operations Management	138,645	2.7%	High	Medium	Low	Low
Authorization Basis Development	23,408	0.5%	Low	Low	Low	Low
	419,135	**8.14%**				

Note: Miscellaneous non-specific landlord functions have been included under "Maintenance."
Costs are inclusive from 1997 through 2007

A function's cost criticality was determined based upon its contribution to RFCP's total prime cost. It should be noted that while costs for the functions were generally allocated on the 6th tier of the K-H Work Breakdown Structure ("WBS"), they would sometimes be allocated on the 7th tier as a cost related to an otherwise unrelated summary activity. For the purpose of this analysis the "nominal" cost of a function represents the 6th tier cost allowance.

- Schedule criticality addresses the relationship the function has to completion of other tasks. For example, if a function such as the operation of the ventilation system is compromised, it could preclude the implementation of critical path process such as decomissioning. This would suggest high criticality.

- Risk criticality concerns the K-H team's ability to mitigate risk through contingency planning. High risk criticality, then, suggests that the function is very difficult to address in the event of operational failure.

- Technical criticality refers to the degree to which the operation has been performed in the past or whether there is a high level of uncertainty in its execution.

Based upon our assessment of criticality, we determined that the primary focus in the Facility Operations Function would be cost. The other criticality determinants were considered less meaningful because Facility Operations are inherantly of lower risk. That is, the tasks performed are generally recurrant procedures which pose no significant management challenges.

For purposes of analysis, we performed a detailed assessment of the Maintenance function for Building Cluster 371.

Planning & Assumptions

The Facility Landlord Function project management team told us that the BOEs, which identify specific procedures for implementing WADlet work activity, were based upon historical data for the cluster. More specifically, actual maintenance activities and costs recorded in 1998 were replicated *in toto* for all ensuing years until project closure. In addition to this, K-H included activities which entailed non-standard work (for example, Activity D1Q0200M00, Recovery Winch into Repair Bay).

Since K-H has overseen the landlord function for a number of years, this basis for planning was reasoned to be sound in the near term. However, in the out-years, K-H applied unit cost adjustment factors to the work scope and cost in order to recognize diminishing work attributable to the incremental deactivation and decommissioning of the cluster.

The basis for the unit cost adjustment factors was reported by K-H management to be historical data garnered from their experience on Buildings 771 and 776 which had recently began deactivation procedures for defined building sets similar to those planned for this cluster. Again, this methodology was reasoned to be satisfactory.

K-H recognizes the inherent weakness of planning for virtual unknowns. In the Project Management Plan ("PMP"), K-H alludes to the notion that the Closure Project Baseline Schedule is a "rolling wave," that is, as the Project gets farther out in time the level of detail gradually diminishes. However, the BOE data input does not recognize this and instead shows the same level of detail all the way out to project completion. While this is a minor point of fact, the

process may lend itself to imperfect data input due to errors related to repetitive processing rather than reasoned (or rolling wave) analysis for each respective time period.

Costs

As indicated above in the discussion regarding Planning and Assumptions, there is minimal recognition of change in scope (this is true both in the PBD and the BOE) with the exception of miscellaneous non-standard work.

We performed a high level cost analysis for the period from 1999 through 2001 to determine where costs reside and how resources are managed. The analysis indicated that while there is ostensibly no scope change as reported in the PBD (per Appendix C WADs), the data through-put from the BOE reflects significant changes. The amount of change is driven by variations in activity line-items where elemental planning is recognized (the 8th Tier in the WBS).

The analysis also showed that the vast majority of prime cost resides in the "Labor" category (averaging 60% over the three year period) and that the "Other" category accounts for a significant component of prime cost (averaging 21% over the same term).

We note that when we asked the Project Management team to describe the process by which costs are rolled-up to the various summary categories reported in the PBD (e.g., Labor, Construction, 3rd Tier, etc.), they were unable to explain it to us. This may suggest an overly complex or cryptic system design.

The BCE incorporates an itemized account of tasks included in the work activities. Additionally, it indicates the BOE type, that is, whether it is based upon:

1. Vendors Quote;
2. Historical Data;
3. Trade Publication;
4. Benchmark; or,
5. Estimators Experience.

The BCE also ascribes risk factors based upon: cost; schedule; and technology. The risk factors range from "1" for commonplace and/or well sourced information to "5" for items with a high degree of uncertainty. There is a prescribed guideline which specifies how these factors are to be applied (Attachment 9 BOE Type Codes/Formats/Cost Risk Codes). We were told that the factors are used to calculate "below the line" contingency which is applied globally to the RFCP.

In our review of the BCE we noted that risk factors greater than "1" were sometimes applied to line items which included superstretch fees or other items which appeared to be inappropriate (e.g., a "2" cost rating on sales tax or on corrective maintenance where historical data is used to establish the BOE). When we asked K-H Project Management about this, they indicated that the risk factors were errantly applied (see BCE – Appendix A, WBS 1.1.06.02.01.02) and have since been corrected.

The BOE, like the PBD, replicates the narrative support for the line items yearly. That is, virtually the same verbiage is used year-on-year to describe the line item work estimating source, scope and detail. This suggests a level of uncertainty which is likely unrealistic (particularly in the out years). K-H Project Management told us that even though the narrative was quite exhaustive and detailed, they usually applied unit cost adjustment factors (as indicated above) to affect a reduction in work scope.

We were told that the basis for the adjustment factors for this WADlet was K-H's experience on Buildings 771/774 and 776/777 which had recently begun phased deactivation. This was referred to as a "Landlord rampdown consistency approach." While this is not unreasonable, the full narrative support appears to be rather contrived (in light of the fact that the factor is being universally applied across the line items).

Risk, Uncertainty and Integration

In general, the Maintenance function does not have a significant amount of intrinsic risk. While there are some exceptions (e.g., room conversions that will be used for NucOps) to this broad rule, the preponderance of activity is stewardship of day-to-day building operations. Notwithstanding this, during the course of this assessment we encountered a number of process shortcomings that may be indicative of inadequate integration. These are identified and discussed below.

- ***Organizational Structure*** – The K-H Manager of WAD 31 (who is also the Maintenance WADlet Manager) told us that virtually no one reports to him. While this manager did accept responsibility and accountability for the overall implementation and management of the WAD, he indicated that others would independently manage most non-Landlord functions. This would appear to suggest that the organizational structure reported in PMP is either ineffective or inappropriate.
- ***Project Controls*** – Pay submittal documentation is segregated from the WAD manager. Specifically, we were told that subcontracting agencies would submit monthly pay requests to a central K-H accounts payable department. The manager is only apprised of costs in a retrospective manner, that is, after costs are submitted to DOE, a summary report (Project Performance Review or "PPR") is issued for the prior month that shows deviation from plan.

  This would appear to suggest that the manager is not well positioned to challenge the accuracy of subcontractors in executing the cost-plus work. In their role as DOE's representative, one would expect K-H to be more proactive in their review of subcontractor diligence.

- ***Resource Swapping/FTE Leveling*** – Our analysis indicated variable FTEs for maintenance over the course of three years (FTEs were calculated by dividing total labor cost by total labor hours and multiplying by hours in a standard work year). When we asked how resources were being allocated, we were told that some of the maintenance crew would be assigned to

other WADlets (that would use the resources in a related maintenance capacity).

We were also told that as buildings sets are deactivated/decontaminated and prepared for decommissioning, the Stationary Operating Engineers and other maintenance staff assigned to this WADlet would be transitioned into deactivation/decommissioning roles.

PuSPS Operations

The purpose of the Pu Metals and Oxides Stabilization Project is to stabilize and package all material greater than 30% weight plutonium in containers meeting the specifications of DOE-STD-3013 ("3013"). The PuSPS installation and operation program has been a dynamic process. That is, the planned methodology for implementation of plutonium packing has changed from a fully automated system using Government Furnished Equipment (GFE) to a hybrid which incorporates K-H-designed, non-automated stabilization and the GFE prototype machine. Furthermore, the planned location of the equipment changed from Building 707 to Building 371.

At present, PuSPS is comprised of the following key elements:

1. The design, fabrication, installation, and use of stabilization equipment (which replaces a GFE integrated and automated component of the entire PuSPS); and,
2. The procurement, installation and use of a proprietary plutonium packaging system.

At the project end state, the PuSPS system will be decontaminated, decommissioned and destroyed.

Approach

The success of the stabilization and packaging of plutonium metals and oxides is critical to achieving the 2006 closure of RFETS. The Pu Metals and Oxides Stabilization Project, PBD 8, consists of three WADs. Given the level of risk and uncertainty associated with the development and implementation of the new processing technology, we elected to evaluate WAD 13, Pu Processing & Packaging.

Following the logic of our previously discussed methodology, we scrutinized the WADlets based upon the following criteria:

- To what degree does the WADlet interface with internal and external projects;
- What level of risk and uncertainty is associated with each WADlet; and,
- Within the WAD, where was the majority of cost allocated relative to overall life cycle cost and the cost required to complete the work.

Based on this methodology, we selected the following two WADlets.

1. WADlet, No. 1.1.04.08.01.05 – PuSPS in Building 371, addresses the design, construction, and implementation of the PuSPS system in building 371.
2. WADlet, No. 1.1.04.09.06 – Op New Pu Metal/Oxide Stabilization and Packaging Process, addresses operation of the PuSPS system and procurement of the required "3013" containers.

Together these two processes account for approximately 69% of the BCWS for WAD 13. Furthermore, they are critical to the timely closure of NucOps at RFETS.

Planning & Assumptions

WAD 13 addresses the design, implementation, and operation of the PuSPS system. The success of this system is critical to the projected 2006 Closure Project Baseline. Key assumptions regarding the Packaging System are summarized as follows:

1. It will perform as designed without significant modification;
2. It will perform not less than 72% of the time;
3. It would require limited maintenance while providing virtually continuous operation;
4. It will be capable of packaging not less than one container every two hours; and,
5. "A DOE approved deviation path will be available for packaging and shipping materials in 3013s which cannot meet the 3013 standard..."

K-H's own empirical evidence suggests that these assumptions incorporate a great element of risk and may in fact be erroneous. Through testing and implementation process the prior assumptions have been compromised.

As mentioned above, the "packaging sytem" was designed and manufactured by BNFL. BNFL performed limited scope performance demonstrations (six contrainers, one day of production) to prove the system's suitability. K-H, however, did not believe that BNFL's testing sample was statistically significant to adequately characterize K-H's projected use of the PuSPS system.

Subsequent to DOE's installation and testing of the nuclear packaging system, K-H took over the possession of the system in Broomfield and proceeded to conduct additional tests. Their findings were documented in a report entitled the Post Accepting Testing Report for the Plutonium Packaging System ("PAT" dated April 13, 1999). For their purposes, the K-H team ran sixty "3013" containers through the packaging process to test the system's efficacy. The PuSPS system was acquired assuming that it could function effectively and efficiently at "Level 1 Operation," that is, completely automatic. The test results demonstrated a 48.3% success rate in this mode, well below the 72% target. In addition, there were excessive maintenance delays, hardware and equipment failures, and cost overruns.

Over the course of the evolution and testing period (the past nine months), the K-H team identified "more than 20 physical and operational upgrades or modifications that are considered necessary to imporove the Packaging Systems's reliability and operability." The K-H team concluded that it could make "no claim that the recommended changes will increase the

FDCM uses an "equivalent area" approach to estimating. This means that K-H has standardized unit costs and manipulates actual areas or volumes to address variance in degree of difficulty or complexity. As a result, unit rates were standardized and remain consistent across WBS elements. For example, when estimating removal of 100 lineal feet of conduit, the unit price basis for non-contaminated conduit may be $2.00 per lf. If the conduit was contaminated, the system would require that the conduit length be adjusted upward to obtain the cost increase.

Approach

Due to the unusual nature of this technique (that is, it utilizes a standard unit cost and allows adjustments to be made to quantities, scope or component characteristics) we employed the following procedures to assess BEST:

- Accessed the CE_DDR2 file within the Joshua reporting system and downloaded $895 million of detailed D&D costs estimated solely by the FDCM.
- Reconciled and noted any estimated cost differences in excess of 2%± of the total D&D. Specifically, we compared estimates between the FDCM (file:CE_DDR2) and the D&D portion of 2006 baseline plan (file:2006_Rev2 - which includes both FDCM method estimating and the bottoms-up detailed cost estimates).
- Verified that unit rates remain consistent for all like WBS elements within the FDCM estimates.

Comments

Through performance of these procedures it was determined that the information within the BEST system portrays an accurate description and detail to the cost estimates performed by the K-H D&D group members.

1. Based upon our current understanding of D&D planning, we found that the $755 million D&D cost estimates identified in BEST are attributable to the following:

    - 40% of cost determined through bottoms-up estimates.
    - 60% determined through the FDCM developed estimates

2. Results of the CE_DDR2 download provided approximately 500 pages of estimate detail for each building cluster and was organized by PBD, WAD and finally by activity. Comparison of this information to the 2006 baseline (contained in the BEST system under file:2006_Rev2) disclosed some inconsistancies and differences. K-H team members provided acceptable explanations for these differences.

3. It was determined that the "equivalent areas" approach used when transferring estimate information from the FDCM to BEST, while not common, is reasonable and provides accurate results within the system. The procedure of testing unit rates across WBS elements resulted in no discrepancies.

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- ***Demolition and Disposal*** – The unit cost for demo and disposal assumes that the buildings are clean. The actual unit cost is developed from the demolition of building #123which is a Type 2 masonry building. Because it is assumed that all buildings are clean the same unit rate was applied to the Type 1 and Type 3 buildings as well. Based on the various types of buildings the unit costs were factored to account for the varying degrees of difficulty. With respect to the massive reinforced concrete buildings it was assumed that its cost would be 60% greater than the unit costs for a reinforced concrete building.

- ***Project Management*** – The cost for project management is based on data gathered from 23 previous construction projects at the RFETS. Those 23 projects were divided into the three categories within the FDCM. Based on the information gathered from various project summary reports, it was determined that for a Type 1 building, the PM cost is 11% of the total cost. For a Type 2 the PM cost was 13% of the total cost and for a Type 3 the PM cost was 16% of the total project cost. The historical data used was from non contaminated buildings and therefore was adjusted accordingly for the varying degrees of difficulty.

- ***Support Services*** – The cost and resources for the support services for the decommissioning activities is directly related to the complexity of the building structure and the contaminants contained within.

Commentary

- Although limited, actual cost information was incorporated into the FDCM model and adjusted to reflect building complexities.
- The cost model assumes that the PA will be taken down in a timely manner. There are no provisions to address the eventuality that this may not occur, that is, K-H did not investigate the impact of delayed closure.
- While a contingency was calculated based on the final cost in the FDCM, the contingency has not been directly transferred into BEST.
- It should again be noted that K-H acknowledges that the FDCM forecast is a "rough order of magnitude" within a plus 50% to a minus 30% range. Expectations for its accuracy should be set accordingly.
- The PBD's identify multiple shift work whereas the FDCM and the bottoms up estimates do not make allowances for shift work.
- K-H set soft costs on a "percentage of cost" basis. Actual costs could be greater than allowed in the FDCM.
- The FDCM assumes that once the building has been deactivated, it will be ready for decommissioning work. Based on the experience with Building 123 this appears to be an optimistic assumption.
- The FDCM's total cost is based on FY99 dollars and includes no escalation or inflation as a majority of the work is to be performed in the out-years.

- The FDCM model assumes a learning curve for Type 1 and 2 buildings. However due to the complexities expected with Type 3 buildings, learning curve savings are excluded.
- The FDCM is considered to be a forecasting, funding, cash flow, and benchmarking tool. It is not a formal estimate for the D&D costs. Additionally it was created to establish credibility to the base line.
- The FDCM was also established to provide K-H with a look ahead for the resources needed in the out-years.

Recommendations

- As more actual cost information becomes available, the FDCM should be updated in an effort to provide a more accurate forecast of the potential final cost.
- Based on the availability of more relevant cost information from Building 779, a Type 3 building, K-H should develop cost models specific to the three types of buildings on site.
- After review of the factors and assumptions used in the development of the glove-box cost, the FDCM should include a factor to address the varying degrees of difficulty involved.
- As more cost data is provided, the FDCM should begin to incorporate learning curves into the various cost models.

4.5.2.7 Basis of Estimate Software Tool (BEST) Interface

The BEST system facilitates the collection and storage of decommissioning cost data, factors and quantities, and retrieves FDCM information. The primary purpose of BEST is to document and integrate cost estimates in a standard format for planned work related to the 2006 closure (see attachment for process flow in prior section). Some key BEST goals are to:

- Make planning tasks easier by automating calculations and reducing paperwork.
- Collect data in a standardized format, so that the data can be readily transferred to other information systems such as P3 scheduler.
- Ensure that data is consistent and validated to the fullest extent possible.

Background

The BEST system has been set up to track costs and work scope from the FDCM "order of magnitude" estimate relative to the initial bottoms-up estimates. Furthermore, it will be used to monitor project life-cycle costs through the change management process. To understand the correlation between the D&D group estimate, how this information compiled and what is reported to the K-H Management and DOE in the 2006 Baseline Estimate, it was important to ensure that costs were loaded into the BEST system completely and accurately. This procedure was performed to guarantee that all estimated costs are being captured in addition to ensuring that the flow of information for K-H's systems is accurate and reliable.

cost for any special security requirements needed for uncleared personnel to perform work inside the protected area.

Work Breakdown Structure

A standard WBS was created to be used for the decommissioning of the site complete. The WBS elements are as follows:

- ***Planning & Engineering***: The scope for this element includes but is not limited to activities such as the preparation of the execution plan, the operation plan, health and safety plan, quality assurance plan, quality control/quality assurance plans, and the like.

- ***Characterization***: This element addresses the tasks specific labor, materials, equipment, and subcontracts associated with the costs for characterization of a decommissioning project. The level of effort included in this WBS does not include the characterization required for Environmental Remediation.

- ***Site Preparation***: This element addresses all the tasks associated with the preparation of the site for a decommissioning project.

- ***Decontamination***: This element addresses all the tasks specific to the costs for the decontamination of a decommissioning project. The scope of this element includes the decontamination of the buildings' interiors and exterior surfaces, equipment, etc. This element also includes the package and preparation of waste, however, it is assumed that once the waste is packaged it becomes the responsibility of the waste management group. The decontamination effort for the gloveboxes, piping and the internal tanks is included in the dismantlement activity.

- ***Dismantlement***: Where applicable this element addresses the tasks specific to the dismantlement of a decommissioning project. The scope of this element includes activities such as strip-out, removal, and size reduction of miscellaneous systems such as building lighting, water systems, and the like, as well as, the isolation of the building from the rest of the site.

- ***Demolition and Disposal***: Where applicable this element addresses the tasks specific to the demo and disposal of a decommissioning project. This scope includes items such as the D&D of structural and non-structural components, roofs, slabs, pads, and any connecting structures.

- ***Project Management***: Where applicable this element addresses the tasks specific to the project management of a decommissioning project. This scope includes items such as construction management, project engineering, project reporting, project controls and document control..

- ***Support Services***: Where applicable this element addresses the tasks specific to the support of a decommissioning project. This scope includes services such as training, security, contract administration, radiological operations, medical health and safety support, regulatory interface and the like.

Cost Associated with the WBS

The unit costs and resources used in the FDCM were generated from a wide range of sources. When possible, the costs were based on completed or ongoing RFETS related projects. When cost information was not available from the site, actual cost from other like projects were used. If no other information was available a detailed conceptual estimate was used. Specifics are detailed below.

- ***Planning and Engineering Costs*** – The planning and engineering costs are based on a percentage of the total cost of the work and therefore are directly related to the size and difficulty of the building. It is assumed that the P&E costs do not change with buildings of different construction types.

- ***Characterization*** – The level of effort required to characterize a building is again directly related to the complexity of the building and the contaminants contained in the individual buildings. Because the cost for characterization is directly proportional to the level of contamination in a given building the cost can range from approximately 40% to 55% of the total dismantlement cost.

- ***Site Preparation*** – The site preparation costs are based on a fraction of the total project cost and are directly related to the size of the building. The FDCM uses three percent of the total cost. The FDCM assumes that the cost for site preparation does not change between buildings of different construction types.

- ***Decontamination*** – The costs for the decontamination of the various types of building is based on the various levels of contamination found in the buildings. The decontamination costs are estimates based on the square footage of the particular building area. The FDCM adjusts the unit cost based on a portion of the buildings interior surfaces needing no decontamination.

- ***Dismantlement*** – The dismantlement costs are based on the costs derived from actual costs for work at RFETS. The dismantlement of the gloveboxes, piping, and the internal tanks is based on the information gathered from building #779. The dismantlement costs for the external tanks were taken from two oil tanks T221 and 224 and two acid tanks 218-1 and 218-2. The dismantlement for all the building types is the actual dismantlement cost for building #123. For the various building types, a factor was applied to account for the different levels of difficulty.

necessary to apply cost factors to account for the different types of facilities. The specific sources of data from actual experience (or analysis) follows.

- ***Building 123*** – The FDCM applies factors to those unit costs to address the different levels of assumed contamination and different types of building construction.

- ***Glove-boxes*** – The glovebox dismantlement costs were derived from the last 11,000 cubic feet left in Building 779.

- ***Mechanical Systems*** – The piping, ducts, and internal tanks cost is based on the current subcontract costs from Building 779 and the best information available from the K-H Project Tam. Until such a time when there is additional information from other Type 3 buildings, the costs for the piping, duct, and tank removal is limited to Building 779.

- ***Miscellaneous D&D Cost Bases*** – The balance of the cost information for the trailers, cooling towers, tents and external tanks is based on existing RFETS cost information.

Assumptions used in the FDCM

The FDCM assumptions are correlated to the forecasted cost in the model. The purpose of the FDCM is to provide a forecast of the decommissioning cost based on physical attributes or dimensions (the area or volume of a building). As such, the forecasted decommissioning costs of individual buildings/facilities or the resources associated with a particular WBS element or building can vary widely. Therefore, the costs developed by the FDCM represent an average cost not an expected cost.

K-H used the following general assumptions in top-down estimating:

- All costs used are unburdened.
- There is no escalation or inflation included.
- The FDCM makes no provision for items such as: SNM Removal, Environmental Remediation, Waste Management, and other clusture closure related items.
- All the decommissioning activities are being conducted in accordance with the existing labor agreements and practices in place.
- Adjustments are included to account for economies of scale for buildings with multiple stories. The assumption is that adding an additional story does not proportionally increase the cost for most of the decommissioning activities.
- The buildings/facilities have been categorized based on the year they were built, pre 1989 facilities are assumed to have a greater level of contamination than post 1989 facilities.
- Building rubble contains no asbestos residues.

In addition to those assumptions, KH incorporated the following "cost factor" considerations in the FDCM:

- The planning and engineering costs are based on a percentage of the total project cost as it relates to actual RFETS experience.
- Characterization has a direct relationship to the dismantlement activity in the WBS.
- The removal of all lead and asbestos is included in the decontamination cost. The unit cost for the removal of those contaminants is based on the removal costs for Buildings 889 and 123. These two buildings were used as they were assumed to be similar in nature to the rest of the buildings on-site.

  Furthermore, the FDCM includes an allowance for miscellaneous materials. The costs for the decontamination of the glove-boxes, piping and internal tanks are not included in the decontaminating costs for the building. The cost for those items is included in dismantlement. The model also includes the cost for size reduction, packaging, and preparation for shipment for the wastes generated during decontamination. Also included is the cost for pre-certification costs incurred prior to transferring responsibility to waste management. Beryllium removal is not included in the costs.
- Included in the dismantlement costs is the assumption that the safety clearance for Building 123 will be the same for the buildings within the PA. The dismantlement costs for the Type 3 and certain Type 2 buildings do not include costs for dismantling glove-boxes, piping, or internal tanks. Dismantlement costs vary greatly between the three building types, this assumption is to account for the removal of process equipment as well as, any ties from the glove-boxes piping, alarms instrumentation and any additional HVAC removal.

  K-H used a cost of $870 dollars per cubic foot of contaminated glove-box (which again is the actual cost for the removal of glove-boxes in Building 779). The demolition and disposal classifies the buildings into four types:

  - Modular;
  - Masonry;
  - Reinforced concrete, and,
  - Massive reinforced concrete.

  Based on these types of buildings, the costs are factored according to the levels of difficulty involved. Costs are included in the model for the disposal of all uncontaminated building rubble to a sanitary landfill. There were no adjustments made for scrap or salvage values. The costs for the removal of all building pads, slabs, and footings are included in this unit cost.

  It should be noted that K-H excluded the following landlord activities: cluster compliance and surveillance, baseline maintenance, operations management, technical support, and maintenance required for the continued operations of building systems required for the support of the decommissioning of the buildings. Also excluded from the cost model is the

5. ***Consistency in Allowances*** – In some cases allowances have been provided for the completion of certain work activities, particularly in reference to support activities such as sampling and testing. These allowances are not consistent between buildings even though actual costs could be taken from already completed or nearly completed buildings such as Building 779.

6. ***Technology Integration*** – One consistency amongst the estimates is their omission of the use of technology that may increase productivity levels and reduce the manpower requirements in buildings. However, this in itself raises concerns regarding the ability to complete the buildings on schedule with the resources currently envisioned, as without technological assistance, a one shift strategy does not allow a rapid enough productivity to meet the 2006 deadline. If technology is required, then it should be included in the estimates, as the use of technology is an assumption upon which K-H relies in meeting its schedule and cost.

7. ***Change Management*** – The tracking of changes to estimates is inconsistent among the estimates reviewed. Only the POWERtool system used for Building 771 requires any changes to be logged in order to be implemented. The others have logged changes, but with the control based on manually created records. It is important that this sort of practice is standardized for all buildings, so that the origins of any alterations are clear.

4.5.2.6 Top-Down Estimate Review

In an attempt to understand the complete scope of work, K-H developed the Facility Disposition Cost Model (FDCM). The FDCM is an order of magnitude estimate with a range of (+50% to –30%). It is an approximate estimate produced from actual, albeit limited, cost information from site decommissioning projects that has been adjusted using scaling factors. This form of estimate is usually used during the infancy of a project.

It is generally accepted that the historic data for D&D work is limited. As a result, K-H relies heavily on the use of actual costs for similar work on the site.

The quantities included in this model were obtained from the Facility Disposition Program Manual, and the Facility Information Management System. Additional information for glove-boxes, piping, and duct costs were based on Building 779 (which is currently being decommissioned). For modeling purposes, the FDCM uses a work breakdown structure ("WBS") to organize decommissioning activities in an integrated framework. Given the complexity and risk associated with a decommissioning effort of this magnitude, the FDCM includes a detailed cost sensitivity analysis that is intended to be used to develop a reasonable level of contingency.

Approach

Based on the review of all available cost related information and several interviews and informal meetings with K-H's D&D group, the assumptions and cost included in the $765 million for decommissioning were substantiated. The assumptions and related cost information that were

used to generate the above cost is covered in the FDCM. The FDCM is comprised of ten sections. Of those sections, eight were used to create the model. Those sections include:

- Model Overview;
- Assumptions;
- Work Breakdown Structure;
- Description of the Facilities;
- Resources and Costs;
- Contingency Analysis;
- Results; and,
- Future Improvements to the Model.

Kaiser-Hill's D&D group developed the FDCM. The purpose for the FDCM is to quantify the scope of work, its complexities and to estimate cost via a rough order of magnitude (ROM). Again, it is recognized that there is limited data to support estimates for this type of work.

Analysis and Discussion

The FDCM estimates the cost for the decommissioning for all types of facilities within Rocky Flats using a top down estimate based on empirical data. For the purpose of the FDCM, all the facilities were categorized by type. Because all the facilities onsite are for the most part atypical, the model allows for adjustments to be made to incorporate special features or characteristics. The model relies on the most recent information available describing the physical dimensions and characteristics of the various facilities at RFETS and, to the extent possible, actual decommissioning cost experience. Listed below are the steps used to develop the FDCM.

- ***Identify Key Assumptions*** – In the FDCM's infancy, critical assumptions were identified early as a foundation for the model's structure. As the model matured and additional information was gathered those assumptions were adjusted as appropriate.

- ***Establish the Work Breakdown Structure*** – A standard decommissioning work break down structure ("WBS") was developed to better organize the estimate into a logical format. Attached is the work breakdown structure format.

- ***Classify the various facilities and buildings*** – The various facilities and buildings were classified by type to standardize the estimating process.

- ***Collect Physical information on the various types of buildings*** – As much as possible Kaiser-Hill used the most recent information and costs available in the development of the FDCM. Much of the information comes from the facilities Disposition Program Manual and the Facilities Information Management System, which are the official sources of information for the site. In addition, quantity information was gathered from various sources within the site.

The cost and resource information used in the FDCM comes from various completed decommissioning projects or activities at RFETS. Where RFETS costs are not available, the FDCM uses costs based on detailed bottoms-up estimates (or, if possible, from actual costs from comparable government or commercial projects). As stated earlier, in some cases it was

Observations:

- ***Unit Rates*** – There appears to be no consistency between this estimate and those of the other buildings. No generic costs or resources can be identified as similar to those of other estimates. For certain activities, in particular Asbestos Abatement, rates have been based on the scheduled duration of the task, and the use of a standardized crew size for that period.

  Unit Rates and Efficiencies – In the FDCM there is a difficulty factor included from Table 7-1 to convert from Building 123 to a Type 2 CA. However, Building 444 is not as heavily contaminated as some of the other Type 2 CA buildings (contamination in Building 444 is Beryllium, rather than depleted Uranium), so therefore this factor may exaggerate the FDCM cost.

  It would be expected that the costs would be reasonably close to those produced by the FDCM, assuming that the Type 2 CA factor is reasonably accurate. In comparison there is a 10% difference which seems to be a fair assessment. Yet, with the funding and schedule problems envisioned, this may well end up as an optimistic viewpoint.

  No learning curve or difficulty factor has been applied to this building's estimate, as the work was assumed to be straightforward.

- ***Cost Allocations*** –- Allowances have been made for several items. For example, as the RCRA Closure Plan was not available at the time of the estimate, an allowance of $500,000 was included in the original estimate. This figure has not been updated since.

  Landlord costs are within the estimate (e.g., hazard reduction and stabilization). These should be removed when comparing this building with other buildings

  K-H calculated the D&D consumables such as small tools as a percentage of the total number of hours worked instead of calculating it based upon those of the workers actually involved in each task. This would not appear to be a good model for estimating.

  The estimate does include costs for PPE and the hours associated with wearing it are built into the estimate. Therefore, the 40 hours per week quoted are not all productive hours.

- ***Characterization*** – Characterization costs have been included in the bottoms-up estimate. Though this is not a major cost for this particular building. The estimate was produced by RMRS, and therefore it was assumed that they would perform this function.

- ***Overtime*** – Decommissioning is broadly based on a 40 hour week with an extra shift added for certain activities. No overtime costs are included.

- ***Schedule Dependent Costs*** – Schedule is dependent on funding. If funding is lower than expected then the schedule will be severely affected. Any slippage in schedule and the associated costs of maintaining the project management and support functions has not been included.

  This building is outside the Protected Area, and deemed less critical than the PA buildings. Therefore it has been adversely affected in its scheduled completion. However, similarly, it should not be overly affected by the need to remove the PA by certain dates.

The estimate for this building does not appear to be updated with any frequency, even to reflect any delays in schedule.

Recommendations

1. ***Unit Rates*** – The development of the unit rates and resource hours for activities has produced a cause for concern. In some buildings these have been developed by drawing on the experiences of those who are involved in the activities, while others are drawing upon the experience of the estimator, or from actual information provided by already completed buildings. So far amongst the estimates, only Building 771 has produced a series of generic unit rates and resources for each activity. Although this may over-simplify the estimate in some ways, at least it is consistent in its application.

   There is the another extreme, as in Building 776, where each set has been taken on a completely independent basis from the rest of the building, and resources have been determined accordingly. This in some ways is preferable to the generic method, as each set is resourced and costed according to its actual requirements, (i.e., a large glove-box is not costed the same as a small one). However, the detail necessary to understand why sets differ is not always present. Building 779 has in some ways produced a middle ground, where areas were taken on an individual basis but the standard costs were applied for the activities, even though they were adjusted from outside industry sources.

2. ***Risk Factors*** – There has been an inconsistent use of factors in each estimate. Each estimate contains factors that are either included in the rates or applied at certain stages in the estimate's development towards a resource's cost. In buildings 776 and 779, PPE factors for productivity were assigned only to those who were affected by the factors, while in the building 771 estimate PPE factors were applied across the board.

3. ***Learning Curve*** – The factors for learning curve have been applied in different ways. Building 776 has them built into each unit rate, whereas Building 771 applies them when transferred to the BEST system on an annual basis. Building 444 excludes them from its estimate entirely. Of the estimates, Building 779 should be providing a wealth of information to develop a better understanding of the learning curve and the level to which it can be applied, however this does not seem to be the case. Estimates have taken information from Building 779 as a basis for certain activities, but there does not appear to be any analysis of similar tasks to determine whether productivity increases have occurred over the course of its completion. It was assumed that the D&D process for that building was the learning curve.

4. ***Consistency in Content*** – Amongst the estimates there are other inconsistencies. Buildings 444 and 779 contain landlord costs while the others have excluded these. There appears to be little in the way of direction as to how costs should be separated. There are points where there is a cross-over between the landlord and decommissioning costs, and a confusion as to which party is responsible for certain activities, such as characterization. There is no set point at which responsibility changes hands. This needs to be defined.

- ***Cost Allocations*** – Consumables have been treated in different ways as well. In building 771, consumables are treated as a product of the total hours worked, while in building 776 a 15% markup on total labor cost has been applied. This is created from the total cost rather than from just those costs created by the workers actually involved in each task (i.e., with Radiation Technicians adding to this total cost). Both estimates cover the cost but in an inconsistent manner.
- ***Characterization*** – The estimate excludes any Characterization costs, which the FDCM contains.
- ***Overtime, Escalation and Contingency*** Escalation and contingency costs were excluded. In addition, even though the work was based on one shift, there are overtime costs in the estimate.

Building 779 Estimate Review

1. The estimate was created by RMRS, rather than by Kaiser-Hill.
2. Each area of the building was surveyed to determine the scope and type of work to be executed.
3. Where possible exact quantities for activities were extracted from drawings and from walkthroughs.
4. Unit rates were created from the estimators' experiences for activity durations and resources required, and from adjusted industry standard estimating information.
5. Where costs & resources were unknown an allowance was made.
6. Following the detailed survey of the building, the unit rates were applied, and factors for difficulty included. These were applied on a room by room basis dependent on the activities required.
7. Data was reviewed, and corrected if necessary.
8. Output from the estimate was put into the BEST system.
9. Bottoms-up estimates replaced FDCM estimates in BEST.

Observations:

- ***Unit Rates*** – The industrial information used to create the unit rates was mostly based on installation costs, therefore these required an adjustment to convert them into the appropriate decommissioning cost for each item.

  This was the first of the bottoms-up estimates to be completed, so much of the information used has been produced from experience and adjusted industry standards. An important question is how accurate the estimates are found when compared to actual data. As an evolving estimate in BEST there is a considerable amount of readjustment to estimated costs as actual information is added.

- ***Unit Rates and Efficiencies*** – No learning curve savings have been applied to the estimate as it was assumed that the learning curve was to be created from doing the work. There are landlord costs within the estimate. These should be highlighted in any comparison to other buildings.

- ***Rolling Wave Knowledge Incorporation*** – As the first Type 3 CA building to be decommissioned, Building 779 has been used by both the FDCM and other estimates to acquire actual data, and these data was used as a basis for all other Type 3 buildings, specifically for glove-box removal. However, it should be noted that Building 779 is one of the less complicated Type 3 CA buildings to have D&D performed. Therefore, there is still a reasonable amount of doubt as to its viability for extrapolating costs to some of the more complex PA buildings (e.g., the use of its glove-box costs may underestimate the complexity of some of the boxes in buildings like 771 and 776).
- ***Planning and Integration*** – Building 779 is being dismantled without the assistance of any waste reduction technology, therefore it is similar to the other bottoms-up estimates in what costs are included, but not in schedule.
- ***Characterization*** – Characterization costs are included in the estimate. This project developed most of the protocols for the characterization process that are now evolving into the standard for the site.
- ***Cost Allocations*** – Consumables have been calculated on a room by room basis, assessing what would be required for the relevant activities. These have been based on the estimator's experience and a calculation of levels of use based on the schedule.
- ***Escalation and Contingency*** – No escalation or contingency is included within the estimate.

Building 444 Estimate Review

1. The building was separated into Clean and Contaminated areas.
2. Standard crew sizes and equipment costs were then assigned to tasks within these two areas.
3. Unit rates were created from the estimators' experiences for activity durations and resources required, and from adjusted industry standard estimating information.
4. Productivity assumptions were made for clean and contaminated areas, and applied to the estimate.
5. Management and facilities costs were based on the schedule for the work sections.
6. Where costs and resources were unknown, an allowance was made.
7. A factor was included for the addition of a second shift to the Asbestos Abatement and Strip-out activities.
8. Data was reviewed, and corrected if necessary.
9. Output from the estimate was put into the BEST system.
10. Bottoms-up estimates replaced FDCM estimates in BEST.

tasks by those actually conducting them is an invaluable tool. By leveraging worker knowledge, K-H has improved the efficiency factor of "1." It should be noted that this efficiency was broadly or generically applied across all activities; this may not always be applicable.

- ***Unit Costs and Information Technology*** - The POWERtool system has been examined, and determined to include enough detail and safeguards to prevent errors in resourcing and pricing, as well as log any changes made to it. This is an important factor in the "rolling wave" concept of estimating. That is, when actual information becomes available it can be readily incorporated.

  A shortcoming in the software, however, is its reliance on the generic unit costs for individual activities. This of course can be remedied once actual costs for specific sets are known, but may result in an excessive amount of duplicative (i.e., redundant input for tasks already accounted for) input to the system.

- ***Cost Allocations*** – K-H calculated the D&D consumables such as small tools as a percentage of the total number of hours worked instead of calculating it based upon those of the workers actually involved in each task. This would not appear to be a good model for estimating.

  The estimate does not include any costs for Personal Protection Equipment ("PPE"). These are assumed to be within the landlord costs. However, the labor hours involved in putting on and taking off PPE are included in the unit rates, so any productivity inefficiencies are built into the unit costs for activities, although at a generic level.

- ***Overtime, Escalation and Contingency*** - The estimate excludes any overtime costs, escalation or contingency amounts.

- ***Characterization*** - The estimate appears to only include "in-process" characterization costs (but does not account for reconnaissance level characterization, which the FDCM contains).

Building 776 Estimate Review

1. K-H used the Decommissioning Operations Plan ("DOP") outline to identify activities. They then created a generic Excel template for each Set.
2. K-H set resource loading based on actual experiences of those conducting the work on a set by set basis. Rather than create a series of generic costs, each set was considered on an individual basis.
3. The factors for efficiency and PPE reductions in productivity were applied to each individual resource depending on levels required, while costs for PPE were included in the labor rates for only those workers requiring it.
4. Data was reviewed, and corrected if necessary.
5. The results for each set were then input into the BEST system within the WBS codes established.
6. No further factors were applied.
7. The bottoms-up estimates replaced FDCM estimates in BEST.

Observations:

Based upon our assessment we have the following comments.

- ***Planning and Integration*** – Building 776 is scheduled to include a Remote Robotic Waste Reduction Facility which will simplify and expedite the D&D of certain contaminated components. This equipment requires less manpower and is designed to be safer (i.e., self-contained). The estimate for this building does not recognize the potential use of this equipment. Additionally, K-H does not recognize the potential use of the Centralized Waste Reduction Facility ("CWRF") in their estimate.

  Should these technology improvements be implemented (and successful), they could have a significant affect on the D&D activities in this building. If this is not the case then there is a high degree of risk that the building D&D will not be complete on time without additional increases in manpower and other associated costs.

- ***Estimating Template*** – K-H created estimating template sheets for all D&D work including deactivation and project management for each set (it should noted that this is ancillary to the D&D work, and not related to the primary deactivation in the building). These outline the Deactivation and Project Management costs associated with each set. These were separated out for input into BEST under WBS codes 1.1.06.12.03 & 1.06.12.04.AA respectively.

- ***Project Funding*** – For FY00 there appears to be a shortfall in the monies required to fund the new size reduction technology. It is our understanding that K-H intends to finance this through the re-sequencing of several work sets, as well as through the change process. In other words, K-H plans to take one of the more difficult sets due to start and finish in FY00, and replace it with a less complex one. If this is the case, an artificial saving has been created which may offset the cost of the technology. However, this is a false economy, as the cost of the work moved to the out years may well be more expensive to complete at that time. It may even have the effect of pushing out the completion of subsequent work.

- ***Unit Rates*** – A consistent approach was used to develop the basic set sheets that give the associated costs for the work, per set only. Therefore a standard unit cost for activities is not available.

  Generic unit rates were not developed for building 776/777. Each set was treated as an individual entity and the costs and resources were estimated on that basis. Similar to building 771, this estimate also utilizes the assessment of the tasks by those actually conducting them. While developing the unit costs and resource loading required, the methodology is applied consistently, even though the unit rates differ vastly from set to set.

- ***Unit Rates and Efficiencies*** – K-H have approached the use of factors to account for difficult conditions in differing ways. For building 776 factors were included within their rates, (i.e., workers requiring PPE have been assessed differently to those not requiring it). In building 771, the costs of PPE have been assumed to be landlord costs. Similarly, the learning curve for building 776 has been included in the rates, while for building 771, learning curve is applied once the estimate reaches the BEST system.

- What methodology was used in deriving cost. We paid particular attention to K-H's consistency in approach to each set, as well as its assumptions and inclusions/exclusions.
- What consistencies or inconsistencies exist across sets.
- What salient differences in costs exist between the bottoms up estimates and those derived using the FDCM. Where are costs similar or dissimilar and why.

To further test the viability of bottoms-up estimating, we interviewed a number of K-H team members (including estimators) and developed an independent review of the build up to the estimates.

Analysis and Discussion

Building 771 Estimate Review

In brief, K-H's methodology used to derive the bottoms-up estimate for Building 771 incorporated the following:

1. K-H outlined the assumptions and activity flow for individual work items;
2. Generic unit rates were developed from actual experiences for known activities including duration, labor and material required. Where costs & resources were unknown an allowance was made.;
3. A detailed quantity survey was conducted of the building. To simplify this, K-H segregated the buildings into modules that were referred to as "Sets". In a number of cases, the "Sets" were rolled up into "Supersets";
4. Unit rates and quantities for distinct sets were fed into POWERtool (POWERtool is a proprietary database system designed for K-H to streamline quantities and costs inputs in the BEST system);
5. In POWERtool, total costs per activity were estimated including waste quantities produced and container requirements per waste type;
6. Project management and support services were added onto the base cost. It should be noted that project management cost was determined using a generic set rate, that is, a percentage of base cost was used to assess associated project management cost;
7. Data was reviewed, and corrected if necessary;
8. The output from POWERtool was input in the BEST system, where learning curve factors were applied to the activity man-hours; and,
9. When the bottoms-up estimates replaced FDCM estimates (which had previously been input in the BEST system as a "bookmark" until better data was available).

Observations:

Based upon our review of the estimate, we have the following comments.

- ***Planning and Integration*** – Building 776 is scheduled to include a Remote Robotic Waste Reduction Facility which will simplify and expedite the D&D of certain contaminated components. This equipment requires less manpower and is designed to be safer (i.e., self-contained). The estimate for this building does not recognize the potential use of this equipment. Additionally, K-H does not recognize the potential use of the Centralized Waste Reduction Facility ("CWRF") in their estimate.

  Should these technology improvements be implemented (and successful), they could have a significant affect on the D&D activities in this building. If this is not the case then there is a high degree of risk that the building D&D will not be complete on time without additional increases in manpower and other associated costs.

- ***Planning and Integration*** - We observed that the assumptions made for each work activity do not appear to conflict with the broader assumptions made in the FDCM. They relate specifically to each task.

- ***Rolling Wave Knowledge Incorporation*** - The bottoms-up estimate includes a level of detail that could allow for better tracking of costs incurred as the work progresses. As a result, meaningful estimating information can be garnered from this project for other buildings or future projects. Unfortunately, because the implementation of tasks will deviate from plan, the level of detail may not be leveraged to the extent hoped for (that is, since it was originally established as a generic model, the generic costs temper the value of having achieved such detail).

  This is an evolving estimate, where new technology and decommissioning methods are envisioned for use in the program, but which are not accounted for in this estimate. Once their use is approved, a better view of actual costs and future expenses can be seen. This dynamic approach to implementation has merit.

  This rolling wave evolution also applies to the basic premise of this estimate that there will be an efficiency factor of "1" and a crew factor of "1." These factors will need to be updated as the work progresses, as they appear to exaggerate the ease of completing this building cluster.

- ***Unit Rates*** - As we noted earlier, unit rates were developed for the D&D of certain property, plant and equipment. The unit rates are broadly defined to include "generic" components of D&D. As a result, they do not cover all eventualities due to the wide variations of scope in some tasks or components (for example, though glove-box construction varies tremendously across the building cluster, the unit costs apply irrespective of particular construction anomalies from box to box).

  The generic unit rates sometimes appear to produce exaggerated costs for those buildings within the 771 cluster which are not Type 3CA (that is, having significant contamination).

- ***Unit Rates and Efficiencies*** – K-H has done a good job to integrate the experiences of workers in the implementation of D&D. Due to the nature of the work, an assessment of the

Level of Confidence Facilities Disposition Cost Model (FDCM)

Comments on Level of Confidence

The cost models goes into great detail to insure their methodology is clearly understood and sufficiently narrated.

Due to the unique nature of this project and the limited amount of both resource and cost information available K-H did a reasonable job based on the information available.. As more cost information becomes available K-H should update their cost information as much as possible.

The project management costs like all other unit costs are a function of the physical dimensions of the building and facilities. As this is now considered a closure project, project management costs should be estimated based on the level of effort required to manage the scope of work.

Item #	Confidence Check	FDCM Ranking
1	Estimating methodology clearly defined.	H
2	FDCM based on the available information identify the Key assumptions used.	H
3	FDCM establish a comprehensive work breakdown structure and is that structure consistent through out.	H
4	Factors consistent between the types of buildings or facilities being estimated.	H
5	Consistent approach to factors being used.	H
6	FDCM identifies the various types of facilities and buildings involved.	H
7	FDCM identifies the complexities and uncertainties with a project of the nature.	H
8	FDCM identifies the resource and costs associated with a project of this nature.	M
9	FDCM identifies the Project Management requirements.	M
	Average Ranking	**M/H**

L = The confidence is Low, though it does not infer that the subject is not already known or that there is no attempt to quantify its effects.

M = The confidence is Medium, inferring that there has been a distinct attempt to mitigate circumstances, but that there is still room for improvement in this area.

H = The confidence is High. The estimate has clearly defined how it has quantified the costs and resources therein, and has addressed the most critical aspects.

Level of Confidence – Basis of Estimate Software Tool (BEST)

The D&D estimates shown in BEST and used during the 2006 CPB are a true representation of forecasted costs produced during bottoms-up and top-down estimates. The detail within the Basis of Estimate supports the assumptions and quantity surveys made by K-H estimators at the time the information was produced.

Confidence Check	Ranking
WBS structure within BEST is consistent with FDCM.	H
All estimated D&D costs have been included in BEST.	H
WorkSets within BEST correspond to bottoms-up estimates	H
Like unit rates tested out against WBS elements.	H
Basis of Estimate detail is clear and concise.	M/H
Average Ranking	**H**

L = The confidence is Low, though it does not infer that the subject is not already known or makes no attempt to quantify its effects.
M = The confidence is Medium, inferring that there has been a distinct attempt to mitigate circumstances, but that there is still room for improvement in this area.
H = The confidence is high, the estimate has clearly defined how it has quantified the elements therein, and has addressed the most critical aspects.

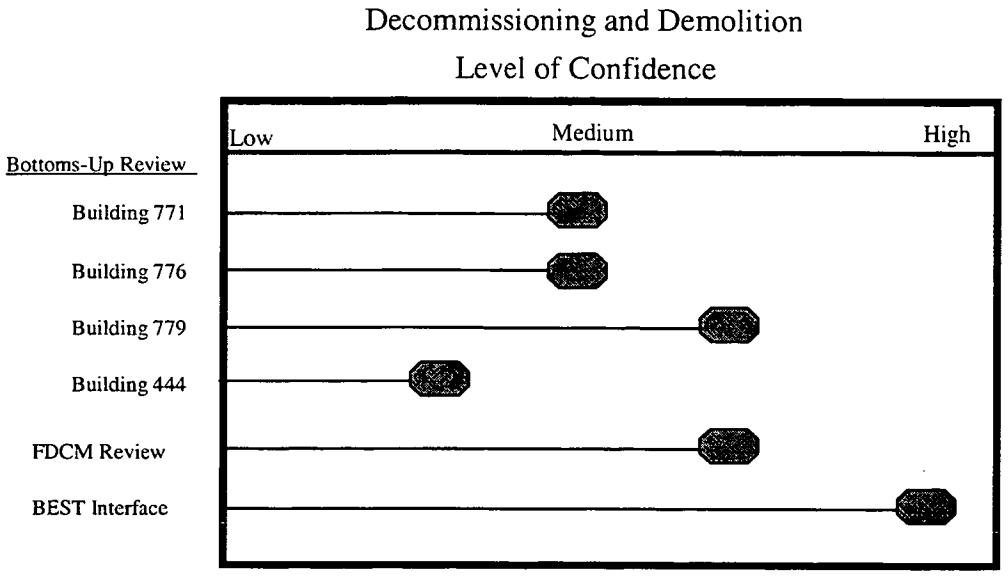
4.5.2.5 Bottoms-Up Estimate Review

The purpose of a bottoms-up estimate is to produce certainty, both in cost and labor resources. The project is dissected element by element and assigned a cost based upon quantities for labor, materials, equipment requirements and sub-contract costs. Once base costs are established, productivity factors are applied to account for difficult circumstances, location, timing issues or other peculiarities related to the task.

The bottoms-up approach takes the proposed work from its most finite elements up to a complete analysis of the work scope. If certain quantities or rates are unavailable, an appropriate allowance is included to cover these elements. These basic components comprise the key information required to assess labor resourcing, allocate required funding, track cost and scheduling the work.

Approach

To assess the bottoms-up approach to estimating, we examined four of the five estimates prepared by K-H. In general, the follow key concerns were addressed:



Level of Confidence Bottoms -Up Estimates

Comments on Level of Confidence

Building 779

- There is limited basis for the estimate and was reliant on estimator experience and assumptions.
- Did not rely on new technology for its completion.

Building 444

- It is unlikely that the current estimate adequately covers the scope for the building, while in its original issue it was defined in detail. Since then the schedule has been extended for this building as its priority has been reduced.
- No factors have been applied, the effects have been built into the rates for work in the Clean and Contaminated areas.
- The estimate has not been updated on a regular basis. This is the case even though there have been frequent changes made to its scheduled completion date.

Building 776

- Costs have been applied on a set by set basis. This has produced a variance in how the unit rates compare between sets.

Building 771

- It should be understood that though there is at least one allowance for each task, the generic nature does not assign mitigation to specific risks.

General Comments

- There will be some impacts, but these, whether positive or negative, have not been analyzed to produce a definite cost outcome.
- The methodologies were maintained within individual estimates as applied to specific building clusters. However, estimating methodologies vary among building clusters. Though some variation will occur due to differing building natures, the basic structure of a bottoms-up estimate should have the same elements within it. Use of variable approaches may result in omissions or discrepancies when attempting to allocate cost and resource the work.
- The methodology for applying efficiency factors is inconsistent (due to estimators' discretion). For example, Building 771 has factors applied across the board, while buildings 776 & 779 have factors applied to particular resources.
- Buildings 771 & 776 rely on new technology; Building 779 does not.

The following summarizes our opinion of the level of confidence.

#	Confidence Check	Building 771	Building 776	Building 779	Building 444
1	Estimating methodology clearly defined.	H	H	M	M
2	Scope for the building well established.	H	H	M	H/M
3	Unit Costs consistent within estimates.	H	H/M	H	H/M
4	Unit Costs consistent between estimates.	L	L/M	L/M	L
5	Out year cost impacts recognized.	L	L	N/A	L
6	Methodology consistent within the estimate.	H	H	H	H
7	Methodology consistent between estimates.	L	L	L	L
8	Consistent use of factors within buildings.	H	H	H	M
9	Consistent approach to factors between buildings.	L	L/M	L/M	L
10	Use of Technology.	L	L/M	N/A	L
11	Estimate updated.	M	M	H	L
	Average Ranking	**M**	**M**	**M/H**	**L/M**

L = The confidence is Low, though it does not infer that the subject is not already known or that there is no attempt to quantify its effects.

M = The confidence is Medium, inferring that there has been a distinct attempt to mitigate circumstances, but that there is still room for improvement in this area.

H = The confidence is High. The estimate has clearly defined how it has quantified the costs and resources therein, and has addressed the most critical aspects.

perceptions of the K-H Project Team. We also used the "Joshua" (a proprietary K-H software package for budgeting and tracking costs) and P3 reporting tools to analyze how cash flows and resources correlated to key milestones.

4.5.2.3 Summary Findings and Concerns

K-H has made sufficient efforts identifying and quantifying various unknowns and knowns that may be expected during deconstruction of RFETS. Based on our review and analysis of the complexities and uncertainties for both scope and cost, we rate the overall confidence in D&D cost estimate of $755 million at a level of "medium". Our findings include both strengths and weaknesses, or exceptions identified within the "bottoms-up" and "top-down" estimates produced by K-H.

Strengths:

- The FDCM serves well as a rough order of magnitude estimate. It provides useful information necessary to determine resources and funding forecasts, when utilized it is a useful benchmarking tool against bottoms-up estimates.
- Rocky Flats D&D historical cost information has been incorporated into estimates and provides a strong basis for estimated costs.
- Adjustment factors (up/down) have been applied to identify expected learning curves, high levels of safety, complexity of work, and inefficiencies produced during constrained working conditions.
- D&D forecasts clearly identify scope of work and define all exclusions and assumptions made during the cost estimating efforts.
- Consistent use of unit costs has been demonstrated within individual "top-down" and "bottoms-up" estimates which are updated as new information is discovered.
- Technology (BEST) has been used effectively, and accurately reflects total estimated costs produced by building estimators and the FDCM development team.

Weaknesses:

- The "bottoms-up" estimates apply historical data generated from K-H's current cost reporting systems. As a result the cost control and reporting methods used provide weak support for their estimated costs.
- Due to the lack of cost information available, K-H's bottoms up estimates do not seem to make many provisions for scope uncertainties or the level of effort required for known scopes of work. K-H assumes that the project contingency will be used for all scope uncertainties rather than applying risk factors to the estimates.
- In terms of cost control and reporting effort, there is little evidence that K-H has made the transition to a deconstruction contractor. As the site moves away from being an operating facility and more towards a deconstruction project the level and type of cost control and

reporting needs to become more focused on unit costs, thereby allowing management to better identify areas where increased efficiency is needed.

- There is inconsistency with the methodology used in developing the estimates. As the site becomes a decommissioning and deconstruction project, we observed that K-H does not use consistent procedures for the development of the various bottoms up cluster estimates. Because there are no established procedures, it becomes difficult to use one building's information for another building.

4.5.2.4 Level of Confidence

Background

Based on the observations made during interviews, telephone conversations, policy manuals, and other material available for review, the following section provides a method of evaluating the D&D estimates performed in the K-H 2006 CPB.

We have derived the following estimate review areas based on the estimate type (top-down or bottoms-up) and their effectiveness. The evaluation scores range from low, medium and high, with high being best. These scores are based on the review and subjective evaluation of the information available at the time of this review. Since all areas are subjectively measured, and no area is deemed more important than another, each area is measured independently, and the overall score is an average of all individual areas.

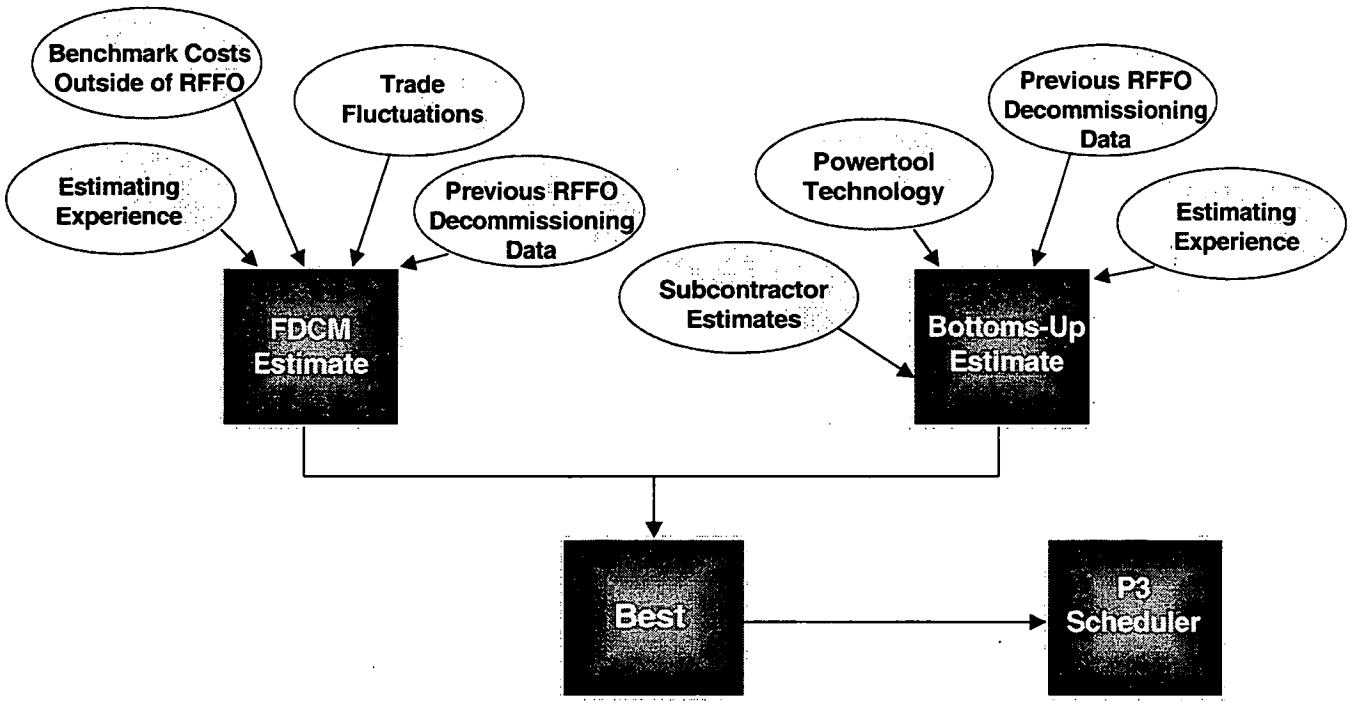
This section is designed to evaluate actual estimate deliverables and test whether the finished product will meet the criteria discussed during our field interviews. This will provide the DOE with both a report on the general D&D estimating processes as described by the K-H representatives. The following illustration is the summary of results. All detailed scoring of the categories reviewed can be found under their associated heading in this report section.

Evaluation Summary

The following illustration is the summary of results. All detailed scoring of the categories reviewed can be found under their associated heading in this report section.

Demolition and Decommissioning

Estimating Sequence



up estimating, we reviewed, in some detail, four of the five estimates that were prepared. We did not review the estimate for Building Cluster 886.

We analyzed the "top-down" estimate produced from FDCM by reviewing, verifying and challenging historical data and estimating assumptions that K-H incorporated in the model.

Finally, we tested the BEST system to insure all completed "bottoms-up" and "top-down" estimates are accounted for and presented accurately.

A summary diagram showing the D&D process is included on the previous page. Specific inputs identified in the diagram will be discussed later in this section.

Support Documentation Review

After selecting PBDs, WADs, and WADlets corresponding to selected buildings and indicative of tops down methodology, we gathered support data pertaining to them which was available through the RFETS intranet network. These documents include but are not limited to the following:

- Project Baseline Descriptions ("PBDs") including Appendix A - Baseline Cost Detail, Appendix B - Change Control Logs, and Appendix C - Work Authorization Documents (by fiscal year);
- Basis of Estimates ("BOEs");
- Primavera Project Planner ("P3") scheduling data; and,
- Joshua, BEST, P&I Reporting database.

Interviews

Upon completion of the preliminary document review, we arranged interviews with key personnel from both the K-H project management team and the Department of Energy. Among other things, the interviews were conducted to confirm the assumptions identified in the PBDs, allow explanation of project management reasoning, discover client perceptions of services delivered and to clarify estimating controls and protocol.

Selective Building Tours

We made selected guided tours of Building 707, 371, 779 and 776/777. The purpose of the tours was to become familiar with the physical plant operations and to better appreciate constraints and encumbrances that are identified in the Bases of Estimate. Building 779 and Building 776/777 were selected based upon their relative status on the critical path to closure.

Analysis

After all support documents were reviewed, and interviews and inspections were completed, we compared K-H Project Management assumptions and planning to our fact-based findings and the

4.5.2 Demolition and Disposal

4.5.2.1 Overview

Decontamination and Decommissioning (D&D) is the series of activities that follows deactivation of a building, portions of a building, structures, or system components. D & D includes: "the surveillance, maintenance, decontamination, and/or dismantlement for the purpose of retiring the building from service with adequate regard for the health and safety of workers and the public and protection of the environment."

Work Organization and Cost

The D&D estimated direct cost for RFETS is addressed in PBDs 014 through 022. Each PBD relates to specific building clusters. In most cases, each cluster contains a set of multiple buildings related by proximity and/or functionality. The cluster groupings incorporate approximately 600 distinct buildings (or ancillary structures such as trailers, cooling towers and tents) located on site. According to the 2006 SPC, K-H has estimated that the D&D direct cost will be $755 million (unburdened and unescalated).

Estimating Methodology

K-H derived the total D&D estimate through a combination of "bottoms-up" and "top-down" estimating techniques. The "bottoms-up" approach is based upon quantitative data including unit prices for labor, material and equipment. Approximately 40% of dollar volume associated with D&D was estimated using this approach.

The "top-down" approach is based upon historical cost data from D&D activity already completed on site and accounts for the remaining 60% of dollar volume associated with D&D. The method used for deriving costs under this model were prescribed in a manual referred to as the Facilities Disposition Cost Model (FDCM).

It should be stressed that top down estimating applies *methodology* across a broad spectrum of work. Bottoms-up estimating, on the other hand, applies highly detailed and finite assumptions regarding buildings and their components to derive cost.

The determination to use one estimating approach or another was dependent upon a number of factors that will be discussed further below. In any event, once an estimate was prepared, K-H fed the input into the Basis of Estimate Software Tool ("BEST"). BEST is a RFETS tracking tool used to integrate cost and schedule.

K-H Organizing Principle: Levels of Contamination

In accordance with Rocky Flats Cleanup Agreement (RFCA), facilities are broadly classified based upon their contamination levels into three types as described in the following table.

Building Type	Description	Complexity and Cost Risk
Type 1	Free of contamination – mostly office trailers and administrative buildings	12%
Type 2	Without significant contamination or hazards. But in need of decontamination	21%
Type 3	With significant contamination or hazard.	68%

4.5.2.2 Methodology

The following discussion is the result of our review of the 2006 Closure Project Baseline for the D&D scope of work. The intent of this confidence review is to validate the basic methodologies that K-H employed to establish the schedule and cost integral to the PMP. The scale and complexity of the RFCP is such that a thorough examination of all D&D is neither feasible nor, given the intent, appropriate.

It is not intended to be a comprehensive review of all PBDs associated with D&D; instead, it is a representative review of specifically identified buildings which are either highly contaminated or otherwise indicative of K-H's methodology

Accordingly, we selected a number of buildings that we deemed "critical" or otherwise indicative of K-H's methodology for review as will be discussed further below.

Criteria for Selection of Sample

The preponderance of D&D scope and estimated cost resides within selected Type III building clusters as follows:

1. Building 371;
2. Building 707;
3. Building 771;
4. Buildings 776/777; and,
5. Building 779.

Of these five, K-H selected the last three building clusters (771, 776/777 and 779) to perform a bottoms-up estimate. K-H also selected building clusters 444 and 886 for bottoms-up estimating. The latter two were selected because they are critical to the timely closure of the site due to their relationship with other operations.

In order to assess the completeness of scope, accuracy, methodology and consistency of estimating in general, we reviewed both the bottoms-up and top-down processes. For bottoms-

pertained to external factors that do not address risks associated with problem areas such as the HCAs.

Costs

In our BCE and BOE analysis for WADlet 1.1.06.02.03 – 371/374 Cluster Deactivation , we segregated prime costs as follows:

Direct Cost	$ 9,406,862	100%
Project Management Cost	$ 6,496,553	69%
Incentive Fee	$ 2,000,000	21%
Other	$ 786,982	8%
Total	$18,690,397	198%

In our BCE and BOE analysis for WADlet 1.1.06.07.03 – 707 Cluster Deactiviation, we segregated prime costs as follows:

Direct Cost	$ 5,420,000	100%
Project Management Cost	$ 3,128,000	58%
Incentive Fee	$ 2,000,000	37%
Other	$ 182,000	3%
Total	$10,730,000	198%

The K-H team informed us that Project Management is inconsistently accounted for across BOEs and is left in large part to the discretion of the estimator. While Planning and Integration guidelines give some direction, we were informed that they lack descriptive detail as to accounting for specific activities.

In light of the the PBDs 27 through 34 that address K-H Analytical Service, RFFO Program Support, K-H Project Management, and Management Project, the additional 65% (weighted average of above) of Project Management burden seems generous.

It should be noted that we tabulated the above based upon the narrative and other information discussed in the BOE; because there is limited consistency in estimators' methodologies across similar WADlets, we accept that our segregation of cost as indicated above is subject to rebuttal. To identify project management costs within each corresponding BCE, we tabulated cost items that were specifically titled Project Management.

There appears to be some overlap in WADlet specific project management and the PBDs for Management Project. For example, there is a line item identified as "K-H Oversight Planning and Integration" (Activity D2BDA007B) that one might expect would be addressed in PBD 30 or PBD 34. While the scope of work included in the WADlet may be appropriate, the narrative is misleading (that is, it appears to suggest an activity covered under another PBD).

We again noted that K-H applied risk factors to incentive fees and project management activities (again, using Activity D2BDA007B as an example, we see "4s," "3s" and "2s" applied to line items such as Personnel Training, Program Management, Equipment Disposition, etc.). This does not appear to be consistent with the prescribed methodology for defining risk.

Risk, Uncertainty and Integration

We identified a number of process shortcomings that may be indicative of high risk, high uncertainty or poor integration. These include the following:

- ***Deactivation*** – In general, the actual work scope identified in the PBDs for deactivation is ill defined. While there is an End State description that is identical in both PBDs, it is not clear what activities are required to achieve it.

  Inconsistencies are readily apparent between the two PBDs. PBD 16 provides some detail as to what is to occur in each "set" while PBD 17 does not comment on the specifics of deactivation work to be performed.

  While RFCA explicitly states what deactivation does **not** include, there does not appear to be a written protocol to diminish the "gray area" between deactivation and decommissioning.

- ***Characterization*** – We noted that the complexity of the HCAs (such as the X-Y Retriever in Building 707 and the Central Storage Vault in Building 371) was not specifically addressed. Because these areas have not been thoroughly characterized, there is a risk that the K-H team may encounter unforeseen contamination that may significantly affect a timely exectuion of the deactivation process.

- ***Internal and External Project Interfaces*** – We noted that the two PBDs do not recognize project interfaces in the same manner. For instance, PBD 17 fails to acknowledge the interface with decommissioning while PBD 16 does.

  In addition, PBD 17 fails to recognize the interface with Building 371 (where hold-up is addressed). We note however, that PBD 16 does recognize the interface. This illustrates further a lack of consistency in planning and suggests that the successful implementation of the work relies on the competence of the project teams appointed to execute the work.

Finally, we note that after numerous attempts we were unable to meet with the WADlet manager for PBD 17. Therefore, we were unable to benefit from the manager's insights regarding the particulars of the project or its latent assumptions.

procedure for requesting additional employees. Through interviews with K-H we have not been able to identify a well managed structured labor pool from which WAD managers can staff specific activities. WAD managers were unable to provide a cogent explanation for how resources are allocated, but did indicate that labor was drawn from a pool of resources on an *ad hoc* basis.

- ***Container Certification***: The 9975 shipping container that will be used for transporting the stabilized metal and oxides within the 3013 container has not been approved by EM70. The 9975 container was originally scheduled to be approved by EM70 in August 1998 (EM70 is a government agency responsible for approving the design of the shipping container). Currently, it is scheduled to be approved in October 1999 where it is in its eighth design review by EM70 (who provide testimony that the integrity of the shipping container will not be comprised during transport). We noted that K-H has very limited control over the rejection/acceptance of the 9975 container.

  When asked about the approval process, K-H told us that EM70 does not provide design direction with regard to specifications, thereby increasing time required for troubleshooting design problems. K-H is confident that the container will be certified in FY00. The first scheduled shipment of Pu metals off-site should take place in January 2000. Should the container be approved in October 1999, only three months would be allotted to implement design changes, procure the containers from a private concern and prepare material for shipment. This is too unforgiving. K-H has not identified a contingency to mitigate this risk.

- ***Project Management***: Within the selected WADlet, Shipment of SNM Metal and Oxides, we noted what appeared to be an excessive number of project managers compared to process specialists. For FY99 and FY00, there is approximately one project manager for every 2.5 process specialists.

Deactivation

Deactivation consists of recovering plutonium holdup generated by the plutonium processing and stabilization functions. Once holdup is recovered and characterized, it must be stabilized (as necessary) and stored in certified containers. Deactivation occurs subsequent to the operations associated with nuclear processing and prior to decommissioning and demolition of building sets. Deactivation is responsible for removing SNM holdup from untoward (i.e., difficult to manage) places and preparing it for off-site shipment.

Deactivation is an intermediate step between NucOps and decommissioning. The 2006 CPB has dissected buildings into sets so that operation, deactivation, decommissioning and demolition can all take place contemporaneously. The role of deactivation is to remove Category I and II holdup that was produced as waste during nuclear operations.

Approach

The deactivation process is scheduled to occur in all PBD building clusters within the protected area. To focus our assessment on process integration, we chose to analyze those deactivation processes that occur within buildings that also interface with high-risk NucOps. To objectively analyze the integration of the 2006 CPB we needed to understand how the specific projects interact with one another. Therefore, we selected deactivation activities within Buildings 371, PBD 16 (which houses the PuSPS) and Building 707, PBD 17 (which houses the majority of nuclear stabilization activities).

We scrutinized the WADlets using the following criteria:

- To what degree does the WADlet interface with internal and external projects;
- What level of risk and uncertainty is associated with each WADlet; and,
- Within the WAD where was the majority of cost allocated relative to overall life cycle cost the and cost required to complete the work

Based on this methodology, we selected the following WADlets.

- WADlet No. 1.1.06.02.03 – B371 Cluster Deactivation
- WADlet No. 1.1.06.07.03 – B707 Cluster Deactivation

Completed milestones for the deactivation process for both buildings is dependent upon the performance of nuclear functions operating within those buildings.

Planning & Assumptions

Deactivation is scheduled to be "dove-tailed" with other activities occuring in the building clusters and is to occur contemporaneously with NucOps, decommissioning and demolition. The work is organized in sequential "sets." The sets are prioritized in a logical manner.

We concur with the DOE (per the DOE Findings and K-H Response Report dated July 30, 1999), that the facility disposition process should be broadened to provide guidance or direction on deactivation. We noted that the characterization of deactivation activities is not consistently defined across the two PBDs that we reviewed.

Ill-defined processes may lead to Planning and Integration problems. For example, both building clusters contain highly contaminated areas ("HCAs") where supplied breathing air ("SBA") is required. Neither PBD (nor the WADlets therein) specifically address deactivation hold-up uncertainties and characterizations. As known problem areas, one would expect greater scrutiny and contingency planning to identify, document and plan for unforeseen site conditions.

The assumptions that were identified in the PBDs included "General Assumptions" for the 2006 Closure Plan (and other broad assumptions) that do not appear to be germane to the deactivation work program. K-H identified no deactivation-specific assumptions. That is, their assumptions

Planning & Assumptions

WAD 22 addresses the procurement of certified transportation containers, the packaging of stabilized SNM into proper shipping containment and the negotiation of available off-site receivers. Several critical assumptions regarding the Shipping process are summarized as follows:

- Operations throughput form the PuSPS will support the required shipping schedules;
- Shipping containers will be certified for the intended use and available when needed;
- The Safety Analysis Report for Packaging ("SARP") will not be changed in a manner affecting use; and,
- Receiver downtime will not prevent shipments.

The PuSPS process was scheduled and estimated based on the fundamental concept that the equipment would operate continuously with minimal modifications. As previously discussed above, this has not been the case. The preparation for first oxide shipment is scheduled to begin in March 2000. Due to the implementation problems associated with the PuSPS system, K-H has informed us that the stabilization of oxides will not begin until June 2000. It is expected that additional changes will continue to erode the schedule's float and consequently negatively affect the CPB.

Selected shipping containers, including the 9975 container, have yet to be certified. K-H informed us that the 9975 shipping container is undergoing the eighth design review by EM70 (expected to be completed by October 1999). It was originally scheduled to be approved in August 1998.

SARP characterizes what types of materials can be transported in specific shipping containers. K-H has assumed that these characterizations will not be altered even though we noted that K-H Management had little confidence that this would happen. The ramifications of not fulfilling the terms of this assumption are difficult to quantify.

Costs

The majority of the budgeted costs are scheduled to be incurred between FY99 and FY01. Through the WADlet lifecycle, approximately 32% of budgeted cost is allocated to the procurement, fabrication and delivery of the 9975 shipping container and project management comprises approximately 18% of budgeted direct cost. In addition to our selection, K-H management indicated that SNM Shipping has dedicated an entire WADlet within WAD 22 to specifically account for project management activities (WADlet No. 1.1.04.10.12, $7,780,000). Note that this is exclusive of project management associated with PBD 30 and 34, KH Project Management and Management Project.

We identified inconsistencies within the BOE that may have a macro effect on the integrity of the 2006 CPB. Our concerns are listed below:

- We noted that quantifiable information provided within the BOE is vague. We were informed by K-H Management that detailed estimates were created for a two year forecast and that out year estimates were limited due to uncertainties. K-H did not identify any change in scope that would differentiate between detailed estimate and the out year forecast.

- We were informed that as actual cost data becomes available as work is completed, the BOEs would be adjusted to reflect "lessons learned." We noted the Pu Parts shipping campaign produced three shipments in FY99, yet the FY00 was estimated based on estimator's experience. In other words, the estimate was not adjusted according to actual cost performance.

- We noted that the BOEs reviewed, did not reflect efficiencies of scale for multiple shipments of similar material. For instance, shipment of unclassified oxides is sheduled to have 58 shipments over a two period, yet the last shipment estimate is a mirror image of the first shipment estimate and the corresponding risk assigned to the cost remained excessive, rated "4."

The risk factors ascribed to each activity within the BOE appear to be inappropriate. For example, shipments are broken down into campaigns based on the material classification. Each campaign consists of multiple shipments. The shipment of unclassified oxides is scheduled to consist of 58 shipments, yet cost risk remains unchanged. Similarly, Pu Parts made three shipments during FY99, yet risks associated with FY00 BOEs remain unchanged (lessons learned).

Risk, Uncertainty and Integration

We identified a number of process shortcomings that may be indicative of high risk, high uncertainty or poor integration. These include the following:

- ***Resource allocation***: In aggregate, all operations at RFETS are scheduled to significantly increase production during FY00. We noted that resources are limited and are spread very thinly across numerous functions. We noted that K-H is struggling to attract sufficient labor from the Denver market due to a strong economy (this notion is supported by secondary data that reports 2.2% unemployment in Jefferson County). New employed workers have an approximate six-month mobilization period where background checks must be completed and hazardous material training must be performed. Thus workers hired today will not be cleared for work well into FY00. Furthermore, during the mobilization period, workers are on the payroll.

  K-H said that to meet expected milestones, workers must work more efficiently and work more overtime. Yet K-H also stated that workers are currently very inefficient, morale of employees is low, and incentives for workers achieving performance milestones is limited. K-H representative could not explain the incentive of the work force.

  We noted the allocation of workers is very inefficient. We have not seen a structured

Direct Cost	$11,617,000	100%
Project Management Cost	$ 2,787,000	24%
Incentive Fee	$ 3,553,000	31%
Other	$ 677,000	6%
Total	$18,635,000	161%

In light of the the PBDs 27 through 34 that address K-H Analytical Service, RFFO Program Support, K-H Project Management, and Management Project, the additional 24% Project Management burden (relative to direct cost) seems generous. We were told by the K-H team that the characterization of costs is left to the discretion of the estimator.

Risk, Uncertainty and Integration

We identified a number of process shortcomings that may be indicative of high risk, high uncertainty or poor integration. These include:

- ***Basis of Cost Estimate*** - While the Baseline Cost Estimate indicates that almost all of the costs were based upon historical indices, we found that the bases are not well sourced (i.e., closed charge codes). More specifically, the bases may not be representative of working conditions that one might encounter during implementation.

  For example, the historical bases for the Program Management activities were based upon K-H's experience on this specific WADlet in the year prior. While this is not necessarily inappropriate, we found that the prior year's total planned cost (according to the Flash Price Spread Report) only accounted for approximately 8% of the project cost. Furthermore, the work performed under the prior year did not have the degree of demand that one might associate with the completion of milestone hurdles.

  We also note that the BCE record of BOE type did not always concur with the BOE narrative (e.g., Activity COC7070004 indicates a historical cost basis on the BCE, but an Estimators Experience on the BOE).

- ***Basis of Cost Estimate*** - K-H indicated that they expect to process 24 kilograms of waste per shift. In later conversations with the K-H representatives, we were told that in reality that might be conservative (in anticipation of unforeseen conditions). While this "conservative" approach is not inappropriate, the purpose of the baseline is to establish K-H's best estimate of production; the risk factors are intended to provide an appropriate contingency to allow for unforeseen conditions.

  This ostensible duplication of contingency allowances does not present an accurate portrayal of project needs.

SNM Shipping

SNM shipping is responsible for the packaging and removal of all Special Nuclear Material from RFETS. Primary materials include pits, enriched uranium, composite parts, metal and oxide and residues. This project must also ensure the availability of off-site receivers and the procurement of off-site travel containers. All material, as previously described, will be shipped to other DOE sites where it will be stored for future processing. The accomplishment of this task is a necessary step to meet the protected area closure mortgage milestone and the timely execution of deactivation, decommissioning and demolition of contaminated building clusters within the protected area.

We note that SNM Shipping is not responsible for the shipment of Transuranic waste to WIPP. Waste management is accountable for the negotiation and delivery of processed waste with <10% weight of Plutonium.

Approach

The deactivation process is scheduled to occur in all PBD building clusters within the protected area. To focus our assessment on process integration, we chose to analyze those deactivation processes that occur within buildings that also house high risk nuclear operations. To objectively analyze the integration of the 2006 CPB we needed to understand how the specific projects interact with one another. Therefore, we selected deactivation activities within Building 371 (which houses PuSPS) and Building 707 (which houses the majority of nuclear stabilization activities).

We scrutinized the WADlets using the following criteria:

- To what degree does the WADlet interface with internal and external projects;
- What level of risk and uncertainty is associated with each WADlet; and,
- Within the WAD where was the majority of cost allocated relative to overall life cycle cost the cost required to complete the work.

Based on this methodology, we selected the following WADlets.

- WADlet No. 1.1.06.02.03 – B371 Cluster Deactivation
- WADlet No. 1.1.06.07.03 – B707 Cluster Deactivation

The completed milestone for the deactivation process for both of these buildings is dependent upon the performance of nuclear functions operating within those buildings. Aside from building characterization risks, the timely completion of deactivation is directly affected by the risks and uncertainties associated with nuclear operations conducted in those buildings.

Approach

To focus the assessment of performance, we reviewed the criticality of the various stabilization operations relative to the goal of closure. We derived the following cost breakdown to establish an order of magnitude correlating to WADs under PBD No's 9 and 10.

PBD No.	WAD No.	Description	WAD Cost (x000)	Percent of Total Cost
9	14	NDA Project	43,857	14.6%
"	15	Salt Stabilization	48,163	16.1%
"	20	Dry Repack, Residues Elimination	28,092	9.4%
"	88	Ash Stabilization	31,918	10.7%
"	89	B371 Residues Elimination	54,111	18.1%
"	90	Residue Program Support	73,743	24.6%
10	19	B371 Liquid Stabilization	12,582	4.2%
"	91	Residue Program	7,330	2.4%
		Total	**299,796**	**100.0%**

Source: Kaiser Hill P&I Reporting System
Flash Price Spread Report

We then scrutinized the WADs based upon the following criteria:

- To what degree does the WAD interface with internal and external projects;
- How much uncertainty and risk is involved in the WAD's implementation;
- Where does the preponderance of expense reside relative to overall life cycle cost and the cost to complete the work.

Based upon this, we selected WAD 20. We disregarded WAD No's 14 and 90 because they pertained to surveillance and support (that is, they did not represent what we considered direct project costs). We disregarded WAD No's 15, 88 and 89 because they were substantially complete. We disregarded WAD No's 19 and 91 because they represented only 6.6% of overall nuclear stabilization cost.

After having selected WAD No. 20, we applied similar reasoning to that presented above to select WADlet No. 1.1.04.09.04.07 - Operate Dry/Shapes Repackaging. Again, our intention in selecting this WADlet was to provide a case study for analysis of processes and methodologies employed in nuclear stabilization operations.

Planning & Assumptions

According to the PBD, this element includes the operation of the dry (inorganic combustibles) and classified shapes destruction/repackaging at the Site. The Project End State is to have the solid residues processed and repackaged in a state certifiable for disposal.

K-H has determined that approximately 24 kilograms of material will be repackaged per shift. Two-shift operation is planned to achieve sufficient throughput to meet the dry residue schedule. This estimate allows for about 40% down-time which was determined by K-H, as reasonably predictable utilizing the Building 707 facility, equipment and staff. It should be noted that when we made further inquiries regarding production goals (how many shifts, length of shifts, over time, etc.) K-H Management was not able to provide immediate answers (the managers had no intimate knowledge of the PBD and BOE narrative content).

In discussions with the Project Management team, K-H has conceded that resources represent their largest challenge. They concede that at present they do not have enough labor to maintain the required production quota to meet the activity's milestone. To mitigate this risk, K-H intends to implement one (or all) of the following options:

- Hire and train additional labor;
- Re-allocate people from other, lower priority NucOps to this activity; and, or
- Increase overtime.

According to the Baseline Cost Estimate ("BCE"), virtually all of the activities related to the implementation of the project (with the exception of the Lawrence Livermore Drum Moves - COD707NA03) were based upon historical costs derived from earlier work on this WADlet or similar engagements.

In our review of the WADlet activities we noted that a majority of the activity was based upon accounting charge codes (e.g., EM253400, EM253300, RD25AB00). The referenced charge codes had been closed. As a result it was extremely cumbersome to determine the basis for estimate (which had been archived).

Costs

As indicated above, most of the costs were based upon historical indices. In the first three years of project implementation (1999 through 2001) the majority of cost (approximately 51%) is carried in the category referred to as "Other" category. While a significant portion of this is attributable to project management, incentive and superstretch fees, it was not readily appearant what else was driving cost.

The risk factors for cost, schedule and technology as ascribed to a number of the activities appear to be inappropriate. For example, risk factors of "2," "3" and "4" have been applied to activities which do not appear to represent any significant risk such as program management which appeared to have a sound historical cost basis (K-H management concurred with this assessment).

In our BCE and BOE analysis for WADlet 1.1.04.09.04.07 – Operate Dry/Shapes Repackaging, we segregated prime costs as follows:

tests. It should be noted that by design it should be possible to handle the end product with minimal safety precautions.

◊ The contaminated weld hood reportedly could compromise the health and safety of the process handlers. The workers in this zone do not use respirators and may be exposed to contamination. In addition, Room 3713 within Building 371 also houses the processing of wet combustibles. Reportedly, these workers may also be put at risk. K-H is in the process of developing methodologies that would mitigate the contamination problem. Only when methodologies are proven through testing, can implementation occur.

K-H has not conceptualized or procured substitute equipment to stabilize, process or package plutonium metals and oxides should the PuSPS prototype fail. Therefore, the timely closure of the 2006 CPB hinges solely on the success or failure of the PuSPS system.

- ***Change Proposal***: K-H Management told us that it has recently submitted a change proposal concerning the PuSPS system that may result in major schedule changes. The change proposal is intended to address some of the concerns identified earlier. Mainly, the contamination of the weld hood prohibits the safe stabilization of oxide materials. In addition, because operational start-ups of metal and oxide process is no longer possible, K-H would be compelled to write dual procedures and run dual operational tests (contrary to their original proposal) to increase efficiency. The proposal also increases the budget by $2.4 million.

  K-H set an original milestone for the completion of stabilization and packaging of metals and oxides for July 2001, while the Defense Board milestone was scheduled for May 2002. Though the current change proposal has not altered the defense milestone, K-H has already consumed ten months of schedule float. Now, the metal and oxides operations are scheduled to finish in May 2002. We have noted that further change proposals of any significance will exceed the May 2002 date and could have a substantial effect on the 2006 closure.

  We noted that K-H does not yet know the full effect of these changes on the rest of the schedule (exclusive of SNM Shipping, which is directly dependent on the success and timely execution of the PuSPS system).
  It would appear that there is a clear need for integration; there is a high level of crosscutting implications related to this function and there is a probability that any changes to it would have downstream ramifications.

- ***3013 Procurement*** – We have been told that the manufacturer is having difficulties fabricating the container due to issues with the press form (more specifically, the deep drawn process). Procurement of these containers is approximately two months behind schedule.

- ***3013 Material Allowances*** – As indicated in the planning discussion above, K-H has assumed that the DOE will allow containment of materials that do not currently conform to the 3013 specification. Specifically, the 3013s are approved only for materials that have in

excess of 50% plutonium weight. At present, K-H is planning to pack materials that have as little as 30% plutonium weight in the 3013s.

Though this poses an external risk to K-H, they developed the schedule and basis of estimate on this assumption. We were informed from K-H management that the 3013 standard is in review by DOE but has yet to be accepted.

It should also be noted that K-H plans to "blend" materials which have between 10% to 30% plutonium weight to a level below 10% such that it will meet transuranic waste requirements.

We have no basis to confirm or deny the viability of these assumptions. ***There is no known contingency for shipping material which is between 30% to 50% plutonium weight in the event of non-acceptance.***

In light of the foregoing review, it appears as though K-H has a well-documented and reasonable defense of their potential inability to perform according to plan. In short, K-H has readily acknowledged that they have low confidence in the PuSPS system.

K-H appears to have made a reasonable effort to ensure peak performance of a flawed system. Notwithstanding this, the effect that the system's potential non-performance may have is considerable. While the DOE may accept accountability for stewarding the permit processes (with respect to minimum standards allowed for 3013s), it may have assumed more responsibility for the PuSPS's performance than is appropriate - particularly in consideration of the intent of their agreement with K-H.

Notwithstanding this, K-H's production goals are more forgiving that one would expect. The 5½ canister of 3013s production target appears very conservative - particularly in light of K-H's diligence in rectifying recognized shortcomings in the system's performance.

Nuclear Stabilization

Nuclear stabilization is comprised of the processing necessary to prepare solid and liquid plutonium waste residues as expeditiously as reasonably possible for shipment to off-site receivers. For purposes of analysis, we have distinguished this from the stabilization of plutonium metal and oxides that are differentiated as Special Nuclear Materials ("SNM").

Stabilization of non-SNM plutonium waste is addressed under PBD No. 9 - Pu Solid Residue Stabilization, and PBD No. 10 - Pu Liquid Stabilization. Wastes are comprised of all the solid and liquid residues generated as byproducts from plutonium production operations that have a blended content of less than 10% plutonium by weight.

likelihood of the PS's ability to attain or sustain the necessary operability needed to support the site mission in the automatic mode in Buidling 371."

Notwithstanding the above, K-H suggested that implemenatation of the recommended modifications – in conjunction with a thorough maintenance program and non-automated operation - would allow enhanced reliability. K-H has produced a detailed Material Campaign Plan that identifies the production conditions and the associated production rates for the PuSPS system. In consideration of the foregoing, the K-H team told us that the BOE reflects the following:

- Building 371 is operational at least 90% of the time;
- The stabilization system runs at 65% efficiency;
- The packaging system runs at 72% efficiency; and,
- Daily production would be at a rate of approximately 5½ cans over two shifts;
- Available operating hours per shift (including dress in and out, breaks);
- 5% rework of containers;
- Weld Quality Control Tests;
- Nuclear Material Control inventories;
- Facility Tests (criticality, emergency generator, etc.).

Under this scenario, they still meet the projected milestones pertaining to this WADlet.

In terms of actual operation of both the stabilization and packaging equipment, K-H told us that they plan to have approximately 21 FTE operators per each twenty-four hour period. The personnel will work in three shifts. The first and second shift will perform operations while the third shift will perform routine maintenance. The first shift will have between nine to twelve operators, the second will have six to eight operators and the maintenance staff will be comprised of about three operators.

Risk, Uncertainty and Integration

The PuSPS system represents what may be considered the single most salient risk factor of the RFCP. Based on the assumptions identified in the PBD, K-H has effectively shed responsibility for the system's functionality. As a result, it would appear as though K-H is released of accountability in the event that the system is unable to meet its performance specification. Accountability concerning the performance of the PuSPS needs to be further articulated.

In our review of the PMP, and based upon interviews of key K-H team members, we encountered a number of "externalities" in the assumptions that preclude any meaningful critique of K-H's process management. Specifically, K-H has identified a number of factors that are ostensibly (and perhaps reasonably) beyond their control. These are identified and discussed below.

- ***PuSPS System Performance*** -The PuSPS system has a scheduled milestone to install and operate the Pu Packaging System in Building 371 by December 1, 1999. We have noted through interviews with K-H management and research of published reports that there are

material concerns regarding this target amongst the K-H team members working directly with the system.

Irrespective of testing and improvements affected through modifications, the packaging component of the system represents a prototype. We have been told that since the time of the purchase of the PuSPS system from BNFL, the manufacturer has made significant modifications and upgrades to the packaging system (to such an extent that could suggest that the acquired system is fundamentally flawed).

In light of these concerns, it is extremely difficult to comment with any assurance about the system's anticipated performance.

- ***PuSPS System Reliability*** – As demonstrated by K-H through the PAT, the PuSPS system is prone to malfunction. K-H has had to troubleshoot, conceptualize and implement additional methodologies for the packaging system to meet regulatory standards. The K-H management team has indicated that their confidence in the overall performance of the packaging component of the system is low. We agree with their assessment.

  K-H informed us that they have identified several potential failure points and have taken appropriate actions to mitigate the risk of system downtime (e.g., early procurement of long-lead replacement items that have a high probability of failure). Nonetheless, the system is reported to be prone to mechanical problems. Furthermore, some of the technical issues appear to still be unresolved. The following concerns have been identified by K-H, but have not yet been mitigated:

  ◊ *Oxide contamination*: During the oxide stabilization process, the automated function that dispenses stabilized oxide from the transporting tray to the 3013 convenience container is not "hermetically sealed." That is, there is a possibility that oxides may contaminate the exterior of the 3013 container due to airborne residues during transmittal. If the exterior of the interior-most component of the assembly is contaminated, it may compromise the integrity of the next component or the welding hood environment.

  ◊ *Welding Hood Contamination*: The weld hood was reportedly designed to be a contaminant free environment. However, K-H management informed us that contamination does occur from oxide material being caught between the bung and the inter-wall of the second container. Subsequent to the initial welding process, the weld hood becomes contaminated when a laser cuts the weld.

  The weld hood was designed assuming that it would be contamination free. The design incorporates access doors and no ventilation system. That is, it is not self contained.

  The contaminated second container is stored in a final container that is then directly handled by process handlers in an open room environment. Within the open room environment, the container is scheduled to be handled and tested for leaks among other

4.6 Waste Management

Based on the review of PBD-002, Waste Management Project, summary level findings were developed in accordance with the Technical Requirements detailed in Section 2. Each of the eleven Technical Requirements has been restated below as a question, followed by a brief summary of key findings.

1. Are the planning assumptions valid and current?

In general, the planning assumptions for the Waste Management component of the RFCP are valid. There are issues, however, that may impact the validity of several of the key assumptions, particularly issues related to the availability of offsite disposal sites to accept wastes from the site in accordance with the RFCP baseline schedule. In addition, although not a site problem per se, the general planning assumptions do not reflect the issue of the potential competing interests of all of the facilities within the DOE complex shipping similar waste to the same repositories during the Site closure period.

Other issues that may impact the validity of planning assumptions include waste volume assumptions. For example, the projected waste volumes estimated in the *Waste Generation, Inventory, and Shipping Forecast* (Revision 1, dated May 7, 1999) have changed since the general planning assumptions for WM were developed. Given the unknowns and unresolved issues related to the D&D and ER activities, it is reasonable to assume that the waste generation forecasts will continue to change as additional closure activities take place.

2. Is the methodology for scope and organization of the work generally sound?

The overall methodology for organization of the WM scope is reasonable and reflects a sound basis, particularly in the allocation of the management of SNM to other scopes of work outside the WM program, due to the nature of the SNM materials. The WM program scope of work does not include the handling, disposition or disposal of SNM, except where SNM wastes can be blended to TRU waste designation.

Since a bulk of the WM activities are LOE, the general organization of the work is reflected in the project baseline schedule as more generic FY activities, rather than discrete activities with incremental detail. This is generally appropriate for LOE type activities, however, a greater level of specificity in the FY detail would better facilitate schedule integration with the key waste generating activities, such as building D&D and ER activities. This is especially important given the emphasis of the site Waste Management Plan on handling and shipping wastes from "point of generation", rather than from intermediate onsite storage. Greater WM activity detail would assist in both scheduling and project planning.

3. Does the work scope reflect the appropriate assumptions, technical bases and an understanding of current conditions?

The current scope of the WM component of the RFCP addresses a wide range of technical waste characterization, handling, packaging, transportation and disposition and/or disposal issues. In general, the activities contained within the various WBS elements are appropriate to an integrated site waste management program. The technical bases for allocating specific activities and costs to this overall scope of work are sound and reflect a very good understanding of the nature of materials to be addressed, the technical closure activities that produce wastes and the general uncertainties inherent in many of the waste generating activities, both in waste volumes and disposal issues.

4. Does the work logic and task sequencing effectively deliver the desired end-state for the proposed schedule?

The overall logic and sequencing of WM activities throughout the closure project generally parallel the principal waste generating activities, such as ER cleanups and building D&D, and appear to deliver the desired end-state for removal of all existing and generated wastes. The bulk of WM activities are reflected in the project schedule as level-of-effort activities, which are generally consistent with the nature of anticipated waste generation activities. Most of the WM PBD schedules, however, do not reflect significant detail with regard to the incremental WM activities to take place during most fiscal years. Although this is generally the nature of LOE activities, there are a number of broad WM activities that may be amenable to more specific schedule detailing to assist in integration with other waste generating activities.

5. Is the total cost of the project integrated with the schedule and does it appear to be reasonable?

The costs for WM generally match the level of effort (LOE) profile of the WM activities in the RFCP schedule. However, the integration of cost to schedule is of limited utility if the LOE baseline schedule fails to adequately reflect the anticipated or potential WM work.

A principal concern is that WM baseline schedule reflects only a LOE forecast and fails to capture the true profile of potential work to be performed. This is substantiated by the fact that K-H uses a separate management tool to forecast waste volumes (i.e. the monthly *Waste Generation, Inventory and Shipping Forecast*). To the extent that the LOE baseline schedule fails to reflect the WM work effort as presented in the *Waste Generation, Inventory and Shipping Forecast*, so too will the LOE baseline costs fail to reasonably reflect future costs.

6. Is the estimating methodology generally sound and does it reflect the environment in which the project is being conducted?

The estimating methodology is sound in that it utilized historical WM cost data and incorporates lessons learned from actual experience at RFETS. However, the historical data is based on

limited experience in that the most significant waste management effort will occur as ER cleanups and D&D activities increase in the coming years.

7. Are the bases of schedule and cost estimates reasonable and at the appropriate level of detail?

The WM schedules and cost estimates are generally well supported and the level of detail contained in the WM BOEs reflects reasonable discipline and care in developing the cost estimates. However, this is a qualified validation in that the schedule and costs reflected in the RFCP baseline are not integrated with the *Waste Generation, Inventory and Shipping Forecast.*

8. Has the uncertainty of the work been adequately addressed and factored into the planning?

Many of the key uncertainties associated with the execution of the WM component of the RFCP have been identified, however, a number of significant issues have not been adequately factored into the overall WM planning. The principal uncertainties related to the WM program include the timely availability of offsite waste disposal facilities, the uncertain volumes of wastes to be generated from the D&D and ER activities, and uncertainties related to the achievement of D&D and ER schedules.

WAD's 003 and 005 include contingencies for the construction of onsite waste storage in the event that offsite disposal is not available on a timely basis. However, the bases of estimate or the WM scopes of work do not include line items to accommodate the uncertain volumes of waste to be generated from D&D and ER activities. These uncertainties could present potentially significant impacts to both the cost and schedule of WM activities, the availability of resources, and could exacerbate other onsite and offsite waste handling and shipment issues. It is not clear that adequate contingencies are in place to address the potential impacts of these uncertainties.

9. Have the factors affecting schedule risk been identified and are they being managed?

Although most of the risks to WM schedule have been identified, many of the principal risks to schedule are due to offsite factors. For example, any disruption of waste shipments to the designated repositories for LLW/LLMW and TRU/TRM waste could result in serious short-term or long-term project scheduling changes or delays. Such disruptions could result from temporary closure or non-acceptance of waste by the facilities for a variety of reasons.

Other onsite risks to schedule include impacts from changes to the schedules of the key waste generating activities. Delays in receiving wastes from these activities, particularly those activities occurring late in the project schedule would potentially impact the WM program's ability to meet the waste disposal and site end-state goals. Although these risks have been identified, it is unclear that defined contingencies are incorporated into the overall schedule planning.

10. Have the factors affecting cost risks been identified and are they being managed (including costs risks that result from schedule risks)?

Two primary WM cost risks have been identified: (1) increased costs due to higher than expected waste volumes, and (2) increased costs due to unanticipated off-site disposal issues.

K-H's efforts to obtain accurate waste forecasts from the waste generators via the monthly *Waste Generation, Inventory and Shipping Forecast* provides a qualified validation of its efforts to manage the risks associated with waste volumes. (Albeit, the baseline cost and schedule needs to be integrated to this waste volume forecast in order to gain full benefit from this effort). With respect to the second risk – unanticipated off-site disposal issues, external impacts such as increased "tipping fees" at receiver sites and "orphan wastes" of radiological activity between 10nCi/gm and 100nCi/gm, present significant challenges. These external risks are presumably insured by the program-level contingency budget. Individual closure projects, including vital support functions such as WM, do not budget and manage contingency on an individual project level.

11. Are resources (number and types) identified and properly allocated?

The review of work scopes and BOEs for selected WBS elements indicates that the resources (number and types) have been identify and appropriately allocated to match the LOE nature of the WM support function. However, the previous concern regarding the potential inadequacy of the LOE approach to WM schedule and costs applies here, as resources should match the best available forecast of WM activities. To the extent that LOE baseline schedule and cost estimates fail to reflect the WM work effort as presented in the *Waste Generation, Inventory and Shipping Forecast*, so too will the identified resources and the allocation of those resources fail to reflect future needs.

4.6.1 General Discussion

The Waste Management Project (WMP) was evaluated by a detailed review of the electronic copy of the 2006 Closure Plan documents (Revision 2, dated May 21, 1999) which included the:

- 2006 Closure Project Baseline (CPB)
- Project Management Plan (PMP)
- Project Baseline Descriptions (PBDs)
- Cost Estimate Report (CER)
- Summary Schedule Booklet, and Risk Assessment Plans (RAP)

We also conducted interviews with personnel at the Department of Energy/Rocky Flats Field Office (DOE/RFFO) and Kaiser-Hill (K-H) who are directly responsible for the activities associated with the WMP.

The WMP, Project Baseline Description 002, is essentially a site closure support function. WMP provides specific services to other site activities, most importantly, Decontamination and Decommissioning of site facilities and Environmental Restoration clean-up activities. WMP activities typically include storage, treatment (if necessary), packaging, staging and ultimate shipment of the following types of waste:

Low Level Waste (LLW) Process
Low Level Waste (LLW) Remediation
Low Level Mixed Waste (LLMW) Process
Low Level Mixed Waste (LLMW) Remediation
Transuranic Waste (TRU)
Transuranic Mixed Waste (TRM)
Hazardous Waste
Sanitary Solid Waste
Sanitary Liquid Waste
Uncontaminated Debris

These wastes do not include material that is excavated from a remediation, either D&D waste or ER waste treated to specific action levels, that is subsequently replaced or used as fill elsewhere. Only those wastes that require further management (e.g., treatment or offsite disposal) are included in the above.

Work Authorization Document (WAD)

The WAD is the contractual agreement between DOE RFFO and K-H and defines the scope of work that supports closure of the site, and associated schedule and cost. A subset of the WAD is the WADlet, which further defines the work activities under the individual WADs. In order to provide a reasonable "confidence level" evaluation of the Waste Management Program, the team decided to conduct a more detailed assessment of those WADlets associated with the highest cost. The following discusses each WADlet according to Scope, Schedule and cost. It should be noted that, although other WADlets are not in the highest cost category, they do support the activities within the WADlets under review. Therefore, these WADlets were also reviewed for consistency in the WMP.

The Work Authorization Documents (WADs) included in the WMP are:

WAD 002-Sanitary Waste Project
WAD 004-TRU/TRM Project
WAD 005-TRU/TRM Construction Project
WAD-006-Waste Disposal Project (Non-TRU)
WAD-007-Waste Treatment Project
WAD-048-Liquid Waste Treatment Upgrades
WAD-062-LLW/LLMW Storage Project

WADs 004, 005, part of 006, and 062 pertain to the LLW/LLMW and TRU/TRM activities. WADs 002, 007 and 048 pertain to the other waste management activities associated with the Closure Plan.

The total budget for the WMP activities is $660,893,000 (Total Life Cycle Costs) with $509,200,000 remaining as of the end of FY 99. 83.35% of Total Budget is allocated to LLW/LLMW and TRU/TRM activities contained in 23 WADlets. The WADlets that contain these activities are:

WAD	WADlet	TITLE
006	1.1.04.04.02.01	LLMW Shipment
004	1.1.04.03.01.08	TRU/TRM Waste Projects
006	1.1.04.04.02.02	LLW Shipment
062	1.1.04.02.01.01	Op and Maintain Site LLW Storage Facilities
004	1.1.04.04.02.04	TRU Waste Shipment
005	1.1.04.03.02.02	Develop and Implement New TRM Waste Storage/Staging Facilities
006	1.1.04.04.01.02	Waste Certification and Oversight
062	1.1.04.02.04.01	Assay and Characterize LLW/LLMW

The remaining 16.65% of the Total Budget is allocated to Landfill Management Operation/Remediation and Chemical Management issues contained in the remaining 50 WADlets. Three of the highest cost items within these categories are:

WAD	WADlet	TITLE
006	1.1.04.04.04.03	Chemical Disposition and Disposal Project
002	1.1.04.01.06	219 Cluster Landfill Closure (OU7)
048	1.1.04.06.01.02	Liquid Waste Treatment Upgrades Project

Critical milestones have been established for WMP activities as depicted on exhibit entitled 2006 Critical Path, Revision 3, dated July 2,1999. Future milestone activities are:

- FY 00 (by 6/30/00) - B-460 new TRU Waste Storage Facility operational
- FY 01 (by 9/28/01) - New TRU Waste Characterization/Certification Module operational
- End of FY06
  - LLW and LLMW Waste shipments complete
  - TRU and TRM Waste shipments complete

In addition, approximately 47 other milestones have been established for the WMP activities as depicted on Exhibit Milestone Sequence Chart, Revision 2.0, dated May 21, 1999. Missing any of these milestones will have a significant impact on project schedule and costs.

4.6.2 Waste Management Assumptions

In preparing the 2006 Closure Plan for the site, several general and specific Waste Management assumptions were made and are contained in the Project Management Plan. These include the following:

General

1. The site's end state following closure will be as follows: (a) all buildings will be demolished; (b) all waste and SNM are shipped off-site.

2. Receiver sites and transportation for SNM, waste, and other materials to be shipped off-site will be available as planned (needed). (The category and associated receiving sites are contained in Table 1.0)

3. The list of key completion activities and quantities of materials to be managed during the RFCP are those described on the *Rocky Flats 2006 Closure Metrics Baseline*, Revision A, dated June 30, 1999.

Specific

1. All concrete rubble meeting DOE established "free-release criteria" would be used as on-site fill material.

2. Hazardous, LLW, LLMW, TRU, TRM, and sanitary waste unsuitable for fill material on-site will be disposed off-site. No significant increases to the planned cost of waste treatment and disposal at DOE or commercial sites will occur during the closure project.

3. LLW and LLWM remediation waste that is generated in excess of shipping and current storage capacities will be managed on an interim basis in on-site storage facilities approved by the appropriate regulators.

4. The site will not bear the costs of off-site TRU waste transportation or disposal at WIPP.

5. No significant changes will be made to applicable treatment or disposal site waste acceptance criteria at DOE or commercial sites, or to waste transportation requirements that are in effect on April 15, 1999.

6. NTS, as well as other LLW and LLMW DOE and commercial sites will be able to receive waste shipments from Rocky Flats.

7. Projected waste generation and shipping estimates from all sources are those described in Waste Generation, Inventory, and Shipping Forecast (WGISF), (Revision 1, dated May 7, 1999), Rev. 0.

Analysis

The **General** and **Specific** planning assumptions appear to be valid. The contracts and pricing for receiving and disposal of the various categories of waste are in place with pricing escalations factored in for the long term. The only waste not currently licensed for shipment is TRM waste which is scheduled for shipment to WIPP upon issuance of a RCRA Permit by the State of New Mexico Environmental Division (NMED) and the U.S. Environmental Protection Agency (USEPA). Currently the site has approximately 1000 drums of TRU and TRM waste ready for shipment.

A potential problem that could impact the schedule is the competing interest of all of the facilities within the DOE complex shipping similar waste to the same repositories over the site closure period. Although not a site problem per se, this situation needs to be addressed in the entire program schedule.

Based on our review of the documentation that supports the 2006 Closure Plan and interviews with key DOE and E&H personnel, the assumptions are not current. In particular, the WGISF (Item 7 above) has been revised (Revision 3, dated 8/4/99) and reviewed as part of this analysis, see Table 2.0, WGISF, Revision 3, dated August 4, 1999, with attachments. No substantive changes have occurred in the following waste categories: Residue Processing, Facility Operations/Pre-D&D, Low Level Mixed (LLM) and Sanitary. Changes have been reported in the Low Level Waste (LLW) and Transuranic TRU/TRM Mixed Waste (TRM) areas. Although volume changes occurred with the LLW estimates, the lifecycle volume is close to the original parametric estimate, therefore, no change to the out-years forecast is anticipated. The volume changes as reported for the TRU/TRM waste did result in rescheduling some waste in the out-years. Given the unknowns and unresolved issues related to the D&D and ER activities, it is reasonable to assume that the waste generation forecasts will change and most likely will change dramatically.

In addition to the general and specific project planning assumptions, each Work Authorization Document (WAD) has a set of assumptions as listed in the individual PBDs.

WAD 002

Sanitary Treatment Plant Operations and Maintenance

1. The NPDES Permit, which specifies operating parameters for the STP, will not change substantially from the permit that was in place in FY98.

2. Both the flow rate and the water quality entering the STP from October 1999 through 2005 will be similar to FY98.

Off-site Sanitary Waste Disposal

1. Decommissioning projects will provide separate WPD(s) for disposal of sanitary waste they generate.

2. CDPHE will approve the proposed RSOP.

3. CDPHE will continue to require groundwater sampling and analysis and an annual report for the RFETS (Present) Sanitary Landfill through FY03.

4. No slope failures, new leachate seeps, significant erosion or settlement will occur at the RFETS (Present) Sanitary Landfill that will require significant repairs prior to construction of the permanent cap in FY04.

OU7 Seep Collection and Treatment Facility Operations

1. Contaminants of concern measured in the treatment facility effluent will remain below action levels specified by RFCA and no significant modifications to facility operations or the surface water sampling and analysis program that was in place during early FY99 will be required.

RFETS (Present) Sanitary Landfill Closure

1. The regulatory agencies will adhere to document review schedules as described in RFCA.

2. The Phase I RFI/RI is adequate as is to support the CAD/ROD and will be approved by the regulatory agencies.

3. Why spend $527K to "update" it?

Analysis

The planning assumptions for WAD 002 appear to be valid and current. However, from a historical perspective, the greatest unknown is the outcome from negotiations with the lead regulatory agencies and various stakeholders.

WAD 004

1. WIPP is open on October 1, 1999 (for TRU waste) and remains open for the duration of the RFETS closure project for receiving RFETS TRU waste.

2. RFETS TRU waste, as designated, will satisfy the requirements for shipment of TRU waste to WIPP, (i.e., no additional burden will be placed on RFETS to rework TRU to make it "super-TRU").

3. WIPP will receive an RCRA permit and will begin receiving TRM from RFETS by January 2000 and will remain open for the duration of the RFETS closure project for receiving RFETS TRM waste.

4. The WIPP RCRA permit issued by the NMED will not significantly impact the Waste Acceptance Criteria such that new requirements will be imposed on disposal of mixed and/or non-mixed waste at WIPP.

5. TRUPACT vessels and vehicles will be available to RFETS from WIPP to support the required shipping schedules.

6. Minimal weather related shipping delays have been anticipated and planned, however it is assumed that major weather related delays along the shipping corridor will not be encountered.

7. Additional commercial characterization capacity (NDA, headspace gas sampling, and solid sampling, RTR) can be acquired in the outyears to support required shipping schedules.

8. An STL variance will be approved by DOE allowing for storage of residues contained in pipe overpack components outside the protected area with no additional required security upgrades (other than those highlighted in the variance request).

Analysis

The planning assumptions for WAD 004 appear to be valid and current. However, from a historical perspective, the greatest uncertainty is the outcome from negotiations with regulatory entities and various stakeholders. Equipment requirements, such as characterization instruments, and shipping containers can only be assured if sufficient lead-time is allowed for procurement or if the typical procurement procedures can be streamlined and accelerated. Competing requirements from other DOE facilities could have a significant negative impact on project schedules and ultimately on cost, assuming project closure time extensions are necessary.

WAD 005

Building 460 Conversion to Storage Project

1. CDPHE will allow 4-high-stacking of drums containing TRU waste in Tents 2 and 12.

2. DOE/RFFO will grant an exemption to requirements of the Uniform Building Code (UBC) that pertain to certain fire protection systems. More specifically, no firewall separating the proposed waste storage area into two rooms will be required.

3. DOE/RFFO employees currently located in the southern portion of Building 460, except for a few offices located adjacent to the firewall, will not be relocated.

Portable Shipping Station for TRU/TRM Waste

1. The proposed portable shipping station will be supplied by WIPPP at no cost to RFETS.

Building 440 Shipping and Characterization Facility

1. The construction project to be completed is defined by engineering drawings dated September 1998, except for future modifications to reduce the amount of radiation shielding provided in the building.

Analysis

The planning assumptions for WAD 005 appear to be valid and current.

WAD 006

1. The Oak Ridge incinerator will not become available until FY02.
2. Disposal cost charged by DOE, NV would not change from the $7.50/ cubic foot rate.
3. Environmental Restoration soil-like material will be disposed of at Envirocare of Utah using the DOE Ohio contract rate of $4.90/ cubic foot.
4. The Hanford facility will become available for disposal of LLMW by October 1, 2004.
5. Waste Control Specialist will become available for the disposal of both LL and LLM waste by April 1, 2004.
6. ASTD funding from DOE Headquarters for $1.75M will become available in FY00 to allow for treatment of selected waste.
7. Due to the increased bulking of waste and repetitive waste volumes generated, Waste Certification support cost will dramatically lower.
8. It is assumed that 50% of out year low-level mixed waste will require treatment.

Analysis

The planning assumptions for WAD 006 appear to be valid and current. However, if the repositories, such as Oak Ridge and Hanford do not come online to receive certain types of waste then more of a contingency needs to be considered in the planning to handle these wastes by storage or onsite treatment. From a historical perspective and in particular the events that occurred in the state of Idaho and New Mexico, the availability of these facilities is considered a high risk. Also, the fact that the majority of the ER activities have been moved to out-years, it is questionable whether the price escalation factors are adequate to cover the disposal cost.

Competition is highly unlikely for waste disposal, and costs of hazardous waste disposal tend to rise very quickly.

WAD 007

1. No major equipment failures will occur in B374 before deactivation.
2. NEPA documentation for on-site LLM waste treatment will be completed and approved in FY99.
3. Offsite TSDF will be available in 2001 and can accept low level mixed wastes with radioactivity levels up to 100 nCi/g.

Analysis

The planning assumptions for WAD 007 appear to be valid and current. However, from a historical perspective, any on-site treatment may pose a serious problem with the appropriate regulators and stakeholders. The availability of an off-site TSDF is equally risky which may require some form of on-site treatment (Blending). Equal weight should be given to each option from a schedule and cost standpoint.

WAD 048

1. Critical Decision (CD) approval by DOE, RFFO will be received within two weeks of the request submittal.
2. Procurement plan approval by DOE, RFFO (or DOE, HQ if required) will be received within six weeks of request submittal.
3. The project scope assumes that all identified aqueous sludge waste streams will be treated by the new treatment system (TSIS).
4. Offsite TSDF will be available in FY01 and can accept and treat low level mixed waste with radioactivity levels to 100nCi/g (i.e., aqueous sludge).

Analysis

The planning assumptions for WAD 048 appear to be valid and current. However, the fact that a suitable technology does not currently exist for the TSIS program and the difficulty of treating this type of waste suggests that offsite disposal should be evaluated equally from a cost standpoint. Conversely, onsite treatment of LLMW with radioactivity levels to 100nCi/g should be evaluated equally as is offsite disposal.

WAD 062

No assumptions therefore no analysis.

4.6.3 Waste Management Approach

Based on our interviews with key personnel with K-H who are responsible for the LLW/LLMW and TRU/TRM waste activities contained in the WMP, we learned that a greater emphasis on "point of generation" for handling waste is the preferred method leading to shipment and disposal of waste. Although the current Plan addresses the generation, storage, treatment (if necessary), characterization, packaging, staging and shipment of waste, no specifics were given regarding the exact disposition of the waste from time of generation to ultimate shipment for disposal. Storage of waste, during which time further characterization and packaging would commence, would utilize the existing inventory of structures at the site. Unless specifically identified, the majority of the structures were lumped together and the generated waste would come from " a variety of sources."

Although temporary storage is a critical element in the WMP, the preferred approach is to ship the waste from the point of generation. This approach would characterize the waste, package it and with the assistance of mobile staging units, ship the waste from the point of generation from either D&D activities or ER cleanup activities. This approach would eliminate some of the need for storage while expediting the movement of waste at the site. In fact, it is anticipated that ER generated waste, which consists primarily of contaminated soil, will be stockpiled at the excavation site for eventual shipment to an appropriate repository.

A very detailed inventory of waste (by category) is used for planning purposes, see Table 2.0. Basically WM receives waste volumes from each generator, (e.g., D&D and ER), that ranges from the current FY through FY06. Also, the waste that is processed and shipped are also inventoried and reported for planning purposes. Both are completed monthly and reported on a quarterly basis as a minimum. The projected inventory is also used to estimate the type and number of packaging units that will be required. Future plans also call for utilizing bulk containers for both truck and rail transport to the designated repositories. Currently, a major impediment for transport by truck is the weight of the shipment. Another constraint is the limitation on the volumes of waste that can be shipped under NEPA.

Analysis

The above summary highlights some of the salient points regarding WMP activities. It does not attempt to go into detail regarding the WADs or associated WADlets. However, our analysis has raised the following issues:

1. The change from a "storage" mode to a "point of generation" mode still requires scheduling details regarding the flow of generated waste from origination to shipment. This would assist in both scheduling and project planning. As experience is gained the appropriate modifications to the WMP can be accomplished. Experience of the teams involved in the characterization and handling of these wastes is a critical element of these activities.

2. The identified repositories for the different categories of waste is acknowledged to be limited and could have significant impacts on both schedule and cost. Only two repositories are currently in use for LLW and LLMW. LLW can be shipped to either Envirocare or NTS while only LLMW can be shipped to Envirocare. Similarly, TRU and TRM waste can only be shipped to WIPP. Any disruption in the shipment of waste to these facilities could negatively impact the entire project. Also, any cost increases for disposal by the repositories would impact the overall project cost. Additional disposal repositories are and should be investigated. Obviously, contingency planning is a critical element of these activities because no matter how efficient the D&D and ER activities are, if the waste cannot be processed correctly and in a timely fashion, it cannot be shipped for disposal. If not shipped, then the waste must be stored in available and permitted facilities.

3. The volume of generated waste is also recognized as potentially having a negative impact on project schedule and cost. Three primary concerns are

    1. the soil cleanup levels (and associated actinide migration study) that affect D&D operations and ER activities;
    2. the Under Building Contamination (UBC); and
    3. land use issues.

    These issues are both regulatory driven as well as unknowns which will either be determined prior to initiation of the activity or during the course of the activity. Regulatory concerns will be dealt with under RFCA and as part of stakeholder acceptance and agreements. Contingency planning is a critical element of these activities.

4. Excavation of contaminated material, as part of the D&D and ER cleanup activities, will require suitable safeguards to control and eliminate the potential for dispersion of contaminates, especially by the very high winds that the site has historically experienced.

5. The "point of generation" (with some storage capacity onsite) strategy will place a greater emphasis on WM personnel to control the characterization and packaging of waste. This will require more of a seamless operation than in the original plan where storage was the primary waste control strategy.

6. The basis for closure of the site is the commitment to ship all of the waste offsite with limited storage and treatment of the waste onsite. This fact places the burden on Waste Management to successfully characterize, package, ship and dispose of the legacy, process and generated waste. Critical factors involve:

    1. having adequate resources (technical specialists) over the course of site closure to handle the waste;
    2. having a sufficient number of shipping vessels to transport the waste; and
    3. having a sufficient number of repositories to accept the waste.

    These factors have been articulated as assumptions to achieve closure within the proposed budget and schedule. These assumptions are actually project risk elements. No matter how

efficient the D&D activities and ER cleanup activities proceed, if Waste Management cannot deliver on these factors the project is in jeopardy.

Waste Management Scope

The scope of the WMP includes safe and compliant management onsite in new and existing storage facilities, safe and compliant treatment of mixed wastes at onsite and offsite locations, and safe and compliant disposal at approved off site repositories. These three functions (storage, treatment, and disposal) will be performed at varying levels of complexity depending on the particular waste type that requires management. Specific waste types include:

1. Uncontaminated Debris – non-radioactive, non-hazardous debris resulting from the decontamination & decommissioning of site facilities.

2. Sanitary Liquids – non-radioactive, non-hazardous waste waters resulting from routine operations including lavatory facilities, showers, etc.

3. Sanitary Solids – non-radioactive, non-hazardous solids resulting from routine office trash, cafeteria waste, etc.

4. Hazardous – non-radioactive, hazardous waste resulting from routine operations and from deactivation, decontamination, and decommissioning of site facilities.

5. Low Level (LL) – Process – low level radioactive, non-hazardous wastes generated from virtually every project at RFETS.

6. Low Level Mixed (LLM) – Process – low level radioactive, hazardous wastes generated from virtually every project at RFETS.

7. LL–Remediation – low level radioactive, non-hazardous wastes generated from facility decontamination and decommissioning and from environmental clean-up and restoration (NOTE: see the General Narrative section of PBD 02 for a discussion of "remediation" vs "process" waste).

8. LLM–Remediation – low level radioactive, hazardous wastes generated from facility decontamination and decommissioning and from environmental clean-up and restoration.

9. Transuranic Waste (TRU) – transuranic radioactive, non-hazardous wastes generated from routine operation, facility decontamination and decommissioning, and from SNM consolidation and residue processing operations.

10. Transuranic Mixed Waste (TRM) – transuranic radioactive, hazardous wastes generated from routine operation, facility decontamination and decommissioning, and from SNM consolidation and residue processing operations.

It should be noted that the scope of this project does not include material that is excavated from a remediation (ER and D&D) activity, treated to specified action levels, and subsequently replaced or used as fill elsewhere. Only those wastes that require further management (e.g., treatment or offsite disposal) as waste are included herein.

To effectively manage the current inventory and anticipated future generation, the Waste Management Project has been divided into several subprojects. These include:

- Sanitary Waste Subproject – includes collection and treatment of sanitary liquids, as well as collection and disposal of sanitary and uncontaminated solids. Additionally, this subproject includes closure of the current landfill and the new landfill. Eventually the work scope for the landfill closure will be transferred to the Buffer Zone Closure Project RF001 (RF0202).

- LL/LLM Waste Storage Subproject – includes storage of LL/LLM in existing facilities and, if necessary, in a new Containerized Storage Facility (Project RF-003). This subproject also includes characterization, material movement, and assay activities, as well as miscellaneous waste management operations including medical waste, TSCA waste and hazardous waste management.

- TRU/TRM Storage Subproject – includes storage of TRU/TRM in existing facilities and, if necessary, in new storage facilities, and includes characterization, loading, and disposal activities and other miscellaneous TRU/TRM management tasks.

- Waste Disposal Subproject – includes transportation and offsite disposal of LL/LLM, hazardous, uncontaminated, and sanitary solids and residuals from treatment of sanitary liquids. Additionally, this subproject includes waste certification and oversight activities as well as pollution prevention/waste minimization activities and excess chemical management activities.

- Waste Treatment Subproject – includes the onsite and/or offsite treatment of LL/LLM waste and TRU/TRM waste prior to ultimate offsite disposal. It also includes onsite treatment of organic liquids and onsite treatment of process wastewaters.

- Waste Management Projects – includes identification, design, engineering, and construction of new waste management projects. Currently, the only specific project included in this subproject is the Liquid Waste Treatment Upgrades project.

Analysis

1. Overall the scope of the work for PBD 002 appears to address all activities that are anticipated for the handling and shipment of waste from the site.

2. The waste categories appear to be inclusive of the type of waste that has traditionally been reported at the site and at other DOE facilities.

3. The breakdown of the subprojects within PBD 002 are logical and appear to satisfy the various controlling elements of waste disposal including generator, handling, shipping, receivership and regulatory.

Technical Strategy

By the end of the project, all waste will have been dispositioned including current inventory and newly generated waste. The waste volumes that will be managed over the life of the RFETS closure corresponding to the scope of the waste type sand subprojects are summarized in section 3.4 (Closure Project Metrics).

Sanitary/Uncontaminated Waste generated from routine activities and operations and from deactivation, decontamination and decommissioning will be used as fill onsite; or will be collected, staged and disposed offsite at a commercial landfill. Sanitary Liquids will continue to be generated from routine Site activities and will continue to be treated in the existing sewage treatment plant. Hazardous Wastes will continue to be collected and staged in onsite storage facilities for shipment to offsite commercial facilities for treatment, recycle, reclamation and/or disposal.

Low Level and Low Level Mixed Process Wastes are currently stored in containers in a variety of locations onsite. Low Level Waste will be shipped to the Nevada Test Site or a commercial facility until FY06. With the exception of a small volume of classified waste and process wastewater, treatment of low level waste is not anticipated. All pondcrete, secondary pondcrete and pondsludge will be shipped to a commercial facility (Envirocare) by December 30, 1999. About 50% of the remaining LLM inventory and the new LLM generation will require treatment prior to disposal. Most, if not all, will be treated offsite. In the event offsite treatment is not available, onsite treatment would occur first through the use of temporary, mobile treatment units. Failing this, fixed onsite treatment units would be required. Much of the existing inventory and future generation of LLM will require disposal at federal facilities (i.e., Hanford) because of radiological constraints at existing commercial facilities. Shipment to such a facility is planned to begin in FY01.

Initially, LL and LLM Remediation Wastes will be collected and stored temporarily in existing facilities. These wastes will be managed in large containers (i.e., roll-offs) to facilitate handling and reduce costs. Beginning in FY03 generation will increase dramatically as remediation efforts accelerate. Contingency storage will be required to handle newly generated remediation wastes. Accordingly, new containerized storage facilities are contemplated (see RF-003) to house wastes until they can be shipped offsite for disposal. Such interim storage will occur in a monitored and

retrievable fashion to facilitate ultimate offsite treatment and disposal. Future disposal locations will be selected based on acceptance criteria for the waste forms generated. Approximately 50% of the LLM waste generated will require treatment prior to final dispositioning.

TRU/TRM Waste is currently stored in containers at various locations onsite while awaiting shipment to WIPP. Consolidation efforts are underway to store TRU/TRM in Buildings 371, 440, 664 and 991. TRU/TRM is being staged and shipped from Building 664 to WIPP. At expected generation rates and desired shipping rates increase, additional shipping capacities will be needed beginning in FY01. Most TRU/TRM will meet WIPP acceptance criteria but it appears that approximately 5% will require offsite treatment prior to disposal. These wastes will be sent to offsite treatment location(s) or will be treated onsite as appropriate beginning in FY04. All wastes will be dispositioned by the last year of generation (FY06).

For all waste types, the storage and disposal functions can be accomplished through the use of industry accepted techniques. Thus, the use of emerging technologies is not expected to significantly alter the approaches discussed above. In the areas of characterization and treatment, however, emerging technologies could assist in reducing costs and expediting schedules for these functions. The Site will continue to monitor the progress of commercial and DOE supported waste management technology development activities that could lead to reduced Site cost and risk. Specific waste management technology development activities that could reduce costs and risks associated with Site closure include:

- expedited characterization and assay techniques for all waste types
- size reduction, characterization, and decontamination technologies for D&D wastes
- mixed waste treatment technologies for immobilization of contaminants,
- destruction of hazardous organic contaminants, and
- separation of hazardous/radioactive contaminants.

Analysis

1. The technical strategy for PBD 002 demonstrates a complete understanding of known solutions to some very complex issues as well as an acknowledgement of the unknowns related to solving problems associated with some of these same issues.

2. Given the unknowns, [e.g., total waste volumes by category; firm and predictable delivery of the generated type waste by the various waste generators (D&D & ER); implementation of activities which by themselves appear to be achievable but taken together is daunting; long-term status of currently identified repositories; status of "future" repositories; long-term costs of shipping and disposal of waste; status of technologies that are yet, if ever, to come on line and their associated costs, and; the regulatory climate both on a national as well as local level] the ability to complete closure within predicted cost and schedules is laudable but highly questionable.

WADlet Analysis

WAD 006 WADlet 1.1.04.04.02.01 LLMW Shipment
$133,892,391 (23.56% of Total)

Scope

Provides the management and infrastructure to profile low-level mixed waste (LLMW) streams, assure WEMS entries have been made, identify loads for shipments, validate that containers have no free liquids, decant and add absorbent as necessary, verify waste stream and compliance with Department of Transportation (DOT) requirements, mark and label containers in accordance with DOT requirements, complete the E-100 forms for shipments, provide disposal facilities with notification of shipments, track and provide status reports of waste being shipped, update intranet shipping status, stage, load and ship low level mixed waste to an approved repository, identify areas for operational improvement, verify type of waste containers required for shipments, and assure packages meet waste acceptance criteria requirements.

1. Containerized pondcrete and secondary pondcrete will be shipped prior to October 1, 1999 and all pond sludge will be removed (including tanks) by December 30, 1999.

2. The Oak Ridge TSCA incinerator will not be able to accept waste from RFETS in fiscal years 2000 and 2001.

3. LLMW less than or equal to 10 nCi/g per container will be shipped throughout fiscal years 2005 and 2006 to Envirocare, waste above 10nCi/g will require blending to lower the radioactivity to acceptable limits for Envirocare acceptance.

4. Transportation, Treatment and Disposal rates are not anticipated to go up during fiscal years 2000 and 2001.

5. LLMW requiring offsite repackaging for disposal will be managed by this activity.

6. Offsite Site Treatment Plan (STP) activities involving shipment of wastes will be included in this activity.

Another important element of this activity is to seek alternative storage, treatment and disposal sites for LLM waste.

Technical Strategy

The strategy for this WBS element is to utilize onsite and offsite resources to assure that low level mixed waste shipments can be completed by FY06. Part of the strategy will implement direct shipment of waste from the generating facility, provide portable docks to accommodate unique packaging systems (i.e., IP2 Cargo on low boy trailers), development of rail shipment capability, profiling remaining LLMW waste streams, bulking of waste into large containers for waste shipment, identification of new disposal facilities, identification of treatment facilities and

implementation of waste packaging teams to expedite the removal of waste (primarily deactivation waste) for offsite disposal. Activities will continue and follow the graded closure schedule. As waste volumes decrease due to accelerated site closure, a reduction of force will be implemented that still achieves the graded closure scenario. Normal subcontracting activities will be employed to augment staff and continue onward with shipping waste to approved waste treatment and disposal facilities. We also anticipate that a minimum of two additional LLM waste disposal facilities will go on line for RFETS LLLM waste by FY04 and be able to dispose of LLM waste above 10 nCi/g.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

2. The success of these activities is dependent on unknowns which could impact both project cost and schedule. These include: (a) the assumption that the Oak Ridge TSCA will not be available in FY00 and 01 but may not be available thereafter and, (b) that orphan waste above 10 nCi/g can be blended and meet acceptable disposal criteria.

Schedule

1. The activities associated with this WBS are LOE. The LOE activities as described above for this WBS are adequately incorporated into the 2006 CPB Schedule, as Package Certification LLMW for Disposal and Certify Shipment LLMW for Disposal.

WAD 004 · WADlet 1.1.04.03.01.08 TRU/TRM Waste Projects
$81,033,556 (14.26% of Total)

Scope

This work element includes the development of specific TRU/TRM program and closure initiatives that relate to individual facility operations. In particular, it includes the development of TRU/TRM waste characterization initiatives, sampling, data transfer, QA/QC, glove washing, repack opportunities, and other development efforts in support of TRU/TRM waste storage and characterization. In addition, this element **can** include other waste initiatives, such as:

1. Gas generation testing.
2. Repack projects.
3. Waste pre-certification.
4. Waste evacuation.
5. Maintenance of the TRU QA program.
6. Management/control for documents needed for TRU handling and processing.

Technical Strategy

The strategy for this element provides staff support for maintaining the base WIPP certification program and also involves maintaining the capability to continue to develop new program elements to address future needs for disposal of TRU/TRM at WIPP. Historical activities in this element have included glove washing, visual examination, characterization development, etc. We anticipate that similar activities will continue to arise as the closure project progresses.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

2. These activities are based on historical and successfully completed work programs and can be gauged more accurately than others in terms of level of effort, resources needed and success/failure ratios.

Schedule

1. A cursory review of the individual WAD 004 WBS Activities and predecessor/successor efforts indicate that the WAD 004 assumptions have not been integrated into the 2006 CPB Schedule.

2. Significant variances in milestone dates are reflected when compared to the 2010 CPB schedule. This is the result of added and deleted work scope, relationship changes and new project approaches.

3. The work scope described in the PBD for WAD 004 TRU/TRM Waste Projects was reviewed with the WBS activities to assure the PBD scope was accurately represented in the 2006 CPB Schedule. The entire work scope is represented in the 2006 CPB Schedule for this WAD.

4. The K-H Schedule Standard 17, Schedule Integration regarding the Expanded Management Summary Schedule (EMSS) states the following:

   The Expanded Management Summary Schedule (EMSS) serves as the primary RFCP schedule integration tool ...The EMSS shall tie to the CPB ... All summary activities represented on the EMSS shall tie to the activity nodes in the CPB.

   A review of the 2006 CPB Schedule Milestones identified in the WBS activities under this WAD have been verified to tie to the EMSS.

5. There is a concern as to the reasonableness of the concurrent D&D efforts and Storage and Staging operations in the same buildings.

6. A review of the WBS activities and relationships fails to address the transfer of operations between buildings.

7. WM Staging and Storage activities reflect immediate critical predecessor/successor activities, but the Staging and Storage efforts are not indicated as critical. This is a direct result of the WM efforts not being properly integrated with the 2006 CPB schedule.

WAD 006 WADlet 1.1.04.04.02.02 LLW Shipment
$61,157,100 (10.76% of Total)

Scope

Similar to the LLMW Shipment work scope this work element provides the management and infrastructure to profile LL waste streams, assure WEMS entries have been made, identify loads for shipments, validate that containers have no free liquids, decant and add absorbent as necessary, verify waste stream and compliance with Department of Transportation (DOT) requirements, mark and label containers in accordance with DOT requirements, provide disposal facilities with notification of shipments, track and provide status reports of waste being shipped, update intranet shipping status, stage, load and ship low level waste to an approved repository, identify areas of operational improvement, verify type of waste containers required for shipments, and assure packages meet waste acceptance criteria requirements.

Also, this work element will seek alternative storage, treatment and disposal sites for LL waste. LLW requiring offsite repackaging for disposal will be managed by this activity. Several assumptions and declarations are also associated with this work effort:

1. Disposal rates for NTS are not anticipated to go up for FY00 and 01.
2. RFETS waste shipments are not curtailed.
3. Waste Acceptance Criteria does not change.

Technical Strategy

The strategy for this WBS element is to utilize onsite and offsite resources to assure low level waste shipments can be completed by fiscal year 2006. Part of the strategy will implement direct shipment of waste from the generating facility, provide portable docks to accommodate unique packaging systems (i.e., IP2 Cargo on low boy trailers), development of rail shipment capability, profiling remaining LLW waste streams, bulking of waste into larger containers for waste shipment and implementation of waste packaging teams to expedite the removal of waste (primarily deactivation waste) for offsite disposal. Activities will continue and follow the graded closure schedule. As waste volumes decrease due to accelerated Site Closure, a reduction of force will be implemented that still achieves the graded closure scenario. Normal subcontracting activities will be employed to augment staff and continue onward with shipping waste to approved waste treatment and disposal facilities. We also anticipate that a minimum of two additional LLW disposal facilities will become available for the disposal of LLW by FY04.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

2. The "point of generation" approach utilizing bulk waste handling containers, skilled resources for characterization and packaging and using rail as well as truck transportation is the stated preferred method for waste handling and shipment of waste. In that these techniques have not been utilized at the site, it is anticipated that until experience is gained and procedures perfected these activities may cause schedule delays as the waste generators are continuing to produce waste product. Although temporary waste storage facilities will probably be available, their utilization may cause serious interruptions in the implementation of the preferred approach.

3. The unknowns involved with this WADlet may cause some serious impacts on project schedule and costs. The unknowns being: disposal rates at NTS being constant for FY00 and 01 and; Waste Acceptance Criteria do not change.

Schedule

1. The activities associated with this WBS are LOE providing the management and infrastructure to profile LLW streams, assure WEMS entries, identify loads of shipments, validate containers, decant and add absorbent as necessary, verifications and compliance with DOT standards. The activities as described in the PBD for this WBS appear to be adequately incorporated into the 2006 CPB Schedule and are logically related within this LOE. However, these LLW shipment activities have no integration links with waste management or waste generation sources.

WAD 062 WADlet 1.1.04.02.01.01 Operate and Maintain Site LLW Storage Facilities
$53,452,083 (9.41% of Total)

Scope

This WBS element provides the tasks related to management of the Site's LLW inventories; physical inspections, container accountability tracking, including any container movements required for field verification, mandatory and job specific training, storage area supervision, performance radiation control surveys, safety meetings/surveillance's, purchase of supplies and rentals. The scope of this activity includes the management and routine operations for LLW storage areas located in the following 46 buildings and areas: 020, 130, 371, 440, 444, 447, 448, 450, 551 pad, 559, 561, 566, 569, 663, 666, 701, 707, 731, 732, 750 Haz., 770, 771, 776, 777, 778, 779, 788, 865, 875, 880, 883, 884, 884C, 886, 887, 889, 903, 904, 906, 964, 974, 985, 991, Contractor yard, OU2, T900D. No new waste is planned to go into storage after 9/30/04.

Key activities within this WBS element involve: receipt of LLW containers for placement into interim LLW storage, purchase of portable storage containers, field verification and maintenance of the WEMS database, small tools and equipment, safety meeting, safety surveillances of routine and unusual LLW operations, quarterly radiological control surveys, repackaging of non-compliant containers, routine preventative and corrective maintenance associated with storage areas, and managing containers stored outside. Several assumptions and declarations are contained in this work element:

1. Waste from B964 will be removed by September 30, 2001.
2. Multiple repackaging facilities will be required and no permanent repack facility is envisioned.
3. Additional off-site repackaging capabilities will be identified to accelerate the backlog/legacy waste reduction.

Technical Strategy

The strategy is to perform daily operations and management of LL waste storage areas/facilities excluding unit 1. Supports the oversight and implementation of all low level waste operations. Activities include, but are not limited to; facility and regulatory inspections, implementation of site procedures/practices; conduct of operations, building authorization requirements, operation of a LLW repackaging facility, etc. Activities will continue and follow the graded closure schedule. As waste volumes decrease due to accelerated Site Closure, a reduction of force will be implemented, but will still allow for achievement of fiscal year goals and objectives. Routine subcontracting for staff augmentation, repackaging supplies and other miscellaneous items will be on going until closure.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.
2. Although the facilities are identified there is no logic provided to link the generated waste with the appropriate facility. It would seem reasonable that this linkage could be provided to assist in planning at least for the short term. It would also appear that the monitoring of these activities would assist in determining "lessons learned."

Schedule

1. This element provides the tasks related to management of the Site's LLW inventories. Key activities within this WBS element involve receipt of LLW containers, field verification and maintenance of WEMS database, safety surveillance's, quarterly radiological control surveys. Waste from B964 will be removed by September 30, 2001.

WAD 004 WADlet 1.1.04.04.02.04 TRU Waste Shipment
$51,730,069 (9.10% of Total)

Scope

The scope of this element includes the activities necessary for transportation of TRU/TRM waste to WIPP for disposal. Specifically, this element includes the management and support necessary to prepare, stage, certify, load and ship Transuranic waste offsite from B664 and B440. Mobile capability is also included first from the 750 pad, followed by mobilization to alternate locations.

Technical Strategy

Transportation and disposal are the key elements of the overall waste management strategy. From a transportation view, WIPP is responsible for providing TRUPACT vessels, trucks for transporting the TRUPACT vessels, and for maintenance of the vessels, vehicles, and operations contract for driver services. RFETS will provide the resources necessary to effectively characterize, load, certify and coordinate shipments from RFETS. We anticipate that waste needing the least effort to be ready for WIPP will be staged first to allow RFETS to build an inventory of "WIPP Ready" waste (i.e., the goal is to continuously have an excess inventory available to ship).

As residue processing proceeds, added focus will be placed on certifying residue waste and the systems necessary to ship as generated. The ultimate goal would be to have shipping capacity keep pace with the generation rate. Although this could be accomplished, the generation profile is such that significant expenditure would be required to accommodate early year generation, with resulting excess capacity in outyears. As a result, the shipment strategy is to increase capacity to a maximum (3000 m3/year) to minimize potential storage impacts, and resource level the shipping requirements over the life of the closure project. This strategy allows for accelerated shipping while conserving capital investment resources that would not otherwise be required to be expended. Additionally, in order to achieve closure in an accelerated manner and to avoid crisis at the end of the shipping project, legacy inventory will be shipped off at a rate of 10% - 15% per year as necessary, within the constraints of new generation priority and shipping capacity.

Over the life of this project, we anticipate that in excess of 15,000 m3 of TRU/TRM waste will require shipment to WIPP (see general assumption WM7). This will be accomplished initially the first year of shipment by three truck shipments per week (1,400 m3), increasing to four shipments per week at mid-year. This rate will then increase to seven shipments per week the second year of shipment (2,000 m3/yr), finally reaching maximum capacity of 10 trucks/week (3,500 m3/yr).

These rates will be achieved through the addition of multiple shifts in B664, the use of mobile loading capabilities at the 750 pad and other "point of origin" locations. To alleviate concerns regarding "single-point" failure potential associated with shipping operations in B664, a new shipping module will be added in B440. Each truck can hold a maximum of 42 drums (8.82 m3),

however, weight and other loading restrictions will likely limit this to 75% of maximum capacity or 32 drums (6.62 m3). This is the planning basis for shipments. Shipment from fixed locations (i.e., B664 and B440) will continue through FY04. Shipments using mobile loading capacity will continue through mid- FY06 to complete the final shipments of waste from D&D to complete closure.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

2. The key elements to successfully implementing these activities are:

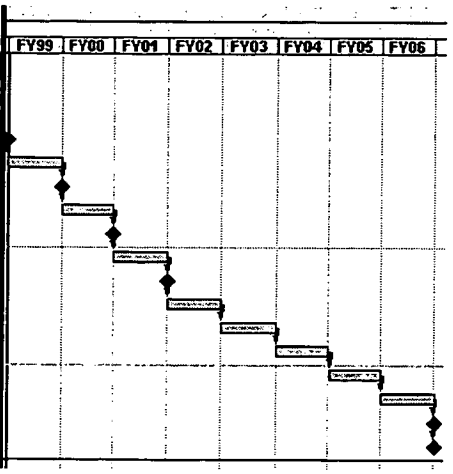
   - the ability of WIPP to accept the anticipated volume of waste on a regular basis;
   - a sufficient number of trucks are made available to accommodate the shipments; and
   - sufficient excess capacity is available to accommodate a reasonably continuous and scheduled flow of shipments.

3. If there are disruptions to these planned activities compounded by disruptions in other waste activities either from generation or shipment, then the ability to meet the proposed schedule is questionable.

Schedule

1. The figure below shows that the WBS activities as described above are included in the 2006 CPB Schedule and are logically related. However, the activities are shown as LOE rather than being described in any detail. We found that the TRU/TRM waste shipment activities have no integration links with waste management or waste generation sources.

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
002 PBD 002 - Waste Management Project				
004 WAD 004 - TRU / TRUM Project				
1.1.04.04.02.04 TRU WASTE SHIPMENT				
A4BEGWPD04	Start WPD 04	0	01OCT98	
A4EC120020	TRUPACT II Loading & Certification Ops FY99	254	01OCT98	30SEP99
A4EMILE123	FY99-M2 Ship 670m3 of TRU/TRM to WIPP By 9/30/99	0		30SEP99
A4EC120045	TRUPACT II Loading & Certification Ops FY00	254	04OCT99	02OCT00
A4EMILE129	FY00-M6 Ship 1340m3 TRU/TRM to WIPP	0		02OCT00
A4EC120050	TRUPACT II Loading & Certification Ops FY01	253	03OCT00	01OCT01
A4EC120052	Ship 2000 m3 of TRU/TRM to WIPP	0		01OCT01
A4EC120055	TRUPACT II Loading & Certification Ops FY02	254	02OCT01	01OCT02
A4EC120060	TRUPACT II Loading & Certification Ops FY03	254	02OCT02	01OCT03
A4EC120065	TRUPACT II Loading & Certification Ops FY04	255	02OCT03	01OCT04
A4EC120070	TRUPACT II Loading & Certification Ops FY05	254	04OCT04	03OCT05
A4EC120075	TRUPACT II Loading & Certification Ops FY06	253	04OCT05	02OCT06
A4EMILE542	FY06-M2 Cmpl Offsite Shipment of TRU/TRM By 2006	0		02OCT06
A4ENDWPD04	Complete WPD 004 - TRU/TRM Project	0		02OCT06



2. The completion of TRU Waste Shipment is correctly tied into the completion Milestones for Waste Management and Site Closure.

WAD 005 WADlet 1.1.04.03.02.02 Develop and Implement New TRM Waste Storage/Staging Facilities
$16,441,065 (2.89% of Total)

Scope

A number of activities and projects were completed under WBS Element 1.1.04.03.02.02 in FY98 and FY99. In addition, the following activities or projects are planned under this WBS Element in FY00 through FY06:

1. The Building 460 conversion to Storage Project (described above) will be constructed. We assume that a construction subcontractor will be selected to perform the construction work using a competitive procurement process. Bids received from subcontractors may be more or less than the preliminary estimate included in this WPD document. The budget for this work will be adjusted up or down after a construction subcontract is awarded. We also assume that any and all authorization basis documents and/or readiness review, anything required to operate the facilities but not required to construct the facilities and achieve "Beneficial Occupancy," will not be charged to WPD 005.

2. A portable TRU Pact II shipping station will be installed at a location that is to be determined. Specific requirements for infrastructure support are also to be determined. However, we assume that a concrete pad, electrical service, and unheated covering (e.g., tent or pole barn) will be required.

3. The Building 440 Shipping and Characterization Facility (described above) will be constructed. Prior to construction, engineering drawings dated September 1998 will be reviewed and modified, if necessary and appropriate, to minimize the amount of radiation shielding included in the design and to reduce project costs. We assume that a construction subcontractor will be selected to perform the work using a competitive procurement process. Bids received by subcontractors may be more or less than the preliminary estimate included in this WPD document. The budget for this work will be adjusted up or down after a construction subcontract is awarded. We also assume that any and all authorization basis documents and/or readiness reviews, anything required to operate the facilities but not required to construct the facilities and achieve "Beneficial Occupancy," will not be charged to WPD 005.

Technical Strategy

Variables affecting the need for additional TRU/TRM waste storage primarily include waste generation rates (actual and projected), waste shipping rates (actual and projected), and the date that WIPP is expected to open to receive unrestricted shipments of TRU/TRM waste from RFETS. Furthermore, some existing waste storage buildings will undergo deactivation and decommissioning beginning in FY04. Analysis of these variables establishes a need for a new storage facility (i.e., the Building 460 Conversion Project) that can store up to 26,000 drums for a

period of up to 5 years. Decisions to build new storage facilities are reviewed and updated continuously. Thus, a flexible approach including reasonable contingency is required.

We anticipate that all remaining storage capacity for TRU/TRM will be filled by 3Q FY99. Arrangements are being made within WPD 05 and other WPDs to store TRU waste temporarily in Tents 2 and 12 on the 750 Pad and to store TRU/TRM more permanently in newly-created storage areas within Building 440. This new space will be filled in 3Q FY00. At that time, and assuming WIPP does not open, the Building 460 Conversion to Storage Project must be operational.

Use of existing facilities to store TRU/TRM waste requires less capital investment compared to new building construction; life-cycle costs are about the same because of higher operating costs. Risks associated with accident scenarios for waste storage in existing facilities are acceptable. RFETS currently has one shipping station for TRU/TRM. This station is located in Building 664 and has a maximum capacity of 1,000 cubic meters per year for single-shift operations. We estimate that approximately 16,000 cubic meters of TRU/TRM must be shipped from RFETS, and the timeframe for completing these shipments is approximately 45 months, (i.e., assume WIPP opens on January 1, 2001, and Buildings 440 and 664 are taken out of service for deactivation on September 30, 2004). This simple analysis concludes that two additional shipping stations will be required, and all shipping stations must operate using double shifts.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

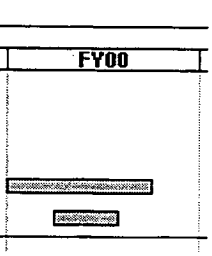
2. The inclusion of an additional storage facility in the WMP is appropriate while at the same time recognizing that current estimated volumes of TRM waste may be inaccurate. The unknown is, by what multiple or order of magnitude is the estimate inaccurate?

Schedule

1. The activities representing this WBS appear to be accurately and logically reflected in the CPB Schedule.

2. The K-H Schedule Standard 10 Guidelines state that, "Current FY activities and FY+1 activities will generally be two working weeks to three months in duration, except for procurement, regulatory actions, or level of effort activities, which do not have intermediate points for performance measurement. The following construction activities indicated below do not follow this guideline.

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
002 PBD 002 - Waste Management Project				
005 WAD 005 - TRU / TRUM Construction Project				
1.1.04.03.02.02 /DEV AND IMPL NEW TRM WSTE STOR/STAG FAC				
A5EC437200	Modify B460 for TRU Waste Storage	191	01OCT99*	30JUN00
A5EC437260	Port Ship System Construction	82	30DEC99	24APR00



WAD 006 WADlet 1.1.04.04.01.02 Waste Certification and Oversight
$14,479,762 (2.55% of Total)

Scope

Provide an independent waste shipment certification and oversight program for low level and low level mixed wastes at RFETS. Provide a core capability to support RFETS low level and low level mixed waste package certification activities.

Key activities are: assure the waste/residue traveler is correct and complete, verify training and qualifications of personnel signing the waste/residue travelers, verify the waste item description code is property packaged, verify that all radiation counts and NDA results are within acceptable limits, verify waste container data in WEMS is consistent with the waste/residue entries, verify no outstanding non-conformance reports against waste package, verify container integrity, correct labeling and marking for Department of Transportation requirements, provide and maintain a Waste Certification and Oversight Program, including maintenance of NCR Program and resolution of non-conformance reports, and transfer of records to Records Management for permanent storage, submission of low level waste profiles to DOE-RFFO for final concurrence by DOE-NV, provide technical assistance in the interpretation of waste acceptance criteria, perform periodic audits of low level and low level mixed waste operations, and provide monthly reports identifying the status of non-conformance reports by subcontractors.

As site closure progresses, there will be up-front waste certification at the point of generation, NTS approval of bulk LLW shipments and direct shipment from waste generating facilities.

Technical Strategy

The strategy for this WBS element is to utilize subcontracted resources for assuring independent oversight and certification to waste acceptance criteria and on-site program requirements to support low level and low level mixed waste shipments are completed by fiscal year 2006. Waste certification program oversight and waste shipment certification activities will follow the RFETS baseline closure schedule and shipping forecast (Waste Generation, Inventory and Shipping Forecast Rev 0b – R. Lahoud 04MAY99). As defined in the WAD Scope Description for 1.1.04.04.01.02, a core capability to support RFETS waste package certification will be provided. The volumetric capacity of this core package certification function, by design, does not equal the projected shipping volumes for low level and low level mixed waste as set forth in

the above referenced forecast (Waste Generation, Inventory and Shipping Forecast Rev 0b – R. Lahoud 04MAY99).

In any given year, the demand for waste package certification support may exceed the core program capacity. Additionally, the exact shipping volumes, categories of LL and LLM waste which make up the waste shipping forecast and the commensurate waste package certification support capability in a given year is expected to fluctuate somewhat. Therefore, the excess demand (above core capacity) for waste package certification support is the fiscal responsibility of individual projects. This strategy will allow potential fluctuations in project schedules to carry the waste package certification support resources along with that schedule adjustment. In order to successfully implement this strategy, programs and projects funding this additional capacity for package certification shall be required to provide these fiscal resources well in advance of their anticipated need date in order to allow for the additional hiring, clearances, training and qualification of subcontracted personnel. It is the responsibility of RFETS Closure Projects to maintain shipment forecasts, to set priority for assigning the core resource and to assure projects appropriate the necessary resources to fund waste certification capacity above the core capability provided herein. Implementation strategy and implementation support for an Up-Front Waste Certification Program will be provided in order to allow for streamlining of certification activities at the point of generation and direct shipments of waste from the generating facility when practical.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

Schedule

1. The work scope described above for this WADlet appears to be adequately represented in the 2006 CPB Schedule for this WAD.

WAD 006 WADlet 1.1.04.04.04.03 Chemical Disposition and Disposal Project
$14,418,443 (2.54%)

Scope

The Waste Chemical Program (WCP) is intended to provide a one-time removal of rad and non-rad waste chemicals from on-site facilities. These waste chemicals will be identified by the generating facility as waste, and the WCP subcontractor will identify containers for waste chemicals, package waste chemicals, determine whether chemicals require treatment or can be directly disposed, update WEMS, interface with on site traffic department for shipments, facilitate non-rad shipments with approved contractors, coordinate with RMRS on radioactive waste shipments, and ship waste chemicals to approved disposal facilities for directed disposal. The Waste Chemical Program is divided into five (5) subprojects.

1. COP - Consent Order Project. This subproject is driven by the Compliance Order on Consent 97-08-21-02. This order implements the Waste Chemical Plan, providing for the proper management, storage and disposal of waste chemicals located at RFETS.

2. Gas Cylinder Project. This subproject is driven by OSHA, HSP and Safety. This subproject is tasked with the identification, roundup and disposal of waste gas cylinders at RFETS that are not currently properly managed.

3. Drum (Waste Chemical) Repack Project. This subproject is driven by a CDPH&E Compliance Advisory. This subproject is tasked to open previously packaged drums of waste chemicals and repackage the chemicals into properly configured and compliant drums for on-site storage or off site disposal.

4. Life Cycle Chemical Project. This subproject is driven by Post Consent Order RCRA Part B Permit and is tasked with the packaging of Life Cycle Waste Chemicals. Disposal of the Non rad waste chemicals will be included in this activity. The disposal of the rad waste chemicals will be deferred to a separate activity within the Waste Disposal PBD-002. The Life Cycle Project for FY99 is scoped to manage only those chemicals generated after 10/01/98 and are considered generated after the completion of the Consent Order Activities.

5. Reactive Chemical Project. This subproject is driven by the Reactive Chemical Plan and RCRA Part B Permit and is tasked with the identification and treatment of Reactive Chemicals for all subprojects listed above. The Waste Chemical Project Plan and Compliance Order on Consent 97-08-21-02 assumes the following;

    1) waste acceptance criteria does not change significantly;

    2) off-site repositories have sufficient capacity and are willing to accept waste chemicals;

    3) RFETS facilities do not experience down time affecting the facility schedules; and

    4) waste chemical inventory will not exceed projections by 10%.

The Chemical program will provide RMRS Waste Disposal funds for transportation and disposal of low level and low level mixed chemicals.

Technical Strategy

The strategy for this WBS element is to utilize on-site and off-site resources to ensure that the Waste Chemical Project will be completed. The Reactive Chemical Project, Life Cycle Project, Drum Repack Project and Gas Cylinder Project are scheduled to continue past FY00. Continuation of these activities is anticipated to extend to FY06 to manage existing and newly generated waste chemicals. As waste volumes decrease due to accelerated Site Closure, a reduction of force will be implemented that still achieves the graded closure scenario. Normal subcontracting activities will be employed to augment staff and continue onward with chemical waste packaging and supporting waste characterization activities.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

Schedule

The activities described above for this WBS appear to be adequately incorporated into the 2006 CPB Schedule and are logically related within this LOE. However, these disposition activities have no integration links with waste management or waste generation sources.

WAD 002 WADlet 1.1.04.01.06 219 Cluster Landfill Closure (OU7)
$12,416,608 (2.19%)

Scope

The Present Landfill comprises the entire area l extent of OU-7 and contains six additional IHSSs and PACs within its boundary. The six IHSSs and PACs have been proposed as no-further-action (NFA). The Present Landfill is in standby mode and is independent from other ongoing or future remediation activities at RFETS. The landfill, operated from 1968 through 1998, is identified as an interim status unit under RCRA and is required to be closed under the provisions of RFCA Attachment 10.

The remedial action for the Present Landfill is to close it by means of a RCRA-compliant engineered earthen cap. The cap is specified in RFCA and is a presumptive remedy by agreement of DOE, CDPHE and EPA. Closure requires background analyses to support cap design. Modeling and analyses will be conducted to confirm and demonstrate performance of various components of the planned cover.

Technical Strategy

The strategy for the landfill cap is to construct a cover that 1) minimizes long-term maintenance and, 2) meets requirements of RFCA Attachment 10 for protection of surface waters via the application of appropriate design concentration limits to the cover design.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

2. The acceptability of the cover by the appropriate regulators and more importantly the various stakeholders is the key issue regarding this WADlet. Apparently, recent stakeholder meetings demonstrated opposition to the proposed cap design. Any modification to the current cap design will increase cost and certainly impact the schedule especially in the out-

years. Acceptance of the cap design could result in changes in soil cleanup criteria (lowering the cleanup levels) which would also increase cost and negatively affect the project schedule.

Schedule

1. These WBS activities as described above are represented in the 2006 CPB Schedule.

2. When the predecessor and successor logic were reviewed for the WBS sequence of activities, the 2006 CPB Schedule activities were found to be logically tied with each other. However, the first driving activity of the sequence, A2O7CAP100 Evaluate Total Water Storage Capacity, was found to be tied to a date constrained Milestone (as opposed to a related waste generation activity), which does not have a predecessor activity.

3. Activity A2CP100000 "Decision Document Preparation, Review and Approval" combines responsibilities of different parties. Typical schedule techniques separate activities by scope and responsibilities. Also, the regulatory agencies are assumed to adhere to document review schedules as described in RFCA. Because different organizations have different responsibilities, it is important from a schedule impact perspective to separate this effort. For these reasons, we recommend that K-H review this activity scope and responsibility.

WAD 062 WADlet 1.1.04.02.04.01 Assay and Characterize LLW/LLMW
$11,396,294 (2.01%)

Scope

This WBS element provides for the non-destructive assay of low level waste and low level mixed waste containers. Activities involve a share of the operation and maintenance of the B371/B569 Passive Active Drum Counters (PADC), B569 Passive Active Crate Counter (PACC), B569 Low Specific Activity Counter (LOSAC), and B776 HEPA LOSAC counter and real time radiograph activities in B569 and B664. As part of these operations, daily planning, management, supervision, container movement, calibration, procedure maintenance, training are required to support daily operations. Movement of the crate counter from B991 will be funded from this WBS element. The assay of LLW and LLMW is required by the site safeguard procedures before waste is moved out the protected area and is not required as part of the waste acceptance criteria.

Technical Strategy

The strategy is to provide for the daily movement and handling of containers that must receive non-destructive assaying (NDA) for FY00 through FY01. Activities include, but are not limited to; container movements, examination process of containers, maintenance and calibration of equipment, "hands-on" training of personnel, project specific site support activities (i.e., QA, Safety), and identification of new equipment and methodologies that can improve the assaying capabilities for the site. As facilities go into deactivation and D&D, NDA operations will be

required to use portable NDA units to properly characterize waste. With the protected area barrier going down in FY02, there may no longer be requirement for a NDA to measure hold up of material, nor a need to perform NDA on low level waste.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

Schedule

The activities representing this WBS appears to be accurately and logically reflected in the CPB schedule.

WAD 048 WADlet 1.1.04.06.01.02 Liquid Waste Treatment Upgrades Project
$9,714,135 (1.71% of Total)

Scope

This element covers the Liquid Waste Treatment Upgrades Project and provides all design, construction, and start-up effort to provide operating, alternate or upgraded systems for radioactively contaminated process waste water until Site closure is accomplished. The project will be completed in FY02; the operating systems will be covered by WAD 007, Waste Treatment. This project includes the Temporary Sludge Immobilization System (TSIS). The scope covers sludge treatment requirements and is presented below as an on-site treatment system. The sludge treatment strategy developed under WBS 1.1.04.06.01.01 could recommend adjustments to the project scope if off-site services contracts are identified as feasible alternatives. (1) Temporary Sludge Immobilization System: A sludge immobilization system will be provided for treatment of the following waste streams: a) Existing low level (LLW) and Transuranic (TRU) waste sludge stored in B374 and B774, b) backlog LLW vacuum filter sludge (by-pass sludge) drums stored in B964, and c) miscellaneous sludge generated during deactivation and closure (evaporator brine is not planned for treatment in TSIS). The TSIS will be sized to treat approximately 55,000 gallons of stored aqueous sludge, 2500 drums of solidified bypass sludge, and 2,000 to 5,000 gallons per year of newly generated sludge. The TSIS will be designed and constructed under a Design/Build subcontract and will be installed on-site at a location which will allow efficient transfer of sludge for stabilization. The end product from TSIS will be a Land Disposal Restriction (LDR) compliant LLM Waste or WIPP compliant TRU Waste, (2) Piping modifications are required in the current process waste transfer system to allow pipeline transfer of sludge to TSIS operations.

Technical Strategy

The general Site strategy for process wastewater treatment is described by the following elements:

1. reduction of the waste water volumes requiring treatment through waste minimization at the point of generation or diversion of waste water currently treated but not required by regulations or agreements,
2. decontamination to allow maximum reuse of the treated waste water, and
3. compliant (to regulations and disposal criteria) final waste forms resulting from waste water treatment.

The required processing capability, to support this strategy, will be provided by current systems, fixed unit price services subcontracts, and/or the Liquid Waste Treatment Upgrades (LWTU) Project which implements cost effective, process waste water treatment systems, sized and designed to treat currently projected waste volumes and characteristics. This project will be accomplished under a fixed price subcontract(s) to provide the Temporary Sludge Immobilization System (TSIS). This WAD affects scope and resources in WAD 007 which will cover the operation of the new treatment systems. The RFETS strategy for Liquid Waste Treatment (WAD 48) is, and has been for several years, to make a capital investment in constructing an on-site treatment facility (a.k.a. TSIS) for the sites aqueous sludge. This strategy is being re-evaluated given the accelerated 2006 site closure planning. One strategy currently under evaluation is to dry and package the aqueous sludge with existing RFETS facilities thereby enabling the sludge to be:

1. readily shippable to an off-site TSDF,
2. treated off-site and
3. ultimately disposed of offsite.

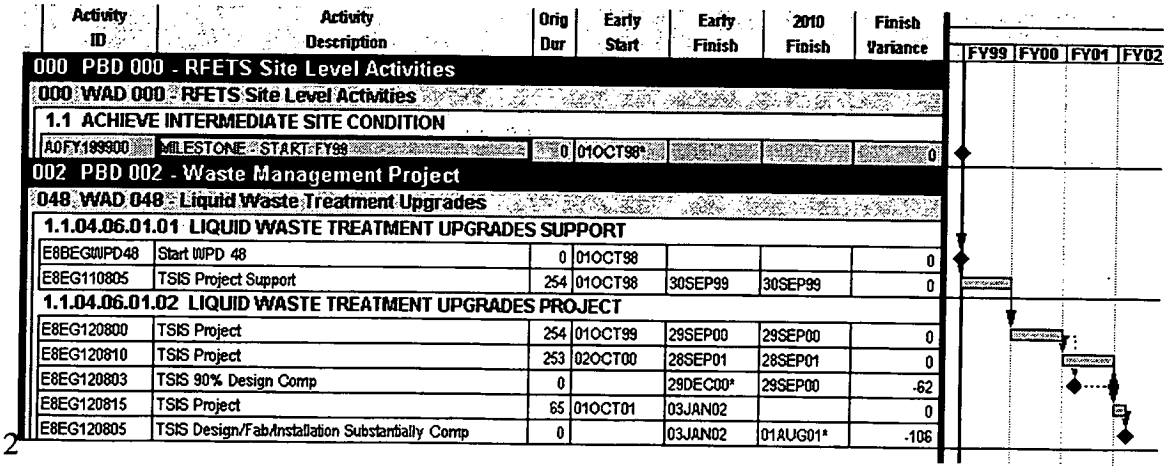
This option is consistent with the 2006 planning assumption to have a TSDF for wastes up to 100 nCi/g wastes, as well as facilitates the site D&D by not constructing a RFETS treatment process that would require construction and D&D to meet the 2006 Plan. By contracting the treatment and disposal as one contract, it eliminates RFETS risk associated with acceptability of treated wastes by the disposal facility. If this strategy is determined to be the most viable option the WAD's impacted (WAD's 7, 48 and 6) will be revised accordingly by way of formal change control.

Analysis

1. The scope of work for this WADlet appears to be logical, complete and generally supports the overall objectives of the WMP.

Schedule

1. The project activities, as described above, will be completed in FY02; the operating systems will be covered by WAD 007, Waste Treatment. This project includes the Temporary Sludge Immobilization System (TSIS). A sludge immobilization system will be provided for treatment of the following waste streams:
   1. Existing Low Level (LLW) and Transuranic (TRU) waste sludge stored in B374 and B774
   2. Backlog of LLW vacuum filter sludge drums stored in B964
   3. Miscellaneous sludge generated during deactivation and closure.
2. The TSIS will be designed and constructed under a design build subcontract and will be installed onsite at a location which will allow efficient transfer of sludge for stabilization.
   1. The figure below shows the 2006 CPB Schedule activities representing this WBS effort.



Activity ID	Activity Description	Orig Dur	Early Start	Early Finish	2010 Finish	Finish Variance
000 PBD 000 - RFETS Site Level Activities						
000 WAD 000 - RFETS Site Level Activities						
1.1 ACHIEVE INTERMEDIATE SITE CONDITION						
A0FY199900	MILESTONE - START FY99	0	01OCT98*			0
002 PBD 002 - Waste Management Project						
048 WAD 048 - Liquid Waste Treatment Upgrades						
1.1.04.06.01.01 LIQUID WASTE TREATMENT UPGRADES SUPPORT						
E8BEGWPD48	Start WPD 48	0	01OCT98			0
E8EG110805	TSIS Project Support	254	01OCT98	30SEP99	30SEP99	0
1.1.04.06.01.02 LIQUID WASTE TREATMENT UPGRADES PROJECT						
E8EG120800	TSIS Project	254	01OCT99	29SEP00	29SEP00	0
E8EG120810	TSIS Project	253	02OCT00	28SEP01	28SEP01	0
E8EG120803	TSIS 90% Design Comp	0		29DEC00*	29SEP00	-62
E8EG120815	TSIS Project	65	01OCT01	03JAN02		0
E8EG120805	TSIS Design/Fab/Installation Substantially Comp	0		03JAN02	01AUG01*	-106

3. Per K-H Scheduling Standard 10 activity duration's/level of detail for current FY and FY+1 should generally be two working weeks to three months in duration, except for procurement, regulatory actions or level of effort activities, which do not have intermediate points for performance measurement. Activities E8EG120800, E8EG120810, E8EG120815 "TSIS Project" represent the construction and start up of the TSIS project and do not appear to meet the K-H scheduling standard requirements. We recommend that the activities for TSIS Project be expanded to include the construction of the TSIS Project and reflect the detail as required by K-H's Scheduling Standard 10.

4.6.4 Waste Management Project Risk

Table 2.0 contains a summary of the project cost, schedule and technical risks for each of the top eleven WADlets as described above, over the project duration. These risk ratings were taken from the RFCP, Baseline Cost Estimate. Based on this review, the following are considered the sum of the project risk.

Schedule Risk

1. Any disruption of waste shipments to the designated repositories for LLW/LLMW (Envirocare or NTS) and TRU/TRM Waste (WIPP) could result in serious short-term or long-term project scheduling changes or delays. Disruption to shipments could result from temporary closure or non-acceptance of waste by the facilities; this could conceivably occur as a result of accidents at the facilities, accidents of waste hauling vehicles, strikes, inability to accept shipments from several facilities at the same time, regulatory non-compliance by the facility, or further constraints on the number of shipments that are allowed under NEPA.
2. Insufficient waste containers or waste hauling vehicles could result in either short-term or long-term changes or delays in the project schedule.
3. Significant increases in the volumes of waste from the D&D, Under Building Contamination, and ER cleanup activities (reduced soil cleanup levels, additional sediment volumes associated with ponds on the site, etc.) could result in short term or long term project scheduling changes or delays.
4. In general, any changes in national or local regulatory policy regarding waste shipments could result in project scheduling changes or delays.
5. Any delays in waste generation, (e.g., D&D and ER cleanup activities will impact the Waste Management Project (WMP) and project schedule).

Cost Risk

1. In some cases, schedule changes or delays could result in increased project cost. Decreased activity over time will continue to result in sunk cost for maintenance of infrastructure and human resources during these down times.
2. Increased volumes of waste will result in increased handling, packaging, shipping and disposal cost.
3. Significant and unanticipated increases in waste disposal "tipping fees" at the designated repositories will increase the project cost.

Technical Risk

1. A small volume of orphan waste (> 10nCi/g) may require some form of innovative treatment technology that does not now exist.
2. A treatment technology does not now exist for the TSIS project.
3. Since the waste to be treated will be either shipped to a facility off-site, or be treated or remediated on-site using standard and proven technology (i.e., thermal desorption), little technical risk is associated with site closure.

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4.7 Environmental Restoration

4.7.1 Approach

Figure 5-3 of the PMP identifies three PBDs under the title "Environmental Restoration" (ER):

- PBD-001, Buffer Zone Closure
- PBD-013, Closure Caps
- PBD-027, Analytical Services.

In addition, the functional role of ER crosscuts many important closure projects. Accordingly, there are significant ER activities in many other PBDs. In fact, K-H tracks ER activities in 21 WADs and 13 PBDs.

For the validation studies, certain ER elements were selected for review to represent the full diversity of the important ER closure activities. In general, attention was focused on the high-cost WBS elements. However, other important factors were also considered, including:

- type of ER activity (planning/characterization, construction, monitoring/evaluation)
- location of the activity (industrial zone, buffer zone)
- cost/schedule type ("Level of Effort (LOE)" or "non-LOE")
- time frame for the work ("early" or "late" in the baseline schedule).

These selection considerations are illustrated below, for the WBS elements reviewed.

Environmental Remediation
WBS Selection Matrix

PBD / WAD / WBS Description	ER Activity: Planning/Characterization	ER Activity: Engineering/Construction	ER Activity: Performance Monitoring/Evaluation	Location: Industrial Zone	Location: Buffer Zone	Schedule/Cost Type: "LOE"	Schedule/Cost Type: "Non-LOE"	Time Frame: "Early"	Time Frame: "Late"
PBD-001, Buffer Zone Closure Project WAD-001, Buffer Zone Misc. Cluster Project									
1.1.03.08.04.01 Sitewide Groundwater Monitoring			✔		✔		✔		✔	✔
1.1.03.06.01.01 Surface Water Monitoring			✔		✔		✔		✔	✔
1.1.03.06.01.08 Actinide Migration			✔	✔	✔		✔		✔	✔
PBD-001, Buffer Zone Closure Project WAD-083, Buffer Zone Environmental Remediation Project										
1.1.03.12.06.02 903 Pad Remediation		✔	✔			✔			✔	✔	
1.1.03.09.02 Misc. Buffer Zone IHSS Rem/Disp.		✔	✔			✔			✔		✔
1.1.03.11.02 Old Sanitary Landfill Closure		✔	✔			✔			✔		✔
1.1.03.08.03.01 Buffer Zone Plumes		✔	✔			✔			✔	✔	✔
PBD-013, Closure Caps Project WAD-023, Closure Caps Project										
1.1.04.11.03 Industrial Area Regrade & Revegetate		✔	✔		✔				✔		✔
1.1.04.11.02 New Closure Caps Construction		✔	✔		✔				✔		✔
PBD-014, Industrial Zone Closure Project WAD-025, Industrial Zone Cluster s Project										
1.1.05.30.02 Misc. Industrial Zone IHSS Remediation		✔	✔		✔				✔		✔

The general approach was to review the selected WBS elements (WADlets) to gain a detailed understanding of important ER activities and to obtain confidence in the processes and level of detail employed in developing the ER closure plan activities. The detailed review of individual WBS elements included a review of scope, schedule, costs and risks, in accordance with the technical requirements of the engagement:

Scope

The narrative scope of work for each WBS was evaluated against the Technical Strategy and Fiscal Year Baseline Statement of Work presented in the relevant Project Baseline Descriptions. The primary purpose was to assess, in a qualitative sense, the degree to which the stated scope of work was considered within the technical approach, the relative detail to which scope activities have been identified, and early FY allocation of scope. This evaluation also provides a qualitative assessment of the relative degree to which the anticipated scope of work for a given WBS has been defined, organized and, at least conceptually, planned. This also provides an indication of the extent to which narrative scope definitions match the schedule and cost elements of the WBS, the manner in which the technical strategies are reflected in schedule logic, and the overall scaling of major scope items against broad FY costs.

Schedule

The WBS schedule was reviewed from an overview perspective to assess integration with the WBS work scope descriptions, fiscal statements of work, and BOE cost profiles. Where appropriate, the WBS schedule review provides a qualitative indication of overall schedule content and logic with respect to activities and sequencing issues identified in the WBS Technical Approach and FY Baseline Statement of Work. Gross disparities between the various narrative portions of the WBS scope and the WBS schedule are general indications of potential changes or uncertainties in scope or timing of activities, or potential coordination issues between management, planning and/or operational functions responsible for the WBS. This review supplements the more detailed schedule review in Section 4.4.

Costs

The WBS costs were reviewed to obtain confidence that the Basis of Estimates (BOEs) were reasonably developed to the appropriate level of detail based on known and anticipated conditions. Larger line item costs were reviewed where appropriate to test the rigor employed in estimating, and in doing so, to gain a confidence in the estimating process. Where possible, comparisons were made of similar line item costs to validate the WBS for internal consistency. The overall scaling of costs against the WBS schedule was also reviewed to compare the general logic of schedule and cost activity for execution of the WBS scope.

Risks

Finally, the principal scope, schedule, and cost assumptions were identified and reviewed for each WBS in order to assess potential risks to the overall WBS performance. These assumptions and risks were considered both within the integrated scope/schedule/cost framework of the WBS itself, as well as within the overall RFCP scope of activities, in order to evaluate both internal and external risk to the WBS.

4.7.2 Findings

Based on the review of scope, schedule, cost and risk for the selected WBS elements, summary-level findings were developed in accordance with the Technical Requirements shown in Section 2. Each of the eleven Technical Requirements has been restated below as a question, followed by a brief summary of key findings.

1. Are the planning assumptions valid and current?

The PMP lists seven principal assumptions for ER. The findings related to each assumption are presented below.

A. *Only the IHSSs/Potential Areas of Concern/Under Building Contamination listed in the Lane Butler to Allen Schubert Memorandum (JLB-013-99), dated April 6, 1999, will require remediation.*

This assumption does not recognize a number of potentially significant unknowns related to the overall project. There is a potential for the discovery of additional areas of contamination during other scheduled cleanup activities that could impact the overall scope, schedule and cost of the ER efforts.

B. *No Further Action (NFA) sites will be identified and dispositioned as defined in Attachment 6 to RFCA. The NFA sites to be dispositioned will be those described in the Lane Butler to Allen Schubert Memorandum (JLB-023-99), dated April 6, 1999.*

Because of the "best judgement" basis of many of the initial proposed NA/NFA decisions, there is significant potential cost and schedule risk with IHSSs sites that have been proposed for No Action/No Further Action. If a portion of the 148 sites pending NA/NFA approval, or the 81 additional proposed NA/NFA sites, are not approved by the regulators, then the ER costs and schedule will be adversely impacted.

C. *ER soil action levels will conform to the final Action Levels for Radionuclides in Soils for the Rocky Flats Cleanup Agreement, October 18, 1996. (All soils with radioactivity less than Tier 2 levels, as defined in RFCA [Attachment 5] can be returned to the remediation site.)*

This assumption does not account for other cleanup levels that may result from the efforts of the Actinide Migration Evaluation Program, which may dictate additional scope related to soil removal and contaminant control activities in order to meet soil cleanup levels that are protective of downstream surface and groundwater quality.

D. *The appropriate regulators will approve the use of engineered caps as an integral part of the Site's closure strategy for landfills, for the Solar Ponds, and for areas within the Industrial Area, including the 700 Area.*

The final decision for closure caps for the landfills, solar ponds and Industrial Area may have cost and schedule risks that are not accounted for in the existing RFCP. The closure caps are assumed to be an evapo-transpiration (E-T) design. RFCA requires the caps to be RCRA-equivalent. The cognizant regulatory agencies have not yet accepted the E-T design as RCRA-equivalent. Planning and cost estimates assume that the overall cap structures will be similar to the cover tentatively approved by CDPHE for use at Rocky Mountain Arsenal. It is not clear that alternatives have been fully developed for alternate design of the caps if the E-T design is not approved for RFETS. Potential impacts could include increased cost of cap materials, increased time for design and approval, and impacts to cap construction implementation schedules.

Additionally, specific sources of soil for the closure caps have not been located or placed under contract or commitment. Although the RFCP indicates that soil will be obtained for closure caps from local sources within ten miles of the site, it is not clear that the availability of adequate volumes within that proximity has been evaluated. It is not clear that roadway access to the site, increased traffic volumes, and other transportation infrastructure issues related to the movement of large amounts of soil for the closure caps has been fully evaluated. These issues could create potentially significant schedule and cost impacts to the capping activities.

E. *The appropriate regulators will approve changes to the environmental site remediation schedule to accommodate acceleration of other RFCP activities, such as nuclear material stabilization and D&D.*

Due to the late schedule of ER activities within the overall RFETS cleanup plan, the time required for regulatory review and approval of ER remedial actions may become critical issues. Accomplishment of ER work within the existing baseline schedule could be seriously impacted if agency reviews and approvals are delayed or prolonged.

K-H and DOE are currently discussing with the regulatory agencies the possibility of developing an expedited decision document process, in order to reduce agency review and approval time. Under this concept, agency requirements for multiple sets of decision documents would be combined into single, more comprehensive "super" decision documents. The current project baseline schedule shows five Record of Decision (ROD) for site closure, and one full set of decision documents per ER work group, or a total of 58 sets.

F. *All existing dams will remain in place, with the exception of Dam C-1, at the end of the RFCP. Dam C-1 will be modified to enhance ecological values.*

This assumption states clearly that Dam C-1 will be modified, and infers that all other existing dams will not be modified. This is consistent with our analysis of the various WBS scopes of work encompassed by ER.

G. At closure, surface water leaving the site will meet the existing RFCA standards for plutonium and americium; the surface water standard for plutonium and americium may not be met onsite.

This assumption is consistent with the overall site guidance provided by RFCA.

2. Is the methodology for scope and organization of the work generally sound?

The methodology for the scope and organization of ER work is generally sound. The bulk of ER work is related to other high priority activities, including building D&D activities. Since access to these areas is a critical factor in the scheduling of ER work, most ER activities are placed late in the overall RFCP schedule. It appears that, where possible, work not related to D&D activities has been segregated into WBS packages separate from activities dependent on D&D. This is a reasonable basis for scope allocation of the ER work among various WBS elements, as it provides some measure of flexibility for scheduling ER work not constrained by other site activities. This is a sound basis for scope organization and execution.

3. Does the work scope reflect the appropriate assumptions, technical bases and an understanding of current conditions?

The overall work scope reflects appropriate assumptions and technical bases for the ER component of the RFCP, as well as a good understanding of current conditions at the site. The overall scope of the ER component of the project includes activities that are based on reasonable assumptions with regard to the type of cleanup and restoration actions to be undertaken. The sequence of activities outlined in each of the ER WBS descriptions reviewed are reasonable, logical and straightforward.

The bulk of ER activities are based on relatively low technology applications, such as bulk soil removal and limited thermal desorption. Accordingly, there is a favorable confidence validation with respect to the ability to execute the technical approach. The converse to this favorable validation is that the risks to the as-planned ER activities are primarily related to non-technical issues, including the established soil cleanup levels, access to work areas, agency review/approval times, sample analyses turn-around times, and the extent of contamination.

For example, the actual volumes of soils requiring removal under a number of the ER WBS scopes of work are predicated on the final soil cleanup levels established for the site. The Actinide Migration Evaluation program is the key element in the determination of soils cleanup levels that are protective of downstream surface and groundwater quality. The Actinide Migration Evaluation program has not determined soil cleanup levels at present. This creates potential costs risks if final soil cleanup levels have not been established at the time design and

remediation activities require such inputs for a given ER activity. However, K-H project management has indicated that if definitive data is not available from the Actinide Migration Evaluation program, then the applicable RFCA and agency agreed limits will be used for purposes of that specific ER activity.

4. Does the work logic and task sequencing effectively deliver the desired end-state for the proposed schedule?

As currently planned, the overall logic and task sequencing for the activities encompassed in the ER scope of work effectively deliver the desired end state for the proposed ER schedule. However, there are a number of issues related to the scope and scheduling of ER activities that create potential risk to the overall success of the ER work. For example, the bulk of ER work is scheduled after FY04. K-H project management indicates that this is due primarily to the baseline project funding profile. Most of the overall project funding in the early years of the schedule are allocated to activities critical to removal of SNM and building D&D, in order to achieve site risk reduction goals as early as possible.

This aspect of the project funding profile creates significant potential impact to the overall ER scope of work by pushing ER activities into the final two years of the closure timeline. These impacts include limited ability to conduct significant ER work earlier in the project schedule, significant schedule burden in the last two years of the project, increased risk to late schedule ER activities, and increased potential for accelerated ER work and associated cost impacts.

While the late schedule for ER activities does create concern for adverse impact, the overall ER scope of work is structured such that some activities or groups of activities are amenable to an "opportunistic" approach to execution. If schedule and funding conditions permit, and access to specific areas becomes available, the present configuration of ER activities in focused work group "packages" may allow flexibility in accomplishing some ER actions earlier than scheduled.

5. Is the total cost of the project integrated with the schedule and does it appear to be reasonable?

Total cost of the ER component of the project as estimated is generally well integrated with the schedule and appears to be reasonable.

6. Is the estimating methodology generally sound and does it reflect the environment in which the project is being conducted?

In general, the estimating methodology used for ER work is based on previous historical information from similar activities at RFETS and subcontractor estimates. For much of the ER work, K-H apparently constructed a series of templates containing a baseline of principal activities for selected ER cleanup elements. These templates were provided to the subcontractors who fleshed out the activity sequence based on their proposed execution of the task, and developed their cost estimates from these. In other instances, for non-remediation ER work, such as surface or groundwater monitoring, the estimation methodology included reviews of actual

quantities and costs from prior years, and per unit estimates based on anticipated sample numbers and/or sampling events.

7. Are the bases of schedule and cost estimates reasonable and at the appropriate level of detail?

Overall, the schedule and cost estimates are developed at a level of detail commensurate with the known and anticipated project conditions. The ER schedules and costs estimates are generally well supported and the level of detail reflects reasonable discipline and care in developing the ER closure activities.

8. Has the uncertainty of the work been adequately addressed and factored into the planning?

Uncertainties related to the ER component of the project have been addressed in some respects, however, a number of overarching issues which have potential impact to both cost and schedule have not been adequately factored into the overall planning of the ER work. Uncertainties exist in closure cap design, soil cleanup levels (based on actinide migration studies), and other regulatory areas.

For example, natural attenuation remedies for various groundwater plumes at the site have not been approved by the cognizant regulatory agencies. Natural attenuation is the planned remedy for the 881 Hillside, 903 Pad/Ryan's Pit, Carbon Tetrachloride, and PU&D groundwater contaminant plumes. While natural attenuation is a low cost approach, the appropriate regulatory agencies have not yet approved this approach as an acceptable groundwater remedy at RFETS. In addition, natural attenuation may not be a viable remedy for groundwater plumes based on the cleanup levels established through the Actinide Migration Evaluation Program. There are no apparent contingencies in schedule or budget for development of other remedies if natural attenuation is deemed unable to meet the criteria for protection of downstream water quality.

9. Have the factors affecting schedule risks been identified and are they being managed?

K-H and DOE have identified a number of factors affecting schedule risks. In attempting to address these risks, K-H has grouped many of the principal ER activities to facilitate operations and gain resource efficiencies. This effectively creates a basis for an "opportunistic" approach to execution. If schedule and funding conditions permit, and access to specific areas becomes available, the present configuration of ER activities in focused work group "packages" may allow flexibility in accomplishing some ER actions earlier than scheduled.

10. Have the factors affecting cost risks been identified and are they being managed (including cost risks that result from schedule risks)?

In general, the major factors affecting risk to the ER scope of work have been identified, and are actively discussed and evaluated for resolution. However, risks associated with soil characterization activities have been identified as significant areas of continued concern.

The scope of characterization work necessary for the bulk of ER work is not fully defined, creating potential risk to the scope and cost of specific ER WBS elements. However, K-H has attempted to develop ER cost estimates on a practical basis by grouping IHSSs for characterization efficiencies, modeling costs where appropriate and using historical cost bases. Where possible, K-H also uses standard templates for specific work group activities, which are then fleshed out by subcontractors specializing in that work.

To help offset the uncertainties related to site characterization issues, K-H has attempted to integrate as many of the site characterization activities as early into the D&D schedule as possible. The ER characterization efforts will parallel the D&D building characterization efforts in order to gain as much schedule efficiency as possible.

Still, a primary cost risk is the potential for undiscovered areas of contamination or contaminant anomalies in areas previously characterized. Although K-H and DOE recognize this potential, it is not clear that adequate contingency or alternative planning has been developed. The ER BOEs do not contain specific contingency line items, as contingency is accounted for on a program wide basis. Given that the ER activities occur late in the closure schedule following SNM removal and D&D activities, contingency funds may be inadequate or unavailable to cover ER risks.

11. Are resource (numbers and types) identified and properly allocated?

Overall, the review of individual WBS work scopes and BOEs indicates that the resources required to conduct ER activities have been identified and appropriately allocated. One notable exception is the availability of qualified contractors and laboratories to collect and analyze the significant number of characterization and confirmation samples in the out years. A resource shortage in this area could adversely impact an already tight characterization and remediation schedule.

4.7.3 Analyses

Background

The ER scope of work under the RFETS PMP encompasses a wide range of activities, including the characterization, remediation and restoration of areas of soil contamination throughout the site and Buffer Zone closure and monitoring activities. Included in these activities are soil sampling and analyses, excavation and removal activities, soil capping, earthwork, and soil engineering activities.

The current scope of RFCP ER work was developed from a review conducted by K-H and DOE of historical information related to areas where environmental releases have occurred on the RFETS site. A total of 370 historical release sites, or Individual Hazardous Substance Sites (IHSS) were identified, and from this initial compilation, "best judgements" were made as to whether or not individual release sites required further remedial action. Although not necessarily based on significant technical information or formal characterization, these "best judgements" were generally aimed at defining areas where work would be contemplated under the 2006 plan.

Of the 370 identified historical release sites, 148 sites have been proposed to the cognizant regulatory agencies as requiring no action or no further remediation. Currently, K-H plans to submit an additional 81 historic release sites to the regulatory agencies as candidates for No Action/No Further Action status. To date, the cleanup of 28 IHSSs have been completed and 106 additional sites are scheduled for remediation. The following table summarizes the IHSS count and status:

Total IHSS count	370
Less Completed Cleanups	(28)
Less NA/NFA Sites	
Submitted and pending regulatory approval	(149)
Additional NFAs to be submitted	(87)
Remaining IHSS sites requiring Remediation	106

From this evaluation process, the IHSSs where ER work is anticipated were segregated into 58 packages of work or Work Groups, based on a variety of factors, including access issues, locations, contaminants, and other factors. The intent of the Work Group segregation was to gain as much efficiency as possible in resource utilization, schedule and overall cost. It also serves to more effectively group those release sites where ER work is dependent on site D&D schedules.

As stated in the PBD-001 guidance document, remediation of these IHSSs *"...will be done in accordance with RFCA and support the RFCA Vision statement and site's closure goals. The closure strategy, identified through RFCA looks for reduction of risk to human health and the environment, being ultimately protective of surface water, and reduction of landlord costs. The general rule is that one year is required for the planning and characterization process (planning documents, agency review and approval, sampling, data analysis) and one year is required for remediation (subcontractor procurement, mob/demob, field construction, confirmatory sampling, data analysis, closeout reporting). Because the 2006 closure strategy significantly compresses the schedule, IHSS/PAC/UBCs are grouped to gain efficiency in cost and schedule. Grouping allows savings in preparation and review of planning documents, remediation contracting and data management. Schedule efficiencies are gained by incurring the minimum events described above."*

At the time the Rocky Flat Cleanup Agreement was signed, all of the identified IHSSs were ranked by risk. However, K-H project management believes that this risk ranking is no longer valid, since the availability of areas dependent on other scheduled project activities, such as building D&D, is a greater driving factor for the scope of ER efforts. Because of this, the bulk of

ER activities are scheduled after building D&D and other priority site risk reduction activities, effectively pushing ER work into the FY04 timeframe and later.

Review of Selected WBS Elements (WADlets)

PBD-001 / WAD-083 / WBS 1.1.03.12.06.02 - 903 Pad Remediation
Total Life Cycle Costs: $39,204,840

The scope of this WBS generally includes planning and remediation tasks associated with remediation of the 903 Pad Drum Storage Area, the 903 Lip Area and the Americium Zone. Volumes of soils exceeding RFCA levels have not been finally determined, and remedial alternatives have not yet been determined.

Summary Findings

In general, the scope of work within this WBS is well defined in terms of activities required to carry out the remediation of the 903 Pad and associated areas. However, a number of items critical to the overall accomplishment of the scope have not been fully determined, and include the volume of soil to be removed and disposed, and final soil cleanup levels. Much of this information is expected to be developed during the site characterization efforts. These characterization activities are reflected within the baseline schedule and cost estimates.

The overall basis of estimate for this WBS is founded primarily on historical experience on similar activities undertaken at the site in the recent past, and appears to be a reasonable and relatively confident basis for cost estimating for this scope of work.

The sequence of activities outlined in the PBD document are reasonable to accomplish the stated scope of work for this WBS. These activities parallel the technical strategy for the WBS and is support by the baseline schedule.

1. WAD Technical Strategy:

   "The strategy for the 903 Pad consists of three parts. First, subsurface radioactive contamination will be determined by collecting and analyzing samples. Second, VOC contamination will be determined by collecting and analyzing samples in areas suspected of being high in VOCs from previous well samples or other indications such as soil stains. Third, the large area in the americium zone will be surveyed for surface plutonium contamination using gamma spectroscopy from americium as a decay product of plutonium. Finally, cleanup levels will be determined based on information developed in the Actinide Migration Study and as agreed upon by the stake holders."

   Accomplishment of this basic scope appears to be contingent on definition of soil volumes and establishment of final cleanup levels as determined by the Actinide Migration Evaluation efforts. Characterization activities for the Pad remediation are expected to be complete by the

end of FY99, so significant technical information to support subsequent planning, approval and remediation activities will be available, reducing the planning risks.

2. The organization of the work tasks provided in the baseline schedule and in the WAD scope description for this WBS is logical and encompasses the elements required to execute the remediation as planned.

3. The scope assumptions for this WBS are based on prior work in the 903 Pad area and other similar activities at the site, and reflect significant knowledge of the site and the technical requirements for conducting the work.

Schedule

1. There are a number of characterization, decision document, and preparatory activities scheduled prior to the actual start of Pad remediation. The actual remediation of the Pad, the lip area and the Americium Zone are scheduled to have a two year duration, beginning in late FY01 and ending in late FY03.

2. The baseline schedule shows significant activity, including site characterization actions, identification and analysis of remedial alternatives, comparative analyses, and other pre-implementation activities in FY00. FY01 shows plan review, contract award, agency review and readiness review, and the initial remedy activities. The bulk of the actual pad, pad lip and americium remedial actions, as well as waste treatment and disposal activities are shown to occur in FY02 and FY03. As indicated above, the peak cost for this WBS is shown to occur in FY01.

3. Scaling of costs appears to precede scheduled scope tasking by approximately one FY. This creates significant disparity between the planned execution of work and FY budget, particularly in FY01 and FY02.

Cost

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   The bulk of the scope under this WBS is scheduled to be accomplished during FY01 through FY03. Total prime costs increase from approximately $2.2 million in FY00 to a project peak of approximately $36.1 million in FY01, and drop sharply back to less than $150,000 in FY02 and FY03. Zero costs for 903 Pad remediation are shown after FY03.

   Generally, the estimated costs are integrated with the schedule. However, cost for certain activities that span multiple fiscal years appear to be fully loaded in the start year. For example, Activity J3GE161540, line item 10, estimates 93,520 labor hours for the 903 remediation over a 12 month period beginning in late FY01 (July 2001). While the schedule appropriately reflects the duration of the activity continuing into FY02, the full cost for this activity is baselined to the start year, FY01.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   Much of the estimating logic is based on historical costs from similar activities undertaken at RFETS, including the Mound and T-1 sites. According to the BOE detail, approximately 94% of the estimated cost of this WBS was determined using historical costs from the RFETS site, including six major activities that account for over 90% of the total life cycle cost of this WBS. This provides good cost estimate confidence, given the nature of the remedial activities.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   For the larger cost line items reviewed, the BOE and supporting cost estimate files included a reasonably detailed development of costs that included a breakout of labor and materials/subcontract costs. Although materials/subcontractor represents the majority costs, the BOE provides an appropriate rationale for the development of the material/subcontractor cost estimates. For example, remediation of the 903 Pad (Activity J3G16540) and the 903 Pad Lip & Americium Zone (Activity J3G161620) account for the majority of the WBS costs. Within these two activities, material and equipment costs (purchase of waste containers and equipment rentals) represent the largest cost item. These costs are clearly identified in the BOE, and are based on the T-1 costs that have been scaled for the 903 Pad Site remediation project. Equipment purchase and rental costs can generally be estimated without complication, and the fact that the estimated costs are based on historical experience at RFETS provides additional estimate confidence.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   The BOE assumes that the tenting used to cover the Pad remediation activities will be leased, not purchased. K-H project managers indicate that the tent may have to be purchased, at approximately twice the cost of leasing, or around $1 million. Cost of purchasing the containment tenting is not included in the WBS BOE.

   Waste containers represent the single largest costs element for this WBS. The quantity of containers is estimated based on anticipated soil excavation volumes. If soil excavation volumes exceed anticipated volumes, increased costs for additional waste containers may be incurred.

5. *Resources (number and types) are identified and properly allocated.*

   Quantities and unit costs are generally identified, priced and extended to develop total prime costs in an appropriate manner (see item 3, above).

WBS Assumptions and Risk

1. The principal scope of work for this WBS is predicated on the volume of contaminated soils and materials to be removed and the soil cleanup levels determined by the Actinide Migration Evaluation efforts. The lack of definition of volumes and planning cleanup levels creates potentially significant scope issues for the entire 903 Pad remediation effort, as well as subsequent waste management activities.

2. While the PDB FY work plans identify a number of specific task items encompassing the Pad remediation, the extent of radiological contamination and soil volumes to be removed have not been finally determined. In addition, remediation alternatives have not been selected, since this appears to be the greatest potential risk to this WBS scope of work. This is indicated in the narrative of the PBD description and technical strategy for this scope of work, as follows:

   "An IM/IRA decision document will identify areas and volumes of soils exceeding RFCA action levels, evaluate and compare remedial alternatives, and recommend a preferred remedial alternative. Additional work planning, including development of the Sampling and Analysis Plan, and implementation of the remedial action will commence following approval of the decision document."

   "The strategy for the 903 Pad consists of three parts. First, subsurface radioactive contamination will be determined by collecting and analyzing samples. Second, VOC contamination will be determined by collecting and analyzing samples in areas suspected of being high in VOCs from previous well samples or other indications such as soil stains. Third, the large area in the americium zone will be surveyed for surface plutonium contamination using gamma spectroscopy from americium as a decay product of plutonium. Finally, cleanup levels will be determined based on information developed in the Actinide Migration Study and as agreed upon by the stake holders."

3. The characterization activities in FY99 assume that the IM/IRA document will indicate that 25% of the 903 Pad soils will qualify as LLMW and the remaining 75% will be LLW. This assumption is predicated on earlier sampling results, however, actual percentages of each waste type are not fully defined at present, and will depend on the results of the site characterization efforts and field verification activities.

PBD-001 / WAD-083 / WBS 1.1.03.09.02, Misc. Buffer Zone IHSS Rem/Disposition
Total Life Cycle Costs: $20,277,354

This element includes the advance planning necessary to define the scope of work required to successfully remediate the specified IHSSs and PACs and obtain authorization for the work from the regulatory agencies. It includes pre-remediation characterization to determine the exact area that will be remediated, the actions necessary to receive agreement and authorization from the regulatory agencies on the scope of work to be performed for each area. The planning/authorization document in most cases will be a Proposed Action Memorandum (PAM), but also could be an Interim Measures/Interim Remedial Action (IM/IRA) decision document.

This element also includes the characterization, remediation and final disposition of the contaminated material in the specified IHSSs and PACs. Remediation or disposition of the miscellaneous inner buffer zone IHSSs/PACs includes characterization and documentation of poorly defined areas of concern. Activities generally include planning, characterization, implementation, and close-out. The execution of all activities in this WBS will result in an area meeting RFCA-approved clean-up levels for the future open space land-use designation for the Buffer Zone. Soils will be excavated and will undergo thermal desorption treatment or other ex situ treatment process as appropriate. However, each IHSS will be evaluated on a case-by-case basis, and the appropriate remedial action will be implemented. In some cases, in situ treatment, containment, or another type of remedial action may be more appropriate. If off-site disposal is available for LLMW, this option will be used in lieu of desorption, if appropriate. All LLW will be shipped off site for disposal.

The release sites within this scope of work include:

- Ponds A-1, A-2, B-1, B-2, B-3
- Trench 7
- Ash Pits 1,2,3,4, Recently Identified Ash Pit

Summary Findings

Overall, the scope of work for this WBS is relatively well defined, in terms of specific tasks identified for each of the three work groups contained in this WBS. These tasks are generally supportive of the baseline project schedule and reflective of the estimated cost of the WBS. Determination of precise volumes of contaminated soil appears to be the critical factor impacting scope, schedule and cost of this WBS.

Schedule

1. The WAD scope description of the B-series pond remediation activities states that "*In order to comply with requirements to protect the Preble's Meadow Jumping Mouse habitat, all field activities must be conducted outside of the May 1 to September 30 time window. Therefore, drying of the ponds will be sequenced to conform to this schedule.*" Pond construction activities reflect this constraint within the baseline schedule.

2. The baseline schedule shows that the B-series pond remediation activities are not constrained by other closure project activities. K-H project management, however, indicates that these activities are placed late in the project schedule due to the potential for downstream contamination from D&D activities.

3. The sequencing of the pond remediation appears reasonable for phased cleanup of related impoundments, and is reasonably well integrated with other buffer zone closure actions.

4. K-H project management indicates that these WBS activities, as well as most of the non-D&D related ER activities, are scheduled late in the project schedule due to funding profiles.

Cost

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   No costs are shown for this WBS during FY01 and FY02. Limited costs shown in FY99 and FY00 are related only to planning, preparation and implementation of the OU-1 french drain system element. Other ER activities under this WBS occur from FY03 through FY06. This basic cost profile generally reflects the WBS scope description and the baseline activity schedule.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   Construction activities related to the B-series ponds represent the largest collective cost elements for this WBS. The cost estimates for these construction activities are based primarily on historical costs from other similar activities undertaken at RFETS. This provides a relatively sound basis of estimate.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   Cost estimates are reasonably developed in good detail. In general, the activities and costs for out year activities are less detailed than early scheduled activities. This is consistent with the closure plan philosophy. However, the BOE for this WBS provides significant cost detail, even for out year activities.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   According to the WAD Manager, the cost estimates for the activities in this WBS are pure costs with no contingency. Costs are based on anticipated conditions. If an unexpected condition is encountered, any additional ER costs that result from that unexpected condition will be covered by the 10% sitewide cost contingency.

5. *Resources (number and types) are identified and properly allocated.*

   A majority of costs for this WBS is material/subcontractor costs. For the larger cost items reviewed, the BOE did not identify the required resources (numbers or types) for subcontractor costs. However, the cost estimator's file that supports the BOE includes additional detail that identifies estimated quantities and unit costs as required to develop total prime costs in an appropriate manner.

WBS Assumptions and Risk

1. Although general activities have been defined for characterization of several of the ponds, it appears that the final treatment and/or disposition of the wastes from each IHSS will be determined once characterization is complete. One of the base assumptions within this WBS is that all waste will be shipped offsite as LLMW.

2. The following statements in the PBD001 document indicate potential risk related to the volume of soils that may require removal.

   "Currently, the sediments in Ponds B-1, B-2, and B-3 are thought to be below the Rocky Flats Cleanup Agreement (RFCA) Tier II Soil Action Levels. However, if the Soil Action Levels are reduced by 25%, as is being considered in FY99, some of the pond sediments radioactivity levels will exceed the RFCA Tier II Soil Action Levels. Therefore, removal of pond sediments above RFCA Tier II Soil Action Levels will be included as a baseline activity."

   "The estimated volume of contaminated sediments requiring removal under this activity depends on the revised Soil Action Levels, the size of the pond basin, and the depth of sediment removal. It is estimated that only 10 percent of the pond basin sediments are contaminated, and to a depth of two feet."

   "The lateral extent of contamination is unknown. The vertical extent of radiological contamination appears to be limited to the trench to a depth of 5 to 8 feet. Trench dimensions are115 feet in length, 15-foot width, and a depth of 10 feet based on the geophysical surveys and boreholes completed in 1995 (RF/RMRS-96-0044.UN). The vertical extent of VOC contamination from boring 11995 is unknown and the lateral extent appears to be bounded to the north and west by borings 12095 and 11895, respectively. Ground water was collected and evaluated during the Phase I RFI/RI for OU-2, which indicates that groundwater, is not impacted by Trench 7."

   This appears to be generally reflective of the uncharacterized nature of most of these areas. In addition, final soil cleanup standards have not been determined, and timeframes for determination of such have not been identified.

3. The WBS scope description states that the Trench 7 remediation will be performed in an enclosure similar to the one used previously for Trench 1. K-H project management has indicated that the cost basis for this WBS assumes leasing of the containment tenting, based on previous experience. There is some risk that it may be necessary to purchase the containment tenting.

PBD-014 / WAD-025 / WBS 1.1.05.30.02, Misc. Industrial Zone IHSS Remediation
Total Life Cycle Costs: $19,445,621

The general scope of this WBS includes the remediation of a number of areas of concern throughout the RFETS site. These areas include the Old Process Waste Line (OPWL) and the New Process waste Line (NPWL), several IHSSs integral to both lines, several other former spill

locations, waste dumping areas, tank and drum leakage areas, former chemical and waste storage areas, and other limited areas of contamination. The work has been grouped by general location, in order to maximize efficiencies of resources by addressing multiple IHSSs at a time.

The general allocation of the IHSSs to specific work groups under this WBS is reasonable, from a scope management perspective. None of the work group scopes are dependent on scheduling or accomplishment of other elements of this WBS. Thus, each of the work group set of activities are relatively independent of one another, and do not create schedule issues within this WBS if one work group is delayed or impacted by other project activities. This allows for greater continuity of overall WBS scope as scheduled.

Summary Findings

Although this WBS includes a number of work group sets of activities, it is generally well organized with regard to scope management and schedule control. The principal risks to this WBS are the potentials for increased sampling and analytical needs and increased soil removal due to unknown site characterization results and potential final cleanup level issues.

Schedule

The baseline schedule for all activities under this WBS have been developed along a template approach, with adjustments for differences in characterization levels, remedial action durations and other IHSS specific factors. Each set of activities includes a reasonable level of detail which generally support the WBS scope description and technical strategy.

Costs

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   Activities for this WBS element are identified at an appropriate level of detail and are scheduled with specific durations and start/finish dates. For the activities and line items reviewed, the baseline cost estimates are appropriately included in the FY period as reflected in the schedule.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   Sampling and analytical costs account for over 46% of the total life cycle costs of this WBS. This is consistent with the uncharacterized nature of the IHSSs within this scope of work. In most instances, the BOE for sampling and analytical costs were derived from vendor quotes and estimator experience on similar projects. For analytical costs, this is a reasonable and appropriate basis of estimate.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   The ER activities in this WBS element occur between FY02 and FY06, following Industrial Zone D&D activities. In general, the activities and costs for out year activities are less detailed than early scheduled activities. This is consistent with the closure plan philosophy. However, the BOE for this WBS provides significant cost detail, even for out year activities.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   This WBS contains significant costs for collecting and analyzing samples. If the extent of contamination exceeds what is anticipated, or if unanticipated types of contamination are encountered, then the number and type of samples collected and analyzed will increase proportionately, as will the costs.

   The estimated costs for sample collection and analyses implicitly assumes that there will be qualified contractors and analytical laboratories available to collect and analyze the increased number of samples beginning in FY 2002. To our knowledge, there has not been an assessment of projected samples v. forecasted laboratory capacity to confirm that the anticipated number and types of samples can be processed in the time frames reflected in the baseline schedule.

5. *Resources (number and types) are identified and properly allocated.*

   This WBS contains significant costs for collecting and analyzing samples. These costs are estimated using unit prices based on a price per sample and an estimated number of samples. Similarly, the cost of confirmation sampling is estimated using unit prices based on cubic yards of soil. For these line items, the BOE reasonably identifies the anticipated resources (types and numbers of samples).

   An assumption has been made that there will be sufficient capacity to collect and analyze the required number of samples in a reasonable turnaround time. If sample volumes and required turnaround times exceed the capacity and capabilities of qualified laboratories, schedule and cost impacts may result (see item 4, above).

WBS Assumptions and Risks

Due to the uncharacterized nature of the IHSS associated with this WBS, the full scope of sampling and analytical needs is not fully known. Since sampling and analysis is one of the key cost components of this WBS, additional sampling beyond the BOE level will have direct impacts on total WBS cost. This risk appears to be relatively significant for some of the activities under this WBS, especially the UBC cleanup under Building 889.

There is significant potential scope, schedule and cost risk associated with the remediation of the under building contamination at building 889. According to the WAD Scope Description, the stormwater runoff from the 889 area is some of the most actinide-contaminated water at the site. Water control measures to date have apparently proven to be only temporary. In addition, the Scope Description indicates that it is reasonable to assume that contamination from two collection tanks has leaked into the subsurface soils near the building foundation. Until characterization, the extent of contamination is not known. It is reasonable to assume that analytical costs for both characterization and confirmation sampling will be high risk from a cost perspective.

The soil cleanup levels for this WBS have not been determined. The volume of soil ultimately requiring removal and disposal, the number of confirmatory samples, and the number of samples required for waste acceptance purposes, will be directly affected by the final soil cleanup levels. These issues compound the potential risk reflected in the uncharacterized sites included in this WBS.

PBD-001 / WAD-001 / WBS 1.1.03.08.04.01, Sitewide Groundwater Monitoring
Total Life Cycle Cost: $15,888,876

The WAD Scope Definition describes this WBS scope as follows: The RFCA Groundwater Program comprises all activities conducted to assure compliance with the RFCA Agreement, State and Federal Regulations (e.g., RCRA and CERCLA) and DOE Orders for RFETS. The RFCA Groundwater Monitoring Program consists of groundwater quality sample collection, compliance reporting, evaluation of groundwater exceedances of RFCA Action Levels and maintenance of the RFETS monitoring well network. Monitoring consists of groundwater sample collection, water level measurements, sample and data management, well development and abandonment. Groundwater reporting comprises quarterly data assessment and presentation to regulators and the public. Groundwater evaluations are done to establish the nature and extent of groundwater contamination that could impact surface water. In addition, the groundwater portion of the Integrated Monitoring Plan implements performance monitoring activities for IHSS remediations and groundwater treatment systems and D&D monitoring of building closures and demolitions.

The scope of the groundwater monitoring program under this WBS is generally accomplished as a level-of-effort series of activities, since a bulk of the efforts consist of regularly scheduled sample collection, analysis and reporting requirements. The baseline schedule reflects activities on a quarterly level of detail through the first several years of the schedule and on an annual basis for the remainder of the project. This is a reasonable level of detail, given the potential for unknown changes in the monitoring level of effort during the out-years.

Performance measure sampling for non-D&D related activities, as well as building related monitoring are included within this WBS scope of work. Also included are activities related to the sitewide groundwater evaluation efforts, which encompass monitoring functions for

contaminant source removal activities, and evaluation of areas where groundwater discharges to surface waters.

Summary Findings

This WBS is very straightforward, with regard to schedule, cost and overall scope of work. The bulk of costs for this WBS consist of sample collection and analytical service costs. The number of samples collected and analyzed is the principal total life-cycle cost driver. Due to the nature of the activities supported by the groundwater monitoring efforts within this WBS, some potential exists for unplanned or emergent monitoring needs and/or ad hoc monitoring projects related to regulatory/RFCA compliance issues or exceedances. The subcontractor managing this scope of work recognizes these cost and resource risks, and appropriate cost items are contained in the PBD Baseline Cost Estimates.

Costs

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   Groundwater monitoring is a continuous activity that occurs throughout the closure plan from FY99 to FY06 (with some activities continuing into FY07). This fact is apparent in the BOE, which reflects a relatively even spread of future costs by year.

   Beginning in FY03, the groundwater monitoring program will include scope and cost elements for the Well Abandonment and Replacement Program (WRAP). Collectively, WRAP costs for these fiscal years are the largest cost element reflected in the BOE for this WBS and are represented in the schedule beginning in FY03. The BOE for these activities are based on previous cost experience at RFETS.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   Eighty-four percent (84%) of the total prime costs for this WBS are based on historical costs at RFETS. The WBS activities, which include groundwater quality sample collection, compliance reporting, evaluation of groundwater exceedances of RFCA Action Levels, and maintenance of the RFETS monitoring well network, are relatively well defined and understood, and the costs can be estimated with good confidence based on historical program costs.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   The WBS is broken-down into the appropriate level of detail required to identify the known activities. Additionally, the costs appear to be reasonably consistent among similar line items.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   Sampling and analysis costs are the largest cost elements of this WBS. These costs are reflected in the BOE and are based on previous cost experience at the site. This is a reasonable cost basis for both sample collection and analytical services, however, the analytical costs are based on FY99 vendor cost schedules, which may be subject to market changes or updates.

5. *Resources (number and types) are identified and properly allocated.*

   The groundwater monitoring and compliance reporting activities associated with this WBS are well defined and predictable. The BOE identifies resources (numbers and types) and allocation of resources as required to perform the groundwater quality sample collection, compliance reporting, evaluation of groundwater exceedances of RFCA Action Levels, and maintenance of the RFETS monitoring well network

WBS Assumptions and Risk

The principal risks associated with this WBS are related to the potential for additional, unanticipated monitoring requirements due to discovery of presently unknown areas of contamination or breaches of groundwater to surface water.

PBD-001 / WAD-001 / WBS 1.1.03.06.01.01, Surface Water Monitoring
Total Life Cycle Cost: $14,282,673

Surface water monitoring scope of work includes:

- water sampling and assessment to support CWA/NPDES compliance
- radionuclide monitoring of offsite effluent
- State regulatory monitoring, RFCA monitoring
- flow monitoring for RFCA and CWA
- reporting for RFCA and CWA
- stakeholder reporting as needed
- hydrologic monitoring
- development of Annual Sewage Sludge Report
- support to RFETS initiatives before the CWQCC hearings

The scope of the surface water monitoring activities appears to be consistent with the overall site and surface water conditions. Within the PBD schedule, the bulk of activity under this WBS can be grouped into three principal areas, which are appropriately reflected in the WBS schedule:

- Fiscal year surface water monitoring

- Buffer Zone Closure Project related analyses
- Discharge monitoring

The scope of this WBS assumes that adequate technical information used to define surface water monitoring needs is available from the Actinide Migration Evaluation efforts. This is a reasonable technical basis for the surface water monitoring activities, since one of the principal objectives of the Actinide Migration Evaluation efforts is to help define monitored limits that are protective of surface water quality, and this issue is a key site closure driver. This creates the need for close interaction between the management team for this WBS and the Actinide Migration Evaluation team, which appears to be in place and actively engaged.

Summary Findings

This WBS appears to be very straightforward, with regard to schedule, cost and overall scope of work. The bulk of costs for this WBS consist of sample analysis costs and labor. The number of samples collected and analyzed is the principal total life cycle cost driver. Due to the nature of the activities supported by the surface water monitoring efforts within this WBS, some potential exists for unplanned or emergent monitoring needs and/or ad hoc monitoring projects related to regulatory/RFCA compliance issues. RMRS recognizes these cost and resource risks, and appropriate cost items are contained in the PBD Baseline Cost Estimates for monitoring ad hoc projects.

All assumptions outlined by RMRS project management are relatively generic in nature and are consistent with general planning assumptions for the Project. PBD 001 does not contain any Milestone Descriptions associated with this scope of work.

Schedule

Overall, the schedule activities for this WBS appear to be consistent with the technical strategies of the PBD. Since the bulk of the work under this WBS are LOE, the work logic is closely tied to timed monitoring events, which are appropriately reflected in the PBD Schedule, and ongoing regulatory/RFCA requirements. Additional monitoring activities incidental to other closure elements, such as D&D performance monitoring, are not reflected in detailed PBD schedule activities. However, it appears that monitoring equipment and resources will be staged into these activities in accordance with their respective schedules, and that the contractor responsible for this scope of work is cognizant of the potential schedule and cost implications of impacts to such activities.

This scope of work appears to be LOE, as monitoring activities will continue throughout the project and are not specifically tied to other scheduled activities, with the exception of IMP performance monitoring related to the D&D activities. These activities are contingent on D&D schedules.

Cost

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   The total life cycle cost of this WBS is allocated relatively evenly across the project schedule. This generally comports with the schedule activity loading for this WBS, and appears to be reasonable, given the LOE nature of the scope of work.

   The WBS does not reflect any type of "ramp down" of costs prior to final site closure. It is assumed that all post-RFCA monitoring activities will be encompassed by a post closure plan, outside of the 2006 CBP.

   There will be some surge in costs beginning in 2004, due to the heavy D&D work, and the RFCA performance monitoring associated with that work. Costs assume that monitoring equipment can be staged for IMP performance monitoring of the D&D activities without significant additional resources. If D&D activities are delayed, re-sequenced, or incur significant change, additional monitoring resources would be required. Alternatively, incidental waters generated during D&D could be retained at the D&D site until performance monitoring and sampling can be undertaken using existing resources.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   The estimating methodology appears to be reasonable and appropriate for this scope of work, and generally reflects the LOE approach of the bulk of activities covered in the WBS. In addition, the estimating methodology recognizes ad hoc project or contingency monitoring needs and incorporates activity sub-items. Costs are based primarily on historical experience at RFETS and vender quotes, thereby justifying a good cost confidence.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   The BOE details the calculation of baseline cost for water sampling and assessments using historical data for number of samples, reports, equipment items, sampling locations, analyses, support tasks, etc. In addition, FY97 and FY98 actuals are used to determine the labor hours and costs for similar activities in succeeding project years.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   Almost all of the samples are analyzed offsite. Currently, a 25/75 validation/verification ratio is used on samples for quality control. There is a possibility of changing to a higher ratio, like 50/50, but not planned right now. This would cause an increase in the incremental sample cost.

5. *Resources (number and types) are identified and properly allocated.*

   Sampling numbers were estimated based on NPDES requirements using both the current and the new draft permit, RFCA requirements based on the Integrated Monitoring Plan (IMP), and the agreed DOE hydrological monitoring programs. The BOE specifies the number of samples per these requirements and estimates costs accordingly.

WBS Assumptions and Risks

1. Fundamentally, this WBS is predicated on relatively few working assumptions, beyond those baseline assumptions for PBD-001. Relevant assumptions include:

   - The current regulatory environment will prevail throughout the duration of the project and no changes will be made to current quantitative limits against which monitoring is performed.
   - D&D activities will proceed as scheduled. Activity sequences will allow surface water Performance Monitoring to commence with adequate advance timing for phasing monitoring equipment into the appropriate activity areas without need for additional capital monitoring equipment or resources.
   - No GS-3 level exceedance events will occur during the project.
   - The new NPDES permit will be adopted and will require the addition of currently anticipated monitored discharge points and the elimination of one currently monitored point.
   - The site will remain under the purview of RFCA, and will not be transferred into the CERCLA program.
   - The general configuration of site detention ponds and surface water control features will remain the same, until breached for wetlands development.
   - Normal weather patterns and conditions will prevail throughout the duration of the project.

2. Factors creating uncertainty within this scope of work include ad hoc requirements for additional monitoring due to emergent cleanup issues, the potential for adverse weather conditions and associated modifications to monitoring programs, and unknown issues related to regulatory and RFCA compliance. These uncertainties appear to be clearly understood by the contractor responsible for this WBS scope of work and have been incorporated into the PBD cost estimates as formal Baseline Cost Estimate line items, which are generally reflected in the PBD schedule.

3. The primary potential impacts to both cost and schedule appear to be IMP performance monitoring issues related to the D&D activities, and contaminant exceedances elsewhere in the monitoring program. If surface water performance monitoring equipment cannot be staged into the D&D activities as currently scheduled beginning in 2004, then additional equipment will be required in order to support both the performance monitoring and other monitoring required under the surface water programs at the same time. This will have overt cost implications and may impact schedule if authorizations for additional equipment are not timely.

If performance monitoring equipment is not available for any reason at the time pre-D&D activities are required, RMRS has identified at least one contingency for accomplishing the necessary monitoring using existing resources. This would involve containment of incidental waters at the D&D site until equipment is available. This contingency, however, would require close coordination with the D&D activity management, and may contain unknown or hidden cost and/or efficiency considerations.

4. RMRS is aware of the scheduled activities that pose the greatest risk to resources and equipment allocation for this scope of work. They have identified the principal activities that will dictate the potential need for additional monitoring equipment or close coordination of existing resources. Although not directly tied to PBD schedule activities, RMRS has indicated that current and planned resources are adequate to accomplish the scope of work outlined in the PBD for this WBS. However, it is not certain that adequate equipment resources are available to handle even low level impacts to other critical site closure activities or emergent contingency issues, such as additional monitoring required by exceedances of established surface water limits, or impacts to D&D schedules.

PBD-013 / WAD-023 / WBS 1.1.04.11.03, Industrial Area Regrade & Revegetate
Total Life Cycle Costs: $12,393,201

The scope of this WBS includes the development of the environmental data required to design the final land surface configuration for RFETS closure based on land use designations and surface water protection standards. It also includes the scope of work necessary to perform the final recontouring, regrading, and revegetation of the Industrial Area after all D&D and IHSS/PAC/UBC remediation, asphalt removal and road removal work is completed.

Summary Findings

This WBS is targeted at some of the final engineering and closure activities at the site, including site re-contouring, landscaping, grading and revegetation. The bulk of activity occurs in the last year of the RFCP, and assumes that all other major closure activities related to the industrial area are completed. This WBS is relatively straightforward and appears to contain the major cost and schedule activities required to meet the overall site closure goals.

The principal risks for this WBS include the late start of actual earthwork and revegetation activities that could be impacted by other predecessor D&D or IHSS work in the Industrial Area. Other major planning and evaluation activities should be relatively unimpacted by other cleanup activity schedules.

Schedule

The WBS baseline schedule includes a number of discrete activities related to geotechnical, geomorphological, engineering and land configuration evaluations, as well as internal review and evaluation efforts. In addition, there are several activities related to the actual conduct of regrading, recontouring and revegetation work. These activities reasonably reflect the overall scope of work defined in the WBS, however the final construction work activities do not provide any detail. This is likely due to the lack of specific data required from the other evaluations and studies that will not occur until the FY00 and FY01 time frame.

Cost

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   Over 94% of the total WBS costs are for performing the final contouring, re-grading and re-vegetation of the Industrial Area after all D&D and IHSS/PAC/UBC remediation, asphalt removal and road removal work is complete. The costs for this work is appropriately included in FY2006 as reflected in the schedule.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   The principal cost of this WBS scope of work is the actual Industrial Area re-grading and re-vegetation activities, accounting for over 94% of the total life cycle cost. The remainder of the cost is related to investigative studies, evaluations and engineering activities. This is a sound cost profile, given the nature of the overall scope of work.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   For the high dollar line items reviewed, the BOE provides sufficient line item detail to establish that the estimated costs are well developed based on known and anticipated activities. Although E&Y has not independently tested unit costs against industry benchmarks, the extension of the unit costs appear to be reasonable, and are appropriately developed based on estimated volumes (cy) of soil excavation and haul (see Activity C3EPER5030, Regrade Industrial Area). Similarly, the extension of unit costs appear to be reasonable and are appropriately developed based on the estimated area (sy) of re-vegetation (see Activity C3EPR5040, Revegetate Industrial Area).

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   Neither cost nor schedule uncertainty is explicitly addressed in this WBS.

5. *Resources (number and types) are identified and properly allocated.*

   Quantities and unit costs are generally identified, priced and extended to develop total prime costs in an appropriate manner (see item 3, above).

WBS Assumptions and Risks

This WBS assumes that all Industrial Area D&D and IHSS remediation activities are completed prior to field construction activities scheduled to begin in mid-FY06. Since access to the Industrial Area is key to the commencement of re-grading, any impacts to these predecessor activities could impact this WBS schedule. The late start of this WBS scope of work within the overall RFCP schedule precludes significant impact to schedule.

PBD-001 / WAD-083 / WBS 1.1.03.11.02, Old Sanitary Landfill Closure
Total Life Cycle Costs: $10,440,441

The overall scope of this WBS includes the closure of the Original Sanitary Landfill and the Water Treatment Plant Backwash Pond site, which is located within the bounds of the Original Landfill Site. Closure will include identification and removal of contamination "hot spots" at both IHSSs, and capping of the landfill area with an evapo-transpiration soil cover.

The WAD description contains a listing of 14 detailed activities for "hot spot" removal and 22 detailed activities for the landfill closure cover. These activities comprise a reasonable level of general planning detail to define the scope of work under this WBS. The logic structure for these activities is good, and incorporates management and infrastructure elements, technical strategy descriptions and general assumption bases.

Summary Findings

This WBS encompasses the removal of contaminant "hot spots" and final closure of the Original Sanitary Landfill and Water Treatment Plant Backwash Pond IHSSs with a soil cover. The overall scope and schedule content for this WBS are reasonable, given the intent to address the bulk of planned activities

This WBS assumes that the cover design will be an evapo-transpiration design, however, this type of cover design has not been approved by the regulatory agencies as an RCRA-equivalent design, as required under RFCA. The principal risks to this WBS as currently planned are potential cost and schedule impacts, if the assumed evapo-transpiration design is not approved.

Schedule

Activities for this WBS during FY01 through early FY04 generally include soil and water modeling, conceptual designs, and agency approval activities. Hot spot removal activities are generally scheduled during FY03. The landfill cover design, and implementation activities

generally occur during the late FY03 through FY05. This scope of activities is reasonable with regard to the detailed activities outlined in the WAD scope description, and is reflective of the WBS cost estimate in terms of general magnitude of costs projected per FY.

Costs

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   The WBS cost estimate includes no costs for FY99 through FY01. Approximately 86% of the total life cycle cost of this WBS occurs in FY05 and FY06, with 99% of those costs classified as material and subcontractor costs. This is reflective of the actual soil cover construction activities and comports well with the schedule for this scope of work.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   For the high dollar line items reviewed, the BOE indicates that the estimates are based on "estimator judgement, historical data, and commercial databases from similar type work." (note: the BOE cost risk for this activity is stated as "4," meaning "Estimator judgement with knowledge on previously completed similar activity." However, the BOE detail indicates that trade publication data was utilized in preparation of the estimate. According to the risk definitions in BEST, a risk rating of "3" is appropriate for such estimates.)

   The re-contouring activities that account for the majority of this WBS costs are straight-forward and common construction activities. As such, the estimated costs for these activities are uncomplicated, and provide for good cost estimate confidence.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   For the high dollar line items reviewed, the BOE provides sufficient line item detail to establish that the estimated costs are reasonably well developed based on known and anticipated activities.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   The principal risks to this WBS as currently planned are potential cost and schedule impacts, if the assumed evapo-transpiration design is not approved.

5. *Resources (number and types) are identified and properly allocated.*

   Quantities and unit costs are generally identified, priced and extended to develop total prime costs in an appropriate manner (see item 3, above).

WBS Assumption and Risks

This WBS assumes that an evapo-transpiration type soil cover will be approved for application by the appropriate regulatory authorities, and that the design will be consistent with the design currently under review at the Rocky Mountain Arsenal site. This assumption is consistent with the baseline planning assumptions for the site as outlined in the PMP.

The key technical assumption for this WBS is that the cap will consist of approximately 42" or more of soil over an 18" biota barrier layer. However, the final design of the cap will depend on results of source soil evaluations, soil moisture and water balance modeling, and other evaluations to determine if the proposed effective soil depth of the cap will meet design concentration limits required under RFCA Attachment 10. These various evaluations and analyses could result in changes to the cap size, thickness, or overall design, although K-H project management appears to be confident that the assumed design will be adequate.

RFCA requires the cover to be a "RCRA-equivalent" design. The cognizant regulatory agencies have not yet accepted the evapo-transpiration design as RCRA-equivalent. It is not clear that alternatives have been fully developed for alternate design of the caps if the E-T design is not approved for RFETS. Potential impacts could include increased cost of cap materials, increased time for design and approval, and impacts to cap construction implementation schedules.

PBD-013 / WAD-023 / WBS 1.1.04.11.02, New Closure Caps Construction
Total Life Cycle Costs: $8,138,648

The overall scope of this WBS includes the closure of the 700 area with an evapo-transpiration design soil cap. This WBS is essentially a construction and closeout scope of work, since all design, permitting and planning activities related to the 700 area cap are contained in WAD-23 1.1.04.11.01, not this WBS.

A list of 8 detailed schedule activities is contained in the WAD scope description. These activities generally comport with the current WBS schedule. These activities effectively encompass the overall scope of work and are reasonable, logically sequenced, and comparable to other closure capping activities to be conducted at RFETS.

Summary Findings

Overall this WBS is relatively straightforward and contains very few major activities, however, many of the same assumptions and risks associated with the Old Landfill, Solar Pond and New Landfill closure cap projects are also valid for this WBS. These issues are primarily related to the assumed evapo-transpiration design of the soil cover. This design has not been approved by the appropriate agencies as an RCRA-equivalent cap, as required under RFCA. If an evapo-transpiration design is not approved, then potential cost and schedule risks may be incurred to this WBS for additional design activities, cap materials, and possible schedule impacts.

Schedule

All of the principal construction activities for this WBS occur in FY05, after the completion of relevant D&D and IHSS activities. Although the principal activities are represented in the WBS schedule, construction activities are generic and not represented in detail.

Costs

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   Work planning, permitting and design for the 700 area cap activities are not included within this WBS. Those costs are included in WAD-023 1.1.04.11.01 – New Closure Caps Work Plan/Permitting/Design.

   The cost estimate for this WBS shows virtually all costs occurring in FY05, with minor costs for closeout reporting in FY06. As with the other similar closure capping projects at RFETS, the vast majority of costs are related to material and subcontractor cost. This is consistent with the overall technical approach to this scope of work and is reflective of the WBS schedule.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   Ninety-five percent (95%) of the cost for this WBS is for construction of the ET cap. It is estimated as fixed-price subcontract costs, using data from a SNL study of a similar ET landfill cover located at Kirtland Air Force Base in Albuquerque, NM. E&Y has not reviewed the SNL study and is unaware if the $6.86/sf cost represents a reasonable estimate for this WBS. However, the methodology of using the comparable data is generally sound and reflects the environment in which the project is being conducted.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   See comments from item 2, above.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   The principal risks to this WBS as currently planned are potential cost and schedule impacts, if the assumed evapo-transpiration design is not approved.

5. *Resources (number and types) are identified and properly allocated.*

   See comments from item 2, above.

WBS Assumptions and Risk

This WBS assumes that an evapo-transpiration type soil cover will be approved for application by the appropriate regulatory authorities, and that the design will be consistent with the design currently under review at the Rocky Mountain Arsenal site. This assumption is consistent with the baseline planning assumptions for the site as outlined in the PMP.

The final design of the cap will depend on results of source soil evaluations, soil moisture and water balance modeling, and other evaluations to determine if the proposed effective soil depth of the cap will meet design concentration limits required under RFCA Attachment 10. These various evaluations and analyses could result in changes to the cap size, thickness, or overall design, although K-H project management appears to be confident that the assumed design will be adequate.

RFCA requires the cover to be a "RCRA-equivalent" design. The appropriate regulatory agencies have not yet accepted the evapo-transpiration design as RCRA-equivalent. It is not clear that alternatives have been fully developed for alternate design of the caps if the E-T design is not approved for RFETS. Potential impacts could include increased cost of cap materials, increased time for design and approval, and impacts to cap construction implementation schedules.

PBD-001 / WAD-001 / WBS 1.1.03.06.01.08, Actinide Migration
Total Life Cycle Costs: $6,322,962

Scope

Part of the principal mission of this scope of work is to establish upstream surface water limits for actinides in order to meet the RFCA site boundary limits. This is accomplished through environmental and chemical fate/transport modeling, conducted both by K-H, and outside consultants, agencies and academics. All costs associated with such modeling/study/evaluation efforts are budgeted within this WBS.

The activity scope of work within this WBS generally includes:

- Actinide migration/fate/transport modeling
- Erosion modeling/deposition studies
- Source studies
- Activities related to the Advisory Group
- Activities related to outside research assistance from academic organizations and private sector assistance

- Support related to Stakeholder meetings
- Research data auditing activities

The formal scope of this WBS includes:

- Evaluating of the physical and chemical nature of Pu, Am and U.
- Evaluating of the migration and mobility of Pu, Am and U in groundwater, surface water and soil.
- Evaluating of short-term and long-term protection of surface water quality and downstream impacts.
- Recommending a path forward for long-term protection of surface water quality.

The overall WBS scope does not address the process for transfer of results to other critical RFCP activities.

Summary Findings

This WBS appears to be critical to all elements of the Closure Plan. Actinide migration, environmental fate and transport modeling conducted under this WADlet provide the basis of much of the technical decision-making required for compliance with the RFCA. It is unclear, however, what schedule drivers affect the feed of data and findings from the actinide migration evaluation into the other elements of the RFCP that require input, particularly those activities with significant engineering design and related schedule drivers.

Schedule

Although a relatively small total life-cycle cost, this WADlet appears to be critical to a bulk of closure design and engineering activities. It appears likely that some critical path decisions will be made on the basis of data in hand at that point, regardless of ongoing studies, in order to ensure successor activities have planning and/or design data inputs.

The scope of this WADlet appears to be LOE, as the actinide evaluations and other assessments and studies will occur coincident with other scheduled activities, and will feed technical and policy decisions related to these activities. The schedule for this WBS is generally allocated as FY levels of effort with few milestone activities. This is a reasonable and appropriate schedule basis.

Cost

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   WBS cost, scope and risk, as presented in the PBD description document are allocated relatively uniformly across the duration of the project. The K-H Manager for this WBS indicated that this is reflective of the unknown nature of the data and evaluation needs over time. Activities under this WBS are more LOE than planned resource loaded.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   The cost estimates based primarily on historical costs from other similar activities undertaken at RFETS. This provides a relatively sound basis of estimate.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   The BOE provides a relatively detailed account of significant costs. The bases of costs are generally reasonable and in sufficient detail.

   The vast majority of costs are for material/subcontract costs. For significant subcontract costs, the BOE indicates that the cost estimates are based on historical experience, existing contracts, or discussions with subcontractors regarding the scope and cost of future studies.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   Anomalies detected during other closure activities increase the need for additional resourcing for actinide issue evaluation and studies, driving both cost and schedule.

   RFCA requirements drive the nature and level of effort required for migration studies. Any changes to RFCA application will affect the scope and direction of the activities under this WBS.

5. *Resources (number and types) are identified and properly allocated.*

   The BOE provides significant detail regarding anticipated resource requirements.

WBS Assumptions and Risks

Principal assumptions for this WADlet are that:

- Modeling and evaluations meet the data and information needs of the other closure project elements, including engineering and design elements.

- Other schedules which require input from the Actinide Migration Group do not incur significant change.
- Decisions relative to critical path items will be made as necessary with the data in hand at that time.
- RFCA and compliance limits will not change.

Key project managers indicate that the relative level of risk to this WBS scope of work, schedule and cost will likely decrease over time, as more definitive modeling and quantitative targets are achieved with data collection and site experience. However, the continued principal risk to this WBS is the potential for discovery of additional contamination sources, or anomalies in areas not yet fully characterized. Such incidents may serve to change the focus of actinide migration evaluation efforts in order to assess impacts to downstream water quality. This creates the potential for cost and resource impacts to the LOE profile of this WBS.

PBD-001 / WAD-083 / WBS 1.1.03.08.03.01, Buffer Zone Plumes
Total Life Cycle Costs: $6,080,561

The scope of this WBS includes the installation and/or continued monitoring of passive groundwater collection and treatment systems for the East Trenches, Solar Ponds, Present Landfill, Mound, and Industrial Area groundwater contaminant plumes. In addition, this WBS provides for the monitoring of the 881 Hillside, 903 Pad/Ryan's Pit, Carbon Tetrachloride, Original Landfill, and PU&D groundwater plume natural attenuation remedies.

Summary Findings

Ten groundwater plumes have been identified at the site, and several of these will require remediation. Under this WBS, a number of low technology passive or low maintenance collection and treatment systems will be installed, including collection trenches and in-situ reactive treatment systems are planned.

The planned treatment approach for several of these plumes will consist only of natural attenuation and continued monitoring. While these approaches involve relatively little total cost, there are potentially significant associated cost risks, since natural attenuation as a final groundwater plume remedy has not yet been approved by the appropriate regulatory agencies. Currently, there are no cost or schedule activities that encompass alternative or contingency approaches if the regulatory agencies ultimately disapprove natural attenuation.

Schedule

According to the WAD Fiscal Year Baseline Statements of Work, a bulk of the installation of the passive collection and remediation systems are scheduled to occur in FY99, including the systems related to the East Trenches and Solar Ponds. The remainder of the major installation

activities will occur in FY04, including the reactive barrier walls for the Industrial Area plume. These activities are consistent with the baseline schedule for this WBS.

Costs

1. *The cost of the project is integrated with the schedule and appears to be reasonable.*

   Eighty-three percent (83%) of the total life cycle costs of this WBS are estimated to occur in FY99 and FY04, reflecting the installation of the primary passive collection and treatment systems. The remainder of the BWS costs are estimated at less than $200,000 per year for plume maintenance activities. This is consistent with the overall schedule of activities for the WBS and the scope of activities outlined in the WAD description.

   A total of 37% of total life cycle costs are tied to two construction activities related to the installation reactive barrier walls for two plumes, occurring in FY99 and FY04. This is consistent with the overall project schedule.

2. *The estimating methodology is generally sound and reflects the environment in which the project is being conducted.*

   Approximately 40% of the WBS costs are for FY99 costs and are based on vender quotes. The balance of the out-year costs are based mostly on estimator's experience, but for the larger line items reviewed, the estimator has utilized data from current vender quotes to support the estimates. Generally, the estimating methodology is sound and reflects the environment in which the project is being conducted.

3. *The bases of cost estimates are reasonable and at the appropriate level of detail.*

   The out-year costs are based mostly on estimator's experience, but for the larger line items reviewed, the estimator has utilized data from current vender quotes, historical data, and trade publication data. Generally, the BOE provides the appropriate level of detail in support of the cost estimates.

4. *The uncertainty of the work has adequately been addressed and factored into the planning. Factors affecting cost risks have been identified and are being managed (including cost risks that result from schedule risks).*

   There are no cost or schedule activities that encompass alternatives or contingency remedy approaches if the regulatory agencies ultimately disapprove natural attenuation.

5. *Resources (number and types) are identified and properly allocated.*

   The BOE provides significant detail regarding anticipated resource requirements.

WBS Assumptions and Risks

This WBS assumes that natural attenuation will be acceptable to the appropriate regulatory agencies as a final remedy for a number of the plumes identified at the site. To date, regulatory agencies have not approved this approach. The risk associated with this issue resides in the apparent lack of alternative or contingency approaches to remediation if the agencies ultimately disapprove natural attenuation. There does not appear to be risk considerations within the WBS cost or schedule for development of alternatives for these plumes.

The viability of natural attenuation as a final groundwater plume remedy is related to the results of the ongoing Actinide Migration Evaluation program, and determination of contaminant levels protective of downstream water quality. It is conceivable that a natural attenuation remedy for some contaminant plumes will not achieve the levels established by that program.

Name	Company	Title	Topic	Date of Interview
Brakken, Kent *(with Norma Castaneda and John Stover)*	DOE	POC, PBD-001	PBD-001, Buffer Zone Closure	TBD (K. Brakken to schedule meeting w/ N. Castaneda & J. Stover)
Castaneda, Norma *(with Kent Brakken)*	DOE	PCO, PBD-013	PBD-013, Closure Caps Project	TBD
Hicks, Dave	DOE	Lead	SNM Shipping	8/3/99
Higley, Jeffery	DOE	WADlet Manager, Operate Dry/Shpaes Repackaging	Stabilization Process	8/11/99
Hill, Gail	DOE	POC-RFCA	RFCA Process/Milestones	8/5/99
Keenan, Kevin	DOE	Lead	PuSPS	8/4/99
Kehler, Kurt	DOE	WAD Manager PUSPS	PUSPS	8/05/99
Moore, Gregg	DOE	Sponsor	Informal	7/29/99
Primack, Bill	DOE	Building 779 Project Manager	Informal	8/3/99
Tower, Steve	DOE	FDCM Expert	Informal	8/3/99
Tyler, Reg	DOE	POC, PBD 002	PBD 002, Waste Management	8/2/99
Yonts, Mary	DOE	Analyst	Financial Reporting	8/9/99
Allen, Bob	Kaiser-Hill	HR (salaried v. hourly)	Operations Management & Risk	8/99
Anderson, Scott	Kaiser-Hill	TRU/TRM Waste	PBD 002, Waste Management	8/4/99
Anderson, Sheldon	Kaiser-Hill	Project Management	Deactivation	8/04/99
Boyd, Wally	Kaiser-Hill	Analyst/Scheduler	B707	7/29/99
Bradley, Jeff	Kaiser-Hill	Deputy Wad Mgr. 002	PBD 002, Waste Management	8/4/99
Butler, Lane	Kaiser-Hill	ER	RFCA/ER	8/5/99

Name	Company	Title	Topic	Date of Interview
Butler, Lane *(with Bob Nininger)*	Kaiser-Hill	WAD Manager for 083, Buffer zone ER Project. Also, Mgr for PBD-013 and WAD Mgr for 023, Closure Cap Projects. Also, WBS Mgr for multiple WADlets of interest.	Wetlands Conversion Project; Misc. Inner Buffer Zone IHSS Rem/Deposition; Old Sanitary Landfill Closure; Buffer Zone Plumes; Pad Remediation; New Closure Caps; Industrial Area Regrade & Revegetate; Sitewide Road & Asphalt Removal	8/5/99
Carlson, Ron	Kaiser-Hill	Manager, PBD 020, Building 444 Project Manager	B881, D&D Estimate	8/24/99 8/13/99
Dart, Bob	Kaiser-Hill	WADlet Manager, SNM Shipping	SNM Shipping	8/12/99
Davis, Gary	Kaiser-Hill	Building 771 Estimator	D&D Estimate	8/4/99
Dayton, Christine	Kaiser-Hill	WBS Manager, Actinide Migration	Technical scope of Actinide Migration Program	8/3/99
Floerke, James	Kaiser-Hill	Manager, PBD 016	B371	7/21/99
Foster, Kirk	Kaiser-Hill	Operations	Building Ops	8/3/99
Gianti, Sam	Kaiser-Hill	Performance	Waste Uncertainty	8/99
Grow, Bob	Kaiser-Hill	Subcontractor to develop FDCM	D&D Estimate	7/28/99
Hahn, Scott	Kaiser-Hill	Sanitary Waste	PBD 002, Waste Management	8/4/99
Hill, Michael	Kaiser-Hill	Lead Analyst	B371	7/14/99, 7/15/99
Hill, Mike	Kaiser-Hill	Lead Analyst	Schedule overview; Planning & Integration	8/5/99
Hutchins, Ned	Kaiser-Hill		D&D Estimate	7/27/99
Kennedy, Colburn	Kaiser-Hill	LLW/LLMW Waste	PBD 002, Waste Management	8/4/99
LaHoud, Russ	Kaiser-Hill	POC, Integration of Waste Mgt. Activities	PBD 002, Waste Management	8/4/99
Larsen, Brian	Kaiser-Hill	Building 771 Project Manager	D&D Estimate	8/4/99
Lorance, Randy	Kaiser-Hill	Scheduler	B771	8/9/99

Name	Company	Title	Topic	Date of Interview
Majestic, Joe	Kaiser-Hill	Project Management	Deactivation	8/4/99
Meins, Tina	Kaiser-Hill	Analyst/Scheduler	WAD 13, 59 / PUSPS	7/15/99, 7/21/99, 7/27/99,8/12/99
Nininger, Bob *(with Lane Butler)*	Kaiser-Hill	Manager, PBD-001, Buffer Zone Closure Also, WAD Mgr for WAD-001	Wetlands Conversion Project Const.; Controls & Mitigating Measures; Misc. Inner Buffer Zone IHSS Rem/Disposition	8/5/99
Nixon, Mary	Kaiser-Hill	Analyst/Scheduler	WAD 31	7/15/99, 7/27/99,8/10
Pace, Linda	Kaiser-Hill	Manager	Project Controls, General	7/14/99
Pizzuto, Vic	Kaiser-Hill	Manager, PBD 018	B771/774	8/9/99
Shelton, David	Kaiser-Hill	VP – Sitewide Compliance	RFCA Process	8/4/99
Tasset, Gerry	Kaiser-Hill	Resource Planning	Operations Management & Risk	8/3/99
Telesmanich, Beth	Kaiser-Hill	Lead Analyst	Waste Management	7/14/99, 7/20/99
Walker, Randy	Kaiser-Hill	Manager, PBD 019	B776/777	7/28/99
Walker, Randy	Kaiser-Hill	Building 777/776 Project Manager	D&D Estimate	8/12/99
Warthur, Bob	Kaiser-Hill	Training	Operations Management & Risk	8/99
White, Paul	Kaiser-Hill	Scheduler, PBD 019	B776/777	7/28/99
White, Paul	Kaiser-Hill	Building 777/776 Estimator	D&D Estimate	8/12/99
Whiting, John	Kaiser-Hill	Building 779 Project Manager	D&D Estimate	8/19/99
Karas, Ted	LATA	Project Manager	Stabilization Process	8/11/99
Scott, Gary	PCA	Analyst	Stabilization Process	8/11/99

Acronyms and Abbreviations

AB – Authorization Basis
ABC – Activity Based Cost
ACWP – Actual Cost of Work Performed (Actuals)
ASP – Activity Screening Process
AWP – Annual Work Plan
BCP – Baseline Change Proposal
BCWP – Budgeted Cost of Work Performed (Earned Value)
BCWS – Budgeted Cost of Work Scheduled (Budget)
BEST – Basis of Estimate Tool
Bldg – Building
BOE – Basis of Estimate
CAB – Citizens Advisory Board
CAD – Corrective Action Decision
CAMU – Corrective Action Management Unit
CAT – Category (quantity level of SNM)
CBA – Collective Bargaining Agreement
CDPHE – Colorado Department of Public Health and Environment
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (the "Superfund" Law)
CHWA – Colorado Hazardous Waste Act
CPB – Closure Project Baseline
CPBT – Closure Project Baseline Schedule
CPM – Critical Path Method (Schedule)
CSS – Rocky Flats Closure Site Services
CV – Cost Variance (BCWP-ACWP)
CWB – Current Working Baseline
CWRF – Centralized Waste Reduction Facility
D&D – Deactivation & Decommissioning
DCI – DynCorp of Colorado Inc.
DI&ET – DynCorp Information & Engineering Technology
DNFSB – Defense Nuclear Facilities Safety Board
DOE – Department of Energy
DOE RFFO – Department of Energy Rocky Flats Field Office
DOP – Decommissioning Operations Plan
ECATS – Environmental Compliance Action Tracking Systems
ECOR – Estimated Cost and Obligations Reporting
EIS – Environmental Impact Statement
EMSS – Expanded Management Summary Schedule
EPA – Environmental Protection Agency
ER – Environmental Restoration
eU – Enriched Uranium
F&A – Finance & Administration
FDCM – Financial Disposition Cost Model
FFCA – Federal Facilities Compliance Act

FTE – Full Time Employee
FY – Fiscal Year
IAEA – International Atomic Energy Agency
I&ET – DynCorp Information & Engineering Technology
ICCB – Internal Change Control Board (K-H chaired)
IHSS – Individual Hazardous Substance Site
IMC – Integrating Management Contractor
IM/IRA – Interim Measures/Interim Response Actions
ISM – Integrated Safety Management
ISMS – Integrated Safety Management System
IWCP – Integrated Work Control Program
K-H – Kaiser-Hill
LANL – Los Alamos National Laboratory
LCB – Life-Cycle Baseline
LLMW – Low Level Mixed Waste
LLNL – Lawrence Livermore National Laboratory
LLW – Low Level Waste
LOE – Level of Effort
MAA – Material Access Area
M&I – Management & Integrating
MSC – Milestone Sequence Chart
MSS – Management Summary Schedule
NA – No Action
NDA – Non-Destructive Assay
NEPA – National Environmental Policy Act
NFA – No Further Action
NMED – New Mexico Environmental Division
NPDES – National Pollution Discharge Elimination System
NTS – Nevada Test Site
OBS – Organizational Breakdown Structure
P&I – Planning & Integration (K-H Organization)
PA – Protected Area
PAAA – Price Anderson Amendment Act
PAD – Project Authorization Document
PAM – Proposed Action Memorandum
PBD – Project Baseline Description
PBS – Project Baseline Summary
PBIMC – Performance Based Integrating Management Contract
PCS – Project Control System
PEP – Project Execution Plan
PIDAS – Perimeter Intrusion Detection and Assessment System
PLA – Project Labor Agreement
PM – Performance Measures
PMP – Project Management Plan
PMBOK – Project Management Book of Knowledge
POA – Plan of Action

POC – Point of Contact
PTS – Progress Tracking System
PuSPS – Plutonium Stabilization and Processing System
RCRA – Resource Conservation and Recovery Act
R&D – Research & Development
RFCA – Rocky Flats Cleanup Agreement
RFCP – Rocky Flats Cleanup Plan
RFETS – Rocky Flats Environmental Technology Site
RF – Rocky Flats
RFFO – Rocky Flats Field Office
RMRS – Rocky Mountain Remediation Services, L.L.C
ROD – Record of Decision
RR – Readiness Review
RRWRF – Remote Robotic Waste Reduction Facility
RSALOP – Radio Nuclide Soil Action Level Oversight Panel
RSOP – RFCA Standard Operation Protocol
S&S – Safeguards & Security
SCCB – Site Change Control Board (RFFO Chaired)
SISMP – Site-wide Integrated Safety Management Plan
SME – Subject Matter Expert
SNM –Special Nuclear Material
SOW – Statement of Work
SRS – Savannah River Site
SS&C – Sand, Slag & Crucible
SS&E – Safety Systems & Engineering
SSOC – Safe Sites of Colorado, L.L.C.
SSSO&I – Safeguards, Security, Site Operations and Integration
STP – Site Treatment Plant
SV – Schedule Variance (BCWP-BCWS)
TRUM/TRM – Transuranic Mixed
TRU – Transuranic
TRUPACT – Shipping Container for TRU waste being shipped to the Waste Isolation Pilot Plant (WIPP)
TSCA – Toxic Substance Control Act
TSIS – Temporary Sludge Immobilization System
UBC – Under Building Contamination
WAD – Work Authorization Document (contractual agreement between RFFO and K-H)
WADlet – Subdivision of a WAD
WBS – Work Breakdown Structure
WGISF – Waste Generation, Inventory, and Shipping Forecast
WIPP – Waste Isolation Pilot Plant
WM – Waste Management
WPD – Work Proposal Document (precursor to WAD documents)
WSLLC – Wackenhut Services, L.L.C

Waste Generation, Inventory and Shipping Forecast

Reported as End FY Volumes
(m3)

LLW	Start	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	Total
D&D Totals		3,065	833	1,274	5,973	6,445	10,593	13,205	0	41,388
ER Totals		62	0	0	22,951	19,790	1,920	21,888	15,270	81,880
Residue Totals		266	362	100	15	0	0	0	0	743
Facility OPs/Pre D&D		1,218	612	563	514	465	308	229	290	4,199
Total Generation		4,611	1,806	1,937	29,453	26,700	12,820	35,322	15,560	128,209
Legacy/Backlog/Reject Workoff	9,285	1,968	1,647	2,251	2,085	1,188	944	231	615	10,928
Inventory Onhand	9,505	14,116	13,292	11,179	35,995	43,338	27,229	42,292	33,949	
Shippable Inv	220	3,595	6,574	6,425	19,356	28,929	20,258	24,029	33,962	
Funded Capacity		2,630	4,050	4,638	19,500	29,500	20,500	23,904	34,050	
Total Shipping		2,630	4,050	4,638	19,356	28,929	20,258	23,904	33,962	137,727
Ending Inventory	9,505	11,486	9,242	6,542	16,638	14,409	6,971	18,389	0	

LLM	Start	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	Total
D&D Totals		23	20	61	386	511	1,632	3,872	0	6,504
ER Totals		0	0	0	3,321	120	1,178	7,670	19,283	31,572
Residue Totals		7	0	0	0	0	0	0	0	7
Facility OPs/Pre D&D		198	162	149	136	123	81	79	77	1,005
Total Generation		227	182	210	3,843	754	2,892	11,621	19,359	39,088
Existing Waste Workoff	5,588	731	2,387	315	671	581	485	418	0	5,588
Inventory Onhand	10,958	11,185	5,663	3,334	6,120	4,295	4,455	13,709	25,170	
Shippable Inv	5,370	6,227	3,099	1,075	2,714	3,015	2,591	7,898	25,170	
Funded Capacity		5,704	2,538	1,058	2,579	2,732	2,367	14,500	25,400	
Total Shipping		5,704	2,538	1,058	2,579	2,732	2,367	7,898	25,170	50,046
Ending Inventory	10,958	5,481	3,125	2,276	3,541	1,563	2,088	5,811	0	

Sanitary (Tons)	Start	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	Total
D&D Totals		990	875	933	119	0	11,599	32,053	16,563	63,133
ER Totals		0	0	0	0	0	0	0	0	0
Residue Totals		0	0	0	0	0	0	0	0	0
Facility OPs/Pre D&D		1,346	1,176	1,176	1,176	1,176	1,176	1,176	1,176	9,578
Total Generation		2,336	2,051	2,109	1,295	1,176	12,775	33,229	17,739	72,711
Existing Waste Workoff		0	0	0	0	0	0	0	0	0
Inventory Onhand		2,336	2,051	2,109	1,295	1,176	12,775	33,229	17,739	
Shippable Inv		2,336	2,051	2,109	1,295	1,176	12,775	33,229	17,739	
Funded Capacity		5,000	5,000	5,000	5,000	5,000	13,000	34,000	18,000	
Total Shipping		2,336	2,051	2,109	1,295	1,176	12,775	33,229	17,739	72,711
Ending Inventory	0	0	0	0	0	0	0	0	0	

TRU/TRM	Start	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	Total
D&D Totals		370	850	1,440	1,495	1,871	929	759	0	7,714
ER Totals		0	0	0	0	0	0	0	0	0
Residue Totals		1,075	2,715	419	45	0	0	0	0	4,255
Facility OPs/Pre D&D		52	17	16	15	14	10	0	0	124
WM Backlog Workoff		0	40	108	53	53	53	51	0	358
Total Generation		1,497	3,622	1,984	1,608	1,938	992	810	0	12,451
Existing Waste Workoff	1,503	93	239	286	264	263	263	96	0	1,504
Inventory Onhand	1,816	3,313	6,835	7,819	7,427	5,965	3,557	1,533	483	
Shippable Inv	313	778	3,886	5,799	5,870	4,506	2,834	1,534	484	
Funded Capacity		100	1,000	2,000	3,400	3,400	3,400	1,050	600	
Total Shipping		100	1,000	2,000	3,400	3,400	2,834	1,050	484	14,268
Ending Inventory	1,816	3,213	5,835	5,819	4,027	2,565	723	483	(0)	

July 30, 1999
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Revision 3

R. Lahoud
Rainbow 2006 30Jul99.xls

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Inventory, Generation, and Shipping
By Project
Summary Detail

All values in m^3 except individual container forecasts

LLW (m3)	Starting Inv.	FY99 1st	FY99 2nd	FY99 3rd	FY99 4th	FY00 1st	FY00 2nd	FY00 3rd	FY00 4th	FY01	FY02	FY03	FY04	FY05	FY06	Totals
D&D		229	239	1,678	919	304	234	180	113	1,274	5,973	6,445	10,593	13,205	0	41,388
ER Totals		62	0	0	0	0	0	0	0	0	22,951	19,790	1,920	21,888	15,270	81,880
Residue Totals		56	42	75	93	96	97	100	68	100	15	0	0	0	0	743
Facility Ops/Pre D&D		500	350	212	157	153	153	153	153	563	514	465	308	229	290	4,199
Gen. Std. Packagings		785	631	1,965	1,168	553	485	434	335	1,937	6,502	6,910	10,901	13,434	290	46,329
Gen. Bulk Packagings		62	0	0	0	0	0	0	0	0	22,951	19,790	1,920	21,888	15,270	81,880
Total Generation		847	631	1,965	1,168	553	485	434	335	1,937	29,453	26,700	12,820	35,322	15,560	128,209
Newly Generated Rejects		39	32	98	58	28	24	22	17	97	325	346	545	0	0	1,630
Rejected from Tech. Review		0	155	123	73	53	70	53	53	595	490	595	517	0	0	2,775
Amount for Admin. NCR		8	6	20	12	6	5	4	3	19	65	69	109	0	0	326
Amount for Repackaging		31	180	201	120	75	89	70	66	672	750	871	953	0	0	4,079
Total Starting Inventory	9,505		14,116				13,292			11,179	35,995	43,338	27,229	42,292	33,949	
Inventory Std. Waste Packaging	9,505		14,054				13,230			11,168	13,044	12,073	15,415	19,445	7,735	
Inventory Bulk Waste Packaging	0		62				62			12	22,951	31,265	11,815	22,847	26,214	Balance
Legacy/Backlog/Reject Waste Workoff	9,285	305	338	1,068	257	652	230	363	403	2,251	2,085	1,188	944	231	615	(1,643)
Needs Profiling	606	305	272			29										0
Profiled - in process	1,440					100	100	150	150	450	490					0
Profiled - Tech. Review	3,964		221	175	104	75	100	75	75	850	700	850	739			0
Administrative NCRs	225							30	30	165	160	80	34	46	257	(377)
Treat	106									50	56					0
Pre-92 Legacy	2,014															2,014
Post 92 Backlog to Repackage	529															529
Repackage Offsite	0			628	180	400										(1,208)
Repackage Onsite	401			387	46	100	100	160	200	1,331	1,169	853	688	185	358	(5,176)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Total Shippable Inv.	220		3,595				6,574			6,425	19,356	28,929	20,258	24,029	33,962	
Shippable Std. Waste Package Inv.	220		3,533				6,512			6,413	7,881	7,559	9,404	12,126	7,748	
Shippable Bulk Waste Package Inv.	0		62				62			12	11,476	21,370	10,855	11,904	26,214	
Funded Shipping Capacity (Total)			2,630				4,050			4,638	19,500	29,500	20,500	23,904	34,050	
Funded Capacity Std. Waste Package			2,630				4,000			4,626	8,000	8,000	9,500	12,000	7,800	Risk
Funded Capacity Bulk Waste Package			0				50			12	11,500	21,500	11,000	11,904	26,250	100%
Total Shipping			2,630				4,050			4,638	19,356	28,929	20,258	23,904	33,962	137,727
Std. Waste Package Shipping			2,630				4,000			4,626	7,881	7,559	9,404	12,000	7,748	
Bulk Waste Package Shipping			0				50			12	11,476	21,370	10,855	11,904	26,214	
Ending Inventory	9,505		11,486				9,242			6,542	16,639	14,409	6,971	18,389	0	
Ending Inventory Std. Waste Packaging			11,424				9,230			6,542	8,163	4,514	6,011	7,445	0	
Ending Inventory Bulk Waste Packaging			62				12			0	11,476	9,895	960	10,944	0	
Newly Generated LLW to NDA/RTR		620	685	1,052	344	733	609	950	654	3,856	6,105	5,616	23,120	595	648	45,587
Newly Generated LLW to Direct Shipment		88	181	319	276	242	211	430	300	5,740	27,054	21,631	10,473	35,682	15,270	117,896

LLM (m3)	Start Inv	FY99 1st	FY99 2nd	FY99 3rd	FY99 4th	FY00 1st	FY00 2nd	FY00 3rd	FY00 4th	FY01	FY02	FY03	FY04	FY05	FY06	Totals
D&D Totals		5	10	8	0	5	2	1	12	61	386	511	1,632	3,872	0	6,504
ER Totals		0	0	0	0	0	0	0	0	0	3,321	120	1,178	7,670	19,283	31,572
Residue Totals		0	0	7	0	0	0	0	0	0	0	0	0	0	0	7
Facility Ops/Pre D&D		104	7	45	42	41	41	41	41	149	136	123	81	79	77	1,005
Gen. Std. Packagings		109	17	60	42	46	43	42	52	210	522	634	1,714	3,951	77	7,516
Gen. Bulk Packagings		0	0	0	0	0	0	0	0	0	3,321	120	1,178	7,670	19,283	31,572
Total Generation		109	17	60	42	46	43	42	52	210	3,843	754	2,892	11,621	19,359	39,088
Backlog Waste Workoff	5,588	150	0	3	578	2,362	0	25	0	315	671	581	485	418	0	5,588
Containerized LLM for Treatment	2,905			3	578	118		25		222	573	483	485	418	0	2,905
Repackage Onsite	234									78	78	78				234
Administrative NCRs	55									15	20	20				55
Pond Sludge	2,394		150				2,244									2,394
Total Starting Inventory	10,958		11,185				5,663			3,334	6,120	4,295	4,455	13,709	25,170	
Inventory Std. Waste Packaging	8,564		8,791				3,419			3,334	2,798	2,432	2,950	5,242	2,052	
Inventory Bulk Waste Packaging	2,394		2,394				2,244			0	3,321	1,862	1,504	8,466	23,118	
Total Shippable Inv.	5,370		6,227				3,099			1,075	2,714	3,015	2,591	7,898	25,170	
Shippable Std. Waste Package Inv.	5,370		6,077				855			1,075	1,053	1,212	1,675	3,267	2,052	
Shippable Bulk Waste Package Inv.	0		150				2,244			0	1,661	1,802	915	4,631	23,118	
Funded Shipping Capacity (Total)			5,704				2,538			1,058	2,579	2,732	2,367	14,500	25,400	
Funded Capacity Std. Waste Package			5,554				294			1,058	1,000	1,196	1,659	4,000	2,200	Risk
Funded Capacity Bulk Waste Package			150				2,244			0	1,579	1,536	708	10,500	23,200	100%
Total Shipping			5,704				2,538			1,058	2,579	2,732	2,367	7,898	25,170	50,046
Std. Waste Package Shipping			5,554				294			1,058	1,000	1,196	1,659	3,267	2,052	
Bulk Waste Package Shipping			150				2,244			0	1,579	1,536	708	4,631	23,118	
Ending Inventory	10,958		5,481				3,125			2,276	3,541	1,563	2,088	5,811	0	
Ending Inventory Std. Waste Packaging			5,237				3,125			2,276	1,798	1,236	1,251	1,978	0	
Ending Inventory Bulk Waste Packaging			244				0			0	1,743	326	796	3,833	0	
Newly Generated LLM to NDA/RTR		108	22	53	42	48	41	54	52	291	414	381	1,819	1,714	77	5,114
Newly Generated LLM to Direct Shipment		152	117	1	0	2,318	71	277	276	3,131	3,407	197	1,952	11,464	19,283	42,645

Sanitary (Tons)	convert: m3/ton	FY99 1st	FY99 2nd	FY99 3rd	FY99 4th	FY00 1st	FY00 2nd	FY00 3rd	FY00 4th	FY01	FY02	FY03	FY04	FY05	FY06	Totals Tons	Totals Meters
D&D Totals SAN	0.51	0	0	682	308	875	0	0	0	933	119	0	11,599	32,053	16,563	63,133	33,416
ER Totals SAN		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Residue Totals SAN		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Facility Ops	10.191	369	389	294	294	294	294	294	294	1,176	1,176	1,176	1,176	1,176	1,176	9,578	97,609
Total Generation		369	389	976	602	1,169	294	294	294	2,109	1,295	1,176	12,775	33,229	17,739	72,711	131,026
Existing Waste Workoff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Inventory Onhand	0		2,336				2,051			2,109	1,295	1,176	12,775	33,229	17,739	Risk	
Shippable Inv	0		2,336				2,051			2,109	1,295	1,176	12,775	33,229	17,739	100%	
Funded Capacity			5,000				5,000			5,000	5,000	5,000	13,000	34,000	18,000		
Total Shipping			2,336				2,051			2,109	1,295	1,176	12,775	33,229	17,739	72,711	131,026
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TRU/TRM (m3)	Start Inv	FY99 1st	FY99 2nd	FY99 3rd	FY99 4th	FY00 1st	FY00 2nd	FY00 3rd	FY00 4th	FY01	FY02	FY03	FY04	FY05	FY06	Totals
D&D Totals TRU/TRM	0	76	67	99	128	233	149	297	171	1,440	1,495	1,871	929	759	0	7,714
ER Totals TRU/TRM		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residue Totals TRU/TRM	0	169	66	152	688	801	801	728	386	419	45	0	0	0	0	4,255
Facility Ops/Pre D&D	0	28	14	2	9	4	4	4	4	16	15	14	10	0	0	124
Waste Management - Backlog Workoff		0	0	0	0	0	0	20	20	108	53	53	53	51	0	358
Total Generation		273	147	253	824	1,038	954	1,049	581	1,984	1,608	1,938	992	810	0	12,451
Backlog Waste Workoff	1,503	22	23	23	24	42	49	74	74	286	264	263	263	96	0	1,504
WIPP Characterization - Ready	684	22	22	22	22	42	42	42	42	110	133	81	58	45		684
B440 Repack	358							20	20	108	53	53	53	51		358

M. Shepard
RMRS Waste Ops.

8/4/99 2:48 PM
Summary Detail
Rainbow 2006 30Jul99.xls

Residue Generation (drums)

(all values in # of drums)

Project			3Q99	4Q99	1Q00	2Q00	3Q00	4Q00	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	# Drums	(m^3)	# Drums	(m^3)	# Drums	(m^3)
[redacted]	Salts	1° TRU (preassayed/secure store)	550	1050	1280	1350	1350	60	0	0	0					5640	1181.6				
		1° TRM (preassayed/secure store)	0	0	0	0	0	0	0	0	0					0	0.0				
		1° TRU (preassayed/nonsecure)	0	0	0	0	0	0	0	0	0					0	0.0				
		1° TRM (preassayed/nonsecure)	0	0	0	0	0	0	0	0	0					0	0.0				
		2° TRU	36	78	78	80	80	10	0	0	0					362	75.8				
		2°TRM	0	0	0	0	0	0	0	0	0					0	0.0				
		2° LLW	30	150	150	164	164	6								664	139.1				
		Subtotal TRU/TRM	616	1278	1508	1594	1594	78	0	0	0					6888	1396.5	6002	1257.4	0	0.0
	Dry Repackaging	1° TRU Pipes (preassayed/secure store)	30	45	277	133	133	0	3	0	0					621	130.1				
		1° TRU (preassayed Cans/secure store)	7	39	96	28	66	28	11	0	0					275	57.6				
		1° TRM Pipes (preassayed/secure store)	0	0	0	245	0	0	75	0	0					320	67.0				
		1° TRM (preassayed Cans/secure store)	0	0	3	48	0	2	7	0	0					60	12.6				
		1° TRU (bags/secure store)	0	0	7	14	80	74	25	0	0					200	41.9				
		1° TRM (bags/secure store)	0	0	7	127	0	0	2	0	0					136	28.5				
		2° TRU	35	24	85	135	101	64	10	0	0					454	95.1				
		2°TRM	0	0	0	0	0	0	0	0	0					0	0.0				
		2° LLW	5	12	36	38	27	18	34	0	0					170	35.6				
		Subtotal TRU/TRM	72	108	475	730	380	188	133	0	0					2086	432.8	1550	324.7	516	108.1
	Ash/Agglomeration	1° TRU (preassayed/secure store)	164	93	92	0	0	0	6	0	0					355	74.4				
		1° TRM (preassayed/secure store)	26	1050	1050	1050	1050	1050	560	0	0					5836	1222.6				
		1° TRU (preassayed/nonsecure)	0	0	0	0	0	0	0	0	0					0	0.0				
		1° TRM (preassayed/nonsecure)	0	0	0	0	0	0	0	0	0					0	0.0				
		2° TRU	72	167	167	92	92	92	44	0	0					726	152.1				
		2°TRM	0	39	144	144	144	144	71	0	0					686	143.7				
		2° TRU (Sand, Slag and Crucible)														0	0.0				
		2° LLW	3	179	195	202	202	202	99	0	0					1082	226.7				
		Subtotal TRU/TRM	265	1528	1648	1286	1286	1286	681	0	0					7980	1671.6	1081	226.5	6922	1368.4
	Wet/Combustible	1° TRU (secure store)	88	125	125	84	94	162	206	132	112	31	0	38	0	1197	250.8				
		1° TRM (secure store)	0	125	125	15	0	0	30	86	92	97	99	42	0	711	149.0				
		1° TRM Pipes (secure store)			0	94	117	100	100	100						511	107.1				
		1° TRU (nonsecure)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0				
		1° TRM (nonsecure)	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2				
		2° TRU	11	40	40	35	19	32	41	26	22	6	0	8	0	281	58.9				
		2°TRM	3	40	40	22	23	20	26	37	18	19	20	8	0	277	58.1				
		2° LLW	5	100	75	59	84	100	126	84	82	51	40	32	0	838	175.5				
		Subtotal TRU/TRM	103	330	330	250	253	314	403	382	245	154	119	96	0	2878	624.0	1476	309.6	1500	314.3
	Gas Gen. Test	1° TRU (nonsecure) - Dry/Repack	61	82	68											211	44.2				
		1° TRM (nonsecure) - Dry/Repack	13	11	12											36	7.5				
		1° TRU (nonsecure) - Wet/Combustible	54	125												179	37.5				
		1° TRM (nonsecure) - Wet/Combustible	7	25												32	6.7				
		2° TRU	0													0	0.0				
		2°TRM	0													0	0.0				
		2° LLW	0													0	0.0				
		Subtotal TRU/TRM	135	243	80	0	0	0	0	0	0	0	0	0	0	458	96.0	380	81.7	68	14.2
[redacted]			1191	3487	4041	3860	3513	1844	1217	382	245	154	119	96	0	20148	4229				
[redacted]			1108	1868	2315	1951	2015	522	346	158	134	37	0	46	0	10501	2200				
[redacted]			50	1290	1381	1745	1334	1316	871	223	110	118	119	50	0	8606	1803				
[redacted]			43	441	456	483	477	326	259	84	82	51	40	32	0	2754	576.9				

interview process, programmatic risk was assessed for each PBD; the results are provided in Attachment 4.

2. **Basis of Schedule Estimate**: This evaluation standard, provided in Table 1, is a matrix that categorizes the schedule estimating methodology used by the RFETS project management organization. Discussed in more detail in Section 4, the basis of schedule estimate is the major consideration when evaluating the level of risk (i.e., uncertainty) within a project's schedule.

Table 1: Basis of Schedule Estimate

Category	Description
Historical Performance	This category is assigned if the schedule duration for an activity is based on historical performance of similar project activities at RFETS. The schedule estimate must be based on historical performance metrics and/or documented project performance. Schedules that are developed from RFETS historical performance information (e.g., metrics, past performance achievements, etc.) contain minimum uncertainty and present the least risk to completing an activity in accordance with its schedule baseline.
Industrial Standard	This category is assigned if the schedule duration for an activity is based on performance of similar project activities at other Department of Energy locations with similar regulatory and oversight controls. For activities that do not involve radioactive material (e.g., asbestos removal, hazardous waste removal, etc) performance at non-DOE locations may also be used. Schedules that are developed from industrial standards contain little uncertainty and present a moderate risk to completing an activity in accordance with its schedule baseline.
Project Manager's Forecast	This category is assigned if the schedule duration for an activity is based on a combination of objective and subjective estimates by the Kaiser-Hill Project Manager. This category of estimate is developed with objective performance measures from "similar activities" and expert opinion based on RFETS work experience. Schedules that are developed from a Project Manager's Forecast contain substantial uncertainty and present noteworthy risk to completing an activity in accordance with its schedule baseline.
Expert Opinion	This category is assigned if the schedule duration cannot be based on objective performance metrics or performance history. It is used for work activities that have never been achieved before and/or have no objective performance metric information. The schedule duration is based on the subjective opinion of knowledgeable and experienced RFETS workers, supervisors, and managers. Schedules that are developed from Expert Opinion contain significant uncertainty and present significant risk to completing an activity in accordance with its schedule baseline.

The expert opinion method of estimating schedules contains the greatest level of uncertainty. It must be noted that this is not a negative reflection on the knowledge or competency of the RFETS workers or managers, but recognition that all elements of nuclear cleanup work are frequently not known and resolved until the work is ready to start. Readiness assessments, stakeholder interests, DNFSB issues, etc. frequently are not reliably described in terms of their impact on schedule and cost until a particular type of work has been accomplished at least once. At RFETS, much of the clean-up work is "first time" work.

2.2 Schedule Risk Analysis Results

Results of the schedule risk analysis for the RFETS Closure Project Baseline (Closure Date: 2006) are presented in the following sections:

2.2.1 Summary Risk Information:

- (a) RFETS Site Closure
- (b) RFETS Protected Area Closure

2.2.2 Elements of Schedule Risk:

- (a) Risk Element #1:
- (b) Risk Element #2:
- (c) Risk Element #3:
- (d) Risk Element #4:
- (e) Risk Element #5:

Appendix A: Programmatic Risk Scores

Risk Scores	Technological	Work Scope Definition	Inter-Site Dependency
5 (high)	• The technology required to accomplish the planned activity does not exist.	• Project endstate is not determined or supported by stakeholders • Waste/material quantities and characteristics are unknown • Process operations are not identified or supported by stakeholders • Final disposition location for waste/material has not been identified	• Activity involves multiple sites • No concurrence has been reached between sites • Stakeholders are opposed to RFETS involvement in the activity
4	• Development of the technology is only at the laboratory level.	• Project endstate is determined but may be controversial to stakeholders • Process operations are identified but may be controversial to stakeholders • Final disposition location for waste/material has not been identified and approved.	• Activity involves multiple sites, site concurrence has been verbally reached • The Waste Acceptance Criteria (WAC) has not been resolved • No funding has been identified and no schedule for receipt or treatment of the waste/material exists • RFETS involvement may be controversial to stakeholders
3	• Technology is in full-scale development and demonstration.	• Project endstate is determined and is expected to be acceptable to stakeholders • Waste/material quantities and characteristics are broadly known • Process operations are identified and expected to be acceptable to stakeholders • Final disposition location for waste/material has been identified and an EIS is being prepared	• Activity impacts another site, site concurrence has been verbally reached • Receiving facility is reviewing characterization data to determine WAC acceptability • Funding has been identified but no schedule for receipt or treatment of the waste/material exists • RFETS involvement is expected to be acceptable to stakeholders
2	• The required technology has been fully developed and demonstrated at another site with a similar waste/material type.	• Project endstate is determined and supported by stakeholders • Waste/material quantities and characteristics are well known • Process operations are identified and supported by stakeholders • Final disposition location for waste/material has been identified and an EIS ROD is prepared	• Activity doesn't impact another site or site concurrence has been documented if multiple sites are impacted • Receiving facility has verified WAC acceptability • Funding has been identified but no schedule for receipt or treatment of the waste/material exists • RFETS involvement is supported by stakeholders
1 (low)	• Technology has been demonstrated at RFETS on some actual waste/materials and is operationally ready.	• Project endstate is determined and supported by stakeholders • Waste/material quantities and characteristics are well known • Process operations are identified and supported by stakeholders • Final disposition location for waste/material has been identified and an EIS ROD is pending	• Activity doesn't impact another site or site concurrence has been documented if multiple sites are involved • Receiving facility has verified WAC acceptability • Funding is identified in an approved PBS and facility is ready to receive the waste/material • RFETS involvement is supported by stakeholders