Rocky Flats Environmental Technology Site

Draft

Interim End State Plan Task Descriptions

September 21, 1995

EXECUTIVE SUMMARY

The team undertook this task to identify and evaluate options for the stabilization, consolidation, and storage of plutonium and plutonium-bearing materials and recommend a feasible course of action. Of import in this task was defining the best form and storage configuration of the plutonium materials during the Interim End State (IES). The approach to placing materials in the defined storage configuration was considered in light of its effect on other activities required to achieve the IES, such as closure and demolition of facilities.

The purpose of this task is to determine the recommended approach to consolidating and stabilizing plutonium materials in support of implementation of the RFETS IES. The goal of consolidation and stabilization is to place the materials at RFETS in a safe, stable, predictable, and ultimately transportable interim storage configuration, within the IES time frame. Weight was given to the need to achieve a low-cost storage configuration that would allow final disposition of the material without significant additional treatment and associated cost.

The scope of this task is discussed first in terms of the materials to be addressed and second in terms of the approach and constraints employed to conduct the evaluation.

For purposes of this task, RFETS categorized the plutonium materials on the site into four major categories:

1. Plutonium metal, oxides and pits;

2. Plutonium solid residues;

3. Plutonium solutions; and

4. Highly enriched uranium solutions (HEUN).

These materials are stored in seven different facilities at the site (Buildings 371, 707, 771, 776/777, 779 and 886). Amounts of the materials at RFETS are approximately as follows:

1. 6,600 kg plutonium metal;

2. 3,200 kg plutonium compounds;

3. 6,100 kg enriched uranium metal and oxides;

4. 3,100 kg plutonium in 106 metric tons of residues;

5. 140 kg plutonium in 29,000 L of solutions; and

6. 570 kg highly enriched uranium in 2,700 L of solution.

Several principles and constraints were established to guide the implementation of this task. They are critical to defining the breadth of the analysis and constraints placed on the findings. While the intent was to consider a broad range of possibilities, implementation of the recommendations needed to be feasible. The following were established to provide a balance reflecting the need to "think out of the box" yet devise an implementable plan of action in today's environment.

1. Be compatible with the IES strategy. The strategy calls for: (1) a rapid site reconfiguration (i.e. consolidation of plutonium materials by the end of 2000 and demolition of facilities by 2003); (2) a safe, predictable, and low-cost IES; and (3) a reasonable cost for final site closure. This results in a strategy to place plutonium materials into a stable, predictable, low surveillance and maintenance form during the IES, as well as in a form that is able to be directly shipped off site as soon as a final repository is identified.

2. Plan only for activities under the control of RFETS. A key to developing a feasible, implementable approach is to plan for only those items within the control of RFETS. If a required action was outside RFETS control, then an issue was framed and an approach to resolving the issues defined that reflected activities under our control.

3. Plan for the benefit of RFETS and not the complex. Similar to the statement above, to determine the most feasible, implementable option, we had to largely restrict our approach to evaluating the benefit to RFETS and not consider national or social policies and goals. As the plan is refined and developed, these considerations can be taken into account, and likely result in higher costs to the site.

4. Cost/benefit analyses were based on total IES project costs. In many existing studies, cost/benefit comparisons are restricted to the individual elements or programs under analysis. As a result a benefit in cost reduction due to resulting site-wide actions would not be taken into account. Because facility operating costs are a major percentage of current site costs, we aggressively viewed actions that allowed taking facilities down (i.e. eliminating operating and surveillance costs) as positive in reducing site costs and fostering achievement of the IES.

5. Consider but do not be constrained by Regulatory Requirements, 94-1 and the Residue Compliance Order. Much high-quality and useful work has been performed in the development of the Interagency Agreement, the 94-1 implementation plan, and the Residue Compliance Order (Settlement Agreement and Compliance Order on Consent No. 93-04-23-01). However, they were not developed in light of achieving the accelerated interim end state described in this white paper. As a result, the logic and lessons learned in the two efforts were deemed relevant, but did not constrain this effort.

As a result of the IES goals and the guidance noted above, an option evaluation approach was used to evaluate the feasibility of the IES. For each Subtask, a range of options was defined and then compared to each other. The comparison surfaced strengths and weaknesses of each option and allowed a qualitative assessment. Because this was an internal comparison, however, the highest scoring option was often not the one recommended due to recognized difficulties in implementation.

Criteria were developed to evaluate options. The first order criteria were: Cost of Implementation (getting to the IES); Cost of Operation (during the IES); Liability Reduction; Feasibility (implementability); and Probability of Success. The first order criteria were further refined to evaluate each option.

The overall goal of this phase of the white paper is to determine the appropriate logic train and feasibility of pursuing an IES. The approach to evaluating options discussed above is sufficient for this purpose. It does not, however, result in an optimized solution or approach, because the options are a chosen range to allow differentiation and comparison. In almost every case, the optimum solution will be combination of options. Because further refinement of the approach is planned to provide stakeholder input and review, optimization and improved definition of the recommended option will occur in the future.

The recommended course of action for each subtask area is summarized below:

1. Storage - Currently, it is recommended that a new storage facility be used based on the modular casks used in England. This option requires further refinement and evaluation. Because the screening matrix also highly ranks building a new vault, the option will be carried forward for additional evaluation.

2. Staging - Consolidation of material in B371 is the preferred option. It will likely be refined and some staging will occur in buildings where processing occurs, but overall the approach is move material to 371 until the IES storage phase is initiated.

3. SNM (Plutonium Metal, Oxides, and Pits) - The preferred approach for metal and pits is to meet the DOE-STD-3013-94 requirements. The recommendation for oxides is to treat the material beyond the DOE-STD-3013-94 requirements to place them in the most stable, predictable form currently used.

4. Liquid Residues - Continue the current approach to treat solutions in current facilities to create stable, solid residues for storage as SNM, TRU waste and some LLW for disposal. This ongoing program can be completed within the IES time frame.

5. Solid Residues - Solid residues are the most complex of the materials to address. The recommended option includes: (1) treating solid residues to a stable, predictable form; (2) store the treated high plutonium content residues in the SNM storage facility; and (3) store the treated

low plutonium content residues in the waste storage facility(s). Because of the number of types of residues, treatment technologies and storage configurations, this area will require further refinement to optimize a single approach.

6. HEUN - Continue the current approach to ship the HEUN off site for treatment and disposal. Shipment of the materials is planned to be completed by FY97.

Generally terms used in this paper reflect standard definitions used at nuclear facilities. When the term SNM is used it generally refers to plutonium metal, oxides, and pits or components existing at Rocky Flats, as well as high-assay solid residues. Liquid residues generally refers to the liquid plutonium solutions resulting from previous processing activities at the site. Solid residues refer to several forms of material resulting from previous processing activities and is defined further in Subtask 4.

The task team comprised both DOE and contractor RFETS employees. The team was divided and assigned to specific Subtasks as described in the next section. This team was supplemented by a one-day work shop in which experts from other sites joined several DOE and contractor RFETS employees that were not part of the task team to review the project approach and recommended options and provide insight and comment to the task team. This workshop included the following individuals from other DOE facilities: Joe Leary/technical consultant; Paul Cunningham/LANL; Dana Christensen/LANL; Mark Bronson/LLNL; John Duane/SRS.

To accomplish Task 1, six Subtasks were defined and assigned to the team described above as follows.

1. Storage - the location and type of facility or facilities required during the IES period until the final state is achieved.

2. Staging - the sequencing and location of materials while configuring for the IES.

3. SNM (metal and oxides) Stabilization - the approach to placing these materials into a form for storage during the IES period.

4. Liquid Residues Stabilization - the approach to placing these materials into a form for storage during the IES period.

5. Solid Residues Stabilization - the approach to placing these materials into a form for storage during the IES period.

6. HEUN - consistency of the current approach to these materials in light of the IES requirements.

This task describes the activities that are planned to address the large volumes of waste materials that need to be dispositioned in order to successfully realize the goals of the interim end state. A technical team of experts from Kaiser-Hill, the Department of Energy (DOE), and a leading consulting organization with expertise in handling waste forms from nuclear weapons production facilities was assembled to address this task. Proper waste management is essential for worker and public safety, environmental protection, and retention of a suitable range of future landuse and/or economic development options for the site. The diverse array of waste forms existing and yet-to-be generated at the site present special challenges because of the unique hazards, formidable regulatory constraints, and the sheer quantity of materials requiring dispositioning.

The Rocky Flats Environmental Technology Site (Site) currently more than 425 facilities. These (See list in appendix A) include nuclear facilities such as former plutonium processing buildings, administrative/shop/laboratory buildings typical of a large industrial complex, and support/infrastructure buildings (steam plant, sanitary sewage plant, etc.). While most of the buildings, and the related support structures, are not contaminated with radionuclides, some contain stored Special Nuclear Material (SNM), plutonium residues and wastes, and other hazardous materials in addition to radioactivity contaminated equipment, tanks, pipes, gloveboxes, and structure.

The objective of the decommissioning task is to safely either remove or bury all Site facilities except (1) those minimal few which are essential to supporting the Interim End State (IES), or (2) those required, managed and funded by non-IES activities such as Department of Energy (DOE), other Federal, State, local government projects, or by private industry. It is estimated that fewer than five of the current Site buildings will remain after achieving IES. In order to decommission buildings and facilities, it will first be necessary to process and remove all stored SNM/residues/wastes. This activity is part of the plutonium task previously described in Section ___. In some cases, plutonium operations will continue for four or five years, which will affect availability of these buildings for decommissioning. It is, therefore, necessary (for a timely, cost effective decommissioning) to begin a phased deactivation and decommissioning while in portions of building while plutonium stabilization/consolidation work is continuing in other portions. Both plutonium and non-plutonium buildings contain various combinations of classified, non-fissile weapon components/equipment/tooling/documents. Removal of classified and hazardous materials (including depleted uranium, beryllium, and commercial chemicals) is the first step of the decommissioning process. This task is also required, but is more easily accomplished in, non-nuclear facilities. In these nuclear facilities which temporarily continue limited operations, it is very important to reduce the surveillance and maintenance costs to the minimum level required for safety and efficiency. The removal of excess materials and reduction in baseline operating costs are referred to as deactivation.

Upon completion of use and deactivation of nuclear facilities, the other decommissioning processes of decontamination, equipment removal, demolition, entombment, etc. can proceed. These processes are clearly greatly simplified in non-contaminated facilities such as office buildings. However the decommissioning of nuclear facilities must be closely coordinated with the Waste Management Task (No. 2) in order to ensure the necessary waste processing and storage capacities are available when the waste is produced. Additionally, the decommissioning must be coordinated with the Infrastructure Task to ensure the support facilities are not prematurely demolished. While the scope of decommissioning more than 425 facilities is a very complex effort that has not been fully defined, the basic approach is illustrated in Figure 3.1. This sequence and process is described in greater detail in Section 3.2. Once the sequence of facility decommissioning is essentially established, the key question becomes what are the best physical processes to use. While conventional commercial processes are planned for non-contaminated facilities, wide ranges of risk, cost and schedule variations can be encountered depending upon the approach used for nuclear facilities. Table 3.1 lists some of the physically possible options, along with a qualitative comparison of their relative advantages and disadvantages. It must be noted that some of the listed options are rruled out due to their risk, cost, or schedule requirements. They are, however, included to illustrate the need for a wide ranging and unrestricted analytical approach to decommissioning in order to achieve the objectives. Based upon a preliminary analysis on-site and incorporating other DOE and commercial external expertise and experience, decommissioning of nuclear facilities will require various processes and yield a range of demolished, demolished/entombed, and entombed facilities depending upon the building structure, contamination, location, etc.. Some nuclear facilities will be decontaminated and demolished, with the uncontaminated and low-level rubble being placed under the cap which will cover the current protected area. However, underground facilities such as Building 881 could be entombed by filling the building with stabilizing materials such as bentonite, concrete, or dirt and then be capped. This approach may also be appropriate for basements or other underground portions of some facilities. A more comprehensive description of options and a discussion of the preferred option is contained in Section 3.3.

All decommissioning activities must be planned and conducted with full consideration of the risks involved and the appropriate work authorization and control in place. While it is recognized that activities such as demolition inherently pose occupational and environmental risks, these activities can and will be managed to necessary standards. It must also be noted that the do-nothing option (continuing on our current course) will eventually become both the most risky and expensive approach as facilities deteriorate. Section 3.4 describes the proposed methodology to ensuring the work is properly authorized and controlled.

Table 3.2 summarizes the scope, purpose, and assumptions for the Facility Decommissioning Task.

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Table 3.1

Facility Closure options*

Option	Pros	Cons
(1) Maintain operating/safety systems (current mode)	Required for Plutionium Operations	Very expensive. Costs & risks increase as facilities age. Does not support IES.
(2) Turn off utilities, lock doors (walk away option)	Lowest implementation cost	Leaves unacceptable contamination & risk. Does not support IES (Sky line or final end state costs).
(3) Administrative deactivation	Low implementation cost Reduces mortgage costs	Same as 2
(4) Administrative & physical deactivation	Modest implementation cost Additional reduction in mortgage.	Same as 2
(5) Deactivation & decontamination of exposed surfaces	Reduces risk somewhat Modest Imp. cost. Major mortgage reduction	Same as 2 - except lower risk/cost.
(6) Deactivate & decontaminate	Eliminates most risk & mortgage	Does not lower skyline or fit final end state cost. Increased Implementation cost.
(7) Deactivate, decontaminate, fill, & cover buildings	Minimal/acceptable risk, plus meets IES criteria	Some buildings would impact PA cap profile & cost. Inccreased cost.
(8) Deactivate, decontaminate, demolish, & cover	Minimal/acceptable risk; meets IES criteria	Highest Implementation cost. Most waste fits cap. Longest schedule.
(9) Deactivate, decontaminate, fill or demolish	Same as 7 & 8 but allows optimizing cost, risk, & waste trade offs.	

Table 3.2

Facility Closure*

Scope:	Deactivate, decontaminate, decommission, and either bury or demolish nuclear facilities. Remove, demolish, or bury all other facilities which are not financially and administratively supported by other federal, state or local government, or by private industry. Does not include removal or treatment of soils under (except for hotspots) or around buildings (building foundations and slabs will be generally left in place).
Purpose:	Eliminate, or reduce to an acceptable level, the risks from aging nuclear facilities. Eliminate operating and maintenance costs of Site facilities. Close facilities not to prevent financial drain while leaving foundation/soil available for clean-up to final end state conditions.
Ground Rules and Assumptions:	• All scope to be completed within 8 years from go-ahead. • SNM/residue processing, and SNM/residue/waste storage, will be completed within 5 years from go-ahead so that all nuclear facilities are available for closure within 5 years. • Regulators and stakeholders will concur with reasonable and timely closure process and criteria. • Finding will not be a constraint. • To be expanded.
*A few existing office buildings may remain open	

This task is a portion of the implementation plan that conceptually addresses closure around the Interim End State (IES) configuration for the Rocky Flats Environmental Technology Site (RFETS). This task consists of several options analyses that were designed to address fundamental challenges in achieving interim closure. This includes closure of landfills, Individual Hazardous Substance Sites (IHSSs) and addresses groundwater contamination and surface water handling. Other significant parameters that impact interim closure are also discussed including land use determinations and cleanup requirements. This task closely integrates activities with other components of the IES such as facility decommissioning, waste management and special nuclear materials consolidation/storage. This integrated approach allows for a united holistic approach in addressing the interim closure of RFETS.

This task describes the activities that are planned to address Rocky Flats Environmental Technology Site (Site) infrastructure and systems. A technical team of experts from the Site including the Department of Energy and contractors with expertise in the Site infrastructure was assembled to address this issue. Minimal Site infrastructure (utilities, Site support services and technical services) will remain in the Interim End State (IES) to support one plutonium (Pu) storage facility, five waste facilities, two administrative buildings and the activities conducted therein. With demolition of most facilities onsite, it would not be fiscally responsible to maintain or upgrade the deteriorating infrastructure for the reduced requirements in the IES. Consolidation of Pu and waste onsite and related activities will require minimal utilities and services that will be addressed in this paper.

The Site infrastructure consists of four main areas: utilities, Site support services, technical services and personnel space management. To best analyze the infrastructure components, the Infrastructure Task Team (ITT) was further divide into four sub-task teams, one for each of these areas.

After analyzing all components of the Site infrastructure and carefully reviewing the alternatives, the ITT has made a preliminary decision to utilize public sources where available, contract services as much as possible and provide minimal support onsite. The ITT based its recommendations upon worker and public safety, regulatory requirements, feasibility and cost effectiveness.

After discussions with the other IES teams concerning their recommendations, the Infrastructure Task Team selected their preferred option based on the following:

1. There will be a Pu storage facility, five waste storage facilities and two administrative facilities remaining onsite in the IES.
2. All other permanent buildings will be demolished and trailers removed.
3. The final Site population will be 500 or fewer persons.

4. All Protected Area (PA) buildings will be demolished and an environmental cap will be placed over the entire PA.

Because each sub-task team looked at various aspects of the infrastructure, additional assumptions may be addressed separately. All recommendations are dependent upon the preferred recommendations of each of the other task teams, notably the schedule for building demolition and locations selected for the new Pu and waste storage facilities.

This section of the workplan describes public information and involvement plans for development and implementation of an interim end state project. The section was prepared by Kaiser-Hill Community Outreach and Internal Communications staffs with preliminary input from the Public Participation Focus Group and key stakeholders at meetings held to discuss the project on September 1, 1995 at the Rocky Flats Environmental Technology Site (Site) and September 4, 1995 at the Rocky Flats Local Impacts Initiative office.

The development and implementation of a concept for accelerated Site closure between now and 2003 provides a unique opportunity for stakeholders to help the Site determine what it should look like in eight years. To this end, stakeholders are being brought in early and are encouraged to join with the Site in exploring the possibilities for achieving a stable interim end state while continuing to store plutonium and waste.

A wide variety of stakeholders are impacted by the Site and its activities and, therefore, will be involved in this project. These include employees, citizens groups, elected officials, nearby communities, regulators, interest groups and oversight entities. Information will also be made available to members of the public and news media who may want to follow the project's progress without participating in its development and implementation.

The purpose of this task is to develop the Interim End State (IES) Project Implementation Plan. This task differs from the other technical tasks in that it deals with the "soft", non-technical aspects of the IES Project implementation. In a project as complex as IES, unless the non-technical issues are addressed, a sound technical plan may not be adequately implemented. Issues such as logistics, funding and stakeholders may become barriers unless addressed early in the planning process. The plan will address the following sub-tasks:

7.1 Project Work Logic

7.2 Cash Flow Profile

7.3 Detailed Project Schedule

7.4 Budget Forecasts and Options Analysis

7.5 Skills Mix Analysis and Resource Assessment

7.6 Contracting and Procurement Strategy Activity

7.7 Authorization Bases and Standards Infrastructure

7.8 Strategic Analysis and Strategic Plan Interface

7.9 Systems Modeling and Technology Application

7.10 Workforce Culture Change and Alignment

These sub-tasks cross cut all of the other tasks and therefore it is vital that they be adequately integrated. In many cases, the IES Implementation Plan will address the logic and processes used to reach conclusions rather than the technical details. It will be the job of the Implementing Task Manager to provide a consistent process by which the technical options are screened and evaluated. The Technical Tasks Teams will provide the options and evaluation criteria, the Implementation Task Team will provide the process by which options are evaluated and then the Technical Task Managers will proceed with the technical baseline based upon the integrated evaluation. The evaluation must be integrated in order that the path selected is the best overall, not just the preferred option for Special Nuclear Material (SNM) Storage or Waste Management, for example. The preferred option must hold together as a compelling proposal from all technical aspects as well as the political, administrative and regulatory points of view.

TASK 1: PLUTONIUM CONSOLIDATION AND STABILIZATION

1.0 Overview

1.1 Task Description

The team undertook this task to identify and evaluate options for the stabilization, consolidation, and storage of plutonium and plutonium-bearing materials and recommend a feasible course of action. Of import in this task was defining the best form and storage configuration of the plutonium materials during the Interim End State (IES). The approach to placing materials in the defined storage configuration was considered in light of its effect on other activities required to achieve the IES, such as closure and demolition of facilities.

1.2 Purpose

The purpose of this task is to determine the recommended approach to consolidating and stabilizing plutonium materials in support of implementation of the RFETS IES. The goal of consolidation and stabilization is to place the materials at RFETS in a safe, stable, predictable, and ultimately transportable interim storage configuration, within the IES time frame. Weight was given to the need to achieve a low-cost storage configuration that would allow final disposition of the material without significant additional treatment and associated cost.

1.3 Scope

The scope of this task is discussed first in terms of the materials to be addressed and second in terms of the approach and constraints employed to conduct the evaluation.

1.3.1 Materials

For purposes of this task, RFETS categorized the plutonium materials on the site into four major categories:

1. Plutonium metal, oxides and pits;

2. Plutonium solid residues;

3. Plutonium solutions; and

4. Highly enriched uranium solutions (HEUN).

These materials are stored in seven different facilities at the site (Buildings 371, 707, 771, 776/777, 779 and 886). Amounts of the materials at RFETS are approximately as follows:

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4. 3,100 kg plutonium in 106 metric tons of residues;

5. 140 kg plutonium in 29,000 L of solutions; and

6. 570 kg highly enriched uranium in 2,700 L of solution.

1.3.2 Approach

Several principles and constraints were established to guide the implementation of this task. They are critical to defining the breadth of the analysis and constraints placed on the findings. While the intent was to consider a broad range of possibilities, implementation of the recommendations needed to be feasible. The following were established to provide a balance reflecting the need to "think out of the box" yet devise an implementable plan of action in today's environment.

1. Be compatible with the IES strategy. The strategy calls for: (1) a rapid site reconfiguration (i.e. consolidation of plutonium materials by the end of 2000 and demolition of facilities by 2003); (2) a safe, predictable, and low-cost IES; and (3) a reasonable cost for final site closure. This results in a strategy to place plutonium materials into a stable, predictable, low surveillance and maintenance form during the IES, as well as in a form that is able to be directly shipped off site as soon as a final repository is identified.

2. Plan only for activities under the control of RFETS. A key to developing a feasible, implementable approach is to plan for only those items within the control of RFETS. If a required action was outside RFETS control, then an issue was framed and an approach to resolving the issues defined that reflected activities under our control.

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account. Because facility operating costs are a major percentage of current site costs, we aggressively viewed actions that allowed taking facilities down (i.e. eliminating operating and surveillance costs) as positive in reducing site costs and fostering achievement of the IES.

5. Consider but do not be constrained by Regulatory Requirements, 94-1 and the Residue Compliance Order. Much high-quality and useful work has been performed in the development of the Interagency Agreement, the 94-1 implementation plan, and the Residue Compliance Order (Settlement Agreement and Compliance Order on Consent No. 93-04-23-01). However, they were not developed in light of achieving the accelerated interim end state described in this white paper. As a result, the logic and lessons learned in the two efforts were deemed relevant, but did not constrain this effort.

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Criteria were developed to evaluate options. The first order criteria were: Cost of Implementation (getting to the IES); Cost of Operation (during the IES); Liability Reduction; Feasibility (implementability); and Probability of Success. The first order criteria were further refined to evaluate each option.

1.4 Recommended Course of Action

The overall goal of this phase of the white paper is to determine the appropriate logic train and feasibility of pursuing an IES. The approach to evaluating options discussed above is sufficient for this purpose. It does not, however, result in an optimized solution or approach, because the options are a chosen range to allow differentiation and comparison. In almost every case, the optimum solution will be combination of options. Because further refinement of the approach is planned to provide stakeholder input and review, optimization and improved definition of the recommended option will occur in the future.

The recommended course of action for each subtask area is summarized below:

1. Storage - Currently, it is recommended that a new storage facility be used based on the modular casks used in England. This option requires further refinement and evaluation. Because the screening matrix also highly ranks building a new vault, the option will be carried forward for additional evaluation.

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1.5 Definitions

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1.6 Team Description

The task team comprised both DOE and contractor RFETS employees. The team was divided and assigned to specific Subtasks as described in the next section. This team was supplemented by a one-day work shop in which experts from other sites joined several DOE and contractor RFETS employees that were not part of the task team to review the project approach and recommended options and provide insight and comment to the task team. This workshop included the following individuals from other DOE facilities: Joe Leary/technical consultant; Paul Cunningham/LANL; Dana Christensen/LANL; Mark Bronson/LLNL; John Duane/SRS.

1.7 Subtask List

To accomplish Task 1, six Subtasks were defined and assigned to the team described above as follows.

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3. SNM (metal and oxides) Stabilization - the approach to placing these materials into a form for storage during the IES period.

4. Liquid Residues Stabilization - the approach to placing these materials into a form for storage during the IES period.

5. Solid Residues Stabilization - the approach to placing these materials into a form for storage during the IES period.

6. HEUN - consistency of the current approach to these materials in light of the IES requirements.

1.2 Subtask Details

1.2.1 Subtask 1—Storage

1.2.1.1 Task Description

The SNM Storage task addresses the storage of stabilized plutonium metal, oxide, and high-assay residues during the IES period. The team characterized each option based on a standard baseline in an attached matrix and discusses the options.

1.2.1.2 Justification

The SNM at Rocky Flats must be either stored at this site for an extended period of time or it must be transported to another location for storage. Continued storage of SNM at the site obligates the expenditure of resources and acceptance of certain risks throughout the duration of the storage. The site must minimize those costs and risks by selecting the safest and most cost-effective method of storage given the uncertainty of the duration. This analysis does not negate the possibility that material could be removed from the site if a receiver could be identified and other factors could be resolved.

1.2.1.3 Scope

The task involves determining the most cost-effective method of storing or transferring all the SNM on the site. If storage is the alternative, then the physical storage space and ancillary requirements must be determined. This task is for the storage of plutonium oxides, metals, pits, and high-assay residues. It does not include the storage of enriched uranium, which is programmed for shipment to Oak Ridge. This task also considers the potential of alternatives to storage at Rocky Flats.

1.2.1.4 Purpose

This task follows the staging and processing of all metals and oxides at Rocky Flats. This analysis will drive the intermediate or final disposition of all the SNM at the site that is classified as Category I or II in quantity and attractiveness level. This task is the key to major mortgage reduction regardless of where the material is stored.

1.2.1.5 Strategy

The team based its evaluation on the following strategy.

1. Process the highest-risk material as soon as possible.

2. Treat material to achieve an acceptable shipment form.

3. Achieve safe storage configuration as soon as possible.

4. Consolidate material into one facility, or as few facilities as possible.

5. Integrate all consolidation and storage activities with D^4 activities.

6. Evaluate options for storage of SNM against a standard set of expert-based criteria.

1.2.1.6 Option List and Discussion

1. Current Buildings Maintained. This option is financially unacceptable because of the tremendous costs associated with maintaining several buildings rather than consolidating. Safety will be a negative factor, as will Safeguards and Security. This option requires inventories, as well as an extensive guard force. This option will not allow the site to complete D^4 in the near or long term. Consequently, this option does not meet the needs of the stakeholders.

2. Building 707 with a new vault. Under this option, all processing and storage would be contained within one building (B707). It would require a phased approach to allow for processing of both residues and Pu and oxide. The residues would be processed in modular platforms, while the Pu and oxide would continue to be processed in the current locations. Once processing is complete, this area would be turned into a vault to store all remaining Pu and oxide.

Because B707 has successfully been resumed, the safety envelope is in a good state of repair. The costs to upgrade and modify this building have not been developed but appear to be feasible. This building currently meets all Safeguards and Security requirements, so it will not need additional funding for upgrades. However, the state of the art accounting system would not be used, necessitating inventories as well as manpower-intensive security measures. The long-term mortgage would be greater than that for a new building.

3. Combination of on-site and off-site storage. This option reduces the requirement for on-site storage and therefore the long-term mortgage. It would be the same as combining the positive aspects of a new facility and shipping all material off the site. This is certainly the favored approach to minimize the storage requirements in any way possible. However, as in shipping all the material off the site, this option requires a receiver and special authorizations to increase the level of storage at another site.

4. Ship material off the site. Under this option, the site will ship all SNM to an off-site receiver for final disposition and/or storage and D^4 all Rocky Flats buildings. This option is obviously the best option if a receiver site were available and acceptance of RFETS material negotiated. If the site can locate a repository for all the material outside of Rocky Flats, the mortgage and costs to the government would be dramatically reduced in the short term and eventually zeroed out. The major issue associated with this option is the difficulty of finding another location that

would accept storage of the SNM and the ability to transport it within an approved container. Processing and/or stabilization would still be required from a safety viewpoint.

5. Continued storage in Building 371. With this option, all SNM will continue to be stored in Building 371 until a final disposition can be made on the material. Building 371 will be upgraded to maintain the appropriate safety levels for extended storage of the SNM. Because the building will be upgraded, the safety envelope will be improved. The site can achieve the schedule for completion of the upgrades within the time constraints of IES. The cost of these upgrades is still being developed; however, without significant upgrades for seismic reduction, the final cost should be close to the cost of constructing a new facility (roughly $250M). The studies conducted to date indicate this option is in fact feasible. This option does not affect waste minimization. Safeguards and Security would not be significantly improved beyond the current state of the building. Improvements on Safeguards and Security would have to be built into the facility at a tremendous cost relative to the savings associated with the long-term storage. Because of the building's age, there is some question as to how long the safety envelope could be maintained if long-term storage becomes the requirement and a reduced mortgage is the driving factor.

6. Storage in new building. This option is to construct a new facility and transfer all material into it. After SNM is stabilized, it will be stored in this building until a final disposition can be made on the material. A new facility will be constructed to meet all common-sense safety requirements; the building could be completed to meet the IES schedule if it is constructed outside of the current Protected Area to facilitate construction and if the site makes maximum use of existing designs developed for other DOE sites. The cost would be similar to the option of upgrading Building 371.

This option is feasible but may be dependent upon the politics of building a new building while the site is in the process of closing. This option also reduces waste in that the building will be constructed in an area that does not cause extensive environmental concerns. From a Safeguards and Security aspect, this option provides the latest technology and will significantly reduce the mortgage for normal operations.

Favored Option:

Sellafield Portable Casks. In this option, concrete ministructures house the Pu and oxide. These structures would be of such substantial construction as to minimize any security concerns. Inventories could be reduced or eliminated because of the material's inaccessibility. Because the material will be stored in individual canisters in a self-contained inert atmosphere, all safety requirements could be met. Costs are not available; however, this option should be relatively inexpensive because it does not require high technology in the construction. The major concern is whether storage of these containers in an open field is acceptable to stakeholders.

Table x.x presents a summary of the rankings for each option.

Table x.x

SNM Storage Options

Criteria	Current Buildings Maintained	B707 With New Vault	Combine Off-Site Shipment And On-Site Storage	Ship Off Site	Upgrade B371	Construct New Vault	Use Modular Vaults
Safety	-1	0	+1	+1	+1	+1	+1
Schedule	-1	0	0	0	+1	+1	+1
Cost	-1	0	+1	+1	0	0	+1
Feasibility	-1	0	-1	-1	+1	+1	+1
Waste Minimization	0	0	0	0	0	0	0
Safeguards and Security	-1	0	0	+1	0	+1	+1
TOTAL SCORE	-5	0	+1	+2	+3	+4	+5

1.2.2 Subtask 2-Staging

1.2.2.1 Task Description

The SNM Staging subtask evaluates options to stage the plutonium metal, oxide, and high-assay residues in a location(s) compatible with other subtasks, particularly the SNM processing activities. The team members used a consistent set of criteria to evaluate each of the identified options and selected a preferred option.

1.2.2.2 Justification

The Staging subtask is a transitional step necessary to position the site to support material processing for safe, interim storage. The objective is to relocate materials to consolidate the SNM into a single, cost-effective facility. In addition, the cost of maintaining the export buildings will decrease because some of the Safeguards and Security requirements will be relaxed as material is removed. At the same time, removal of these materials will allow D^4 tasks to continue and be completed in the most rapid fashion possible.

1.2.2.3 Scope

The scope of this subtask is limited to high-assay forms, including selected residues, and quantities of plutonium and enriched uranium. This includes plutonium metals and oxides, pits, enriched uranium metals, and composite materials. The majority of this material is currently stored in Building 371, followed in order of storage by Buildings 776/7, 707, 771, 779, and 991. There are approximately 6,600 kg of plutonium in metal form, 3,200 kg in compounds, and 6,100 kg of enriched uranium; these are distributed over more than 10,000 discrete "items." Additionally, approximately 3,100 kg of plutonium mixtures are the responsibility of the residue or liquid subtasks, or the waste task. This subtask will accept from the Liquid Stabilization subtask approximately 150 kg of oxide.

1.2.2.4 Purpose

The purpose of this subtask is to evaluate the various options available to address the issue of SNM Staging and to select the option that is deemed to be the most suitable.

1.2.2.5 Strategy

This subtask will begin with the covered materials in their current locations and storage configurations. It will be assumed that HSP 31.11 activities will continue as planned because of the near-term requirement to eliminate the safety risks associated with that material.

A number of off-site shipments of the covered materials are planned. These include enriched uranium to Oak Ridge and LANL, SREP pits to LANL, WR pits to PX, special units to LANL, scrub alloy to SRS, etc. These shipments collectively account for the majority of enriched uranium at the site, but only a small portion of the plutonium. Nonetheless, off-site shipments are a vital component of the current planning for SNM Consolidation and will be an equally important part of IES.

The strategy used in evaluating the options is generally as follows:

Achieve an efficiently staged configuration of material storage as quickly as possible.

Achieve an efficiently staged configuration of material storage as inexpensively as possible.

Ensure that the final staged configuration is compatible with future processing activities.

Integrate the processing requirements with D^4.

Evaluate all options against a standard set of expert-based criteria, including the following:

- Safety: the relative safety of doing the option and of its end product;
- Schedule: the ability of the option to meet schedule objectives;
- Cost of implementation;
- Cost of maintenance: the continuing costs of the option;
- Technical feasibility;
- Waste minimization;
- Storage predictability; and
- Safeguards and security: the efficiency of ensuring continued protection and accountability of the material.

1.2.2.6 <u>Option List and Discussion</u>

Team members considered the following options.

1. No action: leave all materials in current storage buildings and locations.

2. Ship off the site: Ship all materials immediately to off-site receiver, with no intermediate disposition.

3. Consolidate into new building: construct new building, and transfer all materials to new building upon completion of construction.

4. Consolidate into Building 707: transfer all material to Building 707 to await further disposition.

5. Consolidate in both Buildings 371 and 707: transfer all material to storage locations in both buildings.

6. Consolidate into Building 371: transfer all material to Building 371 to await disposition.

The following matrix (Table) reflects the result of applying the evaluation criteria to each of the discussed options. Each criterion is assigned a +, -, or 0, corresponding to a positive (beneficial), negative, or neutral correlation. Elaboration of this evaluation, along with further analysis of each option, follows the matrix.

Table x.x

Staging Options

	1. No Action	2. Ship Offsite	3. Consolidate in new building	4. Consolidate in Building 707	5. Consolidate in Building 707 and 371	6. Consolidate in Building 371
Safety	-	+	+	0	0	+
Schedule	-	+	-	0	+	0
Imp Cost	+	0	-	-	0	0
Mtc Cost	-	+	+	0	-	0
Feasibility	0	-	-	-	+	+
Waste Min.	+	0	-	0	0	0
Storage Predictability	-	+	+	+	+	+
S & S	-	+	+	0	0	+
Total	-3	+4	-1	-1	+2	+4

1. No action. This option would continue the storage configuration already in existence. Although this option would be inexpensive to implement (no action = no cost) and would minimize wastes, it would also allow continued storage in buildings that are difficult and costly to maintain as storage facilities. In addition, the Plutonium Vulnerability Assessment identified specific vulnerabilities associated with continued storage in the export buildings, such as Building 776/7. Further, "no action" will not support the goal of enabling D^4 activities to proceed because material will remain in the buildings, obstructing cleanup activities. Thus, although there are immediate benefits to "no action," the disadvantages very quickly outweigh them, and the team therefore discounted this option.

2. Ship off the site. Although shipping materials off the site for storage is an attractive option, it is not feasible. Removing materials from the site will decrease, or eliminate, safety and security risks; it could maximize efficiency of performing cleanup activities; elimination of the need to

maintain facilities to support storage would reduce outyear costs. This option also would reduce on-site handling, which incurs worker radiation doses, etc. There are however, significant drawbacks to this option. The most oppressive is the lack of a receiver: there is simply no other location equipped or willing to accept the material. Further, the material is not currently in forms or packages compatible with off-site shipment, necessitating shipping in extremely small quantities or packaging into large containers. Thus, although off-site shipment is the preferred option, the team discounted it, at least for the near term.

3. Consolidate in new building. Consolidating SNM into a new building is also an attractive option. Unlike existing buildings on the site, the new facility could be designed to include the currently applicable safety requirements and to minimize maintenance costs. A smaller, tailor-made building will provide more efficient storage than a retrofitted production building, further reducing maintenance costs and the cost of security to protect the material. Unfortunately, constructing such a building is very expensive and requires an estimated 5 years. This schedule would force continuation of current expensive and inefficient storage practices, would not support efficient processing, and would not support rapid commencement of D^4 activities; therefore, the team did not consider it to be a viable option. The issue of consolidating in a new building is discussed further in the SNM Storage subtask.

4. Consolidate in Building 707. Building 707 has many features that make it an attractive location for consolidation: it has undergone resumption, it has an operable authorization basis, it is not highly contaminated, it has a seismically qualified annex for storage, it is centrally located (connected) to Buildings 776/7, 779, and 771, it can support processing activities, etc. However, the building as currently configured lacks sufficient storage space to serve as the consolidation building. Although modification is possible, such modifications would take time and money; Building 371 is poised to accept material (from a space perspective) immediately and will be configured to accept all of the subject material within a year. The annex to the building (J and K modules) is seismically qualified but the rest of the building is not, and consolidation and subsequent processing would certainly require use of the nonqualified portion of the building. Mission and space conflicts may exist with residue stabilization activities as well. Thus, despite the attractive features of Building 707, it cannot serve effectively or efficiently as the only consolidation facility. Consequently, the team discounted this option.

5. Consolidate in both Buildings 707 and 371. This option takes advantage of the most attractive features of both Buildings 371 and 707. Sufficient space exists to ensure storage; processing can be supported; material is removed from the worst, or least safe, buildings; etc. The most compelling drawback to this option is the cost: maintaining two buildings is inevitably more costly than maintaining only one of them. This option also complicates D^4 activities, which cannot be completed until a building is empty of SNM. Therefore, the team eliminated this option.

6. Consolidate in Building 371. Consolidation in Building 371 is the preferred option. Although the DNFSB recommendation questioned the seismic adequacy of the building, B371 is unquestionably superior to all other buildings at the site. It is currently the largest repository of

SNM at the site, and ongoing modifications will ensure sufficient storage capacity exists to store the entire inventory. No other building on the site is large enough to accomplish this storage mission along with the envisioned processing mission, as well. The building's relative isolation in the western portion of the Protected Area ideally suits it to reduce safeguards and security costs for the export buildings. Team members acknowledge potential problems with authorization basis but believe these can be overcome.

Material will be removed from Buildings 771, 776/7, 779, and 991 as quickly as possible to eliminate the cost of maintaining them and the potential safety risk of continued storage in them. Building 707 will be the last building to have material removed. The buildings will be addressed in a phased approach: material from Building 779 will be consolidated to Building 371 first, followed by material from Building 776/7, Building 771, and Building 707. Current schedules project that Consolidation will be complete in late FY99. If this does not allow sufficient time for follow-on activities, the schedules can be adjusted by applying additional resources, particularly personnel.

Significant restraints that will affect the handoff of export buildings to the D^4 tasks are plutonium holdup and security decategorization. As a result of years of production, a large, and mostly unidentified, amount of plutonium remains in ductwork, equipment, and machinery. The plutonium holdup is a portion of the planned SNM Consolidation work, but its effect is difficult to anticipate because of the paucity of data.

1.2.3 Subtask 3—SNM (Metals and Oxides) Stabilization

1.2.3.1 Task Description

The SNM subtask will evaluate options for stabilizing plutonium metal and oxide and packaging it to be compatible with long-term storage requirements. The team will use a consistent set of criteria to evaluate each of the identified options and will choose a preferred option.

1.2.3.2 Justification

When production and recovery operations at the site were stopped in 1989, a large quantity of the plutonium inventory was left in forms and packages unsuitable for long-term storage. These items include potentially pyrophoric and highly dispersible plutonium oxides; metals susceptible to oxidation, which could lead to pressurization or rupture of the storage container; and unsealable and nonrobust storage containers that exacerbate these conditions. This subtask will eliminate these potential problems by determining an appropriate course of action to stabilize the SNM.

In addition, the SNM Processing subtask will allow "mortgage reduction" by reducing or eliminating the regular and frequent material maintenance and surveillance activities required for material not in long-term forms and packages.

1.2.3.3 Scope

The scope of this subtask will generally be limited to plutonium metals and oxides greater than 50% assay by weight, enriched uranium, and pits. However, pits are sealed units, so they require only proper packaging, not processing. Most of the pit inventory is already properly packaged. Enriched uranium does not have the same reactive properties that plutonium does, so it does not require the same level of processing or packaging. In addition, plans are in place to ship the majority of the enriched uranium off the site, either immediately or after decontamination to remove plutonium. A small amount of enriched uranium may remain; this will be dispositioned in manner similar to that of the plutonium.

This nuclear material is currently stored primarily in Buildings 371, 707, 771, 776/7, 779, and 991. There are approximately 6,600 kg of plutonium in metal form, 3,200 kg in compounds, and 6,100 kg of enriched uranium; these are distributed over more than 10,000 discrete "items." There are, in addition, approximately 3,100 kg of plutonium in mixtures, which are the responsibility of the residue or liquid subtasks, or the waste task.

1.2.3.4 Purpose

The purpose of this subtask is to evaluate the various options available to address the issue of SNM processing for safe long-term storage.

1.2.3.5 Strategy

To perform this evaluation, the subtask team assumed that the SNM within the subtask is in compliance with the requirements of Health and Safety Practices Manual Section 31.11 (HSP 31.11). This is an ongoing program at the site; the primary effort to regain compliance should be completed by the end of FY96. After that, only the maintenance and surveillance requirements discussed above will be necessary.

The strategy in evaluating the options is generally as follows.

Achieve safe storage form and packaging configuration as soon as possible.

Achieve safe storage form and packaging configuration as inexpensively as possible.

Process and package higher-risk material forms first.

Ensure that the final form and packaging configuration is compatible with off-site shipping requirements.

Integrate the processing requirements with D^4.

Evaluate all options against a standard set of expert-based criteria, including the following:
- Safety: the relative safety of doing the option and of its end product.
- Schedule: the ability of the option to meet schedule objectives.
- Cost of implementation.
- Cost of maintenance: the continuing costs of the option.
- Technical feasibility.
- Waste minimization.
- Storage predictability.
- Safeguards and security: the efficiency of ensuring continued protection and accountability of the material.

1.2.3.6 Option List and Discussion

The team members considered the following options.

1. No action: leave material in current form and packaging configurations.

2. No Processing; Store in Robust Container: perform no additional processing to prepare material for interim storage; package in a robust container to provide containment.

3. Ship material off the site for processing/packaging: Transport all SNM in current form and package to an off-site receiver, where processing or repackaging, if any, will take place.

4. Process material to specific criteria: perform processing to a specific criterion, such as to enable subsequent shipment to other facilities, including the Waste Isolation Pilot Plant (Waste Acceptance Criteria [WAC]), or to enhance long-term stability, such as vitrification.

5. Perform DOE-STD-3013-94 processing & packaging: stabilize oxide to 0.5% LOI and package both metal and oxide in the material, or the material and boundary, container.

6. Perform additional packaging: identify additional packaging layers or new packaging configurations that will reduce risk (e.g., reduce dispersibility of oxides), and package all SNM to that level.

7. Perform additional processing: identify additional processing steps that will reduce risk (e.g., reduce dispersibility of oxides), and perform that process on all SNM.

The following matrix (Table) reflects the result of applying the evaluation criteria to each of the discussed options. Each criteria is assigned a +, -, or 0, corresponding to a positive, negative, or neutral correlation. Elaboration of this evaluation, along with further analysis of each option, follows the matrix.

Table x.x

SNM Processing Options

	1. No Action	2. No Process, Robust Container	3. Ship off the site for Processing	4. Process to Specific Criteria	5. Process to DOE-STD-3013-94	6. Perform additional packaging	7. Perform additional processing
Safety	-	-	+	0	+	+	+
Schedule	+	0	+	0	0	0	0
Imp. Cost	+	+	+	-	-	-	-
Mtc. Cost	-	-	+	+	+	+	+
Feasibility	+	0	-	-	0	0	0
Waste Min	+	0	+	-	-	-	-
Storage Predict-ability	-	-	+	+	+	+	+
S & S	-	-	0	0	+	+	+
Total	0	-3	+5	-1	+2	+2	+2

1. No Action. Although this option supports schedule requirements, has no implementation costs (no action = zero cost), is technically feasible, and minimizes waste, it is not sufficient to provide safety for long-term storage. Plutonium reacts with oxygen and hydrogen over time to produce pyrophoric and dispersible products (plutonium oxide), and it can pressurize or rupture containers, resulting in possible releases. To prevent or mitigate this possibility, frequent and regular inspections and surveillances are required, along with redundant safety systems in the building. These inspections take time and money and expose personnel to unnecessary amounts of radiation. The Plutonium Vulnerability Study identified several deficiencies associated with current storage configurations and practices at the site, and "no action" will allow these vulnerabilities to continue indefinitely. Further, it is the eventual goal to ship these materials off the site, and current configurations are not compatible with shipping requirements, so processing would be required regardless. Thus, despite the fact that short-term costs for this option are extremely attractive, longer-term considerations, including cost and safety, are more significant. Therefore, the team eliminated this option.

2. No Processing; Store in Robust Container. With this option, all materials will be overpacked in a robust container that would be capable of withstanding natural phenomena externally and postulated material reactions internally. The option offers several advantages: developing and designating such a container is certainly feasible, packaging the materials in them would be relatively inexpensive, and a relatively small amount of waste would be generated. However, this option suffers in terms of safety. Without performing processing first, it is not possible to ensure that undesirable material reactions would not occur because of the wide range of reactive or unstable constituents that may be in the materials. The possibility of reaction means that the contents of the containers, upon subsequent opening either at Rocky Flats or another site, could be in dangerous forms. Attempts to mitigate or prevent these types of reactions would require the same or similar burdensome and expensive inspections and surveillances that "no action" would. Therefore, the team discounted this option.

3. Ship off the site for processing. Shipping materials off the site would reduce both implementation and maintenance costs by eliminating the need for expensive and difficult facility upgrades and maintenance or the associated startup costs, such as Operational Readiness Reviews. This option is also favorable to schedules and waste minimization. In addition, the material will be removed from the Site, so existing deficiencies would be eliminated (although the receiver may have to address them). There are, however, significant drawbacks to this option. The most oppressive is the lack of a receiver: there is simply no other location equipped or willing to accept the material. Further, the material is not currently in forms or packages compatible with off-site shipment, so shipping in extremely small quantities, or packaging into large containers, would be necessary. Thus, although this is the preferred option, the team discounted it, at least in the near term.

4. Process to Specific Criteria. A number of concepts have been developed for the long-term disposition of plutonium metal and oxides, including vitrification or cementation. While the end-state of these processes is certainly a stable and predictable form, it precludes, or at least

increases the difficulty of, future use. In addition, the processes necessary to support these configurations are neither well defined nor technically straightforward at this time. Refining these processes will require significant development time. The process will require funds and will generate waste.

The other aspect of this option anticipates eventual shipment to specific off-site locations, such as WIPP, and would require that the materials be processed to the acceptance criteria of those locations, such as the WIPP/WAC. This option is attractive in its anticipation of removing the material from the site. However, departing from option 3, it does require additional processing, which may incur significant cost, and it will generate waste as well. Further, no locations (and therefore acceptance criteria) have been identified. WIPP, for example, was not intended to store this type of material, and it is doubtful that the acceptance criteria would be modified to do so.

5. Process to DOE-STD-3013-94. DOE-STD-3013-94 offers specific processing and packaging requirements intended to ensure that plutonium is in a safe configuration for long term storage. Complying with the standard also reduces future maintenance costs, since the material will be in a form that is stable and in a package that prevents or minimizes reactions. In addition, the more efficient packaging and form will simplify accountability requirements. The package is also compatible with existing and envisioned offsite shipping requirements. The processing required to do this is not technically challenging; the concepts have been in use for decades, and are fairly well characterized. The drawbacks to this option are only the initial implementation costs and the waste generation.

The site has an ongoing program to perform this type of processing: a prototype line will be installed in Building 707 in early FY97, and a larger capacity line will be installed in Building 371 in mid FY98.

6. Perform Additional Packaging. This option assumes that option 5 has been completed. This option offers identical advantages and disadvantages as option 5, with one addition: packaging material already processed to the standard in an additional package, such as the primary container, provides an extra resistance to natural phenomena or internal reactions. The cost will be marginally higher than that of option 5, and the inevitably larger containers will modify storage schemes, but not to an unacceptable level. This option was discounted because the lack of quantifiable evidence of benefit for the additional packaging: although certainly an improvement over the standard-specified container, it is unknown how much of an improvement, so a cost benefit assessment cannot be made.

7. Perform Additional Processing. This option assumes that option 5 has been completed. . This option offers identical advantages and disadvantages as option 5, with one addition: the additional processing can reduce dispersibility by up to several orders of magnitude. LANL has been conducting research on the benefits of, for example, higher thermal stabilization temperatures, or of pressing oxides, and expect that particle size can be substantially increased. Since the operation to do either of these is not much more involved than the basic DOE-STD-3013-94 process, in terms of either cost or throughput, it is felt that the additional processing is

an effective and efficient way to improve safety. It appears likely that the standard may be revised to include these dispersibility objectives. LANL must continue the research to define the exact processes, and these processes must be incorporated to the ongoing plans for Building 371 or Building 707, or both.

The anticipated cost of installing the process lines and processing the material is in the $90M range (approximately $15M per year for six years), with a scheduled operational date in early 1998, with completion of processing date of approximately mid 2002. This schedule is based upon projected the throughput and up-time of the process lines, and the availability of personnel. Any one of these factors could be adjusted to make the completion date earlier.

1.2.4 Subtask 4-Liquid Residues Stabilization

1.2.4.1 Task Description

Curtailment of plutonium operations at RFETS in November 1989 was anticipated to last for only a short period of time while safety concerns were addressed. However, the end of the cold war resulted in change of the site mission from Defense Programs to Environmental Remediation. Solutions had been left in tanks, piping, and poly bottles at the time of curtailment, in anticipation of resumption. These solutions must now be stabilized to achieve deactivation, decontamination, decommissioning, and demolition (D^4) of plutonium buildings.

Solution Categories - Solutions to be processed include plutonium nitrate, and plutonium and uranium in nitrate and chloride.

Stabilization Locations - Buildings in the Protected Area that can be considered for solution stabilization include Buildings 371, 374, 559, 707, 771, 774, 776/777, and 779. Other options include a portable modular system and shipment to other DOE sites.

1.2.4.2 Justification

Solutions in D^4 Buildings - Solutions must be stabilized before D^4 can occur. During production, solutions were stored for only a short time before processing to recover plutonium as metal for recycle to the foundry. Storage in tanks, piping, and poly bottles - now nearing six years - was not envisioned. Leaks from tanks and piping have increased and will continue to increase in frequency and magnitude if stabilization does not occur. Poly bottles are even more susceptible to failure due to radiolysis, and acid type and concentration.

The Site, in response to concerns raised by DOE, the Environmental Protection Agency (EPA), the Colorado Department of Public Health and Environment (CDPH&E), Los Alamos National Laboratory, Site workers, and stakeholders, is engaged in solution stabilization at present. The Solution Stabilization Program plant priority is second only to maintenance of plutonium building baseline (building maintenance, e.g., HVAC).

1.2.4.3 Scope

Current Inventory - The total solution inventory is approximately 29,900 liters. Of this volume, 29,600 liters of nitrate solution contains an estimated 139 kg plutonium, and 300 liters of nitrate and chloride solutions contain roughly 6 kg actinide (0.6 kg plutonium and 5.4 kg uranium).

Current Storage Locations - Building 371 contains 29 kg actinide in 18,700 liters, in tanks and piping. Building 771 contains 110 kg actinide in 7,405 liters in tanks and piping. There is 6 kg actinide in 3,750 liters solution in 4-liter poly bottles. Most of the bottles are currently in storage in gloveboxes in Building 771, but there are also bottles in Buildings 371, 559, and 779.

Category Inventory/Lists - Lists are available and updated regularly. Additional information is available in published documents.[1, 2]

1.2.4.4 Purpose

The purpose of this evaluation is to consider options and provide recommendations for stabilization of actinide-bearing solutions. The amount of actinide in solution is small, in comparison to the Site inventory. However, solutions remaining in tanks, piping, and bottles are a major issue because (1) solution storage, interim or long-term, is not an acceptable option due to the potential impact on environment, safety, and health; and (2) the status quo will not enable the Interim End State (IES) vision.

1.2.4.5 Strategy

1.2.4.5.1 Overall Approach

Options evaluated in addition to stabilization techniques include continued storage in existing tanks, piping, and bottles; solution transfer to new tanks for storage; and solution transfer into poly bottles for continued storage. While these options are considered below, the assumption is made that continued, indefinite storage of solutions is not an acceptable option. The approach discussion, therefore, discusses general requirements assuming stabilization is chosen.

Staging - Solutions will be staged in the facility or facilities selected for processing. To the extent practical, the number of facilities will be minimized to reduce administrative and facility preparation costs, liquid transfers, and waste generation. Batching will occur based on actinide concentrations and the process(es) selected for that particular solution. Transfer from facilities not selected for solution stabilization to designated facilities will be performed in accordance with existing regulations and plant policies; wherever possible, solutions will be transferred within corridors and tunnels to avoid the possibility of spills into non-HEPA filtered areas.

Treatment - Actinide solutions will be treated as necessary to provide solid products, SNM and waste, that will result in stable, predictable storage or disposal configurations. The only liquid remaining from the processing will be water.

Solid Products - The actinides (plutonium, ^{241}Am - a small amount from the ingrowth from ß-decay of ^{241}Pu, and uranium) will be immobilized as solids. Compounds containing sufficient amount of SNM will be stored in containers and accountable for safeguards purposes. Actinides immobilized in a matrix such that the final form is TRU waste will be stored in larger containers (e.g., 55-gallon drums). Salt solutions from processing will be evaporated and cemented to form "saltcrete;" this is LLW.

Liquid Product - The distillate from salt solution evaporation is recycled as process water onsite.

1.2.4.5.2 Justification

Compatibility with D^4 - Solution stabilization methods and locations will be chosen based on criteria that will permit D^4 to proceed in a time frame that will fit within the IES vision, i.e., by 2003.

Compatibility with D^4 and Minimizing Authorization Basis Issues - Solution stabilization methods and locations will be chosen based on criteria that will permit D^4 to proceed on schedule and that will minimize the amount of institutional requirements (environmental and safety requirements and considerations; safeguards and security; operational requirements (training, qualification, and procedures); and readiness requirements) without compromising the intent of any of these requirements.

DNFSB Recommendations - The Defense Nuclear Facilities Safety Board (DNFSB) addressed, in Recommendation 94-1,[1] the on-going storage of materials in forms and conditions originally intended for use in processing activities. The Recommendation centered on the recognition that the forms and conditions appropriate for in-process handling are not suitable for long term storage. The DOE accepted the Recommendation and issued an Implementation Plan[2] which would result in stabilization of all actinide solutions at RFETS by June 1999. The activities planned to support the Implementation Plan are generally consistent with the needs of the favored option for IES. Some adjustments to detailed schedules may be required.

Safeguards & Security - The SNM in these solutions is accountable and subject to Safeguards and Security controls, as prescribed in DOE Order 5633.3A. Activities must be accomplished in a manner that permits accountability, with Nuclear Materials Safeguard concurrence on procedures, qualification of measurement methods, review and approval of data, etc.

All of these solutions reside in tanks, piping, and bottles within plutonium buildings in the Protected Area. Security is in place and will be maintained for each building until SNM has been stabilized and removed to the extent required for downgrading security. This will enable the Site to "shrink the PA," i.e., remove the Security Inspectors and fences now required.

Waste Storage Issues - Waste will be generated for any scenario envisioned. The waste may include direct waste - waste product from the stabilization - such as 55-gallon drums of cemented solutions, sludge in tanks, and boxes of saltcrete; or indirect waste - waste generated from usage of supplies - such as 55-gallon drums of combustibles (poly bottles, surgeons gloves, paper, etc.) Interim storage of these wastes will be required until off-site storage site(s) are available.

1.2.4.6 Option List and Discussion

1.2.4.6.1 Treatment Location Options

Options evaluated included both actinide solution processing on-site and off-site. On-site options, including a portable modular facility, will be listed first.

On-Site Options - Buildings in the Protected Area considered for solution stabilization include Buildings 371, 374, 559, 707, 771, 774, 776/777, and 779. A brief summary of the historical purpose of the buildings, solution inventory, and equipment available follows.

Building 371 - the new Plutonium Recovery Facility that never achieved planned throughput. It is now used mainly for SNM and waste storage. Equipment available for solution stabilization: the Caustic Waste Treatment System, formerly used to treat building scrubber blowdown. Building 371 has the largest solution inventory but less actinide than in Building 771. A modular facility could be installed for solution stabilization although building use for waste and SNM storage limits options.

Building 374 - the Waste Treatment Facility that supports several other buildings and functions, including actinide solutions from Buildings 371, 774, wash water from the laundry, et al. Building 374 employs the carrier precipitation and saltcrete processes.

Building 559 - the Analytical Laboratory. This facility is limited both in the quantity of SNM permitted and in process equipment; there are no tanks or glovebox lines available for processing.

Building 707 - the Foundry. Casting and machining of plutonium metal occurred here during the production years. The building is being evaluated for solid SNM stabilization, currently has no liquid processing capability, but a modular facility could be installed for solution stabilization.

Building 771 - the old Plutonium Recovery Facility. Production lines are out of commission but the Room 180 Complex, R&D laboratories, have glovebox lines that can be used for solution stabilization. Building 771 has less solution than Building 371 but a larger amount of actinide in solution.

Building 774 - the Waste Treatment Facility that supported several buildings during processing of aqueous and organic wastes during production. Equipment/processes in service include carrier precipitation and a direct cementation glovebox for actinide solutions. Inventory consists of actinide solutions transferred from other buildings.

Building 776/777 - Building 776/777 was used for defense production, e.g., pyrochemical purification of plutonium for the Foundry and backup capabilities for Building 707, until curtailment in November 1989. It is currently a solid waste processing and storage facility.

Building 779 - a building used chiefly for R&D, particularly on pyrochemical processes. Glovebox lines are being evaluated for pyrochemical residue stabilization. The building has one tank for RCRA-regulated solution storage.

A Portable Modular Processing Facility - This modular facility would differ from those mentioned above for Buildings 371 and 707 in that the assumption is made that this facility would be outside and virtually independent of the building containing the solutions. The intent of such a facility would be to use it at various sites, with modules available for aqueous solutions as well as solid SNM stabilization.

Off-Site Options - The shipping of actinide solutions to other site(s) for stabilization and using a combination of both on- and off-site stabilization were also considered. Other sites that could be considered for solution stabilization include INEL, SRS, Hanford, and LANL.

Ranking Matrix - The ranking matrix is shown on page 1-9. Criteria included Safety, Schedule, Cost (both of implementation and product/waste storage), Feasibility, Waste Minimization, Storage Predictability, and Safeguards and Security. The Current Baseline for facilities is use of Buildings 371 and 771. These buildings have the most solution in tanks and piping and equipment (to be discussed below). The Current Baseline is rated as 0 by definition in all criteria, with other facility options rated as better (+1) or worse (-1) than Buildings 371 and 771.

Ordered Rank Discussion - The ranking is done in the least to most favored option order. Table x.x summarizes the ranking.

Combination of On-Site and Off-Site: Safety (-1), requires transportation of plutonium solution on public highways - currently illegal - as well as transportation of solution on-site; Schedule (-1), would require continuing efforts here as well as a substantial study on where liquid stabilization could be done, legal challenges, facility upgrades/preparation somewhere, etc., Cost (-1), for reasons noted; Feasibility (-1), for reasons noted; Waste Minimization (-1), bottling, packaging, and shipping off-site would generate large amounts of waste that would add to those of stabilization and waste generation for on-site activities; Storage Predictability (0), stabilized products would be the same; Safeguards and Security (-1), shipper/receiver differences and guarding of transfer shipments would complicate the process for the off-site portion. Total (-6).

Stabilize Off the Site: Safety (-1), requires transportation of plutonium solution on public highways - currently illegal; Schedule (-1), would require substantial study on where liquid stabilization could be done, legal challenges, facility upgrades/preparation somewhere, shipping containers, etc., Cost (-1), for reasons noted; Feasibility (-1), for reasons noted; Waste Minimization (-1), bottling, packaging, and shipping would generate large amounts of waste that would add to those of stabilization; Storage Predictability (0), stabilized products would be the same; Safeguards and Security (-1), shipper/receiver differences and guarding of transfer shipments would complicate the process. Total (-6).

B559, B776/777, and B779: These buildings are considered together because they have similar problems, e.g., lack of aqueous processing equipment. Safety (-1), would require transfer of the 29,900 liters of solution from B771 and B371 to these buildings in 4-liter bottles; Schedule (-1), would require building upgrades and process facility funding, design, construction, installation, etc.; Cost (-1), more expensive due to reasons listed; Feasibility (-1), technically feasible but impractical due to schedule, cost, concern about liquid transfer in bottles, etc.; Waste Minimization (-1), transferring solution in bottles to these buildings would generate large amounts of plastic (bottle) waste; Storage Predictability (0), same as baseline; Safeguards and Security (0), same as baseline. Total (-5).

B371 Modular, i.e., installation of a modular facility inside B371: Safety (-1), would require transfer of solutions from B771 tanks and piping to B371 in 4-liter bottles; Schedule (-1), would require facility funding, design, construction, installation, etc.; Cost (-1), more expensive for new facility due to design, etc., listed; Feasibility (-1), technically feasible but unlikely due to the current proposed building mission, schedule, cost, and concern about transferring large amounts of solution; Waste Minimization (-1), would require draining tanks and piping into bottles, and transferring bottles to B707, with bottles becoming waste; Storage Predictability (0), same as baseline; Safeguards and Security (0), same as baseline. Total (-5).

B707 Modular, i.e., installation of a modular facility inside B707: Safety (-1), would require transfer of 29,900 liters of solution to B707 in 4-liter bottles; Schedule (-1), would require facility funding, design, construction, installation, etc.; Cost (-1), more expensive for new facility due to design, etc., as listed; Feasibility (-1), technically feasible but unlikely due to schedule, cost, and concern about transferring large amounts of solution; Waste Minimization (-1), use of bottles for transfer would result in bottles becoming waste; Storage Predictability (0), product same as baseline; Safeguards and Security (0), same as baseline. Total (-5).

Portable Modular Processing Facility (the assumption is made that this facility would be outside and virtually independent of the building containing the solutions): Safety (0), almost same as that of baseline, depending on how solutions were transferred into the modular facility; Schedule (-1) would require modular facility funding, design, construction, etc.; Cost (-1), more expensive due to reasons listed; Feasibility (-1), technically feasible, not practical for short term stabilization projects due to schedule, cost, but may be of interest for long-term, complex-wide stabilization projects; Waste Minimization (0), similar to baseline; Storage Predictability (0), same as baseline; Safeguards and Security (-1), probably more difficult depending on how shipping and receiving, and security for the portable facility would be handled. Total (-4)

Current Baseline (B771 and B371): Solutions in tanks and piping in B771 and B371 would be processed in those buildings, mostly in existing equipment, except for modifications being made on the Caustic Waste Treatment System (CWTS). All criteria rated as zero by definition.

Table x.x

Liquid Residue Stabilization Location Options

Criteria	Combination of On-Site & Off-Site	Stabilize Off-Site	B559, B776/777, & B779	B371 Modular	B707 Modular	Portable, Modular Liquid Processing Facility	Current Baseline (B771 & B371)
Safety— Rad Exposure Nuc Safety Indust. Exposure	-1	-1	-1	-1	-1	0	0
Schedule	-1	-1	-1	-1	-1	-1	0
Cost	-1	-1	-1	-1	-1	-1	0
Feasibility	-1	-1	-1	-1	-1	-1	0
Waste Minimization	-1	-1	-1	-1	-1	0	0
Storage Predictability	0	0	0	0	0	0	0
Safeguards & Security	-1	-1	0	0	0	-1	0
Total Score	-6	-6	-5	-5	-5	-4	0

1.2.4.6.2 Stabilization Options

Solutions to be stabilized include plutonium and americium nitrate, and plutonium and uranium in nitrate or chloride. Concentrations range for 0.01 to 140 g/liter, i.e., from waste to "product" solutions.

Options - A brief summary of the stabilization options follows.

The "no action" option would mean leaving actinide solutions in their current condition in tanks, piping, and bottles in the plutonium buildings.

Bottle and storage would consist of draining tanks and piping into bottles and storage of the bottles, and subsequently changing the bottles as necessary.

Storage in new tanks would require new tank installation and transfer of solutions from existing tanks, piping, and bottles into the new system.

Polymer encapsulation involves evaporation of water and fixation of the residues remaining in molten low density polyethylene (LDPE).

Vitrification consists essentially of denitration to the oxides, addition of glass-formers and heating to stabilize the oxides in a glass matrix.

Denitration/Salt Distillation consists of solution evaporation until all water has been removed. Continued heating decomposes nitrate to nitrogen oxides, leaving actinide oxides. For chlorides, actinides could be oxidized and chloride salts could be distilled; this requires higher temperatures. Scrubbing would be required during the evaporation and denitration steps, and salt distillation would require s salt removal (condensation) step.

Carrier precipitation is conducted on waste nitrate solutions in Buildings 774 and 374. Actinide concentration is limited to 0.0245 g/l in Building 774 and 0.001 g/l (0.004 g/l if from Building 371) in Building 374. The process uses ferric sulfate, magnesium sulfate, calcium chloride, and a flocculent to precipitate actinide as a sludge. The sludge will be stored until a sludge-processing system is on-line.

Direct Cementation - This process involves pH adjustment with sodium hydroxide and actinide solution mixing with portland and Ramcote cements in a 55-gallon drum. Concentrations are limited to < 6 g actinide/l due to criticality concerns. The resulting waste form is TRU waste and would be stored at the Site until a waste repository is available.

Oxalate precipitation could be used for actinide (plutonium and americium) nitrate solutions containing > 6 g actinide/liter. Oxalic acid would be added to precipitate the actinides; a second precipitation with magnesium hydroxide would remove additional actinide. The precipitates would be filtered and calcined to the oxide for storage as SNM. The filtrate would be sent to carrier precipitation.

Hydroxide precipitation would be used to treat mixtures of uranium and plutonium in nitrate and chloride solutions containing > 6 g actinide/liter. (Oxalic acid doesn't precipitate uranium effectively, uranium contamination in liquid waste treatment causes NDA measurement and criticality safety concerns, and chloride is corrosive to equipment.) Magnesium hydroxide will be used to precipitate the plutonium as hydroxide, uranium as uranates. The precipitate would be calcined to plutonium oxide and magnesium uranates and stored. The filtrate is cemented in Building 774 regardless of actinide concentration due to chloride corrosivity.

Hydroxide precipitation of plutonium with magnesium hydroxide would also be used in the CWTS in Building 371 to stabilize all solutions in tanks and piping. The products will be treated/stored the same as in Building 771.

The Current Baseline is the selective use of direct cementation, carrier precipitation, oxalate precipitation and hydroxide precipitation based on solution actinide concentrations and other constituents, i.e. nitrate and chloride.

Ranking Matrix - The ranking matrix is shown in Table x.x. The same criteria used to evaluate facilities were used to evaluate stabilization processes. As with location, the Current Baseline is rated as 0 by definition in all criteria, with other stabilization options rated as better (+1) or worse (-1) than the four favored options. However, each of these stabilization options is also rated based on its capability to process all of the actinide solutions.

Ordered Rank Discussion - The ranking is done in the order of least to most favored option.

No Action Alternative. Safety (-1), continued storage in tanks, piping, and bottles is unsafe; Schedule (+1), easier to do nothing in short term; Cost (-1), less cost in short term, but more in long term due to leaks, spills, job remaining to be done; Feasibility (-1), technically feasible but unacceptable under any scheme; Waste Minimization (-1), less short term, more in long term due to leaks, spills; Storage Predictability (-1), continued storage of liquid is unsafe, with increasing leakage rates for tanks and piping, and poly bottle failure at increasing, but not predictable, rates; Safeguards and Security (0), same as baseline. Total (-4)

Bottle and Store : Safety (-1), unsafe to store in poly bottles; Schedule (+1), easier to do than processing; Cost (-1), less expensive than processing in short term, but more in long term; Feasibility (-1), technically feasible but not acceptable for IES or any other scheme; Waste Minimization (-1), less short term, but more long term; Storage Predictability (-1), storage unsafe, bottles failing depending on radiolysis and acidity; Safeguards and Security (0), same as baseline. Total (-4).

Transfer to New Tanks: Safety (-1), safer in long term but would be years before sufficient tankage could be put in place, also continued personnel exposure; Schedule (-1), line item funding required; Cost (-1), line item, as noted; Feasibility (-1), technically feasible but not acceptable for IES or any other scheme; Waste Minimization (-1), more waste in short term (D&D of existing equipment to make room for new tanks) and long term, more tanks requiring closure, etc.; Storage Predictability (0), storage unsafe in short term, safer in long term, but only delaying activity; Safeguards and Security (0), same as baseline. Total (-5).

Vitrification: Safety (+1), safest form, not dispersible and less leachable; Schedule (-1), line item funding required; Cost (-1), line item, as noted; Feasibility (-1), technically feasible but not acceptable for IES or any short term scheme; Waste Minimization (-1), considerable waste generation, depending on actinide loading level in glass; Storage Predictability (+1), safest storage form; Safeguards and Security (+1), actinide in monolithic "logs," more secure from diversion. Total (-1).

Polymer Encapsulation: Safety (+1), less leachable, less dispersible; Schedule (-1), line item funding required with long lead time; Cost (-1), line item, as noted; Feasibility (-1), not used for TRU waste due to radiolysis of polymer, not used for chloride wastes; Waste Minimization (-1), only 22 g ^{239}Pu could be encapsulated per 55-gallon drum using 400 lbs low density polyethylene (LPDE); Storage Predictability (-1), due to radiolysis of LPDE and hydrogen gas formation; Safeguards and Security (+1), actinide secure as drummed monolith. Total (-3).

Denitration/Salt Distillation: Safety (0), comparable to precipitation; Schedule (-1), equipment not available on-site, funding, design, construction, etc., required; Cost (-1), for reasons noted;

Feasibility (-1), technically feasible for nitrate solutions, more difficult to apply to chloride, and not acceptable for IES schedule; Waste Minimization (+1), scrubber solution processing required but not many TRU waste drums would be generated; Storage Predictability, (0),same as baseline; Safeguards and Security (0), same as baseline. Total (-2).

Carrier Precipitation: Safety (0), like baseline; Schedule (-1), it would take far longer than cementation to treat 145 kg actinide at liquid waste treatment levels; Cost (-1), long processing time, large amounts of sludge, currently no way to process sludge; Feasibility (-1) for reasons mentioned; Waste Minimization (-1), large amounts of sludge and solutions would be generated; Storage Predictability (0), same as baseline except for uncertainty on where to store large amounts of sludge until sludge treatment process on line; Safeguards and Security (0), same as baseline. Total (-4).

Direct Cementation: Safety (0), same as baseline; Schedule (-1), it would take a long time to cement all the solutions; Cost (-1), lengthy processing time and waste generation; Feasibility (-1), technically feasible but not acceptable for IES or any short term scheme; Waste Minimization (-1), generation of a large number of TRU waste drums; Storage Predictability (0), with some uncertainty on hydrogen gas generation; Safeguards and Security (0), same as baseline. Total (-4).

Oxalate Precipitation: Safety (0), same as baseline; Schedule (-1), it would take a long time to treat all solutions by oxalate precipitation; Cost (-1), longer time to process all the solution; Feasibility (-1) for reasons listed, and because uranium oxalate solubility is high enough that recycle would be necessary; Waste Minimization (-1), more saltcrete would be generated; Storage Predictability (0), same as baseline; Safeguards and Security, same as baseline. Total (-4).

Hydroxide Precipitation: Safety (0), same as baseline; Schedule (-1), it would take a long time to treat all solutions by hydroxide precipitation; Cost (-1), longer time to process all solution; Feasibility (-1) for reasons listed; Waste Minimization (-1), more saltcrete would be generated; Storage Predictability (0), same as baseline; Safeguards and Security (0), same as baseline. Total (-4).

Current Baseline: A combination of carrier precipitation, direct cementation, and oxalate and hydroxide precipitation based on solutions to be processed.

Table x.x

Liquid Residue Stabilization Process Options

Criteria	Do Nothing	Bottle & Store	Transfer to New Tanks	Polymer Encap-sulation	Denitration/ Salt Distillation	Carrier Precipi-tation	Direct Cemen-tation	Oxalate Precipi-tation	Hydroxide Precipi-tation	Current Baseline

Safety— Rad Exposure Nuc Safety Indust. Exp.	-1	-1	-1	1	0	0	0	0	0	0
Schedule	1	1	-1	-1	-1	-1	-1	-1	-1	0
Cost	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
Feasibility	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
Waste Minimization	-1	-1	-1	-1	1	-1	-1	-1	-1	0
Storage Predictability	-1	-1	0	-1	0	0	0	0	0	0
Safeguards & Security	0	0	0	0	0	0	0	0	0	0
Total Score	-4	-4	-5	-4	-2	-4	-4	-4	-4	0

1.2.4.7. Recommendations For Follow-On

Combination of Options - Two different trade-off studies were conducted to evaluate alternative strategies for liquid stabilization.[3, 4] The first focused on the process alternatives discussed above. The second study included the processing locations discussed above, including on-site buildings and the modular building. Off-site locations were not considered due to the shipping problem.

Evaluate in Detail in Next Phase - based on the stabilization achieved using magnesium hydroxide, the suggestion has been made that perhaps all solutions should be stabilized by precipitation using magnesium hydroxide vice oxalic acid.

Some additional study of cost and waste generation might be considered. However, it should also be noted that stabilization by the "Current Baseline" is in progress and implementation of other technologies and/or facilities at this time would impact ongoing activities and schedules. Additional information is available.[5]

1.2.4.8. References

1. Recommendation 94-1, Improved Schedule for Remediation in the Defense Nuclear Facilities Complex, DNFSB, May 26, 1994.

2. Defense Nuclear Facilities Safety Board Recommendation 94-1 Implementation Plan, DOE, February 28, 1995.

3. W. V. Conner, Revised Process Selection and Waste Generation From Processing or Waste Treatment of Existing Actinide Solutions at Rocky Flats, RO 93-01, March 2, 1993.

4. Actinide Solution Disposition Study, Rocky Flats Plant, Golden, CO, November 18, 1993.

5. Liquid Stabilization Program Plan, PADC-95-01105, April 18, 1995.

1.2.5 Subtask 5-Solid Residues Stabilization

1.2.2.5.1 Task Description

This task addresses the stabilization, consolidation, and interim on-site storage of the wide variety of complex forms of nuclear materials, called solid residues, that are currently stored in several of the previous RFETS plutonium operations buildings. A team of experts from the K-H team and Los Alamos National Laboratory was assembled to evaluate and define the necessary criteria to ensure the lowest-cost demonstrated stable, predictable storage of the residue materials throughout the quiescent interim end state vision and to identify and evaluate processes to ensure that these defined criteria are achieved. Team members have in-depth knowledge and experience in the Rocky Flats site, plutonium chemistry and operations, materials science, chemical and nuclear engineering, and project management methodology. The team evaluated the credible processing options and the ways to sequence the necessary activities of these options to reach the interim end state vision of the site in the shortest, most cost-effective way. Although technically achievable, this is an enormously complex and difficult task from many perspectives, mostly politically and institutionally.

A panel of technical experts from the site, the DOE, and other plutonium facilities within the DOE complex with expertise in solid residue issues was also assembled to assist in identifying and evaluating issues, evaluate the team's study methodology, and review and comment on the most promising options the team recommended.

This white paper provides a top-level assessment of the team's conclusion and recommendations for stabilizing and consolidating the residues to reach the IES vision as defined in the introduction of this paper. It discusses the constraints arising from the defined IES vision on the activities for stabilization, consolidation, and storage of the residues; the requisite criteria for the demonstrated predictable, safe storage of the residues; the issues to be resolved to meet this interim end state; and the identification and evaluation of the options.

The most promising path (set of options) is discussed at a summary level. As this project proceeds, the team expects that modifications of the approach will logically evolve to ensure that the optimum interim state is reached in the most cost-effective and timely way.

1.2.5.2 Justification

When the Rocky Flats Plant was shut down in 1989, a wide variety of plutonium-bearing materials, or residues, were left in various forms and storage conditions throughout the site. Most forms of plutonium are chemically unstable or reactive, and these materials were thus either in special, controlled-atmosphere production lines awaiting further processing or in temporary storage. They were not in a chemically or physically stable form and were never intended for long-term stable storage.

The largest cost savings to be achieved along the path to plant closure and attainment of the interim end state occurs with the taking down of the nuclear buildings, and the greatest component of these cost savings comes from removing the nuclear materials from the buildings. Thus, the removal of this material from the buildings becomes a critical item along their path to D^4.

1.2.5.3 Scope

The Rocky Flats solid residues include 106 metric tons of a wide variety of materials containing 3.1 metric tons of plutonium. The solid residues, about 4000 drum equivalents, are located in several buildings (B779, B776/7, B771, B371, and B707). Along with plutonium metal and oxide, holdup, solutions, and wastes, the solid residues must be placed in a stable, storable form in one or more locations to enable the D^4 of existing plutonium buildings. High-plutonium-content residues will require storage in a secure location, probably along with the plutonium metal and oxides. Residues with sufficiently low plutonium content may be storable along with TRU wastes. The volume of these two categories will affect the size and configuration of the IES special nuclear material storage facility and the waste storage facility.

1.2.5.4 Purpose

The goal of the IES vision is an interim site configuration that enables the safe storage of the nuclear materials in the lowest possible cost configuration throughout the entire and indefinite quiescent interim state, until the national policy for the final disposition of the these materials is determined. This is estimated to be at least 2020.

To achieve this established goal, the materials must be stored in a state that has been demonstated to be safe and predictable so that material surveillance programs and the required facility vital safety systems can be minimized. The stored material must also be in a form that does not preclude meeting shipping requirements, with minimal additional packaging and inspection, as soon as a disposition path has been determined. It should be noted that the shipping requirement does not necessitate the material being stored in a DOT certified container, which might require significantly more interim storage space, but rather that the material be sufficiently stable that it requires only repackaging and certification to the DOT and repository acceptance criteria. No capabilities will be retained in the IES for additional stabilization of nuclear materials.

1.2.5.5 Strategy

The strategy to address stabilization, consolidation, and storage of the solid residues consists of several important components. The objective is to achieve an interim storage storage condition for the residues in a minimal storage facility to ensure the lowest possible mortgage throughout the IES. Meeting this objective requires that residues be in a storage state that has been demonstrated to be safe and predictable. The team has recommended that this objective be reached through a complex, staged process that enables all buildings planned to be down by the start of the IES to have been taken down completely by 2003, which then is the start of the IES.

The first component of the team's recommended strategy is to remove the materials from their current locations in the D^4 target buildings and consolidate them into a single building, as soon as possible. This allows the D^4 activities to proceed expeditiously. Concurrently (second component), capabilities for drum unpackaging, sorting, assaying, treatment, repackaging, waste handling, and certification for safe interim storage must be installed in a single building in such a way as to minimize the costs and complexity of the stabilization and consolidation activities. In the third component, the residues are treated, as necessary, to ensure that they can be stored to meet the IES objectives. The high-plutonium, stabilized residues will be stored in the future SNM storage facility and low-plutonium-content residues will be stored in the future waste storage facility.

The treatment of the residues to give a demonstrated safe, predictable storage form exceeds the draft safe interim storage standards being developed by the DOE addressing the concerns of DNFSB Recommendation 94-1. Although some of the initial milestones of the current site baseline, as described in the Site Integrated Stabilization Management Plan (SISMP), might be delayed, all final milestones for completion of the residue stabilization activities should be met. The more conservative storage criteria are driven by the need to meet the extraordinarily low cost mortagage requirement set for the IES vision and the need to maintain minimal processing capability to repackage and certify the material for off-site shipment when a repository becomes available.

In summary, stabilization of the residues minimizes the cost of surveillance and eliminates the need for stabilization processing capabilities during the IES. Staging and consolidating the residues in a single facility expedites D^4 and minimizes the costly authorization-basis issues. Storage of high-plutonium-content residues in the future SNM facility will facilitate meeting safeguards and security requirements. Storage of low-plutonium-content residues in the future waste storage facility minimizes the effect on the footprint of the high-cost SNM storage facility and addresses the likely need to store TRU wastes during the IES. Finally, placing the residues in a form that is readily convertible to a shippable form will facilitate their eventual removal from the site.

1.2.5.6 Option List And Discussion

The plutonium subtask team members developed various options and evaluated them against a common set of criteria based on the key attributes that the options should possess. To assist the subtask team in evaluating the options against the criteria, a zero value was assigned to the option deemed most likely to meet the criteria, and this option was then called the "new baseline." The team determined whether each of the other identified options was better (+1), about the same (0), or worse (-1) than the new baseline for the criteria. The criteria scores for each option were added together to give an overall figure of merit, which the team used to rank the options. Although it is certain that some potential options have not been listed, the team tried to identify all option extremes and the most likely options in between.

Options were evaluated for the stabilization treatment of the residues and for the locations for storing the materials during the transition period prior to the IES in order to stage them for treatment, for conducting the treatment, and for IES storage.

1.2.5.6.1 Options for Staging, Treatment, and Storage Location

The team evaluated eight options for the treatment location. Table x.x lists these options versus the evaluation criteria considered relevant for treatment location. The treatment location options are listed below in order of increasing desirability, based on the evaluation matrix.

1. Do nothing. No treatment will be done, so no treatment location is needed. The team rejected the option because it does not address safety issues or enable IES.

2. Current baseline. This is the pathway RFETS was pursuing before the IES proposal. It consists of stabilizing residues in various buildings (B779, B707, and B371), using previously existing facilities to the extent possible. The processes selected are pyro-oxidation of pyrochemical salts in B779, calcination of ash in B707, repackaging of inorganics in B707, chemical oxidation and electrochemical decontamination of combustibles in B371 (new capability), and drying and various other processes for wet/miscellaneous residues in B371 (new capability). The current baseline was selected before the desire to accelerate evacuation of plutonium buildings to allow D^4 and achievement of the IES much sooner than expected. It suffers in this evaluation primarily because it does not accommodate D^4 and the need to develop authorization bases for the processes in various buildings.

3. Current capabilities. This option is similar to the current baseline, except no new processes would be installed. It suffers for similar reasons, but would be less expensive than the current baseline.

4. Combination of B707 modular, B371 modular, and previous capabilities. A combination of self-contained modules installed in B707 and B371 and previous capabilities would be used to stabilize residues. The details of this option would have to be worked out, but an example would be to use pyrochemical furnaces in B779, an aqueous washing/drying module on B371, a repackaging module in B707, and calcining in B707. Again, use of existing, un-resumed facilities damages this option except where modules with accompanying authorization bases are used. Costs of using multiple buildings are also a problem.

5. B371 Modular. All necessary treatment capabilities would be installed in B371 as self-contained modules which require either no or minimal authorization bases from the building. This option is relatively attractive, but loses points from a likely interference of staging and consolidation in B371, probable higher costs for installation of modules in B371 because D&D would be more difficult than B707, and a less favorable authorization basis environment in B371 than B707.

6. B707 Modular. This is the preferred option, called the new baseline, because the modular

approach addresses authorization basis issues, B707 has been resumed for some operations already, B707 probably has enough space that is readily D&D'd for emplacement of modules, and treatment in B707 does not interfere with D^4 of other buildings. There remains some uncertainty in the feasibility of the modular concept because the Los Alamos National Laboratory study on it is not yet complete. However, results to date are promising and other mobile modules (Real Time Radiography and Segmented Tomographic Gamma Scanning) have been demonstrated at RFETS.

7. Stabilize Off-Site and Return Materials to RFETS. This option would ship all residues off-site for treatment using capabilities at other DOE sites. It is more attractive than the new baseline, B707 Modular, because it avoids the issues of authorization basis and associated costs and schedule problems at RFETS, and would allow earlier D^4 of B707. It is not the favored option because it is not feasible to ship all residues off-site if they do not meet DOT requirements. Some residues may be shippable and thus should be considered where the off-site capability exists.

8. Combination of B707 Modular and Off-Site Treatment with Materials Return to RFETS. This option combines the best properties of #'s 6. and 7. above. It is not the favored option because some doubt still exists as to the shippability of some residues and it relinquishes some control over the outcome to another site, partially violating IES guidance. However, it should be retained for further consideration because of its desirable features: optimiztion of DOE Complex capabilities, minimization of processing requirements at RFETS, and acceleration of stabilization.

Table x.x

Solid Residue Stabilization Location Options

Criteria	Current Baseline	B707—Modular	B371—Modular	Previous Capa-bilities	Combin. of B707 & B371 Mod. and Limited Previous Locations	Stabilize Off-Site/ Mtr'l Comes Back	Combin. of On-Site (B707) and Off-Site/ Mtr'l Comes Back
Safety— Rad Exposure Nuc Safety Indust. Exposure	-1	0	0	-1	0	1	1
Probability of Success Implementation	-1	0	0	-1	-1	-1	1
Compatibility with D4 Goals/Timing	-1	0	-1	-1	-1	1	1

IES Start Date	-1	0	0	-1	-1	1	0
Cost—Implementation	-1	0	-1	-1	-1	0	1
Cost—Site Mortgage e.g. Maintenance & Surveillance	0	0	0	-1	-1	1	0
Available Existing Space/Capacity	1	0	-1	1	1	-1	1
Facility/Process Preparation Complexity Cost	-1	0	0	1	0	1	0
Authorization Basis	-1	0	-1	-1	-1	1	0
Waste Generation	-1	0	0	0	0	0	0
Minimize Mat'l Movement	0	0	1	0	1	-1	0
Security Classification of Bldgs.	0	0	0	-1	-1	0	0
Risk Reduction	0	0	0	0	0	1	0
Total Score	-7	0	-3	-6	-5	4	5

1.2.5.6.2 Options for Stabilization

The team evaluated fourteen options for the stabilization process. Table x.x lists these options versus the evaluation criteria considered relevant for the stabilization process. The stabilization process options are listed below in order of increasing desirability, based on the evaluation matrix.

1. Stabilize to Meet the Current WIPP/WAC, Store On-Site, and Ship to WIPP. In addition to repackaging the residues to meet current WIPP Waste Acceptance Criteria and generating about 65,000 drums of TRU waste, this option would require the expense of stabilization in current facilities. The very large waste storage volume required on-site if WIPP does not open as planned would be insurmountable.

2. Entombment On-Site. This option would process residue to some stable form, such as glass, and be stored indefinitely on-site in some very stable facility, such as an underground vault. This option is unsuitable because of concerns about safety of indefinite storage on site, technical feasibility questions, costs of implementation, and the difficulty of placing the residues in a shippable form after such treatment.

3. Current baseline. This is the pathway RFETS was pursuing before the IES proposal. It consists of stabilizing residues in various buildings (B779, B707, and B371), utilizing previously existing facilities to the extent possible, and repacking residues to meet WIPP/WAC. The number of TRU waste drums generated would be reduced by not packaging in <200 g Pu drums until WIPP opens. The processes selected are pyro-oxidation of pyrochemical salts in B779, calcination of ash in B707, repackaging of inorganics in B707, chemical oxidation and electrochemical decontamination of combustibles in B371 (new capability), and drying and various other processes for wet/miscellaneous residues in B371 (new capability). The current baseline was selected before the desire to accelerated evacuation of plutonium buildings to allow D^4 and reaching the IES much sooner than expected. It suffers in this evaluation primarily because it does not accomodate D^4 and it requires authorization bases for the processes in various buildings.

4. Repack and Store to WIPP/WAC. This option would not perform any stabilization treatment except that required to meet WIPP/WAC, such as drying. In addition to serious waste storage problems from the 65,000 drums of TRU waste, this option does very little to address residue stability concerns and would interfere with D^4 because of drum storage and would require high surveillance.

5. Entombment in D^4 Buildings. Residues would be left in their current locations and entombed in place by filling the building with concrete or some undetermined method that would not disperse the residues into the environment. This option is ranked higher than the current baseline because material movement is eliminated, facilitating D^4. However, there are serious concerns about the feasibility and acceptability of this option.

6. Actinide Separation, Store SNM in New Vault, and Store Waste in New Storage Facility. This option would perform actinide separation, removal and concentration of plutonium from the residue materials, and store the resulting minimal volume of plutonium (~700 cans) in a new vault, and store the resulting TRU waste (~16,000 drums) and Low Level Waste (LLW) (~13,000 drums) in a new waste facility. The expense and complexity of installing the capability to perform actinide separation on all residues tends to overshadow the benefits of having well-stabilized, storable materials. The amount of waste generated is also a detriment. However, some residues are still candidates for actinide separation because of recent improvements in processing (e.g. salt distillation) which could stabilize the material and result in dramatic reductions in the amount of waste generated when compared to any other feasible option.

7. Repack and Store in Robust Container. In this option, residues would be welded into a thick-walled steel container, which would be strong enough to withstand any safety hazard generated by the residues. This option is currently only a concept, with a low confidence factor. It may also interfere with D^4 and the IES start date because of delays in implementation. Long-term surveillance costs would also likely be higher than the new baseline because no stabilization was used. The containers would not likely be shippable as is and thus would require major repackaging efforts once final disposition is approved.

8. Repack and Store in Pipe Component. This option would repackage residues to meet WIPP/WAC with only minimal treatment to meet the WAC. The residues would be stored in the "pipe component", a container under development by DOE/RFFO designed to alleviate radiation and fines issues with residues that arise if they are only repackaged for WIPP disposal. The repackaged residues would occupy an estimated 17,000 drums of TRU waste. Presumably, to save space, the pipe components would be stored in fewer drums and be repackaged to meet the 200 grams of plutonium per drum limit only after WIPP opens. This option does not give full stability to the residues and induces doubt and therefore more surveillance requirements. It probably would not fulfill Defense Board recommendations and may interfere with D4 because of the large number of drums of TRU waste that would be generated from the residues.

9. Remove from D^4 Buildings and Consolidate in B371 and/or B707. No stabilization would be performed in this option. Residues would only be removed from buildings to be subjected to D^4 and relocated into B371 and/or B707. This option has the advantages of being simple and inexpensive to implement, allowing removal of residues from several buildings and possibly not requiring B707 for processing, depending on the capacity of B371. This option would also generated very little waste. This option has the distinct disadvantage of doing nothing to address the safety concerns of residues and would entail high costs from surveillance and maintenance of stabilization capabilities during IES.

10. Do nothing. No treatment will be done, so no treatment process is needed. The team rejected the option because it does not address safety issues or enable IES.

11. Stabilize in B707 and Store in B371. Stabilization of residues would be accomplished in modular systems in B707 and stabilized residues would be stored in B371, without construction of a new vault. A new waste facility may or may not be prepared. This option avoids the costs and uncertainties of a new vault, but will have the associated costs of indefinite storage of residues in B371. This option may be viable.

12. Favored Option: Stabilize in B707 and Store in New Vault and Waste Facility. This is the preferred option, called the new baseline, because the modular approach addresses authorization basis issues, B707 has been resumed for some operations already, B707 probably has enough space that is readily D&D'd for emplacement of modules, and treatment in B707 does not interfere with D^4 of other buildings. There remains some uncertainty in the feasibility of the modular concept because the Los Alamos National Laboratory study on it is not yet complete. However, results to date are promising and other mobile modules (Real Time Radiography and Segmented Tomographic Gamma Scanning) have been demonstrated at RFETS. Stabilization would occur in existing facilities where it would not interfere with D4 and would be relatively easy. After stabilization, residues would be repackaged into fewer drums than they currently occupy by taking advantage of packing drums to the maximum criticality limit (1000 grams of plutonium) and utilizing current residue storage vault space in B371 until the new vault is available. Thus, logistics should be accomplishable. Stabilization satisfies residue safety concerns and gives a material with predictible behavior.

13. Ship Off-Site Directly. Residues would be shipped to an unknown site, possibly a missle silo or Indian Reservation, without any treatment. The lack of an identified site to receive the residues and ignoring safety concerns offset the low cost and simplicity of this option and make it not feasible.

14. Stabilize Off-Site and Return Materials to RFETS. This option would ship all residues off-site for treatment using capabilities at other DOE sites. It is more attractive than the new baseline, B707 Modular treatment, because it avoids the issues of authorization basis and associated costs and schedule problems at RFETS, and would allow earlier D^4 of B707. It is not the favored option because it is not feasible to ship all residues off-site if they do not meet DOT requirements. Some residues may be shippable and thus should be considered where the off-site capability exists because of the attractive features of this option eventhough some control over the outcome is lost.

Solid Residue Stabilization Options Evaluation Matrix

Criteria	Current Baseline	Do Nothing	Repack, Store—WIPP/WAC	Repack, Store—Pipe Component	Repack, Store—Robust Container	Stabilize in B707, Store in New Vault &/or Waste Facility	Stabilize Off-Site & Store in New Vault &/or Waste Facility	Stabilize, Meet WIPP/WAC, Store and Ship to WIPP	Ship Off-Site Directly	Stabilize in B707, Store in B371	Entomb On-Site	Entomb in D4 Bldg(s)	Remove from D4 Buildings, Consolidate in B371 &/or B707	Actinide Separation, Store SNM in Vault, Waste to New Storage
Safety— Rad Exposure Nuc Safety Indust. Exposure	0	-1	-1	-1	0	0	0	-1	0	0	-1	-1	-1	-1
IAEA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DNFSB & Reg Req. vs Promises	-1	-1	-1	-1	0	0	1	0	-1	0	-1	-1	-1	0
Probability of Success Implementation	-1	1	0	1	-1	0	0	0	-1	1	-1	-1	1	0
Compatibility with D4 Goals/Timing	-1	-1	-1	-1	-1	0	0	-1	0	0	-1	0	-1	-1
IES Start Date	-1	-1	-1	-1	-1	0	0	-1	0	0	-1	0	0	-1
Cost—Implementation	-1	1	0	1	0	0	0	-1	1	1	0	1	1	-1
Cost—Site Mortgage e.g. Maintenance & Surveillance	0	-1	-1	-1	-1	0	0	-1	1	-1	-1	-1	-1	1
Available Existing Space/Capacity	1	1	-1	0	0	0	1	-1	-1	0	0	1	0	0
Facility/Process Preparation Complexity Cost	-1	1	1	1	0	0	0	0	1	0	0	-1	1	-1
Workforce Availability Impact (Exposure)	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Authorization Basis	-1	1	0	0	1	0	1	0	0	-1	0	0	0	-1
Waste Generation	-1	0	-1	0	0	0	0	-1	1	0	0	-1	1	-1
Minimize Mat'l Movement	0	1	0	0	0	0	-1	-1	0	0	0	1	1	0
Security Classification of Bldgs.	-1	-1	0	0	0	0	0	0	1	0	-1	-1	-1	1
Risk Reduction	0	-1	-1	-1	0	0	0	0	-1	0	0	-1	-1	0
IES Surveillance	0	NA	NA	-1	-1	0	0	-1	1	0	-1	-1	-1	1
Total Score	-8	-1	-7	-4	-4	0	2	-9	2	0	-8	-6	-2	-5

defined

1.2.5.6.2 Description of Favored Options

Stabilization options:

1. Do not stabilize and continue to store as-is (after completion of drum venting) with increased surveillance.

2. Repackage into vented containers to remove direct contact of plutonium with plastic.

3. Perform minimum processing to stabilize to meet interim storage standards, taking into account possible ultimate disposition.

4. Separate plutonium from matrix and stabilize products.

5. Destroy residue matrix and stabilize plutonium.

6. Ship off the site for stabilization.

7. Prepare for disposal if WIPP opens.

8. Various combinations of the above options.

Stabilization Location: Sufficient space in B707 will be made available for installation of modules for residue stabilization. Based on priority and capacity, residues will be campaigned through the modules, resulting in residues meeting interim storage standards. Modules will provide NDA/NDE, unpacking, processing, and repackaging capabilities as well as any needed support services and safety envelope not provided readily by B707. B707 undergoes D^4 as soon as residues and metal/oxide are stabilized for storage.

Justification: Stabilization in B707 accelerates D^4 of other buildings. B707 provides best compliance with authorization basis on site. B707 already provides limited calcination and repackaging capability needed for many residues. This option maximizes the return on investment in B707 resumption.

Consolidation: Residues will be moved to B371 and rooms D&D'd, as required to accommodate residue storage. After establishment of interim residue storage standards, residue stabilization requirements will be determined and stabilization processes will be located in B707 (the baseline location). Residues requiring stabilization will be processed in B707 and shipped back to B371 or to the new storage facility (if available).

Justification: Staging in B371 allows acceleration of D^4 of other buildings and provides acceptable storage until the new storage facility is available. Transfer to the new storage facility is necessary for D^4 of B371 which is not optimum for long-term storage.

Stabilization: The option chosen for stabilization will depend on the interim storage criteria and the particular residue. The Favored Options for each residue category are shown below:

Combustibles: 17,500 kg bulk wt. (748 drums)

Favored Option: ~6000 kg of dry combustibles:
Option 2 - Repackage to verify identity and confirm packaging integrity for interim storage.

~11,500 kg wet combustibles (Ful-Flo filters, ion exchange resin, grease oxide, and grease fluoride):
Option 3 for grease oxide and grease fluoride (calcination), and ion exchange resins (cementation or salicylate ion exchange),
Option 4 for nitrate-contaminated wet combustibles and Ful-Flo filters (washing and plutonium removal by water-soluble chelates or hydrochloric acid),
Option 4 for carbon tetrachloride-contaminated wet combustibles and Ful-Flo filters (low temperature thermal desorption followed by detergent washing including water-soluble chelates or hydrochloric acid leaching)

Justification: Dry combustibles: The safety concerns with dry combustibles are minimal. Hydrogen generation is addressed by venting the container. Repackaging is necessary to segregate any materials in drums not belonging in this IDC.

Grease oxide, grease fluoride, and ion exchange resins: Calcination of the grease oxide and grease fluoride is necessary to destroy the organic materials which are a very large source of hydrogen gas. This treatment would allow these materials to be handled as >50% oxide. Ion exchange resins require cementation or salicylate exchange because they are combinations of fuel and oxidizer with low ignition temperatures. This treatment would stabilize them sufficiently for interim safe storage.

Nitrate-contaminated wet combustibles and Ful-Flo filters require water washing to remove nitrates (a source of corrosion and a potential oxidizer/fuel problem) and raise their ignition temperature. Water-soluble chelates or hydrochloric acid washing greatly reduces the plutonium content, reducing hydrogen generation and allowing a much smaller number of drums to be disposed as TRU waste.

Carbon tetrachloride-contaminated wet combustibles and Ful-Flo filters need low temperature thermal desorption to remove any residual carbon tetrachloride (a source of corrosive hydrogen chloride from radiolysis). Detergent washing including water-soluble chelates or hydrochloric acid leaching removes any trace carbon tetrachloride, making the material non-LDR and removing plutonium, giving the same benefits as with nitrate-contaminated wet combustibles.

Salts: 16,000 kg bulk wt. (641 drums + 2954 cans)

Favored Option: Option 3 for ~1200 kg DOR Salts and other calcium chloride-based salts with low Pu content (oxidation with calcium carbonate in pyrochemical furnaces).
Option 4 for the remainder (~14,500 kg) of the salts (oxidation with carbonate in pyrochemical furnaces followed by salt distillation, may want to include scrub alloy for MSE salts to remove americium).

Justification: DOR salts and other calcium chloride-based salts contain calcium and plutonium reactive metals and are likely to contain moisture, generating hydrogen both from chemical reaction and radiolytically. The presence of plutonium hydride cannot be ruled out. The salts are corrosive, especially when wet and can compromise metal containment. Pyro-oxidation will simultaneously destroy the reactive metals and dry the salt, allowing their storage in sealed metal cans. Calcium chloride salts are not good candidates for salt distillation because high temperatures (>1000° C) required will volatilize plutonium and make a poor separation.

The remainder of the salts are sodium chloride- and potassium chloride-based and contain reactive metals and some moisture (probably less than the calcium chloride salts), giving the same safety concerns. Pyro-oxidation and storage in sealed containers will alleviate these problems. Salt distillation is advantageous because the products will be a LLW or low-TRU waste salt and an impure plutonium oxide. The distilled salt can be packaged into about 250 drums or less and the impure plutonium oxide into about 200 cans, reducing the number of drums by more than a factor of 2 and the number of cans by a factor of 14. The LLW or low-TRU waste salt should be readily shippable to an off-site waste disposal facility. (Scrub alloy processing before oxidation and distillation of MSE salts has the advantages of (1) greatly reducing the americium content, making salt distillation more likely to produce LLW or low-TRU waste, (2) placing the americium in a self-shielding button, reducing radiation exposure, and (3) potentially allowing removal of the americium and a large amount of plutonium from the site by shipment to SRS for further processing.)

Inorganics: 32,800 kg bulk wt. (665 drums + 129 cans)

Favored Option: Option 2 - Repackage all inorganics to verify identity and minimize gas generation.

Justification: Repackaging is necessary to make sure inappropriate materials are not included and to minimize plutonium contact with plastic. In addition to minimizing hydrogen gas generation, this will allow shipment of more material per drum to WIPP or other off-site disposal facility. Otherwise, these materials are stable and safe to store.

Ash: 27,400 kg (1426 drums + 456 cans)

Favored Option: Option 3 - Oxidation (calcination) to destroy hydrogenous materials and reactive metals, and to dry the remaining matrix.

Justification: Calcination of ash will minimize gas generation, making the material safer to store and requiring shipment of fewer drums to WIPP or other disposition site. Calcination of SS&C will stabilize plutonium metal, greatly reducing the potential for hydrogen generation or plutonium hydride formation.

Wet/Misc. 12,600 kg (448 drums + 366 cans)

Favored Option: Option 3 - Wash, dry, or size reduction and repackaging.

Justification: There are a wide variety of materials in the Wet/Misc. category, requiring a variety of treatments. Currently identified processes are adequate. Sludge need to be dried or solidified to make into a shippable form. Fluorides need to be converted to oxides to minimize neutron exposure. Gloves, filters, and Raschig rings will be washed to remove plutonium and any other reactive materials (nitrates, etc.). Classified shapes require only size reduction to destroy the shape. Repackaging will minimize gas generation and enhance shippability.

1.2.5.7 Approach

The approach required to implement the residue IES strategy and favored options is illustrated in Figure _. The activities described in the strategy section above are shown with their time sequencing. Residue risk mitigation will occur first, essentially continuing and enhancing current activities. It is anticipated that hazard mitigation will no longer be needed by FY98 because this will be sufficient time to address current high-risk items and any new ones identified.

Residue characterization will also continue current activities and greatly enhance them by adding RTR capability, whether fixed or mobile, to allow all residue drums to be examined. Segmented Tomographic Gamma Scanning (STGS) may also be desirable to allow visualization of nuclear material concentrations within drums. Headspace gas sampling and gas generation studies will also be useful for some drums, especially combustibles. Until the proper process operations are available, it is unlikely that opening drums and performing visual inspections and solid sampling will be desirable because of the radiation exposure entailed during such hands-on operations, which would have to be repeated if processing were required and not available. Characterization activities would be focused on FY96, especially the RTR of all drums. These activities would continue after FY96 only where necessary to establish the absence of urgent hazards or as required as a preliminary step to processing, repackaging or storage.

Once high risks are mitigated, and characterization is under way, residue staging and storage operations would commence, currently envisioned in B371. Drums will be shipped from their current location to RTR (either in B707 or to a mobile unit adjacent to their current location), then to B371 for staging and storage until processed, repackaged, or determination as safe to store.

Residue repackaging operations, currently planned for B707, will also commence in FY96. There currently some doubt as to the exact definition of repackaging. If residues are truly to be shipped to WIPP as waste, repackaging once to WIPP/WAC using the pipe component would be desirable. However, this action would multiply the number of residue drums up to ~17,000 (if packed to meet the 200 g FGE limit) and would require subdividing large numbers of individual packages with an increase in the amount of time required for repackaging. Following the IES principle to perform action based on those things controlled by RFETS, repackaging to meet WIPP/WAC is not advisable unless there is essentially no additional effort required. Provision will have to be made to have the capability to repackage residues to WIPP/WAC if disposal at WIPP is the final end state of residues or some fraction of the residues.

Residue treatment operations will commence in FY97. Those residues requiring treatment or processing to achieve safe interim storage will be stabilized, probably in modular facilities to be installed in B707. Current knowledge indicates the required operations will be calcination (for ash and SS&C), pyrosalt oxidation, an aqueous-based operation (for wet combustibles and miscellaneous residues), and thermal desorption (for carbon tetrachloride-containing combustibles). After processing and repackaging the residues will go to interim storage in B371.

Residue shipment to WIPP or other off-site repository would be the final step in the approach to managing residues and would occur as soon as possible. It is not possible to guarantee what that date will be.

2.5.8 Institutional Issues

Waste Management Issue

Stored TRU wastes share some hazards with residues that are independent of the plutonium content, such as the presence of nitrates in combustibles and reactive materials on leaded gloves. Stabilization of TRU wastes must be accomplished in the required time.

Space

The amount of space and resources needed for residue operations and storage is likely to be large. The interactions with other activities needed to reach the IES and residue management are essential to acknowledge and resolve. The most likely competitors are in the SNM stabilization and storage sub-task because it will also require the use of secure facilities such as B371 and B707.

Waste Generation Issue

Residue stabilization activities will generate LLW and TRU wastes which will impact the current on-site storage problem with these materials. Estimates of this waste generation will be needed and work arounds developed to prevent exceeding the site on-site storage limits.

1.2.5.9 Political Issues

94-1 Implementation Plan goals
Residue Compliance Order
RCRA Compliance

1.2.5.10 Promising Option Parallel Investigation

Combination of B707 Modular and Off-Site Treatment with Materials Return to RFETS - This option combines the best properties of options #'s 12. and 14. above. The details have not been worked out yet, but residue salts are a prime candidate for processing off-site while ash could be calcined and inorganics repacked on-site. Combustibles could not be shipped and would be washed for stablilization. Wet/misc. residues also could not be shipped and could be handled by on-site processes. This option is not the favored option because some doubt still exists as to the shippability of some residues and some control over the outcome is surrendered to another site, partially violating IES guidance. However, it should be retained for further consideration because of its desirable features: optimiztion of DOE Complex capabilities, minimization of processing requirements at RFETS, and acceleration of stabilization.

1.2.6 Subtask 6-Highly Enriched Uranyl Nitrate Solutions

1.2.6.1 Task Description

This subtask is to remove from Building 886 and Rocky Flats Environmental Technology Site (RFETS) Highly Enriched Uranyl Nitrate (HEUN) and process it to an acceptable storage form. This subtask is named the HEUN Removal project.

1.2.6.2 Justification

The completion of the HEUN Removal project results in preparing the building for D^4. This project eliminates the risk of HEUN spills and leaks in Building 886, reducing the building baseline costs. This reduction in cost results from removing the HEUN, which is a fissile, accountable material. Both the surveillance and safeguards and security requirements will decrease after the solution is removed.

1.2.6.3 Scope

The scope of the HEUN Removal project is to drain and remove the HEUN contained in eight tanks and associated piping in Building 886. This HEUN consists of two concentrations (1700 L of 121 g/L solution in five tanks and 1000 L of 368 g/L solution in three tanks) of 93.2% ^{235}U. The scope includes rinsing the tanks and piping, if necessary, to a level that does not roll-up to Category 1 or 2 material, as defined by Safeguards and Security requirements.

1.2.6.4 Purpose

The purpose of the HEUN Removal project is to remove the HEUN from RFETS so that D^4 can begin in Building 886. The D^4 of Building 886 is scheduled to begin in FY97, a date that is supported by this subtask.

1.2.6.5 Strategy and Assumption

The HEUN Removal project strategy is to remove the HEUN from B886, process HEUN to a form more convenient to store, and store it off the site as an oxide. The HEUN removal is to begin in May 1996 and is completed by October 1996. The strategy incorporates minimization of plant resources, safety envelope requirements for removing the solution, and storage off the site in a stable form.

This strategy assumes that Oak Ridge National Laboratory is the U.S. repository for Highly Enriched Uranium (HEU) oxide. The HEU oxide is acceptable for storage at Oak Ridge. Storage at Oak Ridge is in agreement with DOE strategy for HEU material.

1.2.6.6 Option List and Discussion

For the HEUN Removal project, team members evaluated four basic options. Results are summarized in the matrix table below (Table x.x).

1. Do nothing.

2. Process to an oxide at RFETS and ship oxide off the site.

3. Blend to <20% ^{235}U at RFETS and ship off the site for processing to LEU oxide.

4. Ship in bottles as HEUN and process to HEU oxide off site.

1. Do Nothing Option. This option would leave the HEUN in tanks and lines in Building 886. This results in continuance of the present surveillances and requirements as defined in the Basis of Interim Operations (BIO) for the storage of HEUN and performance of baseline activities. The liability costs, which will remain constant until the solution is removed, include not only the surveillances, but also the security requirements for safeguarding the material. The risk of leaks and spills continues to increase because the liquid remains in tanks and piping.

2. Process to an oxide at RFETS and ship oxide off the site. This option is feasible. The chemistry required to perform the processing is known and the capability exists in Building 371. However, this option would affect both the Plutonium Solution Stabilization project and the HEUN Removal project, because the same equipment would be used for both projects. The HEUN would be processed after the plutonium solution because the plutonium solution removal date is a state commitment.

Cross contamination of the uranium with plutonium is very likely. This would make the material more difficult to remove from the site. In addition to Building 886 having to meet the requirements necessary to bottle the solution, a hazard assessment for processing the HEUN in Building 371 is required. Thus, more resources are needed for this option than for bottling and shipping off site. This option does not meet the schedule dates for removal of HEUN from the site.

An advantage of this option is that the material will be in a form that is easier to ship by Safe, Secure, Transport (SST) vehicles, which would minimize the dependency on the Albuquerque Operations Office and reduce the number of round trips required for transfer to Oak Ridge. Containers for transportation are not an issue with this option.

This option was disregarded because of the increase in site requirements for processing, the interference with the Plutonium Solution Stabilization Project, and the inability to meet the schedule requirements.

3. Blend to <20% ^{235}U at RFETS and ship off site for processing to LEU oxide. This option is feasible. The blending process has been demonstrated and licensed at the Nuclear Fuel Services (NFS) facility in Erwin, Tennessee. However, this process is not demonstrated or licensed at RFETS using skid-mounted equipment, nor at the ^{235}U level that is proposed for this project. The usual level of enrichment at NFS is <4% ^{235}U instead of <20% ^{235}U, which is the enrichment level for this project. The higher enrichment level was chosen to reduce the number of tanker trips required. This difference in enrichment necessitates further criticality safety analyses. The blending option also requires removal of equipment from Building 886 in order to make room for the blending skids. The transportation of the blended LEUN is weather-dependent, which increases schedule risks. Shipments of this material cannot be made before May or after September because of decrease in temperature along the shipment route.

An advantage of the blending operation is that it minimizes the number of shipments of fissile material because the tanker to be used for this option can carry a larger amount of the low enriched uranyl nitrate than of the highly enriched uranyl nitrate. The HEUN form is limited to critically safe containers. A disadvantage is that the tanker does not have the safety defense in depth that an SST vehicle has if an accident should occur.

Even though this option would meet the dates required for shipment, team members disregarded it for two primary reasons: concern about the tanker not having the safety defense in depth and the schedule risk. The schedule risk is higher because of the additional modifications required for the building; the increase of criticality analyses with blending at a higher enrichment state than is done at NFS in Erwin, Tennessee; and the weather-dependency of shipments.

4. Ship in bottles as HEUN and process to HEU oxide off site. The chosen option is bottling and shipping the HEUN off the site. The logic flow for this option is as follows:

Implement the Basis of Interim Operations (BIO) in Building 886.

Bottle the HEUN in approved shipping containers.

Transfer to a shipping dock and load SST vehicles.

Transport to NFS for processing.

Process to HEU Oxide.

Ship to Oak Ridge for storage as a national reserve or for sale.

This option is the most favorable because it meets the required dates for removing the liquid, it minimizes the waste generated, and it requires fewer modifications and building repairs than does blending and processing on site. This option also limited the dependency on resources and interfaces at RFETS. This option is also weather-independent because SST vehicles are used for shipments. The limited dependency on resources and interfaces at RFETS, along with the independence from weather, reduces the schedule risks associated with blending and processing at RFETS. This option also minimizes safety risks because the HEUN will be shipped in SST vehicles rather than tankers.

The costs for blending versus bottling are approximately equal at $30M. Approximately $21M is required in FY96, and $9M is required in FY97 to process the HEUN to HEU oxide at the NFS facility.

The following major issues must be managed to ensure the successful completion of the removal of HEUN by the end of September 1996:

1. The availability of 10-L shipping containers. These containers have been identified as being available at Hanford. Condition of the containers must be evaluated to determine the restoration required.

2. The availability of SST vehicles. DOE Albuquerque has committed verbally to a convoy of three SST vehicles every two weeks from RFETS.

3. The final storage or sale of the HEU oxide must be determined. The HEUN is processed at NFS to an oxide. However, the final storage or sale of this oxide is not resolved. An interim resolution of this issue is to store the oxide at NFS for a fee. Oak Ridge has made a verbal commitment to store this material.

4. A NEPA determination is required. This evaluation is expected to result in a categorical exclusion.

5. On-site resources in FY96 must be made available for Building 886 to implement the BIO, prepare the building for processing, and process the HEUN.

6. Building 991 needs to be available through FY96 for off-site shipments.

Table x.x

HEUN Removal Options

	Ship in Bottles as HEUN and process to HEU Oxide off the site	Blend to <20% ^{235}U at RFETS and ship off site for processing to LEU Oxide	Process to an oxide at RFETS and ship oxide off the site
Safety	+1	0	-1

Schedule	0	0	-1
Implementation Costs	0	0	-1
Costs After	-1	0	0
Feasibility	+1	-1	-1
Waste Mgmt.	+1	-1	-1
Storage Potential	0	0	0
Safeguard & Security	+1	0	0
TOTAL SCORE	3	-2	-5

1.2.6.7 References

1. R.J. Erfurdt, ltr (RJE-104-93) to W.C. Rask, Highly Enriched Uranium Solution Stabilization-Final Report, September 1993.

2. R.E. Fray, ltr (94-RF-12452) to Leanne W. Smith, Transmittal of Uranyl Nitrate Solution Compatibility Analysis, December 1994.

3. J.J. Listemann, Evaluation of Methods for the Removal of Highly Enriched Uranyl Nitrate (HEUN) Solutions From Building 886, August 1995.

4. Ben Gannon and Al Williams, Summary Report Team 2 of the Technical Advisory group for Support to Operations and Waste Management Activities at Rocky Flats, January 1995.

5. Harold Heydt, Value Engineering Report, Bldg 886 Highly Enriched Uranyl Nitrate (HEUN) Solution Process, March 1994.

TASK 2 - WASTE MANAGEMENT

2.0 Waste Management

2.1 Overview

This task describes the activities that are planned to address the large volumes of waste materials that need to be dispositioned in order to successfully realize the goals of the interim end state. A technical team of experts from Kaiser-Hill, the Department of Energy (DOE), and a leading consulting organization with expertise in handling waste forms from nuclear weapons production facilities was assembled to address this task. Proper waste management is essential for worker and public safety, environmental protection, and retention of a suitable range of future landuse and/or economic development options for the site. The diverse array of waste forms existing and yet-to-be generated at the site present special challenges because of the unique hazards, formidable regulatory constraints, and the sheer quantity of materials requiring dispositioning.

2.1.1 Purpose

The purpose of this task is to develop a waste management program to address both standing inventory and newly generated wastes arising from implementation of interim end state. A number of treatment, storage, and disposal alternatives are being considered to develop a program that is technically prudent, cost-effective, and which achieves meaningful risk reduction. This will be accomplished by (1) identifying viable alternatives for waste dispositioning; (2) developing information pertinent to issues affecting waste management decisions; (3) evaluating these alternatives in terms of technical and regulatory feasibility, cost-benefit, risk and liability reduction, stakeholder acceptability, and ease on implementation; and (4) selecting the apparent-best alternative.

2.1.2 Scope

The scope of wastes to be addressed are process wastes from previous and ongoing operations, construction debris from demolition activities, and soils from remediation activities. These materials include uncontaminated demolition debris and soils, hazardous waste, low level and low level mixed waste, transuranic and transuranic mixed wastes, asbestos, and polychlorinated biphenyls. Sanitary solids (e.g., office trash) are not evaluated here because such wastes will continue to be disposed in the onsite sanitary landfill until such time as arrangements are made for offsite municipal disposal.

2.1.3 Descriptions of Waste Forms and Containment Systems

2.1.3.1 Waste Forms and Attributes

Existing and future waste forms can be grouped into categories according to source (i.e., process, demolition, or remediation wastes) as well as by the nature of the contaminants present (e.g., hazardous, low level, low level mixed, etc.).

Waste Categories by Source

Process wastes are generated by nuclear and non-nuclear manufacturing, stabilization, and maintenance processes. They are typically metals, plastics, glass, spent chemicals, and a wide variety of other materials generated from processing operations. Demolition wastes arise from deactivation, decontamination, decommissioning, and demolition activities. These wastes consist of excessed equipment (e.g., machinery, tools, gloveboxes) and construction debris (e.g., scrap metal, concrete, piping, plenums). Materials with recycle and/or salvage value are not included in this category. Remediation wastes are typically environmental media such as soils, sludges, and liquids that are generated as a result of cleanup actions to eliminate source terms and to decrease the potential for migration of radioactive and chemical hazards.

The origin of the waste, in some cases, determines the regulatory influences that affect how the waste is managed. For example, while process wastes and remediation wastes are both subject to regulation by the CDPHE and/or EPA, they are subject to different sections of the Resource Conservation and Recovery Act (RCRA) regulations and, thus, different requirements. Specifically, process wastes that are considered hazardous under State of Colorado hazardous waste laws must be disposed of in landfills that meet the definition of RCRA Subtitle C. Similar remediation wastes can be disposed of in a landfill meeting the definition of a Corrective Action Management Unit (CAMU) and are subject to different requirements, i.e., need not meet land disposal restrictions (LDR) nor minimum technology requirements.

Waste Categories by Contaminants

Rocky Flats wastes can be contaminated by radioactive materials, hazardous chemical constituents and/or biomedical hazards.

Radioactive Wastes: Radioactivity results from spontaneous changes in the nucleus of certain atoms which typically release high levels of energy and can release particles. Hazards from radioactive materials result from the release of alpha particles, beta particles, gamma rays and/or neutrons. Alpha particles are relatively large, highly energetic helium nuclei. Alpha emissions have relatively poor penetrating power based on their size and ability to transfer energy. They can be stopped by a thin piece of paper or by the outer skin tissue. They represent a hazard when they enter the body through inhalation or through an open wound. Beta particles are ordinary electrons with corresponding mass and charge. Beta radiation has higher penetrating power than alpha emissions. Beta particles can be stopped by a thin sheet of aluminum or thick plastic. Gamma rays are not particles like alpha or beta, but are emitted spontaneously as a result of alpha and beta transformations. Gamma rays are highly energetic and their emission occurs as part of the mechanism for eliminating excess energy from the nucleus. Gamma rays are similar to x-rays and have a very high penetrating power, i.e., they can pass through the human body. Neutrons result from spontaneous fissions as well as from nuclear reactions. Neutrons are highly energetic and are also highly penetrating. Neutrons are a major exposure concern. Their ability to propagate nuclear chain reactions within fissile materials (commonly referred to as nuclear criticality) is also of concern.

The principal radiation hazards associated with Rocky Flats radioactive wastes are from alpha particles. Specific radioisotopes that produce this hazard are plutonium and americium, as well as naturally occurring elements such as uranium and thorium. Transuranic wastes are contaminated with alpha emitting radionuclides with half-lives greater than 20 years and in concentrations greater than 100 nanocuries/gram (nCi/g). Low level waste has concentrations of alpha emitting radionuclides of less than 100 nCi/g with no specified minimum level of activity.

Hazardous Waste: Hazardous wastes exhibit the characteristics of reactivity, corrosivity, ignitability or toxicity, or contain chemical constituents such as organic solvents or heavy metals that are regulated under RCRA. Other waste forms considered hazardous, but not regulated under RCRA, are (1) asbestos which is regulated under the Clean Air Act and Occupational Safety and Health Act (OSHA), and (2) polychlorinated biphenyls (PCBs) regulated under the Toxic Substances Control Act (TSCA).

Medical Waste: The Colorado Medical Waste Act imposes requirements on the management of medical wastes generated in the diagnosis, treatment, or immunization of humans or animals. Rocky Flats generates limited quantities of these wastes which are handled in accordance with required statutes.

Mixed Wastes: Mixed waste contains both radioactive contaminants and regulated chemical constituents. The more common waste forms at Rocky Flats are transuranic mixed and low level mixed wastes.

Residues: Residues are radioactive liquids and solids with plutonium concentrations above formerly defined economic discard limits (EDL). These materials have a high radioactive content and are undergoing stabilization as part of the interim end state initiative. Materials resulting from the processing of residues will be managed as low level and transuranic wastes.

2.1.3.2 Containment Systems and Protective Measures

Because of the hazards associated with waste forms at Rocky Flats, considerable care is exercised in the packaging and containment of these materials. Wastes are typically managed in containers including steel drums (35-gallon, 55-gallon, 83-gallon), other steel containers (8801, 8802 cans), steel boxes, wooden boxes (half crates and full crates) and cardboard boxes (triwalls). Certain wastes are managed in bulk form (e.g., construction debris).

Radioactive waste is collected and packaged in accordance with stringent procedures as specified in approved Type A packaging. Type A packaging requirements are governed by the Department of Transportation (DOT). A typical Type A package must be able to withstand a series of standard tests for water resistance, free drop, compression, and penetration. In addition, "strong, tight containers" are utilized for storage and shipment of Low Specific Activity waste. Both "strong, tight containers" and Low Specific Activity are defined by DOT.

Low level and low level mixed waste is packaged in three different types of containers: (1) metal drums, (2) wooden boxes, and (3) triple-walled corrugated cardboard boxes. Within these containers, there are a variety of inner packaging requirements. In the case of metal drums, the packaging configuration includes some or all of the following:

- fiberboard liner for hard materials
- double polyethylene or polyvinyl chloride plastic bags
- carbon composite filter in drum lid to prevent pressurization due to gas buildup
- bolted drum closure ring

In the case of wooden boxes, the packaging configuration includes fiberboard liner, polyvinyl chloride plastic liner, and plywood flush panel box. For cardboard boxes, one or more plastic liners are used.

Transuranic and transuranic mixed wastes are collected and stored in two different configurations. Packaging configuration for metal drums consists of the following:

- fiberboard liner for hard materials
- double polyethylene or polyvinyl chloride plastic bags
- high density polyethylene rigid liner
- carbon composite filter in drum lid
- bolted drum closure ring

In the case of metal boxes (commonly referred to as TRUPACT II Standard Waste Box), the packaging configuration consists of the following:

- fiberboard liner

- polyvinyl chloride plastic liner
- two carbon composite filters in box lid
- bolted or welded closure

Hazardous wastes are packaged in strong tight containers (drums or boxes) with rigid liners and plastic bags depending on the nature of the material.

These packaging systems are designed to provide for the highest degree of protection to the worker and to the public during onsite management and offsite transportation. In addition to the physical package, a variety of other protective measures are used to maintain wastes in a safe condition. These measures include: (1) nondestructive assay for determination of radioactive content, (2) radiological surveys to confirm container integrity, (3) stringent packaging, collection, storage, and management procedures, (4) frequent inspections, (5) characterization either by process knowledge or chemical analyses, and (6) certification prior to shipment.

2.1.3.3 Waste Volumes

Table 2.1 presents a summary of the standing inventory and projections of newly generated wastes produced in achieving the interim end state. Total waste volume, collectively, is 662,000 cubic meters (m3).

Table 2.1 - Existing and Projected Waste Volumes

Waste Type m3	Standing Inventory m3	New Generation m3	Total Waste
HAZARDOUS			
• Containerized	146.07	1326.20	1472.27
• ER	239.23	12436.75	12675.98
• Construction	0.00	30.00	30.00
LOW LEVEL			
• Containerized	5470.98	12305.05	17776.03
• ER	2.20	12350.00	12352.20
• Construction	0.00	996.22	996.22
LOW LEVEL MIXED			
• Containerized	2888.86	199365.58	202254.44
• ER	80.38	194037.39	194117.77
• Construction	0.00	29.40	29.40
• Pondcrete	5698.33	0.00	5698.33
• Saltcrete	3468.57	6426.00	9894.57
• Pond Sludge	2676.00	0.00	2676.00
TRANSURANIC			
• Containerized	584.08	1355.27	1939.35
• Construction	0.00	53.80	53.80

2.2 Alternative Evaluation

2.2.1 Assumptions

The following assumptions affect the selection of waste management options at Rocky Flats:

- currently there is no offsite facility available to store or dispose of transuranic wastes

- the Waste Isolation Pilot Project (WIPP) will open in late 1998 and will be available to receive transuranic waste forms from Rocky Flats

- WIPP can receive as much transuranic wastes as the site can ship

- Nevada Test Site (NTS) will have a RCRA disposal permit in 1998 and will receive low level mixed waste

- treatment and disposal alternative selection will be based on economic considerations and on technical and regulatory feasibility

- the site will continue to ship low level waste to NTS and some forms of low level mixed wastes to Envirocare

- Buildings 374 and 774 will not be available for liquid treatment after FY 98 and alternative treatment systems will be needed

• high gram quantities of residues or residue products requiring hardened facilities will be stored in the SNM building, thereby allowing transuranic waste storage facilities to be enhanced metal buildings.

2.2.2 Options Analysis

There are three general methods for dispositioning site wastes. These are storage, treatment, and disposal, each of which can be accomplished both onsite and offsite. A number of basic options are being considered. Variations among these options are indexed to the waste forms addressed and the amount of waste material being treated, stored, or disposed. These options are then grouped together in various combinations to form alternatives. The basic options are discussed below:

2.2.2.1 <u>Storage</u>

Historically, Rocky Flats stored only small quantities of waste prior to shipment to offsite facilities for disposal; this storage was typically short-term as staging for shipment. In the late 1980s, restrictions were applied which prevents shipment and disposal of certain types of Rocky Flats waste. Additional restrictions to offsite disposal of Rocky Flats waste occurred in 1990. These restrictions resulted in a significant increase in the quantity of waste requiring onsite storage. Currently, approximately 17,700 m3 of waste are stored onsite. Onsite storage requirements are driven by the availability of disposal sites and the acceptability of Rocky Flats waste at these sites. Several options have been identified to provide necessary waste storage capacity as the site proceeds toward the interim end state. The options considered are discussed below.

Construct New Onsite Centralized Storage Facility

This option would require the construction of a new facility to accommodate waste volumes which do not have an acceptable disposal option. This new facility would be centralized, to the extent possible, to achieve operating efficiencies and cost savings. Specific requirements and costs for a new storage facility will be based on the types and quantities of waste to be stored. Construction costs for storage facilities could vary from approximately $50/sq. ft. to $130/sq. ft. depending on the type of waste. The basic structure would be a metal building with various levels of ventilation, segregation of waste, berms, and alarms based on waste types. If the plutonium content of the stored waste, in aggregate, exceeds 10 kilograms, then a hardened building would be required (e.g., reinforced concrete).

Any new facility designated to store RCRA regulated waste (low level mixed, transuranic mixed, and hazardous) will require a site RCRA permit modification. Based on the potential magnitude of the capacity change, it is anticipated that a "Class 3" modification will be required; this requires a longer, more involved public comment period than lesser modifications.

The following issues could impact the cost and technical feasibility of this option:

- potential difficulty in locating a large storage facility

- plutonium inventory must be kept at 10 kilograms or less or current DOE requirements must be relaxed to avoid significant increases in the facility criteria and related costs (e.g., cost could approach $1000/sq. ft.)

- storage of liquid waste requires more stringent criteria with related cost increases

Retrofit Existing Onsite Building(s) for Storage

Retrofitting existing site buildings for waste storage is an alternative to new construction. For this to be an acceptable alternative, existing buildings with significant floor space available for conversion must be identified; a large number of small storage areas will not achieve the operational and cost efficiencies necessary. Estimates based on previous conversion studies indicate that retrofitting costs could vary from approximately $34/sq. ft. to $85/sq. ft. Typical upgrades necessary to convert an existing facility to waste storage are: (1) removal of physical features impacting waste movement and storage configuration, (2) upgrade to floor physical features impacting waste movement and storage configuration, (3) upgrade to floor condition, (4) addition of berms to satisfy secondary containment requirements (5) addition of alarms and monitors, (6) upgrade of ventilation systems.

Waste storage facilities, created by retrofit of existing site buildings, designated for RCRA regulated waste will require a permit modification. The specific type of modification will be dictated by the magnitude of the change.

The following barriers/issues could impact the feasibility of retrofitting existing buildings for waste storage:

- availability of large buildings to support consolidation of wastes for storage
- plutonium inventory above 10 kilograms could significantly increase costs depending on the type of building chosen for retrofit

Maintain Existing Centralized Onsite Storage Facility

Several onsite storage facilities currently exist (Centralized Waste Storage Facility and Building 664) and could be maintained to provide storage capability to support the interim end state. These facilities have limited capacity and, depending on the storage requirements remaining after treatment and disposal options are identified, could satisfy site waste storage needs. Modification should not be required to continue storing waste; optimization of waste types and configurations will maximize capacities. No additional permitting actions should be required to maintain these facilities. The major issue associated with this option is whether adequate capacity would be available to cover storage requirements. Current plutonium inventory limits applied to Building 664 could also impact the viability of this option if requirements were not relaxed.

Offsite Storage

Offsite storage of Rocky Flats waste at other DOE sites or commercial facilities may be a potential option to support interim end state waste storage needs. However, no commercial facilities are currently accepting DOE waste for storage (DOE is utilizing commercial disposal capability). Other DOE sites are not pursuing storage of Rocky Flats waste or other offsite DOE waste generators.

2.2.2.2 <u>Treatment</u>

Many waste forms generated at the site require treatment prior to final disposition. Treatment is performed for several reasons: (1) volume reduction to make waste easier and less expensive to store and dispose, (2) stabilization to make waste easier and safer to store, transport, and dispose, and (3) to meet regulatory disposal requirements, e.g., LDR. The fundamental decisions governing treatment options are (1) is treatment prior to final disposition a necessity because of regulatory requirements or an advantage due to cost-benefit considerations, (2) which treatment technology is most appropriate for the affected waste form, and (3) should treatment be conducted onsite or offsite. The following paragraphs discuss some of the more promising treatment technologies for Rocky Flats wastes.

Stabilization/Immobilization

Waste immobilization is the primary treatment envisioned for some of the highest volumes of low level mixed waste forms (e.g., Solidified Bypass Sludge). In addition, it is required as the final component for other treatment trains to meet both LDR standards and disposal site waste acceptance criteria. In other words, the intermediate waste forms or by-product wastes produced by oxidation, surface organic contaminant removal, and other technologies may require immobilization before final disposal.

Several low level mixed wastes and by-product wastes requiring immobilization are contaminated with a variety of volatile organic compounds (VOCs) and/or metals. Three immobilization technologies are currently under consideration for these wastes: (1) cementation, (2) polymer solidification, and (3) microwave melters.

Cementation: This method is the most widely used immobilization technology and therefore has the best-developed base of experience. In this solidification process, Portland or other cements, water, and waste are mixed and cast into various containers to harden. Some cement solidification processes mix the constituents directly in the final waste drum. The strength and leach resistance of the final waste form vary widely depending on the final composition and numerous processing variables. Fly ash, clay, blast furnace slag, diatomite, or other commercial products are sometimes added to the cement to alter and enhance the properties of the final waste form. The principal advantages of cementation are its generally wide applicability and its low relative cost. Its principal disadvantage is its inability to form a chemical bond with some chemicals. Cementation usually results in the largest volume increase of the immobilization technologies.

Polymer Solidification: This technique has been under development since the mid-1960s, and a variety of polymers have been evaluated. With polymer solidification, dried waste is either extruded with a thermoplastic or mixed with a thermosetting plastic to form a solid waste form. Waste can be either mixed and co-extruded or macroencapsulated with the polymer. Commercially available equipment and materials are used. The principal advantage of polymer encapsulation over cementation is its higher tolerance of chemical variations in the waste form than cementation processes, which allows for higher waste loading and broader application. Recycled thermoplastic may be used to reduce cost and to treat a waste with a waste. Its principal disadvantages are its higher cost relative to cementation and the fact that immobilization is limited to physical encapsulation, although additives can easily be incorporated into the polymer matrix to provide for chemical bonding of contaminants. Polymer solidification units show great promise as portable treatment units because of their relatively compact size and straightforward utility requirements. Portable treatment units could be brought to the site of waste generation and would have significant applicability for treatment of debris and ER wastes.

Microwave Melters: Microwave melters are used for processing wastes by incorporating inorganic and metallic constituents in a glass matrix using microwave energy. Microwave melters may reduce the volume of certain types of wastes while at the same time forming a solidified glass-like mass. Dry wastes and glass frit are semi-continuously fed into the drum, which is attached to a microwave generator. The drum becomes the resonant cavity, and temperatures between 1,000°C and 1,200°C are generated. Decomposition gases and moisture are driven off, and metallic and inorganic substances are trapped in the glass matrix. When the drum is removed from the chamber, the waste is in a form appropriate for shipment and disposal. This technology's principal advantage is the stability of the final waste form. Its principal disadvantage is its limited applicability to Rocky Flats wastes because it is unsuitable for waste with significant organic content. Waste loadings of 70 percent have been obtained for some waste forms.

Thermal Treatment

The three thermal destruction technologies under consideration for treatment of these wastes are fluidized bed unit (FBU), controlled air incineration, and plasma arc furnace (PAF). In general, the incineration technologies require a combination of characterization, test burns, and process controls that ensure 99.99 percent removal of most contaminants and 99.9999 percent removal for some contaminants (e.g., PCBs). Although incineration technologies are relatively robust (i.e., insensitive to variations in feed stream), most wastes will require sampling and analysis to supplement the present characterization. Incineration is technically feasible for treatment of many wastes at Rocky Flats. Pretreatment will likely involve sorting for fuel value content and shredding for some waste forms. The final waste form will be an ash containing the contaminant metals and the radionuclides. This ash will require immobilization before final disposal. The greatest uncertainties associated with the incineration technologies related to obtaining operating permits.

Fluidized Bed Unit (FBU): The FBU has been evaluated at Rocky Flats for treatment of low level waste. The technology was demonstrated effective for treating liquid PCBs to 99.9999 percent destruction in an EPA-approved and CDPHE-monitored test burn in 1984. Because the FBU operates at low temperatures (525°C and 600°C), many of the disadvantages associated with high-temperature thermal treatment processes are eliminated. Complete destruction at these low temperatures is possible because of the use of an oxidation catalyst in the bed media. Most high-temperature processes require the use of a refractory, which is a heat-resistant lining that insulates the metal walls of the incinerator from high operating temperatures. Refractories are fragile, absorbs radionuclides, and increase the potential for radiation exposure to maintenance personnel during manual replacement. Because the FBU operates at low temperatures, refractories are not needed. The elimination of the refractory lining allows for frequent and rapid thermal cycling and greatly reduces metals volatilization and nitric and sulfuric oxide generation.

The FBU operates by suspending solids in a continuous turbulent air stream. This turbulence prevents formation of "hot spots" and at the same time expedites combustion of waste materials. Sodium carbonate is added to the bed media to absorb and neutralize these acids. As a result, wet scrubbers (liquid added to capture particles or remove acid gases to dilute/clean waste by-products in the vessel) are not required, which substantially reduces the secondary waste form.

A final FBU benefit is that it operates at negative pressure, which means that any unexpected leakage would be from the outside into the unit; thus, all wastes and exhaust gases are safely contained.

Controlled Air Incineration: This device is a variation of conventional incineration practices. Wastes enter the primary combustion chamber and are heated to approximately 870°C in an oxygen-poor atmosphere. The wastes are broken down into gases and ash. By minimizing the air flow rate, turbulence in the chamber is restricted and ash dispersion is reduced. The gases then enter a secondary combustion chamber and are oxidized in an oxygen-rich atmosphere. Exhaust gases pass through a scrubber and HEPA filter system before being released. Wastes with a tendency to form refractory tars and cokes when burned in an oxygen-poor atmosphere are not suitable for this type of incineration. Controlled air incineration technology is commercially available. The principal disadvantage of this technology is the higher operating temperature, which necessitates the use of a refractory lining, severely limiting thermal cycling and aggravating metals volatilization and acid gas generation.

Plasma Arc Furnace (PAF): The PAF uses a high-temperature gas to treat waste material. In the PAF, waste material introduced into a rotating reactor is melted to a slag by the intense heat of a plasma initiated by an electronic arc between the torch and the reactor vessel. The rotation of the reactor vessel forces the slag to the outer walls and away from the center discharge hole in the bottom of the reactor. Volatile gases released from the waste material are subjected to the high temperatures of the plasma gas as they pass through the discharge hole. At plasma temperatures, organic molecules completely decompose to individual atoms. The high-temperature off-gas is quenched while oxygen is introduced to promote the formation of water and carbon dioxide. The off-gas is treated through a conventional flue gas treatment system to remove acid gases, particulate, and volatile metals prior to release to the atmosphere. The slag formed in the reactor is discharged and allowed to freeze in waste disposal containers. The glassy slag binds hazardous materials such as toxic metals and radioactive isotopes, rendering them leach resistant. In addition, the PAF is reported to be a technology capable of processing a variety of materials such as liquids, solids, slags, combustibles, and inerts. The principal advantage of the plasma arc furnace is the stable metal/slag end product. The principal disadvantages are significant acid gas generation and metals volatilization; these constituents must be captured and treated.

Alternatives to Thermal Treatment

Alternative treatment technologies are non-thermal (<350°C) treatment technologies that destroy hazardous constituents by oxidation using chemical oxidizing agents, hydroxyl ions, free radicals, etc. These technologies usually employ catalysts and promoters to improve process efficiency. The following oxidizing technologies are included in the category of incineration alternative technologies: ultraviolet (UV) oxidation, mediated electrochemical oxidation, catalytic chemical oxidation, supercritical water oxidation, non-thermal plasma, alcoholic-base-driven dechlorination, and alkaline or electrochemical chlorination. In general, the incineration alternative technologies will require a higher level of waste characterization than incineration. A lesser degree of volume reduction is expected with such technologies because of the less aggressive treatment conditions employed. Pretreatment will again involve shredding for some waste forms. The greatest uncertainties associated with these technologies are technical in nature. Many of the technologies have been proven for other uses, but their utility for the matrices and contaminants associated with Rocky Flats wastes is uncertain. For both incineration and incineration alternatives, organic contaminants are destroyed and the metals and radionuclides are passed through into a treatment waste that must be subsequently immobilized.

Separation - Decontamination

Separation technologies treat mixed waste by removal of the hazardous component to a concentration below the treatment standard. The hazardous contaminant is either collected for management as a hazardous waste or destroyed in situ. Separation technologies consist of hot dodecane wash, mercury stripping, steam stripping/cleaning, low-temperature thermal desorption, supercritical carbon dioxide (CO2) extraction separate organics from a solid matrix. Water treatment is effective only on liquid or aqueous waste forms.

Some low level mixed waste forms consist of matrices whose surface(s) are contaminated with various VOCs, PCBs, and mercury. The majority of these contaminants consist primarily of chlorinated solvents. These wastes can be treated by separation or surface organic contaminant removal technologies. The PCB, organic, and aqueous by-product waste fractions recovered as a result of this waste treatment would be processed in the oxidation/destruction and aqueous waste treatment units, respectively. Pretreatment may involve sorting and shredding for some waste forms. The final waste form will be an intermediate waste form containing the contaminant metals and radionuclides. These wastes will require immobilization before final disposal.

2.2.2.3 Disposal

Waste disposal capability is necessary in order to: (1) reduce risks posed by large quantities of radioactive wastes, (2) reduce costs associated with waste storage, (3) reduce site liability, (4) overcome impediments associated with limited offsite disposal capability, and (5) avoid impacts resulting from limited onsite storage capacity. Waste forms include those from processing operations, construction debris from demolition activities, and remediation wastes (e.g., soils and sludges). Two basic options exist - dispose onsite or dispose offsite.

Onsite Disposal

Construction debris, low level, low level mixed, and hazardous waste generated during conversion of the site to the interim end state could be disposed on in an onsite landfill. The design of the facility would vary depending upon the degree of retrievability desired for wastes placed in the disposal cells. Kaiser-Hill recommends that the facility be designed to meet RCRA Subtitle C landfill requirements and Part 2 siting requirements for low level, RCRA, and potentially RCRA waste forms, including a double composite liner system with groundwater monitoring, leak detection, and leachate collection systems. The waste would be placed in both bulk and containers and its location mapped for retrieval. A portion of the facility would be designated as a CAMU and receive remediation wastes from environmental restoration activities. The other portion would be designated as a RCRA-permitted facility and be used for process wastes.

The CAMU allows for centralized disposal of remediation wastes generated from various operable units (OUs) and does not need to meet LDR or minimum technology requirements. Agreement needs to be reached on whether or not the CAMU could receive construction debris from demolition activities. Kaiser-Hill, DOE, and the EPA include construction debris under the definition of remediation wastes. THE CDPHE does not. The cost for an onsite landfill ranges from $290/m3 to $915/m3 assuming a 76,460 m3 (100,000 cubic yard) disposal cell with minimal post-closure and monitoring for 30 years. The cost estimate does not include treatment of waste to meet disposal acceptance criteria. Several siting locations for the disposal facility are being evaluated including (1) the vicinity of the new sanitary landfill, (2) the west spray field, (3) the western side of the industrial area near Building 130, and (4) the vicinity of the solar ponds. At each location, the landfill will be designed to meet Subtitle C and 1000-year siting requirements. Because of the hydrogeology (i.e., shallow depth to groundwater) in the industrial area and solar pond area, the landfill will be enhanced with an upgradient groundwater diversion system and may be constructed above ground.

A Subtitle D disposal cell would be used for uncontaminated construction debris from demolition activities. The location of the disposal cell is being evaluated in light of interim end state goals. A new Subtitle D disposal cell (i.e., sanitary landfill) with a 153,000 m3 (200,000 cubic yard) capacity is under construction. Other locations being considered are the area west of Building 991 and the area south of the diesel fuel tanks.

Offsite Disposal

Several offsite facilities are available to receive Rocky Flats waste. Low level waste is sent to Nevada Test Site and occasionally to Hanford. Saltcrete and certain remediation wastes are sent to Envirocare in Utah. Hazardous wastes are sent to various commercial disposal and recycling facilities. Waste shipments could be expanded to include other waste forms. Also NTS and WIPP are expected to receive low level mixed waste and transuranic/transuranic mixed waste, respectively, in 1998. Costs to package, perform load preparation activities such as certifications and staging, loading, shipping, and disposal fees are approximately $3300/m3.

2.2.2.4 Temporary Storage, Staging, and Shipping Facility Needs

Regardless of the alternative ultimately selected, there are prerequisite actions that need to be done in preparation for interim end state. These actions include (1) developing temporary storage area(s) so that wastes can be removed from buildings scheduled for stripout and dismantlement, and (2) having a staging area for final load preparation and loading for shipping to either onsite or offsite locations. Plans are underway to evaluate out-of-service processing areas in Buildings 371 and 707 to locate suitable temporary storage areas for wastes with high plutonium gram values which require HEPA filtration and other protective and safeguard measures offered by former production buildings. These rooms would have processing equipment (e.g., gloveboxes, hoods, fabrication machinery, etc.) removed to enable storage of containerized waste. Other buildings such as Buildings 440, 460, and/or 906 are also being examined for temporary storage of waste and for staging and loading activities.

2.2.3 Alternative Analysis

2.2.3.1 No Action Alternative

The No Action Alternative would continue the storage of wastes onsite throughout multiple facilities. Limited offsite shipping would be done for waste forms meeting offsite disposal facilities waste acceptance criteria. This would include such wastes as certain low level wastes being sent to Nevada Test Site, saltcrete and certain remediation wastes being sent to Envirocare, and hazardous wastes being sent to commercial recycling and disposal facilities. Current annual operating costs to maintain the numerous facilities where wastes are stored (e.g., 68 buildings, tents, storage pads, and cargo container areas) and to stage and ship wastes is approximately $________ million (based on FY 95 actuals). Most of this money is associated with maintaining buildings in a safe operating configuration (i.e., building baselines), waste storage, and with characterization to meet regulatory requirements and offsite repository waste acceptance criteria. $_________ million was spent in FY 95 for shipping waste offsite. This is clearly a large annual expenditure for retaining wastes in existing site facilities.

2.2.3.2 Alternative Evaluation Logic

In order to evaluate the various combinations of options possible for the diverse array of waste forms present at the site, a logic continuum (Figure 2.1) was developed such that the baseline case (i.e., starting point) assumes onsite storage of all waste. Estimates are prepared for the size of the required storage facility and the storage costs (both construction and annual operating costs). All subsequent alternatives are compared against the baseline case to determine the benefits derived from dispositioning certain waste forms. The benefits are presented in terms of decreased amount of land area committed to longterm waste storage (i.e., size of storage facility), and to reduced construction and operating costs (i.e., cost savings). To achieve these benefits, numerous options are displayed for dispositioning specific waste forms. The incremental costs associated with these options and the barriers to overcome to implement are presented. Seven alternatives are presented along the logic continuum. A preliminary preferred alternative was selected based on least cost and feasibility in overcoming the technical and regulatory constraints imposed by the options included in the alternatives.

2.2.3.3 Apparent-Best Alternative and Rationale for Selection

The apparent-best alternative is a variation of Alternative No. 6. Transuranic wastes (both straight and mixed) are retained onsite in a retrofitted storage facility (e.g., Building 460) until they can be transferred to the newly constructed centralized waste storage facility. Wastes would remain in this facility until WIPP opened and it became fiscally prudent to ship offsite. The duration of onsite storage is dependent upon the opening of WIPP, the availability of transport vehicles and outyear funding levels. Utilization of an existing facility for temporary storage allows for timely relocation of transuranic wastes from buildings being dismantled, and avoids delays associated with construction leadtimes and line item funding cycles. The storage facility would be an enhanced metal structure located in the Building 371 parking lot area. This option will require close coordination among surplused buildings removing transuranic wastes to temporary storage and the WIPP facility. Portions of the existing standing waste inventory which are readily available for shipping will be sent offsite to approved disposal facilities in FY 96 and FY 97. Such shipments are necessary to allow for relocation of stored wastes from surplused buildings and to make storage space available for newly generated wastes from accelerated stripout and dismantlement activities. Waste forms sent offsite for disposal in FY 96 and FY 97 include saltcrete, hazardous, and low level wastes.

Subpopulations of these wastes which cannot readily meet waste acceptance criteria of offsite disposal facilities without performing major recharacterization work or repackaging would be retained for onsite disposal (e.g., legacy waste). Demolition wastes (i.e., construction debris) and environmental remediation wastes (e.g., soils, sludges) will be disposed onsite in landfill disposal cells. In addition, other waste forms such as containerized low level (unshippable), low level mixed, and pondcrete will undergo retrievable and monitored disposal in an onsite landfill. Some waste forms will require onsite treatment prior to disposal, e.g., pond sludge, waste liquids, land disposal restricted. The specific treatment method has not as yet been determined. Additional longterm treatment capability is anticipated to handle any liquids arising from monitoring and collection of leachate from landfills. Such treatment systems are expected to be of limited size and cost less than $ _________ annually to operate.

Implementation of the apparent-best alternative will cost approximately $ _________ million and require an annual operating cost of about $ _______. The annual cost is for operation of the transuranic waste storage facility and for collection and treatment of leachate. Selection of this alternative attempts to optimize cost savings, environmental protection, risk and liability reduction and future landuse/economic development desires of stakeholders. It provides a balanced approach to achieving interim end state in a technically defendable and cost-beneficial manner. The costs associated with the apparent-best alternative when compared to the No Action Alternative (i.e., continue doing what we're doing) shows a payout of ___ years.

TASK 3 - FACILITY DECOMMISSIONING

3.1 Overview

The Rocky Flats Environmental Technology Site (Site) currently more than 425 facilities. These (See list in appendix A) include nuclear facilities such as former plutonium processing buildings, administrative/shop/laboratory buildings typical of a large industrial complex, and support/infrastructure buildings (steam plant, sanitary sewage plant, etc.). While most of the buildings, and the related support structures, are not contaminated with radionuclides, some contain stored Special Nuclear Material (SNM), plutonium residues and wastes, and other hazardous materials in addition to radioactivity contaminated equipment, tanks, pipes, gloveboxes, and structure.

The objective of the decommissioning task is to safely either remove or bury all Site facilities except (1) those minimal few which are essential to supporting the Interim End State (IES), or (2) those required, managed and funded by non-IES activities such as Department of Energy (DOE), other Federal, State, local government projects, or by private industry. It is estimated that fewer than five of the current Site buildings will remain after achieving IES. In order to decommission buildings and facilities, it will first be necessary to process and remove all stored SNM/residues/wastes. This activity is part of the plutonium task previously described in Section ___. In some cases, plutonium operations will continue for four or five years, which will affect availability of these buildings for decommissioning. It is, therefore, necessary (for a timely, cost effective decommissioning) to begin a phased deactivation and decommissioning while in portions of building while plutonium stabilization/consolidation work is continuing in other portions. Both plutonium and non-plutonium buildings contain various combinations of classified, non-fissile weapon components/equipment/tooling/documents. Removal of classified and hazardous materials (including depleted uranium, beryllium, and commercial chemicals) is the first step of the decommissioning process. This task is also required, but is more easily accomplished in, non-nuclear facilities. In these nuclear facilities which temporarily continue limited operations, it is very important to reduce the surveillance and maintenance costs to the minimum level required for safety and efficiency. The removal of excess materials and reduction in baseline operating costs are referred to as deactivation.

Upon completion of use and deactivation of nuclear facilities, the other decommissioning processes of decontamination, equipment removal, demolition, entombment, etc. can proceed. These processes are clearly greatly simplified in non-contaminated facilities such as office buildings. However the decommissioning of nuclear facilities must be closely coordinated with the Waste Management Task (No. 2) in order to ensure the necessary waste processing and storage capacities are available when the waste is produced. Additionally, the decommissioning must be coordinated with the Infrastructure Task to ensure the support facilities are not prematurely demolished. While the scope of decommissioning more than 425 facilities is a very complex effort that has not been fully defined, the basic approach is illustrated in Figure 3.1. This sequence and process is described in greater detail in Section 3.2. Once the sequence of facility decommissioning is essentially established, the key question becomes what are the best physical processes to use. While conventional commercial processes are planned for non-contaminated facilities, wide ranges of risk, cost and schedule variations can be encountered depending upon the approach used for nuclear facilities. Table 3.1 lists some of the physically possible options, along with a qualitative comparison of their relative advantages and disadvantages. It must be noted that some of the listed options are rruled out due to their risk, cost, or schedule requirements. They are, however, included to illustrate the need for a wide ranging and unrestricted analytical approach to decommissioning in order to achieve the objectives. Based upon a preliminary analysis on-site and incorporating other DOE and commercial external expertise and experience, decommissioning of nuclear facilities will require various processes and yield a range of demolished, demolished/entombed, and entombed facilities depending upon the building structure, contamination, location, etc.. Some nuclear facilities will be decontaminated and demolished, with the uncontaminated and low-level rubble being placed under the cap which will cover the current protected area. However, underground facilities such as Building 881 could be entombed by filling the building with stabilizing materials such as bentonite, concrete, or dirt and then be capped. This approach may also be appropriate for basements or other underground portions of some facilities. A more comprehensive description of options and a discussion of the preferred option is contained in Section 3.3.

All decommissioning activities must be planned and conducted with full consideration of the risks involved and the appropriate work authorization and control in place. While it is recognized that activities such as demolition inherently pose occupational and environmental risks, these activities can and will be managed to necessary standards. It must also be noted that the do-nothing option (continuing on our current course) will eventually become both the most risky and expensive approach as facilities deteriorate. Section 3.4 describes the proposed methodology to ensuring the work is properly authorized and controlled.

Table 3.2 summarizes the scope, purpose, and assumptions for the Facility Decommissioning Task.

Table 3.1

Facility Closure options*

Option	Pros	Cons
(1) Maintain operating/safety systems (current mode).	Required for Plutionium Operations	Very expensive. Costs & risks increase as facilities age. Does not support IES.
(2) Turn off utilities, lock doors (walk away option)	Lowest implementation cost	Leaves unacceptable contamination & risk. Does not support IES (Sky line or final end state costs).
(3) Administrative deactivation	Low implementation cost Reduces mortgage costs	Same as 2
(4) Administrative & physical deactivation	Modest implementation cost Additional reduction in mortgage.	Same as 2
(5) Deactivation & decontamination of exposed surfaces	Reduces risk somewhat Modest Imp. cost . Major mortgage reduction	Same as 2 - except lower risk/cost.
(6) Deactivate & decontaminate	Eliminates most risk & mortgage	Does not lower skyline or fit final end state cost. Increased Implementation cost.
(7) Deactivate, decontaminate, fill, & cover buildings	Minimal/acceptable risk, plus meets IES criteria	Some buildings would impact PA cap profile & cost. Inccreased cost.
(8) Deactivate, decontaminate, demolish, & cover	Minimal/acceptable risk; meets IES criteria	Highest Implementation cost . Most waste fits cap. Longest schedule.
(9) Deactivate, decontaminate, fill or demolish	Same as 7 & 8 but allows optimizing cost, risk, & waste trade offs.	

Table 3.2

Facility Closure*

Scope:	Deactivate, decontaminate, decommission, and either bury or demolish nuclear facilities. Remove, demolish, or bury all other facilities which are not financially and administratively supported by other federal, state or local government, or by private industry. Does not include removal or treatment of soils under (except for hotspots) or around buildings (building foundations and slabs will be generally left in place).
Purpose:	Eliminate, or reduce to an acceptable level, the risks from aging nuclear facilities. Eliminate operating and maintenance costs of Site facilities. Close facilities not to prevent financial drain while leaving foundation/soil available for clean-up to final end state conditions.
Ground Rules and Assumptions:	• All scope to be completed within 8 years from go-ahead. • SNM/residue processing, and SNM/residue/waste storage, will be completed within 5 years from go-ahead so that all nuclear facilities are available for closure within 5 years. • Regulators and stakeholders will concur with reasonable and timely closure process and criteria. • Finding will not be a constraint. • To be expanded.
*A few existing office buildings may remain open	

3.2 Facility Use/Decommissioning Logic & Schedule

3.2.1 Purpose

Develop a facility use/decommissioning logic and schedule that integrates: 1) SNM and waste processing and storage activities; 2) facility deactivation to reduce cost of operations and make way for final decommissioning; 3) cleanup and decommissioning activities in programmatic facilities; 4) infrastructure downsizing; 5) implementation of alternatives to current support facilities; 6) environmental restoration in the vicinity of industrial area facilities, and 7) security facilities consolidation and restructuring for IES and post-IES requirements.

3.2.2 Justification

An overall facility use and decommissioning schedule is needed so that (1) there will be a single integrated schedule of facility use consistent with IES objectives, (2) there will be agreement when programmatic, support, and administrative uses of each building must be concluded, (3) there will be agreement when to start facility decommissioning tasks for each building, and (4) there will be a basis for allocation of facility decommissioning resources.

3.2.3 Scope

This sub-task includes all facilities in the Site industrial area and selected facilities in the buffer zone (B130, T130A-J, B131). It defines an overall logic and integrated sequence of moving through the more than 425 facilities, but not the complete logic, sequence, or schedule of activities within an individual building.

Figures 2 and 3 provide a decommissioning flowchart and building work logic/schedule.

3.2.3 Discussion

3.2.3.1 Assumptions

- The term "decommissioning" as used in this document assumes removal of SNM holdup from equipment, gloveboxes, and ducts will be addressed in Table 3.1. Decommissioning includes removal and disposition of excess equipment and non-SNM material; facility characterization; decontamination; RCRA closures; termination of surveillances and maintenance activities no longer needed; and deactivation of safety systems and utilities no longer needed. Late in the sequence of activities for former plutonium/uranium process buildings, there may be some characterization of the soil under the foundation/slab and removal of hot spots. The final step would be to convert the building to a safe storage or entombment condition or to collapse/demolish it.

- After removal of containerized Cat I and Cat II SNM, the presence of SNM holdup will not be a safeguards issue that would prevent shrinking the Protected Area (PA).

- Environmental Management (EM) division "ownership" and funding availability will not be a constraint on decommissioning sequence or schedule.

3.2.3.2 Facility Uses & Interdependencies

For purposes of planning the logic/sequence, facilities have been divided into five facility types:

1. Programmatic Facilities for SNM metal, oxide, and waste processing/treatment and storage, including ancillary and necessary facilities such as cooling towers, emergency generators, filter plenum buildings, and nearby miscellaneous buildings such as paint storage sheds;

2. Infrastructure Facilities, including all utilities and service buildings (e.g. garage);

3. Security Facilities, including guard towers, PA perimeter facilities, and alarm systems;

4. Programmatic Support Facilities, including Health Physics, Filter Test Facility, Analytical Laboratories that directly support SNM and waste programs; and

5. Office/Personnel Space Facilities.

There are interdependencies within each of the first three types (e.g., plutonium (Pu) metal retrieved from one building, stabilized in a second building, and stored in a third, while samples are taken and analyzed in a fourth building. This generates waste which must be assayed in a fifth building and stored in a sixth. Or fire detectors in one building routed through wiring in a second building to an alarm panel in a third building. All are supported by electrical substations and distribution systems, a water treatment plant and distribution system, a centralized steam heat system, and a sanitary sewer line and treatment network.)

Facilities in types 2 through 5 all support programmatic activities in type 1 facilities. Strategies will be worked out for each type, all depending on the sequence for the Programmatic Facilities Type, and then the five facility types integrated in a single logic.

A further interdependency is when one building or facility stands in the way of heavy equipment access to another for decommissioning.

3.2.4 Options

1. Classify buildings by geographic location and type of contamination as follows: a) protected area/Pu contaminated, b) outside protected area/U contaminated and c) uncontaminated. Develop logic/sequence for each group.

2. Base logic/sequence on programmatic needs and subsequent building availability for decommissioning.

3. Develop logic/sequence by working backward from IES end date and allowing time necessary for decommissioning of each building to determine the decommissioning start date.

4. Base logic/sequence on an existing document, such as the Baseline Environmental Management Report (BEMR), which addresses buildings in clusters and emphasizes clearing space for new facilities early and then clearing corridors for access and staging; or the Environmental Restoration (ER) Major Systems Acquisition (MSA) baseline , which starts with smaller, easily emptied buildings across the site, but moves into some of the largest, most contaminated buildings early in order to provide maximum time for decommissioning activities.

5. Develop new logic/sequence with consideration of all of the above factors, plus requirements for removal of excess material (SNM and non-SNM), building interdependencies, security, infrastructure, and Individual Hazardous Substance Site (IHSS) issues and remediation requirements. Make provision for, but minimize, interim

relocation of some functions. Allow decommissioning to start within a building while programmatic activities continue in selected rooms. Overlap decommissioning activities as necessary, so that several buildings can be pursued simultaneously.

6. Give top priority to risk reduction, and consequently put buildings with the greatest plutonium and other hazardous material content or contamination first on the list for decommissioning.

7. Give top priority to reducing cost of operations.

The following table compares advantages and disadvantages of the seven options:

Opt	Basis	Advantages	Disadvantages
1	Contamination Tree	• Simple. • Easy to understand.	• Useful for other planning purposes, but too simple for determination of a decommissioning sequence; doesn't distinguish between light contamination & major process facility, for example. • Doesn't consider decommissioning logistics issues.
2	Programmatic Needs	• Simple. • Strong emphasis on established commitments.	• Doesn't support IES schedule.

3	IES End Date	• Simple. • Easy to understand.	• Cannot have all decommissioning activities stack up at end of schedule. • Does not address programmatic needs. • Doesn't consider decommissioning logistics issues.
4	Existing Document	• Already on the record. • Some environmental restoration buy-in at DOE/HQ. • Does not require so much explanation.	• Not optimized for IES compressed schedule and innovative approaches. • Runs risk that technical options would be constrained by schedule. • If compressed to meet IES schedule, would not support programmatic needs.
5	Integrated	• Result should be least disruptive option for plutonium and waste programs, with highest probability of being successful in meeting IES end date (i.e., fewest surprises and dead ends). • Since this option is most	• Requires additional analysis and negotiation. • In considering this range of factors, the resulting schedule will be complex and more difficult to explain in limited time or limited space.

		accommodating to multiple objectives, it should be the most cost-effective.	
6	Risk Reduction	• Risk reduction is an urgent priority. • Easy to understand.	• Should be a factor in strategy, but probably not wise to take on all the most difficult challenges first, and in parallel. • SNM processing/ treatment and storage activities in the early years in these same buildings also reduce risk..
7	Cost Reduction	• Good for taxpayer. • Frees up money for other decommissioning activities.	• Should be a factor in strategy, but must be handled in a way that does not undermine risk reduction objective.

3.2.5 Favored Option/Approach

Option 5. This will be the least disruptive option for plutonium and waste programs, with highest probability of being successful in meeting IES end date (i.e., fewest surprises and dead ends).

3.2.5.1 Use/Decommissioning Logic & Schedule

An outline of the recommended schedule is shown in Figure 3.2, "Interim End State Master Plan 1." (Insert Master Plan 1 following.) Analysis and planning are ongoing, however, and the schedule is still subject to change. A logic diagram-based feasibility analysis is available separately.

Decommissioning is a project involving one-time activities, not an ongoing operation. The strategy focuses on the programmatic facilities, as discussed above ("Facility Uses & Interdependencies"). Early activities should clear space for new Pu storage and waste/residue storage facilities, and then for access to other facilities for decommissioning. Early administrative deactivation in several high-cost buildings will reduce operating costs and free up money for other uses. Most capital line item and General Plant Project (GPP) projects will be inappropriate to the compressed schedule and should be cancelled. Security-related facilities (being analyzed in another IES Task and not fully integrated in this draft) will have to be consolidated in a manner that supports both security needs and IES facility decommissioning strategies. Infrastructure facilities (also being analyzed in another IES Task and not fully integrated in this draft) will have to be consolidated in a manner that supports both programmatic and decommissioning needs and IES facility decommissioning strategies. Decommissioning of Support facilities (e.g., analytical labs, filter test facility, central computer facility, etc.) depends on implementing an alternative means of providing that support. Decommissioning of facilities, as well as siting of new facilities will be coordinated with IHSS remediation requirements, and schedules coordinated with IHSS remediation actions. Economic conversion to a new use could take a building or cluster out of the proposed sequence and will be addressed as conversion plans become available.

In the course of decommissioning, a great deal of heavy equipment and material (excess equipment, waste, rubble/debris, etc.) will have to be moved. The logic for decommissioning will require that Category I and II SNM be consolidated as quickly as possible and that the size of the Protected Area be reduced as quickly as possible, so that requirements to transit in and out of the Protected Area are relieved. Decommissioning activities inside the Protected Area will be limited to those with minimal waste generation until the new waste facilities are constructed within the existing Protected Area.

Other guidelines are 1) Try not to move things (especially radioactive materials) more than once; 2) avoid moving radioactive materials into new (i.e., previously uncontaminated) areas; and 3) consistent with overall budget priorities established by the logic described above, decommission buildings with no further use as early as possible.

3.2.6 Barriers/Solutions

Acceleration of SNM consolidation, to clear buildings for decommissioning. This will have substantial advantage for efficiency of equipment, waste, and debris removal from PA buildings, by allowing early shrinking of PA. (Pu Consolidation and Stabilization task interface)

Revised definition of SNM and solid residue processing facility use requirements to meet IES schedule. (Facility Decommissioning Task)

Definition of plan and immediate funding for transuranic (TRU) and TRU mixed (TRUM) storage consolidation, to 1) provide storage space for TRU waste generated in early decontamination activities, 2) allow earliest shrinking of PA and 2) clear Pu buildings for decommissioning. Should define (quantify) any need for interim storage and identify location, pending availability of new TRU storage facility. (Waste Management task interface)

Definition of plan and immediate funding for residue storage consolidation, to 1) allow earliest shrinking of PA and 2) clear Pu buildings for decommissioning. Should define (quantify) any need for interim storage, pending availability of new TRU/residue storage facility. High-Pu residues storage and processing safeguards issues need to be kept in mind. (Waste Management task interface)

Definition of accelerated plan and funding for consolidation of low level (LL) and low level mixed (LLM) waste out of the Protected Area (PA) and into Bldg 440, to clear Pu buildings for decommissioning. (Waste Management task interface)

Definition of alternative plan for Proposed Site Treatment Plan activities, to support IES schedule. (Waste Management task interface)

Acceleration of funding for excess non-SNM material inventory activities to assist in scoping IES requirements. (Pu Consolidation and Stabilization task interface)

Definition of building (type)-specific decommissioning concept/model/ requirements. (In development by Facility Decommissioning task)

Definition of joint Infrastructure-Facility Decommissioning strategy for shrinking the PA. Phased shrinking of PA, rather than all at once, has substantial advantage for efficiency of equipment, waste, and debris removal from PA buildings. (Infrastructure task interface)

Definition (quantitative) of need for office space driven by IES scenario. Office areas are easy targets for decommissioning, but the need for administrative support to accomplish IES in the proposed time frame may dictate retention of office space for several years. Development of a personnel space consolidation plan, to address needs driven by as-yet-un-quantified IES activities, would provide a planning basis. (Infrastructure task interface)

Development of master material movement logistics plan, to integrate and optimize plans for security and movement of all SNM metal & oxide, residues, and waste. (Pu Consolidation and Stabilization task interface, Waste Management task interface, and Infrastructure task interface)

Development of a strategy for integrating IHSS remediation requirements and schedules with Facility Decommissioning activities. (Closure task interface)

3.3 Decommissioning Plan

3.3.1 Purpose

The objective of the Interim End State (IES) Facility Decommissioning Program Plan is to provide a strategy to establish a decommissioning program at Rocky Flats Environmental Technology Site (Site) which will provide an approved baseline by which all Facility Decommissioning projects will be executed.

3.3.2 Scope

The goal of the Program is to decommission more than 425 Site surplus facilities by the end of FY 2003. This includes 68 plutonium contaminated facilities (Group 1); 53 other radiologically contaminated facilities (Group 2); and more than 308 facilities which are radiologically clean (Group 3). Many of these facilities were used directly to conduct production operations while others were ancillary facilities used for storage, administration, and support services.

These more than 425 facilities will be decommissioned using variations of three options: 1) dismantlement (DECON), 2) entombment (ENTOMB), and 3) safe storage (SAFSTOR). Selection will be based on a cost/benefit evaluation with emphasis on safety, risk management, proven technology, site appearance, and acceptable residual contamination levels. Facility-specific decommissioning models will be developed before each project execution.

Included as part of the facility decommissioning plan scope are deactivation activities to prepare the buildings for dismantlement/entombment:

- Special Nuclear Material (SNM) holdup removed.

- Combustibles removed.

- Process lines blanked, shrink wrapped, sealed or capped off.

- Chemicals removed.

- Nuclear Material Safety Limits (NMSLs) shall be removed or replaced with "Exempt Fissile Material Only" limits. (Deactivated and removed from the criticality mannual per procedure)

- Equipment and tooling in the glovebox which are not attached or oversized in relation to the glovebox opening should be removed.

- Electrical connections shall be isolated at the power source and disconnected at the glovebox and sealed using approved sealant or tape and marked appropriately.

- Piping to glovebox will be drained, disconnected at the glovebox and sealed using approved sealant and marked appropriately, if required.

- Classfied materials removed and dispositioned.

3.3.3 Discussion

3.3.3.1 Objective

a) The objective of this task is to evaluate the feasibility of decommissioning more than 425 surplus facilities at the Site within the presumed IES preparation period and to develop a resource baseline for costs, schedule, waste generation, and labor.

3.3.3.2 Approach

a) Define the attributes for the various decommissioning options (i.e., DECON, SAFSTOR, ENTOMB, Do nothing). Evaluate the relative benefits of each attribute for application at Site. Rank the options appropriately.

b) Develop several decommissioning models that specify the content and sequence of decommissioning activities (e.g., characterization, engineering, decontamination, equipment removal, structural dismantlement, excavation, grouting, waste sorting and packaging, final survey, etc.) that may be applied to decommisssion various types of surplus facilities.

c) Assign a decommissioning model (preferred) to each surplus facility.

d) Calculate the labor, waste generation, cost and time required to decommission each surplus facility using the preferred decommissioning model.

e) Prioritize facility decommissioning activities in accordance with facility end-use dates and the presumptive 8-year IES time period. Levelize the annual resource demands.

f) The Facility Decommissioning Program Plan will be the work authorization basis for conducting facility decommissioning activities. The facility decommissioning program will be managed and executed in accordance with the Facility Decommissioning Program Plan.

g) The facility decommission program will be conducted as "non-time critical removal action" in accordance with the United States DOE (USDOE)and United States Environmental Protection Agency (USEPA) Policy on decommissioning of DOE facilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

h) The most cost effective decommissioning approach will be utilized, consistent with worker and public safety, negotiated soil contamination end points, site appearance, and proven technology.

i) A facility-specific decommissioning approach will be developed before each project is executed. The Facility Decommissioning Program Plan will be updated to reflect actual experience and resource requirements will be re-estimated annually.

3.3.3.3 Summary

a) Eight decommissioning models adequately address the special needs presented by the more than 425 surplus facilities. (See Section 3.3.4)

b) The cost of decommissioning the more than surplus facilities is $1.78 billion (1995 dollars).

c) Decommissioning activities generate 24,000 cubic meters of low level waste, 2900 cubic meters of TRU, 1000 cubic meters of hazardous waste, 500 cubic meters of mixed waste, and 2000 cubic meters of other regulated waste that must be disposed of at on-site and/or off-site repositories. In addition, 166,000 cubic meters of construction debris will be generated.

d) The decommissioning labor effort is 10,500 person-years. The peak labor demand is 1680 FTEs in year 2002.

e) All surplus facilities can be decommissioned within the 8-year period. The mean number of buildings decommissioned per year is 54 and the maximum number of buildings decommissioned in any one year is 71 which occurs in year 1.

3.3.3.4 Assumptions/Requirements

1) Facilities or portions of facilities will be available for facility decommissioning with sufficient time to execute the designated approach.

2) Suitable waste handling facilities will be made available to either process or store facility decommissioning generated waste. Decommissioning-generated waste will be removed from the facility work site by the Waste Management Group without impact to the decommissioning schedule. Treatment, storage, and disposal costs will be defined under Task 2, Waste Management.

3) A reasonable soil contamination release level will be approved for residual material left in foundations, undergrounds, and building structures covered by earth.

4) Approval will be obtained from DOE, EPA, and CDPHE for on-site low-level radioactive waste, mixed and Toxic Substance Control Act (TSCA) disposal.

5) The Decommissioning program will be conducted in accordance with CERCLA as non-time critical action or to less restrictive requirements.

6) Entombment is an acceptable disposal option for low level radioactive waste, residual levels of Plutonium contaminated waste and hazardously contaminated facilities.

7) DOE Orders will only provide guidance; compliance will not be mandatory.

8) Approval of the Facility Decommissioning Program Plan by DOE, Colorado Department of Public Health & the Environment (CDPHE), EPA, and stakeholders will suffice as the Work Authorization to conduct all decommissioning operations. Individual decommissioning Work Packages and lower tier documents, which are based on the Facility Decommissioning Program Plan, will be approved by established Project Management procedures and will not be subjected to external review.

9) A streamlined approach to facility characterization will be implemented. Data quality objectives will be minimal as the data will be used to determine:

a) worker protection requirements

b) waste volume estimates for purposes of developing cost estimates

c) a discriminator between TRU and Low Level Radioactive Waste (LLRW)

d) Hazardous contituents

10) The Project Manager has the ultimate responsibility and authority to conduct day to day project operations. All support functions report to or through the Project Manager.

3.3.3.5 Transition to Safe Shutdown

Normally within the DOE system, the ownership of facilities transfers from operating (Defense Program) to short term surveillance and maintenance (EM60) and then to decommissioning (EM40). The facility hand-offs are supposed to be conducted formally using checklists to confirm readiness (limited hazards) and to ensure that no further programmatic use exists. The major concern is appropriation of adequate budgets for surveillance and maintenance (S&M) activities and decommissioning. The transfer to EM60 occurred abruptly when the Site mission was changed from production to environmental cleanup in 1989. However, the transfer of facilities to EM40 for decommissioning has occurred only for Building 889.

Since only one objective exists for IES, formal transfer within the DOE system should be transparent, eliminating the need for formal checklists. However, before spaces are turned over for decommissioning, certain facility conditions should be established to make best use of valuable resources and to minimize risk.

A summary of facility conditions that should exist at the start of decommisssioning are illustrated below:

FACILITY CONDITIONS	OPERATIONS	DECOMMISSIONING	COMMENTS
Security and criticality alarms	Active and Operational	Disabled	Locked doors may be used to separate security areas
Nuclear systems and equipment	Energized and operational	Drained, de-engrgized, tagged out but operable	Installed pumps and valve lineups may be used to flush and clean piping systems

Waste Processing	Active	Completed	Only the waste operations within the D&D area need to be completed
Consolidation of stored waste	Containerized TRU, LLW, Mixed or hazardous waste stored	All containerized waste removed	Some containers may be tolerated if not interferring with D&D
Pu consolidation	Holdup and rollup quantities may exist	Holdup and rollup quantities may exist	Removing holdup may be done more expediently by D&D workers
Security	Q or L clearances required	L or Q clearances required	Q cleared workers too expensive
Contamination	Loose radioactive and hazardous material may be present	Loose radioactive and hazardous material may be present	Decontamination is an essential part of D4.
Surveillance and Maintenance	Required	Required	S&M activities will be ongoing until D4 is completed

3.3.4 Evaluation of Options/Models

The four decommissioning options which are being considered for decommissioning of the Site are (1) continue with current action, (2) safe storage, (3) dismantlement, and (4) in place stabilization (entombment). Combinations of variations of these options are considered for each facility.

Continue with current action - continue with work as outlined in the three Activity Data Sheet (ADS) Volumes 1030, 1031, and 1032 designated as the Rocky Flats Environmental Restoration Management Subproject Baseline. This is an 75 year project estimated to cost approximately $4.4 billion.

Safe Storage (SAFSTOR) - This option leaves the facility in place with surveillance required. Loose contamination is removed, temporary but rigid barriers are provided, and protective systems remain operational. The site is unavailable for other uses. Eventually the building is dismantled.

Dismantlement (DECON) - The facility is totally dismantled with contamination removed to unrestricted levels.

In Place Stabilization (ENTOMB) - The facility is encased, covered, or removed to an entombed location. Contamination is fixed, physical barriers are provided, and surveillance is required in perpetuity. The site has restricted use.

Assessment of these options is based on the following considerations:

a) waste volumns and types generated

b) cost

c) schedule

d) health & safety

e) environmental risk

f) construction risk

g) location inside/outside the protected area

The Table below shows the result of this assessment. The best decommissioning option is Entombment followed by DECON. It was also recognized using one option for all the Site was not practical nor desirable. Rather, it was concluded that several features of DECON and Entombment options should be utilized to decommission some facilities. It was also recognized that options could be more specifically defined to consider the differences in degree of effort required to dismantle plutonium, uranium and clean facilities. Therefore, decommissioning models were develped to define the activities required to decommision types of facilities.

Relative Rating of Decommissioning Options

Decommissioning Option	Attributes	Attribute Rating	Option Rating
Do Nothing	Risk	-	4
	Waste	+	
	Cost	0	
	Safety	-	
	Appearance	-	
SAFSTOR	Risk	0	3
	Waste	+	
	Cost	-	
	Safety	0	
	Appearance	-	

DECON	Risk	0	2
	Waste	-	
	Cost	0	
	Safety	-	
	Appearance	+	
Entombment	Risk	+	1
	Waste	+	
	Cost	0	
	Safety	+	
	Appearance	0	

Key:

+ better than average   0 average   - below average

3.3.5 Preferred Option

The preferred decommissioning option is a combination of dismantlement which removes contamination including holdup, hazardous waste, depleted uranium, classified equipment/material; followed by entombment which involves placement of low-level and mixed waste in basements of existing structures, filling the voids with either bentonite or soil and covering with an engineered cap. This option is predicated upon the establishment of an area within the current protected area where decommissioning waste will remain in an entobed condition.

Building structures which are currently above grade within the protected area will either be demolished and used as rubble of left standing (within the constraints of the cap) and covered with a cap; depending on their location, height and structure robustness. Building structures outside the protected area will be dismantled/demolished, rubblized and used as fill within the new engineered cap.

Once the decommissioning option has been selected for the Site, detailed baseline cost estimates and schedules are developed for each facility using several models which include:

Approach	D&D Model
a) Dismantlement (DECON)	1. Plutonium contaminated facilities
	2. Uranium contaminated facilities
	3. Clean facilities
	4. Removal from Site
b) Entombment (ENTOMB)	5. Total facility
	6. Below Grade, dismantle superstructure
c) Safe Storage	7. Decontamination and S&M
d) No Action	8. S&M as is

Re-prioritization of facilities is conducted on a yearly basis in accordance with a weighted criteria as illustrated below:

CRITERIA	DETERMINATION	WEIGHTING FACTOR
Facility or space reuse	Programmatic need	Go/No-Go
Regulatory driver	DOE, Public, Site Mgmt	10
Risk reduction	Risk analysis	10
Available resources	labor, funding, equipment, facility	8

Waste generation	Characterization	7
Cost	Cost-benefit analysis	6
Site Visual enhancement	Site management	5

The weighting factor is an arbitrary scale from 0 - 10, with 10 the highest priority. A go/no-go decision overrides any weighted evaluation.

3.3.5.1 Baselines

The resource database and the priorities developed were used to develop decommissioning schedules and resource requirements to accomplish the closure plan within the 8-year period as shown below:

3.3.5.2 Cost Estimate (Rough Order-of-Magnitude)

The total decommissioning cost for the 8 year program is estimated at $1.78 billion beginning in FY 1996. Yearly cost estimates for the 8 year D&D Program, expressed in $ millions, are:

Year	$$
FY 1996	98
FY 1997	200
FY 1998	235
FY 1999	235
FY 2000	243
FY 2001	234
FY 2002	275
FY 2003	263

3.3.5.3 Schedule

A summary schedule indicating the number of building completed each year (Figure 4) for the 8 year D&D Program is attached. Also shown is a figure indicating cumulative building starts and finishes. (Figure 5)

3.3.5.4 Labor

A rough order of magnitude estimate of the full time equivalent (FTE) labor required to support the Facility Decommissioning Program is:

Year	FTE
FY 1996	600
FY 1997	1200
FY 1998	1400
FY 1999	1400
FY 2000	1450
FY 2001	1400
FY 2002	1680
FY 2003	1450

3.3.5.5 Barriers & Solutions

a) Residues - move wastes stored throughout the facilities and consolidate in one location.

b) DOE Orders - Only DOE Orders which are necessary and sufficient to accomplish the decommissioning activities safely should be required. RFFO should waive the requirements of all other Orders. Conflicting guidance from DOE on decommissioning Project Management systems and the regulatory process must be resolved. The decommissioning Program Plan establishes the Project Management/Control system which will accomplish this.

c) Release Criteria - Establish acceptable residual levels of radioactivity for soils and buried waste.

d) Availability - Facilities must be made available to the Facility Decommissioning Program in accordance with the schedule provided below.

e) CDPHE agreement to the IES is required.

f) Labor - resistence by site employees. Site employees are also stakeholders. Their input to decommissioning of the Site must be considered by decisionmakers.

g) Technology - Existing technology will be used throughout the Facilities Decommissioning Program. The Facilities Decommissioning Program will not be used to demonstrate or validate new technology since it is cost/schedule driven. As new technology becomes available it will be implemented on a non-intereferrence basis.

3.3.5.6 Regulatory Requirements and Stakeholder Involvement

Decommissioning activities will be conducted in full compliance with the community relations and public participation requirements established by CERCLA, the National Contingency Plan (NCP), and DOE policies. The nature and scope of these stakeholder involvement requirements will depend on the type of removal action taken. All non-time critical removal actions will comply with the public participation requirements applicable to such actions outlined in the NCP. Where applicable, a formal community relations plan (CRP) will be prepared, specifying the community relations activities to be conducted during the removal. The CRP will be prepared prior to completion of the analysis of removal alternatives. In addition, stakeholders will be provided notice and an opportunity to submit comments on the analysis of removal alternatives. Written responses to public comments will be prepared.

DOE will establish an Administrative Record as provided by CERCLA section 113 and the NCP for non-time critical removals. The Administrative Record will include the results of the removal site evaluation and other factual information and analyses upon which the decision to conduct response action was based. As additional information is developed that forms the basis for selection of the response action, such information will be included in the Administrative Record. The administrative Record will be accessible to the public, consistent with the requirements of the NCP. Public comments, and DOE's response, will be included in the Administrative Record.

Use of non-time critical removals for conducting decommissioning activities effectively integrates DOE lead agency responsibility, EPA oversight responsibility, and stakeholder participation. The DOE Decommissioning Program will utilize DOE expertise in devising and implementing appropriate solutions to decommissioning projects. Effective EPA oversight and stakeholder participation will be provided in compliance with applicable requirements. Decommissioning projects will retain sufficient flexibility to tailor activities to meet specific site needs, and achieve risk reduction and restoration expeditiously.

3.3.5.7 Approach

In order to assure comprehensive involvement of the local community in decisions about the Site Facility Decommissioning Program, an organizational structure similar to that illustrated before should be created:

Community Sounding Board

Rocky Mountain Remediation Services (RMRS) Steering Committee

Subcommittees

- Decontamination & Decommissioning
- Waste Management
- Public Outreach
- Support Services
- Human Resources
- Business Plan

A RMRS steering committee should be established and tasked with assessing community acceptance of the Facility Decommissioning Program. The steering committees task is to use professional judgment in assessing the degree of public acceptance. To do this, the steering committee would follow several paths: establishment of a public sounding board, use of public meetings, use of a formal issue response process to identify key community concerns and formally respond to each concern, use of reading rooms to distribute printed materials, site tours, and representation of constituency concerns by the steering committee members themselves.

A Community Sounding Board should be established for the purpose of reviewing proposed resolutions to issues that surface during the project and provide non-binding feedback to the Steering Committee before the resolutions are proposed to the public at large. The following eleven local community organizations are examples of those which could participate on the Sounding Board:

- °City of Arvada
- °City of Broomfield
- °Jefferson Economic Council
- °American Friends Service Committee
- °Chambers of Commerce
- °Rocky Flats Employees
- °City of Westminster
- °Jefferson County Commission
- °Rocky Flats Cleanup Commission
- °United Steelworkers of America
- °Coalition of Jefferson County

3.3.5.8 Site Work Force

The RMRS decommissinging workforce will draw from the pool of dislocated DOE defense program workers at Site. RMRS intends to establish a new culture among these workers, one based on pride in participation in the important missions of cleanup and recycling. Teamwork will emphasize the important "role" each person has as a member of the team.

An innovative training plan implemented for the Facility Decommissioning Program starts with modular training packages, prepared by the instructors, and involves "training the trainers," who will be RMRS workers and not professional trainers. A specific training plan will be developed for each worker by comparing his or her existing qualifications to the requirements of the role to which each aspires. Verification that the additional skills necessary to perform the role have been achieved is a key part of the training. After it is demonstrated within the Facility Decommissioning Program, this plan will find wide favor among workers, contractors, and the DOE as a way to convert former defense program workers to decontamination and decommissioning workers with benefits accruing to all parties.

3.3.5.9 Public Meetings

Some meetings should be dedicated exclusively to the decommissioning projects. At some of these meetings, detailed project overviews and issue status reports could be presented. At a minimum, a table should be set up and attended by steering committee representatives to receive public comments. Issues received at the public meetings will be collected and added to a comprehensive list for tracking and resolution.

3.4 Work Authorization

3.4.1 Purpose:

The purpose of this subtask is to define the Work Authorization that will be required to conduct facility decommissioning activities as part of the Interim End State Project Work Plan (IES) and to integrate the findings of the Authorization Basis Process Development Improvement Team (PDIT) into these activities.

3.4.2 Scope:

Work Authorization is applicable to all facility decommissioning activities conducted under the IES and is essential to ensure the safety of the worker, public, and environment and it must withstand the review of stakeholders. The process for defining the Work Authorization is a standards based approach to conducting project tasks and covers all areas of applicable standards (i.e. regulatory statutes, safety regulations, security requirements).

3.4.3 Discussion:

With the change in Site mission from nuclear production to that of a plutonium stabilization, deactivation, decommissioning and environmental remediation, it has become apparent that the existing set of authorization basis, standards and requirements were not established for this new mission. Additionally, the process for identifying the applicable standards, and establishing changes to the authorization basis must be developed for a mission of projectized activities as opposed to that of a facility undergoing continuous operations. Therefore, it is necessary to define a work authorization process which provides for the evaluation of project specific activities while controlling work in a safe and compliant manner.

The process to be followed to define the work authorization for IES tasks is an activity based planning methodology which will allow for the use of the existing Site infrastructure and authorization basis where it is most efficient and cost effective, but will allow for the development of activity based specific plans for the tasks which are not defined by the existing infrastructure and authorization basis.

The essential elements of an activity based work authorization process are:

-Define the activities to be performed.

-Characterize the associated hazards (radiological, chemical, and industrial).

-Identify the necessary standards.

-Develop the authorization basis to conduct work (nuclear and non-nuclear).

-Establish the activity closure criteria.

-Conduct readiness assessments.

The risk associated with the facility deactivation activities must be evaluated as part of this activity based planning. The risk will be different for each phase of these projects; deactivation, decommissioning, demolition, and long term closure. The risk to the worker, collocated worker, maximum offsite individual, population within 50 miles and the environment must be analyzed for major activities and a set of controls established for the projects which mitigate this risk. The acceptable risk levels and controls need to be agreed upon with the stakeholders, however, a balance of short and long term risks, and cost associated with these activities must be considered. Along with the evaluation of risk for the facility decommissioning activities a set of closure criteria with performance measures is to be developed for these projects. This closure criteria and monitoring requirements are an essential element to ensuring the risk to the public and the environment is within defined limits.

3.4.4 Options:

Due to the diversity in facility type, hazard classification, activity description and existing authorization basis documentation there must be a graded approach to the rigor with which the work authorization requirements are applied. The process for defining the work authorizations described above however must be consistent to ensure a defensible process is in place for all D4 projects.

The following are a listing of options as to how this graded approach may be applied based on the type of activity to be conducted.

1. For deactivation activities, and for disassembly of equipment within buildings with an authorization basis, use the existing authorization basis and reduce the system classification and hazard category when possible. This option may require development of a Basis for Interim operation (BIO) for those facilities.

2. For deactivation activities, and for disassembly of equipment within buildings without an existing authorization basis develop BIO's to support these activities.

3. Develop a Site Safety Analysis Report (SAR) or BIO to govern the authorization basis for those facilities without a defined authorization basis.

4. Develop activity based plans and work authorization procedures for specific building D4 projects or for categories of D4 projects.

5. Follow the DOE Decommissioning Resource Manual graded approach to decommissioning activities which allows for removal actions under CERCLA. However an exemption to applying these requirements may be necessary for the facilities with little or no hazards.

6. Relieve DOE Order requirements for work authorization basis and strictly follow industry standards and regulatory statutes as they apply.

7. Develop and approve work authorization documentation for Facility Decommissioning Program Plans established for different facility categories and activities. This would allow for the approval of a set of governing standard operating procedure,

project controls and performance standards for the program plans by which each specific project could be implemented without individual review.

8. Other options or a combination of these options may be evaluated.

3.4.5 Favored Option:

A accelerated activity based approach must be applied to decommission the low hazard facilities with a minimum of work authorization documentation. The higher hazard category facilities will require more controls than the lower hazard category facilities, however, this must be reduced from the existing infrastructure requirements or the proposed time frame will not be met.

The preferred option is to define a set of standards and work authorization procedures for Facility Decommissioning Program Plans. The D4 tasks will be grouped together by hazard category and by complexity of the activities to be performed for a given set of facilities. The set of applicable standards and work authorization documentation will be defined and approved based on the program plan for that category of D4 tasks. The subsequent project specific activities will be conducted within this established set of criteria. The project specific plans will not require individual review and approval.

3.4.5.1 Example:

A Facility Decommissioning Program Plan would be developed for all facilities below hazard category 3 radiological. This plan would be developed to define all of the hazards and activities necessary to complete a D4 project on this type of facility. (i.e. electrical hazards, asbestos abatement, crane operations) The necessary standards and regulatory controls would then be defined for this program plan and a set of standard operating procedures would be developed to implement the work. These procedures would then be used for each D4 project in the hazard category. If an activity or hazard is encountered which was not bounded by the program plan then an activity specific plan would be developed to supplement the standard operating procedures for that project.

3.4.5.1 Interdependencies/Considerations:

Authorization Basis PDIT.

Basis for Interim Operation (BIO) and Technical Safety Requirement (TSR) development.

DNFSB Recommendation 90-2 and Standards/Requirements Identification documents.

Price-Anderson Act implementation.

Sitewide Environmental Impact Statement.

Development of the Site Safety Analysis Report (SAR).

Rocky Flats Cleanup Agreement negotiations.

Stakeholder involvement/Public review process.

Interim Closure (Task 4) Closure standards identification and risk assessment analysis.

Site Land Use Proposal.

TASK 4 - INTERIM CLOSURE EXECUTIVE SUMMARY

4.0 Introduction and Description of Task

This task is a portion of the implementation plan that conceptually addresses closure around the Interim End State (IES) configuration for the Rocky Flats Environmental Technology Site (RFETS). This task consists of several options analyses that were designed to address fundamental challenges in achieving interim closure. This includes closure of landfills, Individual Hazardous Substance Sites (IHSSs) and addresses groundwater contamination and surface water handling. Other significant parameters that impact interim closure are also discussed including land use determinations and cleanup requirements. This task closely integrates activities with other components of the IES such as facility decommissioning, waste management and special nuclear materials consolidation/storage. This integrated approach allows for a united holistic approach in addressing the interim closure of RFETS.

4.1 Purpose

The purpose of this task is to define the components required to provide the logic for determining the favored options and to bring the site to interim closure. It should be noted that as more information becomes available, new ideas come to light and input is received from the stakeholders that the favored options may (and no doubt will) change. This is all part of the iterative process that will align the political, and institutional forces allowing the IES to be accomplished to the benefit of all.

4.1.1 Overview of Recommended Solution

The following section provides an overview of the recommended solution and presents parameters that were considered when developing the solution.

4.1.2 Land Use Assumptions

The land use assumptions for interim closure include use of the Industrial Area (IA) that could result in potential exposure to an office worker or construction worker and use of the buffer zones that could result in exposure to a user of these areas as open space.

4.1.3 Cleanup Standards

In areas of the Site where cleanup is warranted, the team will consider all relevant cleanup standards. The standards include risk-based values (i.e. risk-based preliminary remediation goals), Applicable, Relevant and Appropriate Requirements (ARARs), and Department Of Energy (DOE) orders (where appropriate). These standards are often specific to an environmental medium (soil, surface water, etc.).

4.1.4 Overview of Categories for Interim Closure

The categories described below include the designation, remediation and closure of IHSSs across the site. This includes categorizing the Individual Hazardous Substance Sites (IHSSs) in order of risk priority, defining an approach to remediation of highly contaminated IHSSs, gathering minimal information on IHSSs that are not adequately characterized and describing the process for closure of all IHSSs. The closure of the current landfills is also addressed in a separate section from IHSS closure. Water management at the site is divided into two sections, they are groundwater and surface water categories. Contaminated groundwater at the site is addressed and the handling and release of surface water.

4.1.5 Preferred Alternatives and Conceptual View of the Site

Each category evaluated several options with the current information available. This evaluation generated a preferred option for each category that is in alignment with the IES. Primarily, this is an approach for various degrees of source control of contaminated media at the site.

Currently the preferred option for remediation of the IHSSs is primarily source removal and treatment. The one exception to this may be some of the process waste lines that may be grouted and abandoned in place. These IHSSs would then go through closure using the No Action/No Further Action (NA/NFA) decision document along with IHSSs that pose no significant risk. The preferred option for the existing landfills is capping Operable Unit (OU) 7 and slope stabilization and soil cover for OU 5. The preferred groundwater option is a series of reactive barriers designed to remediate volatile organic compounds (VOCs). The preferred surface water option is to convert the current batch release system to a flow through system.

The interim end state will be achieved when the plutonium has been placed into a safe configuration, all of the buildings except for Plutonium storage and administrative buildings have been demolished, the D&D material has been consolidated into the Protected Area (PA), the Waste Management Facility (the Corrective Action Management Unit (CAMU) and Subtitle C Low Level/Low Level Mixed Waste landfills) has been closed, all high and medium IHSSs that require it have been remediated, and passive groundwater treatment is operational. At this time, the site would consist of a few buildings with a consolidated mound of waste and D&D material. A Resource Conservation and Recovery Act (RCRA) cap will be placed over the D&D materials and the landfills (if they are placed in the PA) to prevent contact and inhibit contaminant migration.

4.1.6 References

The following references were used in developing this section:

Draft Preliminary Environmental Risk Ranking	K-H, 1995
Draft No Action No Further Action Decision Criteria (NA/NFA)	K-H, 1995
Programmatic Risk-Based Preliminary Remediation Goals	EG&G, 1994
Hazardous Release Report (HRR)	EG&G, 1995
Interim Measure/Interim Remedial Action for OU 7	EG&G, 1995

4.2 Interim Closure

4.2.1 Task Description

The Rocky Flats Environmental Technology Site (RFETS) was placed on the National Priorities List (compiled by EPA pursuant to CERCLA) for cleanup in 1989. Approximately 173 individual hazardous substance sites (IHSS) have been identified for cleanup. IHSSs are defined as individual locations where solid wastes, hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents may have been disposed or released to the environment within the larger "RFETS" at any time, irrespective of whether the unit was intended for the management of these materials. This task evaluates options for interim closure of the IHSSs, necessary to put the site in a state that is both protective of human health and the environment and prevents further releases of hazardous substances to the environment.

This task describes interim closure of the site. In order to better analyze this task the following sub tasks were created: all IHSS's have been prioritized into either a high, moderate, or low rank; highly ranked IHSS's outside the IA will be closed to standards consistent with ecological/day use and highly ranked IHSS's inside the IA, which are not complicated by existing buildings that will remain, will be closed to standards consistent with industrial/ commercial use. Low ranked IHSS's will seek a No Further Action Justification Document. Moderately ranked IHSS's will be addressed on a case-by-case basis. All landfills will be closed. Groundwater will be addressed as a single unit as well as surface water. The pond system will remain, but should require minimum attention.

Interim closure will include minimum ongoing surveillance, operation and institutional control. Closure will be such that where cost-effective, eventual final closure to a residential standard is not unduly impacted.

4.2.2 Purpose and Justification

The purpose of this task is to develop a conceptual plan for the interim closure of the site around the interim end state configuration. Interim closure is necessary to put the site in a state that is both protective of human health and the environment and prevents further releases of hazardous substances to the environment. While the final end state for the site has not been determined, the interim closure of the site will be consistent with the final end state since putting the site into a protective state will be required for any final end state selected.

4.2.3 Assumptions

For purposes of developing the conceptual plan for interim closure of the site, the following assumptions were made:

- Adequate funding is provided. Preliminary cost estimates indicate that conducting interim closure of the site is more cost effective than continuing to characterize and study the site under a formal process until a final end state is selected.

- The Environmental Risk prioritization and NA/NFA Decision Criteria documents have been approved by the agencies. Interim closure has been tied to the prioritization and NA/NFA Criteria documents. Had these documents not been developed a similar approach, as outlined in the documents, would have been developed in order to accomplish an integrated and safe interim closure for the site.

- Barriers are removed for achieving an integrated and safe interim end state (relief from regulations). The development of the conceptual plan for interim closure did not take into account impact and time frames of compliance with environmental regulations. Regulatory approval of documentation (permits, PAMs, IM/IRAs, etc.) will be granted in a timely manner. Without this assumption, it will be difficult to achieve interim closure in the time frame outlined by this project.

- The inner buffer zone, IA or PA, will not be closed to residential standards. The team has estimated that it will cost approximately $5.2 billion (1995 dollars) to clean the site to a residential land use scenario at risk levels equal to 1E-6. This estimate is based on projected total waste volumes of 1,700,000 m3; projected $3 billion for remediation costs; projected offsite disposal costs of $2 billion; and projected $200 million for cleanup of groundwater and surface water. Remediation cost estimates were calculated for each OU based on a residential land use scenario at risk levels equal to 1E-6 by using a known cost data point for each OU and multiplying that cost figure by standard cost factors. Offsite disposal costs are based on projected total waste volumes disposed at the Envirocare facility in Utah.

- The public will accept the residential capable scenario for the outer buffer zone; open space for the inner buffer zone; and industrial/RCRA closure use for the IA/PA. While this assumption is inconsistent with recommendations made by the Rocky Flats Future Site Use Working Group and preliminary recommendations by the Department of Energy/Rocky Flats Field Office, it is not the purpose of the interim end state to make final land use decisions for the site. However, interim closure will only be to the scenarios outlined above. If DOE were to release all or parts of the site, then institutional controls may need to be in place to ensure that the land is only used for the scenarios outlined above. In addition, this assumption was critical to developing preliminary cost estimates to achieve interim closure.

- The goal of interim closure is source control, containment, and engineered barriers. Source removal will occur for the highly ranked areas. When these goals are obtained, interim closure of the site will be protective of human health and the environment and will prevent further releases of hazardous substances into the environment.

- The pond system will remain, but will require minimum attention.

- There will be operational treatment facilities on site.

- Primary contaminants found in the groundwater will be VOCs.

- Approximately four buildings will remain on site, all others will be D4.

- All landfills will be closed.

• Costs are based on the current prioritization list and onsite storage. The potential exists for costs to increase as additional information is obtained and if offsite storage/disposal is required.

The following section presents background information and management options for each of the categories requiring interim closure:

4.2.4 Interim Closure Categories

4.2.4.1 Introduction

Land Use Assumptions

The team made land use assumptions that are consistent with stakeholders and DOE-RFFO recommendations for future land use. These assumptions include use of the IA that could result in potential exposure to an office worker or construction worker (industrial/commercial) and use of the buffer zones that could result in exposure to a user of these areas as open space (ecological/day use). These assumptions are necessary since DOE has not made an official future land-use determination for RFETS.

Cleanup Standards

In areas of the Site where cleanup is warranted, the team will consider all relevant cleanup standards. These standards include risk-based values (i.e. risk-based preliminary remediation goals), ARARs, and DOE orders (where appropriate). Some of these standards are specific to an environmental medium (soil, surface water, etc.). For example, soil cleanup standards are generally risk-based values since there are very few ARARs for soil contaminants. For surface water, however, there are usually both State and Federal ARARs that must be considered in determining a cleanup standard. DOE orders, as they relate to cleanup, are generally related to limiting radiation doses to workers and the public, and are not specific to environmental media.

DOE-RFFO has developed site-specific risk-based preliminary remediation goals (PRGs) for use at the Site. These PRGs are based on potential adverse effects to humans and were derived based on EPA guidance. Assumptions necessary for deriving these values, e.g. exposure receptors and pathways considered have been approved by both EPA Region VIII and CDPHE. The methodology for developing these PRGs may be found in "Programmatic Risk-Based Preliminary Remediation Goals" (DOE 1995). DOE has used these PRGs as part of the process for performing several OU-specific human health risk assessments and for several screening level assessments.

It should be noted that identification of a cleanup standard is only one step in the process of identifying an action level for implementation during remediation. The team must consider other factors and their potential impacts on the cleanup standard. These factors to be considered include available technology, feasibility, costs, and other considerations. Thus, the team must identify a cleanup standard and make a preliminary decision on an action level by considering other relevant issues.

Prioritization of IHSSs

In order to support interim closure around the interim end state configuration, the team developed and implemented a screening method to prioritize the IHSSs for potential actions. The method results in a risk prioritization score based on comparison of contaminant levels to PRGs, evaluation of mobility of contaminants, potential for future release, and use of professional judgement to interpret the first three components. Development of the site-specific PRGs is discussed above. The risk evaluation uses all available site-wide data for surface soils, subsurface soils, and groundwater.

For each datapoint, the relative degree of contamination is determined by comparing maximum measured concentrations of each analyte to appropriate PRGs to determine a risk ratio. The team determined appropriate PRGs by making reasonable assumptions about current and future land use. These assumptions were listed in Section 2.3 and result in the following application of PRGs:

- Surface soil data for the industrial area are compared to PRGs for an office worker;
- Surface soil data for the buffer zones are compared to PRGs for open space;
- ubsurface soil data are compared to PRGs for a construction worker;
- Groundwater data are compared to the open space surface water PRGs.

Groundwater data are compared to surface water PRGs because it is highly unlikely that groundwater will be used for drinking at RFETS. Therefore, groundwater impacts would be limited to areas where it could be exposed at the surface.

Any exceedances of PRGs are plotted on maps and are related to an IHSS if appropriate. Ratios for all analytes are summed for all media at each IHSS. This total is referred to as a total chemical score.

The team developed a second step to adjust the score based on the potential impact for offsite migration and/or further releases into environmental media. This is accomplished by applying a mobility index multiplier and a potential for further release multiplier to the chemical score. The mobility index multiplier ranges from one to three based on the number of contaminated areas associated with the IHSS (as shown on the maps discussed previously) and contaminant mobility. The potential for further release multiplier also ranges from one to three based on the presence or absence of free product in the ground and the degree of cross-media contamination.

The product of the total chemical score, mobilility index multiplier, and further release multiplier is the risk prioritization score. The team then established preliminary ranges of scores that are used to establish categories for interim closure of IHSSs.

Overview of Categories for Interim Closure

As stated earlier for the purpose of interim closure the Site has been broken into the following categories:

- IHSSs
- Existing Landfills
- Groundwater
- Surface Water

Based on the results of the IHSS Prioritization, the IHSS have been further characterized into the following categories: These categories and their definitions are as follows:

- High ranked sites - sites with risk prioritization scores of 100 or higher

- Moderate ranked sites - sites with risk prioritization scores between 50 and 99

- Low ranked sites (potential for no action/no further action) - sites with risk prioritization scores less than 50

A detail discussion of interim closure for each of these categories is presented below. A summary of interim closure for the entire site is provided at the end of the section.

4.2.4.2 Remediation of High Ranking IHSSs

Category Description

This section addresses remediation of the IHSSs that have a high ranking (risk prioritization scores of 100 or higher) based on the Environmental Risk Prioritization scheme. High ranking sites generally have high levels of contamination and contain the source of that contamination. The first step in the remediation process is to remove the source of contamination to prevent further migration of contaminants therefore remediation is required. High ranking sites are contaminated with hazardous, radioactive, and mixed hazardous and radioactive wastes. Hazardous wastes include radionuclides, nonradioactive metals, volatile and semi-volatile organic compounds, and inorganic ions.

Based on the IHSS prioritization discussed in Section 2.6.1 there are currently 15 IHSSs that are ranked the highest according to risk. These sites are shown in Figure 1. There are additional IHSSs, PICs, PACs, UBCs and newly identified sites that have not been adequately characterized. Once information is obtained, additional IHSSs could be added to the high rank category. For the purposes of the interim end state it is assumed that an additional 10 to 15 IHSS, could be added.

Description of Options

There are three options for achieving interim closure of the high ranking IHSSs which include No Action, In Situ Treatment and Ex Situ Treatment. Each of these options are described below:

Option 1 - No Action. This option entails leaving the high ranking IHSSs in place and not taking any corrective action at the sites. Long term monitoring would be conducted to determine if there is risk to human health and the environment.

Option 2 - In Situ Treatment. This option entails conducting corrective action of the high risk IHSSs in place using technologies such as vitrification, in situ bioremediation or soil vapor extraction. After successful application of the in situ technology, the IHSSs would be closed in place.

Option 3 - Ex Situ Treatment. This option includes excavation of hot spot or source areas followed by treatment if necessary and final disposal in an onsite waste management facility or offsite disposal. Some of the treatment technologies that could be used include low temperature thermal desorption, bioremediation or stabilization. Since, most likely, there would be contamination remaining such as radiological or metal contaminants, the treated material would be transported offsite for final disposal or placed in an onsite waste management facility. The final disposition of this material is discussed in more detail in Section (Gary Potter's Task 2 Waste Storage Disposal).

Evaluation of Options

The three options discussed above are evaluated below using the following parameters:

- Overall Cost - What is the cost of the option?
- Feasibility - Is this option possible, is it effective and implementable?
- Uncertainty - What are the unknowns regarding this option?

Each option is scored for each of the parameters. The score ranges from 0 to 1, with 0 being the least favorable and 1 being the most favorable. The scores for the three parameters are multiplicative to calculate the overall score.

Higher Ranking IHSSs Option 1: No Action		
Parameter	**Description**	**Factor Score**
Overall Cost	Minimal Cost	.9
Feasibility	Due to the sources of contamination that still remains not technically feasible. Long term monitoring would be required to monitor contaminant migration. Most likely action would be required at some point.	.1
Uncertainty	Stakeholder/Regulatory acceptability	. 1
Score of Option 1		.009

High Ranking IHSSs Option 2: In Situ Treatment		
Parameter	**Description**	**Factor Score**
Overall Cost	Moderate.	.5
Feasibility	Although technologies have been implemented at other facilities they are considered innovative and would require onsite development. No excavation would be required, therefore minimize worker exposure.	.5
Uncertainty	Regulatory/Stakeholder acceptability. Technology implementation at RFETS. Contaminated foot print would not be consolidated.	.4
Overall Score		.010

High Ranking IHSSs Option 3 - Ex Situ Treatment		
Parameter	**Description**	**Factor Score**
Overall Cost	Moderate to High (Depends on volume of material to excavate/treat)	.3
Feasibility	Reduces contaminated footprint at the site. Technologies are more demonstrated than in situ technologies. Allows for good control of the treatment technology selected.	.8
Uncertainty	Regulatory/Stakeholder acceptability. Technology implementation at RFETS. Risk to workers due to increased potential for exposure.	.7
Overall Score		0.17

Based on the evaluation presented above Option 3 is favored due to the feasibility and uncertainty parameters.

Favored Option

The favored option is Option 3 Ex Situ Treatment. Ex Situ treatment will allow better control of the treatment technology selected and will allow for disposal of the residual materials (i.e. soil and ash contaminated with low level radiological and metal contaminants). On or off site disposal could be utilized. In addition ex situ treatment reduces the overall contaminated area of the site. This approach will also facilitate closure of each IHSS either by formal RCRA closure where required or through a No Action/No Further Action Document. This should limit the long term monitoring required.

Several areas at RFETS are contaminated with contaminants that may adversely impact human health and the environment. These areas have received the highest ranking for the IHSS prioritization. The option to address the majority of these contaminated areas is source removal, treatment and final disposal. There may be some IHSSs where this option might not be practicable (such as the original process line). Each IHSSs will be evaluated on a case by case basis. The remediation of these IHSSs will utilize the prioritization scheme developed in FY95 to establish which IHSSs should be remediated first. After the IHSSs have been identified, they will be screened to determine what technologies could be applied to groups of similar contaminated media. This will allow for an economy of scale during remedial activities. The treatment unit would be pilot tested and permitted if required. Field operations would include excavation, treatment and disposal of the remediation wastes. The IHSS would then be closed using the NFA criteria currently under development or through RCRA closure if required and could require minimum monitoring or institutional controls.

It is anticipated that the cost would range from $2 to 6 million per IHSS depending on the size, complexity, available treatment technology, etc. A total cost of $40 to 120 million could be expected depending on the number of IHSSs that fall into this category.

4.2.4.3 Remediation of Low Ranking IHSSs

Category Description

This section addresses remediation of the IHSSs that have the lowest ranking (risk prioritization scores less than 50) based on the Environmental Risk Prioritization scheme. This prioritization scheme was developed in FY 95 to establish which IHSSs should be targeted for cleanup. Low ranking sites have no significant levels of contamination or have already been remediated. These sites could be contaminated with hazardous, radioactive, and mixed hazardous and radioactive wastes. Hazardous wastes include radionuclides, nonradioactive metals, volatile and semi-volatile organic compounds, and inorganic ions.

Based on the IHSS prioritization discussed in Section 2.6.1, there are approximately 130 IHSSs that have the lowest priority. This number includes IHSSs, PICs, PACs and UBCs.

Description of Options

There are two options for achieving interim closure of the lowest ranking IHSSs which include No Action, and The No Action (NA)/No Further Action (NFA) Decision Criteria. Each of these options are described below:

Option 1 - No Action. This option entails leaving the low ranking IHSSs in place and not taking any corrective action at the sites. Long term monitoring would be conducted to determine if there are impacts to human health and the environment.

Option 2 - NA/NFA Decision Criteria. This option utilizes the No Action/No Further Action Decision Criteria. No action or no further action can be justified for an IHSS if one of the following criterion is met:

- If a previous removal action has removed a contaminant source from an IHSS
- If a contaminant source has been removed from an IHSS through natural attenuation processes
- If historical release information/data indicate that any concentrations remaining in an IHSS does not exceed background
- If historical release information/data indicate no release occurred
- Detailed evaluation of data from the IHSS indicates that there is acceptable risk

If one of the above criteria is not met, then appropriate remedial actions will be implemented.

Evaluation of Options

The following is an evaluation of the options presented above using the same procedures for High Ranking IHSSs.

Lowest Rank IHSSs Option 1: No Action		
Parameter	**Description**	**Factor Score**
Overall Cost	Minimal Cost	.9
Feasibility	Straightforward, Implementable, however, some regulatory requirements would not be met.	.7
Uncertainty	Stakeholder/Regulatory acceptability	.1
Overall Score		.063

Lowest Ranking IHSSs Option 2 - NA/NFA Decision Criteria		
Parameter	**Description**	**Factor Score**
Overall Cost	Moderate	.5
Feasibility	Straightforward, implementable	.9
Uncertainty	Stakeholder/Regulatory acceptability fairly certain due to buy in of approach.	.9
Overall Score		.405

Based on the evaluation presented above Option 2 is favored due to the feasibility and uncertainty parameters.

Favored Option

The favored option is Option 2 No Action/No Further Action Decision Criteria. Many of the locations identified as IHSSs (or PACs, UBCs or PICs) will not require any remediation and will be candidates for NA/NFA. In addition other locations that have undergone remediation will need to go through this process.

The initial locations for NA/NFA will be identified using the IHSS prioritization process and the HRR. Other locations will become candidates after remedial activities have been conducted. Available data will be evaluated for each candidate location. After the locations have been identified they will be grouped (whenever possible) so that a single NA/NFA justification can be generated for the group for an economy of scale savings. A recommendation for an NFA decision for a location is presented to DOE, EPA, and CDPHE as either a NFA Justification Document (NFAJD) or an NFA Decision Agreement (NFADA).

It is anticipated that the cost would range from $10 to 25 thousand per location depending on the size, available data, and how many locations can be grouped together. A total cost of $0.5 to 3 million could be expected depending on the number of IHSSs that fall into this category.

4.2.4.4 Remediation of Medium Ranked IHSSs

Category Description

This section addresses remediation of the IHSSs that had a medium ranking (risk prioritization scores between 50 and 99) based on the Environmental Risk Prioritization scheme. Medium ranking sites generally have low levels of contaminants. These sites could be contaminated with hazardous, radioactive, and mixed hazardous and radioactive wastes. Hazardous wastes include radionuclides, nonradioactive metals, volatile and semi-volatile organic compounds, and inorganic ions.

Based on the IHSS prioritization discussed in Section 2.6.1 there are approximately 10 IHSSs that have a medium ranking. These sites are shown in Figure 2. There are additional IHSSs, PICs, PACs, UBCs and newly identified sites that have not been adequately characterized and once information is obtained additional IHSSs could be added to this category. For the purposes of the interim end state it is assumed that an additional 20 to 30 IHSSs could be added.

Description of Options

There are two options for achieving interim closure of the medium ranked IHSSs which include No Action and Management/Closure of Medium Ranked IHSSs. Each of these options are described below:

Option 1 - No Action. This option entails leaving the medium ranked IHSSs in place and not taking any corrective action at these sites. Long term monitoring would be conducted to determine if there are potential impacts to human health and the environment.

Option 2 -Management/Closure of Medium ranked IHSSs. This option incorporates the preferred options from both the low and high ranked IHSS categories. This option utilizes the No Action/No Further Action Decision Criteria. The first step is to evaluate the data from the IHSS and determine if a no action or no further action can be justified using the following criteria:

- If a previous removal action has removed a contaminant source from an IHSS
- If a contaminant source has been removed from an IHSS through natural attenuation processes
- If historical release information/data indicate that any concentrations remaining in an IHSS could not exceed background
- If historical release information/data indicate no release occurred
- Detailed evaluation of data from the IHSS indicates that there is acceptable risk

If one of the above criteria is not met, then either a minimal amount of additional data will need to be collected to make the determination for NA/NFA or remediation will be required. If remediation is required it will most likely include source removal, treatment and final disposal. This was discussed in more detail in the High Ranking IHSS section. Alternatively, institutional controls may be adequate to address minor contamination at a specific location.

Evaluation of Options

The following is an evaluation of the options presented above using the same procedures for High Ranking IHSSs.

Medium Ranked IHSSs Option 1: No Action		
Parameter	**Description**	**Factor Score**
Overall Cost	Minimal Cost	.9
Feasibility	Straightforward, implementable, however some regulatory requirements would not be met. Long term monitoring would be required. Eventually there could be contaminant migration from sites that could require remediation.	.3
Uncertainty	Stakeholder/Regulatory acceptability	.1
Overall Score		.03

Medium Ranked IHSSs Option 2: Management/Closure of Medium Ranked IHSSs		
Parameter	**Description**	**Factor Score**
Overall Cost	Moderate	.5
Feasibility	Straightforward. Mechanisms would already be in place from the other categories (e.g. NA/NFA Decision Criteria, and treatment/disposal scheme). Contaminated foot print could be consolidated further.	.9
Uncertainty	Regulatory/Stakeholder acceptability.	.4
Overall Score		.8

Based on the evaluation presented above Option 2 is favored due to the feasibility and uncertainty parameters.

Favored Option

The favored option is Management/Closure of medium ranked IHSSs. There are several actions that can be taken to close these locations:

- Data Evaluation and NA/NFA determination; or
- Source Removal/Treatment/Disposal; or
- Institutional controls

The IHSS Environmental Risk Prioritization developed in FY95 will be used to determine which IHSSs fall into this category. The first step will be to evaluate the existing data and records for the IHSS to determine whether it meets the NA/NFA criteria. After this determination has been made the appropriate actions can be implemented. If there is insufficient data, limited data will be collected to determine which action to take at the location.

The cost of this option will vary based on the remediation that is required (approximately $2-8 million/IHSS) or, if additional data is required to evaluate the location.

4.2.4.5 Remediation of Landfills

Category Description

This section addresses remediation of the IHSSs that are existing landfills. These IHSSs are contaminated with hazardous, radioactive, and mixed hazardous and radioactive wastes. Hazardous wastes include radionuclides, nonradioactive metals, volatile and semi-volatile organic compounds, and inorganic ions. There are currently two IHSSs that are existing landfills. They include Operable Unit 7 (IHSS 114) which is a RCRA interim status landfill and Operable Unit 5 (IHSS 115) which is regulated under CERCLA. These sites are shown in Figure 3.

Description of Options

There are three options for achieving interim closure of existing landfills which include No Action, Excavation/Treatment/Disposal and Closure in Place. Each of these options are described below:

Option 1 - No Action. This option entails leaving the landfills intact with no final closure. Long term monitoring would be conducted to determine if there is risk to human health and the environment.

Option 2 -Excavation/Treatment/Disposal. This option entails excavating and treating the material in the existing landfills, followed by disposal of the material on or off site. Treatment of the materials may or may not be necessary depending on contaminant levels. If necessary, treatment technologies could include solidification, or low temperature thermal desorption.

Option 3 -Closure in Place. This option includes closing the landfills with a cap. A RCRA cap would be required for OU 7 due to RCRA regulatory requirements. A cap designed to prevent infiltration would be required for IHSS 115. In addition limited monitoring may be required to evaluate the effectiveness of the cap. This monitoring may be incorporated into the site wide monitoring program once interim closure has been achieved.

Evaluation of Options

The following is an evaluation of the options presented above using the same procedures for high ranking IHSSs.

Existing Landfills Option 1: No Action		
Parameter	**Description**	**Factor Score**
Overall Cost	Minimal Cost	.9
Feasibility	Long term monitoring would be required to determine if contaminant migration is occurring. Most likely action would be required at some point. Does not meet regulatory requirements for OU 7.	.1
Uncertainty	Stakeholder/Regulatory acceptability	.1
Overall Score		.01

Existing Landfills Option 2 - Excavation/Treatment/Disposal		
Parameter	**Description**	**Factor Score**
Overall Cost	High	.1
Feasibility	Reduces contaminated footprint at the site. Technologies are demonstrated . Allows for good control of the treatment technology selected.	.7
Uncertainty	Regulatory/Stakeholder acceptability. Risk to worker due to exposure.	.4
Overall Score		.03

Existing Landfills Option 3 - Closure in Place		
Parameter	**Description**	**Factor Score**
Overall Cost	Moderate (dependent on size of landfill)	.5
Feasibility	Standard industry practice. A draft IM/IRA Decision Document for OU7 has been prepared.	.8
Uncertainty	Regulatory/Stakeholder acceptability.	.5
Overall Score		.20

Based on the evaluation presented above Option 3 is favored due to the feasibility and uncertainty parameters.

Favored Option

The favored option includes an engineered design (i.e. a cap) to prevent direct contact with the landfill contents, and minimize infiltration and resulting contaminant leaching into the groundwater. OU7 would undergo a RCRA closure since it is an interim status regulated unit. IHSS 115 could be closed using the NA/NFA Decision Criteria.

The present worth cost for OU7 estimated in the Draft IM/IRA Decision Document July 27, 1995 is approximately $10 million. The estimate for closure of IHSS 115 is estimated at $5 million.

4.2.4.6 Groundwater

Category Description

This section of the addresses management of contaminated groundwater at the site. The groundwater contamination is the result of historical waste disposal practices, spills and leaks at several locations throughout the site. The primary contaminants detected in groundwater are volatile organic compounds (VOCs) and is the focus of this section. These compounds are typically more mobile than other contaminants and are detected in groundwater at concentrations significantly above PRGs at the site. Metals and radionuclides are not addressed in this discussion. This is appropriate since analyses of these compounds indicate that in general, concentration in site groundwater are equivalent to background levels in groundwater. The options described below are examples of groups of technologies that would be applicable to groundwater treatment for VOCs. The remediation of groundwater would coincide with the removal and treatment of source areas as previously described (to minimize/eliminate any additional groundwater contamination) as part of a comprehensive remediation strategy for the site and to achieve the IES.

Description of Options

There are three options for managing contaminated groundwater which include No Action, Pump and Treat and Reactive Barriers. The options evaluated below were initially selected because they could all theoretically address VOC groundwater contamination at the site. All options assume removal of significant contaminant source areas. Each of these options are described below:

Option 1- No Action. This option would allow contaminated groundwater to continue to migrate and leave the remediation to natural processes. This would include attenuation of contaminants from their dispersion and natural degradation of the contaminants over time.

Option 2 - Pump and Treat: This option would utilize traditional pump and treat technologies to remediate contaminated groundwater. As the name implies, this is an active approach that uses a series of groundwater wells (or a collection system and a single pump) to pump contaminated groundwater to the surface where it is then treated either on or off-site. This approach is widely used in the industry today.

Option 3 - Reactive Barriers. This is a group of passive technologies that is emplaced at or near the leading edge of contamination perpendicular to the direction of groundwater flow (in the saturated zone, typically in a trench). Contaminated groundwater is then allowed to flow through a reactive media where the VOCs are subsequently degradated.

Evaluation of Options

The following is an evaluation of the options presented above using the same procedures for High Ranking IHSSs.

Groundwater Option 1: No Action.

Parameter	Description	Score
Overall Cost	Minimal Cost. Long term monitoring would probably be required.	.9
Feasibility	Very feasible.	.9
Uncertainty	This action would probably not be acceptable to stakeholders.	.1
Overall Score		.08

Groundwater Option 2: Pump and Treat.

Parameter	Description	Score
Overall Cost	Moderate to high initial capitol cost and significant maintenance cost. Higher cost for off-site transport and treatment	.3
Feasibility	This technology is widely used throughout the industry.	.8
Uncertainty	There is some question to the effectiveness of the systems and the long term operation typically required. The requirements for groundwater may be site-specific standards set by the State.	.5
Overall Score		.12

Groundwater Option 3: Reactive Barriers.

Parameter	Description	Score
Overall Cost	Moderate initial capitol costs but minimal operational costs.	.5
Feasibility	This technology is easy to install and has been successfully utilized at other locations.	.8
Uncertainty	This series of technologies is still in the innovative phase. State site specific cleanup requirements may be imposed Stakeholder/regulatory acceptability.	.4
Overall Score		.16

Based on the evaluation present above Option 3 is favored due to the feasibility and uncertainty parameters.

Favored Option:

The favored option is Option 3 Reactive Barriers This is a series of technologies that uses a passive-reactive system emplaced at or near the leading edge of a contaminated groundwater plume (typically as a trench filled with treatment media in the saturated zone). The system then relies on the natural flow of groundwater to transport VOC contaminants to the treatment system. This may also include slurry walls to divert contaminated groundwater to the treatment site. Once the contaminants reach the system, they flow through reactive media causing degradation and destruction of the contaminants and remediated water is allowed to flow through the system. This group of technologies was selected because it has many of the desirable attributes needed (i.e., effective passive technology, cost effective and low or no maintenance, and could still function under a cap) to feasibly treat the contaminated groundwater at the site. The approach is amenable to incorporation into an overall remediation strategy and the IES vision.

The implementation of a passive barrier technology is relatively simple and straight forward. First, the appropriate technology is selected for the exact conditions and contaminants at the site, passive barriers are a group of technologies) and the engineering of the system is conducted. The system would then be installed and limited monitoring of its performance would be conducted. Figure 4, is a map of VOC contaminated groundwater above PRGs at the site and a conceptual passive barrier system has been imposed on the figure for reference purposes. A passive barrier system as shown on the figure would cost approximately $12-15 million dollars or about half of the cost of a traditional groundwater pump and treatment system.

4.2.4.7 Surface Water

Category Description

This subtask addresses management of surface water flowing through and off of the site. Surface water is currently allowed to collect in the pond system, sampled and then released in a batch style. This system is effective, but difficulty is encountered when large storm events occur and the retention system is already at or near capacity.

Therefore, as a part of the overall IES strategy, surface water is being examined for other possible options.

Description of Options

There are three options for managing surface water which include a No Action (Continue Batch System) and a Flow Through System approach. Each of these options are described below:

Option 1 - No Action. This option would cease any transferring or sampling of water prior to release.

Option 2 - Batch System Operation: This option would continue the status quo operation of the surface water system, sampling and release.

Option 3 - Flow Through System. A flow through system would allow for surface water the pass through the retention areas in a continual fashion.

Evaluation of Options

The following is an evaluation of the options presented above using the same procedure s for High Ranking IHSSs.

Surface Water Option 1 - No Action.

Parameter	Description	Score
Overall Cost	Minimal Cost.	.9
Feasibility	Very feasible.	.9
Uncertainty	Unacceptable to stakeholders Non compliant	.1
Overall Score		.08

Surface Water Option 2- Continue Batch System Operation.

Parameter	Description	Score
Overall Cost	High Cost.	.1
Feasibility	Feasible, now operating this system but very cumbersome and not efficient.	.6
Uncertainty	The current system is not always reliable. Remaining in batch mode will add additional stress to the dam systems and will probably necessitate expensive repair and maintenance	.5
Overall Score		.120

Option 3 - Implement a Flow Through System.

Parameter	Description	Score
Overall Cost	Initial capital investment required then reduced operating cost.	.6
Feasibility	Very feasible, simpler than current system.	.7
Uncertainty	Will require regulator buy into change the status quo system.	.6
Overall Score		.25

Based on the evaluation present above Option 3 is favored due to the feasibility and uncertainty parameters.

Favored Option.

The favored option is Option 3 - Flow Through System. Implementing a new flow through system for surface water was chosen because it reduces overall costs and should be more reliable and less cumbersome. This system would include the installation of several gates on the upgradient portion of the site to control the flow through system. This system would then minimize the amount of water currently being transferred and allow for better surface water control during storm events. The capital cost for this system is approximately $1-1.5 million dollars and would easily pay for itself in 3 years.

4.2.5 Summary of Interim Closure

4.2.5.1 Summary Description of Interim Closure

This section briefly describes how the site would look after implementation of interim closure in conjunction with the other IES tasks as previously described using the favored options. A conceptual logic flow diagram for the components described within this task are presented in Figure 5. This diagram graphically depicts the categories and their inter-relations in achieving interim closure. The high ranking IHSSs will be remediated by source term removal and treatment or grouting in place and the remediation waste generated will be disposed of on or off Site. Some of these IHSSs may require minimal monitoring after completion of the removal activities which can be incorporated with the Sitewide Monitoring Program. The low ranking IHSSs and IHSSs previously remediated will have gone through the NA/NFA determination process and justification documents will have been completed. All of the moderate ranked IHSSs will have been placed into one of the other categories by either data review, negotiations or minimal additional investigation (or any combination thereof). The existing landfills will be closed using a presumptive remedy and RCRA closure for the OU landfill and slope stabilization and soil cover for the OU 5 landfill. The landfills will require minimal monitoring after closure. The groundwater contamination at the site will be remediated using a reactive barrier system. This system would be installed after/concurrent with IHSS remediation to stop/minimize additional groundwater contamination. Surface water will be managed using a Flow Through System. This system will minimize the amount of water being transferred and allow for better control of surface water during storm events. A conceptual schedule of events for the various categories previously described is presented in Figure 6. After completion of remediation activities and site deactivation, any new waste management facilities will be appropriately closed and the PA will be covered with a RCRA cap. This will allow for a minimized contaminated footprint for the site and allow for retrievability for waste emplaced under the cap if required.

4.2.5.2 Summary of the Interim End State Condition

The interim end state will be achieved when the plutonium has been placed into a safe configuration, all of the buildings except for Plutonium storage and administrative buildings have been demolished, the D&D material has been consolidated into the Protected Area, the Waste Management Facility (the CAMU and Subtitle C LL/LLMW landfills) has been closed, all high and medium IHSSs have been remediated if necessary, and passive groundwater treatment is operational. At this time, the site would consist of a few buildings with a consolidated mound of waste and D&D material. A RCRA cap will be placed over the D&D materials and the landfills (if they are placed in the PA) to prevent contact and inhibit contaminant migration.

The cap is estimated to be 80 acres in size, includes a drainage layer, and a five- to six-foot cover. The material for the cover would be mined from the western portion of the site. In addition, a groundwater diversion system will be placed upgradient of the 80-acre area. The preliminary estimated cost of the 80-acre RCRA cap would be approximately $60-80 million.

TASK 5: SITE INFRASTRUCTURE

Introduction

This task describes the activities that are planned to address Rocky Flats Environmental Technology Site (Site) infrastructure and systems. A technical team of experts from the Site including the Department of Energy and contractors with expertise in the Site infrastructure was assembled to address this issue. Minimal Site infrastructure (utilities, Site support services and technical services) will remain in the Interim End State (IES) to support one plutonium (Pu) storage facility, five waste facilities, two administrative buildings and the activities conducted therein. With demolition of most facilities onsite, it would not be fiscally responsible to maintain or upgrade the deteriorating infrastructure for the reduced requirements in the IES. Consolidation of Pu and waste onsite and related activities will require minimal utilities and services that will be addressed in this paper.

The Site infrastructure consists of four main areas: utilities, Site support services, technical services and personnel space management. To best analyze the infrastructure components, the Infrastructure Task Team (ITT) was further divide into four sub-task teams, one for each of these areas.

After analyzing all components of the Site infrastructure and carefully reviewing the alternatives, the ITT has made a preliminary decision to utilize public sources where available, contract services as much as possible and provide minimal support onsite. The ITT based its recommendations upon worker and public safety, regulatory requirements, feasibility and cost effectiveness.

After discussions with the other IES teams concerning their recommendations, the Infrastructure Task Team selected their preferred option based on the following:

1. There will be a Pu storage facility, five waste storage facilities and two administrative facilities remaining onsite in the IES.

2. All other permanent buildings will be demolished and trailers removed.

3. The final Site population will be 500 or fewer persons.

4. All Protected Area (PA) buildings will be demolished and an environmental cap will be placed over the entire PA.

Because each sub-task team looked at various aspects of the infrastructure, additional assumptions may be addressed separately. All recommendations are dependent upon the preferred recommendations of each of the other task teams, notably the schedule for building demolition and locations selected for the new Pu and waste storage facilities.

Site Utilities

Site Utilities provide products necessary for the day-to-day operation of buildings in accomplishment of the defined mission.

The following options were considered for all Site Utilities:

1 Retain existing systems status quo

2 Privatize existing onsite utilities

3 Utilize public or private utility sources

4 Install smaller self-contained systems

5 Close and remove utility systems

Systems	Options	Advantages	Disadvantages	Rec
Water Fire water Electric Natural gas Telephone Paging	Retain as is	Minimal front-end cost	Continued aging and deterioration Maintenance costs continue to increase Capital expenditures to upgrade for long-term use Must retain staff to operate and maintain	
	Privatize	Substantial long-term operations and maintenance cost savings	Finding private entity to assume operation Potential high front-end costs to upgrade systems to current standards	
	Use public/private sources	Substantial long-term operations and maintenance cost savings Supports IES objective	Willingness of local municipality to provide water Cost to reconfigure and/or install new lines	X
	Install small self-contained systems	Long-term operations and maintenance cost savings	Some continued cost for maintenance Cost to install new systems	

Systems	Options	Advantages	Disadvantages	Rec
Sewage	Retain as is	Minimal front-end cost	Continued aging and deterioration Maintenance costs continue to increase Must retain staff to operate and maintain Capital expenditure to upgrade for long-term use Continued permitting requirement Large asset for small capacity need	
	Use public/private sources	Substantial long-term operations and maintenance cost savings	Willingness of local municipality to accept sewage Cost to reconfigure and/or install new sewer lines or septic tank collection systems	
	Construct sewage lagoon w/effluent discharge	Long-term operations and maintenance cost savings	Significant cost for construction Continued permitting and monitoring requirement Some continued staffing to operate	
	Construct sewage lagoon w/ no effluent discharge	Long-term operations and maintenance cost savings No monitoring or permit required	Significant front-end cost to construct Some continued operating staff and costs	X

Systems	Options	Advantages	Disadvantages	Rec
Steam plant Nitrogen plant Radio system Fuel oil tanks Plant air Health physics vacuum LS/DW system Filter test fac Raw water system	Retain as is		Continued cost of maintenance and operations Does not support IES objective	
	Privatize			
	Use public/private sources			
	Close and remove	Long-term operations and maintenance cost savings		X

Utilization of public or private water sources is the common method for the *water treatment and distribution system*. The existing water treatment plant (Building 124) and distribution system at Site are old, are deteriorating and are becoming more costly to maintain. If a local municipality such as Westminster or Broomfield cannot supply water, the team favored installation of self-contained water treatment units in the remaining buildings. The water source to these units could be either the existing raw water supply system from Ralston Reservoir or new wells. This would allow demolition of the water treatment facility (Building 124), the water tower and storage tanks.

The existing *sewage treatment plant* (Building 995) and sewer lines are old, are continuing to deteriorate and becoming more costly to maintain. The sewage treatment plant would not be utilized to capacity in the IES. The current treatment plant is an activated sludge system which requires significant sludge raw sewage feed input to operate. This type of system does not function with low volume input as would be the case in the IES with a very small Site population. For small remote Sites that are beyond practical pipeline connection to a municipal sewage treatment plant the two most common methods for sewage treatment are (1) septic tank collection systems with associated pumping and trucking of the sewage to a treatment plant and (2) constructing small-scale sewage collection/digestion lagoons similar to the system currently in operation at Building 060. The team currently recommends installing smaller scale onsite lagoons since these would most likely be more cost effective in the long run as opposed the cost of frequent pumping, transport and offsite treatment.

The existing *fire water system* would not be needed in the IES and would not be utilized to capacity. The remaining buildings will require a fire suppression system provided by either municipal domestic water supply or raw water if local municipal water is not available. Fire water booster pumps could be installed in the remaining buildings to provide water pressure for the suppression system if necessary.

Domestic water is commonly obtained from public or private water supply sources. If domestic water supply cannot be obtained from a local municipal or private source or from newly installed wells, part of the existing *raw water system* would need to be reconfigured to supply self-contained water treatment units in the remaining buildings. Raw water could also be used for the fire suppression systems in the remaining buildings.

The *steam plant (Building 443) and steam distribution system* are old, are continuing to deteriorate and are becoming more costly to maintain. The steam system would not be utilized to capacity in the IES and would not be cost effective to operate and maintain. The team recommends installing individual natural gas-fired heating systems for heating the remaining buildings, as is common practice for small Sites and groups of buildings.

The *electrical system* is old, is continuing to deteriorate and is becoming more costly to maintain. The electrical substations and distribution system would not be utilized to

capacity in the IES and would not be cost effective to operate and maintain. The common method of obtaining electricity is utilizing public sources. Public Service of Colorado (PSCo) currently owns the substation onsite near the T130D trailer. The existing Site utility distribution system can be reconfigured to provide electricity from this substation to the remaining buildings and then turned over to PSCo. The remainder of the Site electrical substations and distribution system would be closed and removed.
The majority of the *natural gas system* would no longer be used in the IES. PSCo already supplies natural gas to Site at a main header hear Building 850. The existing natural gas distribution system will be reconfigured to supply natural gas to the remaining buildings with the remainder of the system closed and removed. The reconfigured gas lines would be turned over to PSCo.

When SNM is stabilized, nitrogen will no longer be required for inert atmospheres, so the *Nitrogen Plant* can be closed and removed.

The *bulk fuel oil storage tanks* (Building T443F)supplies fuel for the steam plant that will not be retained in the IES. These tanks could be closed and removed prior to the demolition of the steam plant by establishing a contract to keep the new above-ground day tanks full.

The existing *telephone and paging system* would not be utilized to capacity in the IES and would not be cost effective to own, operate and maintain. The team recommends use of readily available public and private communication services.

The significant reduction of security and emergency response forces projected for the IES would not fully utilize the capacity of the existing *radio systems*, and it would not be cost effective to operate and maintain. A much smaller self-contained radio system could be purchased and installed in the remaining buildings.

Plant air, health physical vacuum and Life Safety/Disaster (LS/DW) systems are essentially self-contained inside buildings scheduled for demolition. The systems remain until the buildings are removed. The team recommends retaining the LS/DW system until a small public address system can be installed in the remaining buildings.

The *filter test facility* located in Building 442 is required only as long as the Pu process buildings remain in operation. Once they are closed, the filter test facility is no longer needed. The system could initially be relocated to one of the Pu buildings such as Building 707 (to allow earlier demolition of Building 442) and then relocated to another DOE Site for continued DOE complex support.

To effect these changes, the buildings identified to remain or to be constructed in the IES will have their own heating systems. A new water line must be installed from a local municipality or wells drilled to provide potable water to remaining buildings.

Kaiser-Hill Cost Estimating has estimated $10 million to change the utilities to the recommended configuration.

Site Support Services

Site Support Services are defined as services utilized in support of the Site mission. This sub-task team added the following assumptions: The Collective Bargaining Agreement (CBA) with the Steelworkers Union can be modified or terminated such that subcontracting activities can be established. The Pu does not require frequent inspection and does not require substantial Personnel Protective Equipment (PPE) and PPE can be disposed of as waste. Pu is in a state that pyrophicity is not an issue. The Pu storage facility has adequate built-in adversarial delays to minimize the security force. Local municipalities will support the initiatives.

Site Support Services also considered five options:

1. Retain services on Site but downsize and consolidate them to meet diminished requirements. This is a more costly option if there are few facilities on Site. However, if there are many facilities that require infrastructure support, then the cost may be comparable or less than contracting.

2. Privatize to local contractors or small businesses. This is the least expensive option if only a few facilities require maintenance.

3. Utilize public sources such as municipal services.

4. Utilize a combination of small onsite forces for initial responses with contracts for backup support from the local communities as necessary.

5. Discontinue service.

Systems	Options	Advantages	Disadvantages	Rec
Security Emergency Fire Medical EOC Maintenance Laundry Respirator Test Cafeteria Shipping/Rec Trucking/Garage Roads/Walks repair Snow Removal Custodial Filter Test Metrology Property Disposition Laboratories	Continue w/onsite forces (status quo)	Quicker response Economical if big workload and reasonable or no union contract Regs require security for SNM	Union contract too expensive	
	Contract w/private companies	Lease expensive w/small number of buildings and small workload No special skills required Good application for SBE/SDBE	Slower response times Possible union backlash and political pressure	
	Utilize public services	Established well-trained resources	Not available for all services	
	Combination of onsite forces w/ back-up by offsite forces	Quicker initial response	Onsite forces may not have adequate workload to make them economical	
	Discontinue services	No operating cost	No services	

Physical security and classification security would consist of a small onsite force sufficient to safeguard remaining SNM and classified material. Security must remain onsite as long as SNM or classified material exists. The location of Site makes it virtually impossible for an offsite force to comply with DOE orders for a timely response to a security threat.

If the Pu in its end state is not pyrophoric, the team recommends reliance on municipal *fire protection.* Security guards and other workers would be trained as EMTs for onsite medical emergencies similar to a Building Emergency Support Team (BEST) concept. An onsite *medical* staff would not be required with EMTs in place. The proximity of Avista Hospital allows for rapid medical aid and "Flight for Life" is still available for emergencies beyond the abilities of the EMTs.

If the Pu in its final state is still pyrophoric, then a small firefighting force trained in Pu fires would be retained to provide initial response. Local community fire departments could provide backup as necessary. Since it is virtually impossible for an offsite force to provide a timely response to a plutonium fire, a small initial response force must be maintained onsite to be rapidly deployed while municipal units are responding. As long as the small force is onsite, it can also be trained to provide emergency medical aid and perform routine security inspections.

Onsite personnel would be trained to staff the *Emergency Operations Center* (EOC) as is done now. They could also provide *Emergency Preparedness* services as collateral duties.

Offsite private contractors would provide required services for *maintenance, laboratory analysis, custodial, road repair, snow removal, trucking, property disposal and vehicle repair.* An offsite contractor can provide services at a significantly lower cost than could be attained with an onsite stable workforce because he can schedule his effort to send the correct mix of skills for the work to be done. A contractor would have a much larger labor pool from which to draw.

Many contractors in the area can provide intermittent services such as laboratory analysis, snow removal, weed control, vehicle repair and trucking services much more economically than a constant onsite force. In the Interim End State the workload would not be sufficient in these areas to justify a constant onsite force. Many companies also specialize in custodial services and can adjust their workload and schedules to provide the required service. Property utilization and disposal can also be turned over to a company that specializes in that kind of business. It might even be economical to turn that effort over to another government agency at the Federal Center in Lakewood.

Since Building 130 is already equipped with a *cafeteria* and a *shipping/receiving* area, it is logical to utilize them. Many contractors who specialize in those services could use our existing facilities and reduce costs.

Services such as *respirator testing*, *filter testing* and *laundry* can be discontinued once the Pu is placed in the storage facility. *Metrology* can be discontinued once calibrations are no longer required.

A number of buildings are used solely for support service functions, that is, Buildings 121 (Security), 122 (Medical), 331 (Garage and Fire Protection), 333 (Paint Shop) and 334 (Maintenance). Utilizing the preferred options above would allow those buildings to be demolished when the services are contracted or relocated in the case of security and fire departments. Once the Pu is stored, Buildings 125 (Metrology), 442 (Filter Test Facility) and 566 (Laundry) can be demolished.

The team has estimated an annual cost of $12 million for services (including an offsite fire department) based on approximately $150,000/FTE, which would include contractor overhead, profit, etc.

Technical Services

Technical Services are required services unique to the facilities and materials found onsite. The programmatic technical infrastructure team considered three options: Retain the technical infrastructure (status quo) but downsized as the service infrastructure is downsized. This represents the highest cost option. Turn over the technical infrastructure to subcontractors on a graduated basis, with oversight by the Integrated Management Contractor (IMC), as the service infrastructure is downsized.

Turn over the technical infrastructure, without continued oversight, as the service infrastructure is downsized. This option assumes that the federal, state and local regulations and policing agencies can adequately be applied to the limited Site operations.

The level of *radiological control* required is heavily dependent upon the final Pu storage configuration. If the Pu within the storage facility does not require continued manual surveillance or attention, radiological control may be eliminated. However, if the future Pu storage configuration requires periodic attention, a radiological control program which includes a number of rad control technicians, health physics instrumentation, dosimetry, radiological engineering, etc., would be needed. Even in this case, the radiological control would be provided by subcontractors.

Certain programs are required by federal law, such as *OHSA compliance* and *chemical and hazardous materials control*. In the event the technical infrastructure is provided by subcontractors, compliance with these programs would be ensured by the subcontractor. If the IMC maintains oversight of the technical infrastructure, a small group would be required to ensure subcontractor compliance with the federal laws.

Nearly all aspects of the remaining programs and services included within the technical infrastructure would not be required to support the IES. These programs and services, such as *asbestos control, quality assurance, NCR reporting, procedure development, root cause analysis, conduct of engineering, drawing release, criticality safety* and *training programs* would have been gradually turned over to subcontractors, and then eliminated as the regulations which required them ceased to apply.

Personnel Space Management

Personnel Space Management is the provision of appropriate office space for personnel retained onsite. It will include relocation of the retained workforce and assignment of offices for additional workers required for the IES.

This sub-task team has also added three assumptions: Decontamination, deactivation, demolition and decommissioning (D4) activities will exceed the rate at which the plant population is reduced. A peak period of Site activity will create an increase in (de)construction and associated personnel and a minimal increase in administrative support personnel before achieving the projected workforce of 500 persons. Interlocken and Building 060 will be the only offsite facilities with existing leases.
The Personnel Space Management task team explored four options: Relocate identified workforce functions and personnel to an offsite leased facility (within close proximity to Site) to provide space for personnel displaced from the D4 areas. This option would use the D4 schedule to plan the movement of personnel to alternate (temporary or permanent) locations as D4 activities progress.
Identify administrative functions of the workforce that could be accomplished from home offices. Construct additional temporary structures onsite to house displaced personnel as D4 activities progress. Use current onsite administrative office space made available by

the restructuring of the workforce through voluntary and involuntary separations as each building is demolished.

Options	Advantages	Disadvantages	Rec
Relocate personnel to offsite leased facilities	Less impact to D4 activities Reduction in multiple moves Creates space for D4 activities Assists in reducing infrastructure	Cost of offsite leases Transportation costs	X
Construct additional facilities onsite	No offsite leases Reduces personnel transportation and travel costs Close proximity to Site resources	Requires additional infrastructure Difficult to identify potential Sites Cost to construct facilities	
Use current Site facilities	No additional offsite lease costs Close proximity to Site resources	More difficult and costly to reduce infrastructure Site population unlikely to decrease at same rate as building demolition No extra space to house personnel displaced by D4 activities Possible negative impact on D4 activities	
Relocate personnel to home offices	Assists in reducing infrastructure More flexibility Less travel time Increased morale Reduced air pollution	Immediate availability of certain Site resources Logistics issues Less personal interaction with other employees	X

This team recommended the development of a space management plan incorporating a combination of the first two options in close coordination with the D4 plan proposed in Task #4 so that all employees have appropriate office space. This plan would include the identification of administrative support functions able to operate from leased offsite and home offices.

The justification for utilizing offsite offices and home offices (in addition to available onsite facilities) would be to reduce the potential for personnel space issues to impede the demolition schedule. Based on previous Site experience, some functions can be performed from an offsite location, so those persons could work from a leased facility or home office. The use of offsite facilities would reduce the number of moves required to keep personnel away from demolition areas and retain the highest level of worker productivity. The team recommends adding a shuttle service between the Site and the offsite leased facility for minimal worker impact.

Criteria would be established by which to evaluate all administrative support functions for their need to be retained onsite. An established team of personnel would complete the evaluations and make determinations. The identified administrative support functions would then be relocated to a leased facility or home office. Each subcontractor would be responsible for providing offices for its personnel. Subcontractors would be allowed to erect temporary trailers and portable toilets, etc., as needed for (de)construction and other short-term direct support activities.

The team suggests offsite leased space for approximately 1000 employees to make space available in the longer term administrative buildings for personnel needing to remain onsite. Space would be set aside onsite and offsite for use as a temporary staging area of personnel for incoming and displaced workers. Trailers will continue to be vacated in preparation for demolition according to the priority list and schedule. Additional offsite office space may need to be added during the peak years of demolition. As Site IES activities and the supporting population declines, offsite leases would be terminated and personnel located into remaining administrative buildings onsite.

The annual cost of leasing space for 1000 employees (based on current leases) would be $3.2 million. A shuttle service (one van and driver) would cost approximately $100,000/year. Relocations of personnel would average $300,000 year (800 moves at $370 each), which assumes an employment increase through the year 2000 and a subsequent decrease to the 500 employee level for the Interim End State.

Conclusion

By implementing the recommendations set forth, the Infrastructure Task Team agrees that the long-term cost associated with operations of the Site (mortgage) will be reduced substantially. During the Interim End State the Site will be supported by an infrastructure commonly used at any remote facility, which can easily be adjusted to the Final End State, yet to be determined.

TASK 6: COMMUNICATION/HUMAN RESOURCES

6.0 Stakeholder Information and Involvement

6.1 Overview

This section of the workplan describes public information and involvement plans for development and implementation of an interim end state project. The section was prepared by Kaiser-Hill Community Outreach and Internal Communications staffs with preliminary input from the Public Participation Focus Group and key stakeholders at meetings held to discuss the project on September 1, 1995 at the Rocky Flats Environmental Technology Site (Site) and September 4, 1995 at the Rocky Flats Local Impacts Initiative office.

The development and implementation of a concept for accelerated Site closure between now and 2003 provides a unique opportunity for stakeholders to help the Site determine what it should look like in eight years. To this end, stakeholders are being brought in early and are encouraged to join with the Site in exploring the possibilities for achieving a stable interim end state while continuing to store plutonium and waste.

A wide variety of stakeholders are impacted by the Site and its activities and, therefore, will be involved in this project. These include employees, citizens groups, elected officials, nearby communities, regulators, interest groups and oversight entities. Information will also be made available to members of the public and news media who may want to follow the project's progress without participating in its development and implementation.

6.2 Objectives

This interim end state concept represents a variety of major activities to be conducted over an eight-year period and promises to deliver, at the end of that period, a safe and stable Site that looks and functions vastly differently from the current Site. The concept essentially treats closure of the Site as a comprehensive project, with a transformed Site in 2003 as its deliverable. One essential component to the success of this project is political and institutional alignment to ensure that adequate resources are provided over the life of the project and that barriers are removed to allow this accomplishment.

Stakeholder buy-in will be a necessary element of political and institutional alignment. Therefore, this plan is designed to meet the following objectives:

- Involve interested stakeholders early in the process of developing the interim end state concept to determine the broad desirability of the concept and its key elements.

- Following general agreement on the overall concept, involve interested stakeholders in determining the concept's key elements, exploring and analyzing options and defining an end product that is acceptable and consistent with community plans for the Site.

- Inform and provide opportunities for involvement to the broader public.

- In partnership with stakeholders, develop a project plan that has the community support necessary for funding decisions.

6.3 Key Policy Assumptions

Achieving stakeholder buy-in on the broad desirability of the interim end state concept will require agreement with several key policy assumptions concerning onsite storage of plutonium and waste, Site regulation and cleanup and the retention of buildings for future reuse. Consideration of some policy assumptions has already begun within the stakeholder community. Thoughtful and informed consideration of all policy assumptions will need to take place over the next few months to support an early 1996 decision regarding whether or not to move forward with implementation of the concept.

6.3.1 Interim Storage of Plutonium

DOE is preparing a programmatic environmental impact statement to review long-term storage options for weapons-useable fissile materials, including plutonium, and a draft of the document is scheduled to be available for public review and comment in December 1995. Several public comment meetings will be held around the country in early 1996, and input received by DOE will be factored into a final decision document in August 1996. Assuming an acceptable storage location will be determined and the necessary permitting and other legal requirements for design and construction are met without significant delay, a new facility for the nation's stockpile of plutonium and other special nuclear material could be available in 10 to 20 years.

Until an offsite facility is available, Rocky Flats remains a storage Site for 14.2 tons of plutonium. As currently defined, the site's interim end state concept assumes that plutonium will be stored onsite in a single facility until approximately 2020.

6.3.2 On-Site Storage of Transuranic Waste

Rocky Flats currently stores onsite transuranic waste, which is waste contaminated with plutonium at concentrations at or above 100 nanocuries per gram of waste material. In some of the waste, termed transuranic mixed waste, hazardous materials are also present.

The DOE's Waste Isolation Pilot Plant, developed to receive and store the nation's transuranic waste, is currently scheduled to open in 1998, 10 years later than originally planned. The interim end state concept assumes that the Waste Isolation Pilot Plant will not be available in 1998 to receive the site's waste and proposes that this waste be stored onsite in a central location until WIPP can accept the waste.

6.3.3 On-Site Storage of Low-Level and Low-Level Mixed Waste

Low-level and low-level waste mixed with hazardous constituents include waste generated during processing; construction debris from deactivation, decontamination, decommissioning and demolition activities; and soils from remediation activities. These wastes are currently shipped to an offsite commercial disposal facility and to other DOE repositories. The costs of preparing the waste to meet U.S. Department of Transportation shipping requirements, shipping the waste and disposing of it offsite are significant. The interim end state concept assumes the safe storage of these wastes onsite in a form that will be robust enough to last decades.

6.3.4 Site Regulation Under the Comprehensive Environmental Response, Compensation and Liability Act Only

Environmental restoration and waste management activities are currently regulated under both the Comprehensive Environmental Response, Compensation and Liability Act and the Resource Conservation and Recovery Act. The interim end state concept assumes the regulatory structure is simplified by eliminating overlapping jurisdiction and allowing the Site to be regulated under the Comprehensive Environmental Response, Compensation and Liability Act only.

6.3.5 Demolition of Buildings

As initially presented to stakeholders, the interim end state concept assumed all Site buildings would be demolished or buried with the exception of two required office buildings (Buildings 130 and 850), a plutonium storage facility, a containerized waste storage facility or facilities and the minimum infrastructure necessary for their support. Early stakeholder questions regarding the potential impacts of demolition and the financial savings expected from demolition will be taken into account in evaluating with stakeholders the extent of demolition desirable.

6.3.6 Economic Conversion

The demolition of buildings no longer needed to support DOE activities impacts the future of economic conversion of the Site. Some stakeholders have expressed support for continuing the National Conversion Pilot Project and for converting current DOE facilities to other uses. This stakeholder feedback resulted in the site's acknowledgement that buildings that could support economic conversion efforts could be excepted from demolition. These buildings, however, would not have the current Site support infrastructure system available to them, so alternatives for access to utilities, water, steam and other support systems would have to be evaluated.

6.3.7 Cleanup Level Assumptions

The interim end state concept does not state explicitly the assumed cleanup levels for the protected area, the industrial area and the buffer zone by 2003. Project-specific cleanup levels will be determined in consultation among DOE, the U.S. Environmental Protection Agency, the Colorado Department of Public Health and Environment, Kaiser-Hill Company and stakeholders.

6.3.8 Deferred Activities

The interim end state concept does not articulate the activities that will be deferred until after 2003. Early stakeholder feedback indicates that this information should be provided to stakeholders prior to decisions related to acceptability of the concept.

6.4 Integration of Related Activities

While the interim end state concept assumes agreement with several major policy conditions, such as the continued onsite storage of plutonium, some current Site programs are examining options for implementing some of these policies. In the case of plutonium, until an alternate Site is selected and prepared for the long-term storage of plutonium from Rocky Flats and elsewhere, the Site and its interim end state concept will acknowledge that plutonium will continue to be stored safely onsite. How to best meet that responsibility is currently the focus of a Site study of plutonium storage options in response to the Defense Nuclear Facility Safety Boards Recommendation 94-3.

Clearly, these ongoing and planned activities must be integrated with development of the interim end state concept. In fact, in some cases, specific programs might need to be delayed so not to preclude the consideration of all options within the interim end state process. These activities, and others that come about over the next few months, will need to be managed by DOE and other groups with public involvement responsibilities so that interrelationships between activities are clearly understood and decision points are scheduled appropriately with respect to those interrelationships.

6.4.1 Site-Wide Environmental Impact Statement

DOE is developing a Site-Wide Environmental Impact Statement (SWEIS) for the Rocky Flats Environmental Technology Site, which will evaluate the impact of activities associated with the site's cleanup mission. Impact statement scoping has been completed, and outreach activities are ongoing. As currently scheduled, the implementation plan for the SWEIS will be available in October 1995, and the draft SWEIS will be available for public review and comment in August 1996.

Certain activities implemented as part of the interim end state concept will require review and evaluation under the National Environmental Policy Act (NEPA). For some activities, the NEPA requirements will be met through documentation required by the Comprehensive Environmental Response, Compensation and Liability Act. The NEPA requirements for others could be met through inclusion in the SWEIS.

The NEPA process requires public involvement at various stages of document development. Decisions to include specific activities associated with the interim end state concept in the Site-wide evaluation will need to be coordinated closely with the SWEIS effort.

6.4.2 94-3 Analysis and Recommendation

The Defense Nuclear Facilities Safety Board, a congressionally appointed technical review board, issued recommendation 94-3, requiring Rocky Flats to analyze options for safe, consolidated storage of plutonium onsite. The analysis, which will be completed by late November 1995, will consider four options:

- Upgrade Building 371;
- Build a new plutonium storage facility onsite;
- Build or modify a storage facility offsite; and
- Design and build an improved storage container that could withstand building collapse.

Since mid-July 1995, Site personnel have participated in several briefings to discuss plutonium storage options with interested stakeholders, including elected officials, the Rocky Flats Citizens Advisory Board, the Rocky Flats Local Impacts Initiative, regulatory agencies, local governments and business representatives. The CAB's Plutonium and Special Nuclear Materials Committee is working closely with Site personnel on this issue. Additional public involvement opportunities will be available throughout October and November as the Site prepares to recommend a preferred option to DOE Headquarters in late November 1995.

6.4.3 Rocky Flats Cleanup Agreement

The Rocky Flats Cleanup Agreement, the planned replacement for the 1991 Interagency Agreement for environmental restoration, has been in negotiation for more than one year. A Quality Action Team, comprising members from the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Colorado Department of Public Health and Environment and Kaiser-Hill Company, meets weekly to negotiate specifics of the agreement and to identify core, unresolved issues. Senior staff from DOE and EPA

Headquarters will participate in a Work-Out Session in Denver on October 10 and 11 to resolve outstanding issues, and a draft agreement is expected to be developed for public review and comment in November 1995 and finalized in January 1996.

6.4.4 Low-Level and Low-Level Mixed Waste Storage/Disposal Facility

The Site has provided several briefings and public presentations on a proposed low-level and low-level mixed waste storage/disposal facility since July 1995 to provide information and to solicit input on project specifics such as design, location and potential alternatives. These briefings have included sessions with the Citizens Advisory Board and its Site-Wide Issues Subcommittee, the Rocky Flats Local Impacts Initiative, local elected officials and attendees of the site's September public information meeting. Input during these briefings, along with applicable recommendations from the Site-Wide Issues Subcommittee's policy on waste management expected in late 1995, will be taken into account in the development of the proposed decision document for the facility. The proposed decision document is scheduled for public review and comment in January 1996.

6.4.5 Future Site Use Working Group Recommendations

Following a year of research and deliberations, the Future Site Use Working Group adopted future Site use recommendations for submittal DOE in June 1995. The areas on which the group reached agreement include:

- Protect health and safety of the public and workers;
- Clean up to average background level for Colorado, through research, technology and use of skilled work force;
- Retain current buffer area primarily as managed open space;
- Retain core as industrial area for cleanup and environmental technology;
- Future uses should occur in the context of three phases of cleanup; and
- Protect or acquire property rights - including surface minerals, gas and oil easements and water rights.

The interim end state concept, as modified to allow for reuse of buildings that can obtain support infrastructure, is consistent with the recommendations of the Future Site Use Working Group. The recommendations report states that, "Areas in the industrial area not impacted by contamination and clean up activities may be considered for adjunct environmental technology activities." The Future Site Use Working Group agreed that existing structures should be reused or adapted for reuse for these activities.

DOE's Rocky Flats Field Office is currently preparing a Future Use Vision Document, which responds to and builds on the recommendations of the Future Site Use Working Group. A draft of the vision document will be made available to stakeholders for review and comment in November 1995, and document finalization is currently scheduled for March 1996.

6.4.6 Citizen Advisory Board Papers and Recommendations

The Rocky Flats Citizens Advisory Board is currently developing a variety of papers and recommendations on issues impacted by the interim end state concept. A plutonium paper, developed by the CAB's Plutonium and Special Nuclear Materials Committee, is designed to provide CAB members with a framework for obtaining information and making decisions and recommendations concerning the "big picture" issues of plutonium disposition. A waste management policy, which is being developed by the Site-Wide Issues Committee, is expected to be available in late 1995. Additionally, the Alternative Use Planning Committee has developed a recommendation for DOE on mortgage reduction. This timely input, as well as ongoing work with the CAB, will play an important role in the development of a credible and acceptable interim end state concept.

6.4.7 Budget Planning

Current planning for the site's FY96 budget reflects risk and mortgage reduction activities but does not presume preliminary implementation of an interim end state concept. If the Site and its stakeholders decide to move forward with the concept in FY96, existing funding would need to be reallocated to accommodate scope changes. If a decision is made to implement the interim end state concept in FY97, funding priorities would need to be incorporated into FY97 and FY98 budget planning in January 1996. Stakeholder involvement in annual budget planning activities will continue regardless of the future of the interim end state project.

6.4.8 Performance Measures

Performance measures, which provide the foundation of the contract between Kaiser-Hill and the U.S. Department of Energy, define specific goals, tasks and timelines for work to be completed at the Site. Performance measures will be negotiated with DOE on an annual basis to reflect Site goals and objects for the coming fiscal year.

If budget or prioritization assumptions change, performance measures can be reviewed and modified by Kaiser-Hill and DOE to ensure alignment with Site goals and objectives. Current performance measures are consistent with the risk reduction and safety priorities developed at the Rocky Flats Stakeholder Summit held in March 1995. If the interim end state concept is pursued, performance measures will be developed to support the related activities.

6.5 Decision Making Framework and Timeline

In terms of public involvement, the interim end state project is unique to this Site in that it seeks to involve stakeholders in the project in its conceptual phase. The Site is asking stakeholders to join with it in exploring the possibilities for achieving a safe interim state through participation in onsite working groups for specific topics. Once the concept is agreed upon, stakeholders will continue to be involved in the design and implementation of specific activities.

Simply put, stakeholder involvement will comprise two general phases — Phase I will address the conceptual "what" questions; Phase II will address the "how" questions. The following guiding principles must be understood by the Site and its stakeholders at the onset of public involvement in this project:

- The interim end state concept is a work in progress.

- Stakeholder buy-in on the broad desirability of the concept and its key elements will require additional information.

- Stakeholder buy-in on the concept (Phase I) does not presume buy-in on the specifics (Phase II).

- The interim end state concept is not a final remediation solution.

The ability to move forward with the project will depend largely upon the site's ability to secure a funding commitment for the duration of the eight-year effort. Because planning for the FY97 and FY98 budget priorities is occurring in January 1996, the Site needs buy-in from stakeholders and DOE Headquarters regarding the broad desirability of the concept within the next few months if it is to move forward with the project. While a decision in December 1995 is optimal, the Site is committed to full stakeholder involvement and is prepared to extend the decision into early 1996 if necessary.

This decision, which will represent the completion of Phase I, will follow multiple opportunities for stakeholder briefings and work sessions with team leaders for the various topic areas covered in the project. During this phase, stakeholders and DOE Headquarters personnel will have the information needed to make judgements on the driving policy assumptions, such as the need for continued safe storage of plutonium onsite until an offsite storage facility is available.

Assuming Phase I culminates in a decision to move forward with Project Safe Site, Phase II will involve the development of specific strategies and plans for implementation. The Phase II studies will determine the feasibility of various implementation options and will define specific actions for achieving safe plutonium storage; waste storage; building deactivation, decontamination, decommissioning and, where appropriate, demolition; environmental cleanup; and elimination of unnecessary support infrastructure. The Phase II plans and preparations for implementation of the concept be developed primarily in last three quarters of FY96 and will continue thereafter at a lower level of effort as actual implementation occurs. Stakeholder decision timetables for the specific project plans will occur throughout the life of the project and have not yet been determined.

Phase I	Concept development (draft in Dec. 1995)	Oct. 1995 - Dec. 1995/Jan. 1996
Phase II	Development of specific project plans	Feb. 1996 - Completion

The Master Plan timeline reflects major interim end state milestones and the schedules of the related ongoing activities described above in Section 6.4.

6.6 Stakeholder Involvement Strategies

Because of the broad impact of the interim end state concept, a wide variety of external stakeholders will be involved in its development and implementation. As described below, the involvement strategies will vary among groups due to differing levels of interest and differing areas of influence. Several information and involvement tools and opportunities, however, will be available to all stakeholders. These include public meetings, fact sheets, the draft interim end state workplan and supporting technical documents, one-on-one briefings upon request, speakers bureau presentations, Site tours and a database to capture and track stakeholder comments and concerns for response by the Site. Information on interim end state could also be made available through a short video program, an exhibit for display in public locations, an interactive multi-media presentation accessible via computer and a World Wide Web Home Page.

6.6.1 DOE Headquarters

DOE Headquarters will play a major role in the funding and oversight of the interim end state concept. In addition, Headquarters-driven DOE orders, policies, standards and requirements in several of the project areas will have to be taken into consideration throughout Phase II development of specific project plans. In some cases, orders, policies, standards and

requirements may need to be waived, modified or eliminated where reasonable to accommodate Site-specific activities in support of concept implementation.

Some key DOE Headquarters personnel have received preliminary briefings on the interim end state project and have participated in initial work sessions on development of the overall concept. Additional briefings and work sessions, such as the October 10-11, 1995, Rocky Flats Cleanup Agreement Work Out Session, will involve DOE Headquarters decision makers and technical experts throughout both phases of the project.

6.6.2 Employees

Employees of the Site are key stakeholders in the interim end state concept in that they will be the true implementors of the effort and will be significantly impacted by the operational and work force changes brought about by the project. This stakeholder groups includes DOE Rocky Flats Field Office employees and union and non-union contractor employees. Information and involvement activities will be designed to meet several objectives:

- Shift the existing corporate culture from one that supports ongoing, indefinite activity to one that is project- and end-date-oriented.

- Generate employee enthusiasm about the positive professional and community aspects of the interim end state project;
- Increase worker awareness of professional development opportunities, choices and programs available to them over the implementation period;

- Solicit employee ideas and strategies based on unmatched Site and systems knowledge; and

- Develop employees as advocates and ambassadors for the interim end state project.

Internal communications will be closely coordinated with external communications activities to ensure consistency and adequate opportunities for all interested stakeholders. Information will be disseminated through existing Site publications, including Crossroads and Managers Preview, and opportunities for interested employees to participate in project planning will be made available through existing stakeholder groups, at a minimum.

6.6.3 State Elected Officials

State elected officials, primarily the governor, the lieutenant governor and the state's congressional representatives, will play a critical role in the site's efforts to obtain support and funding for implementation of the interim end state concept. Without buy-in from this stakeholder group, the project will struggle to secure the level of funding needed to accomplish the Site stabilization and cleanup activities envisioned over the next eight years.

The Site has held preliminary discussions with elected officials and staff and will continue to do so as appropriate to provide officials with the types and levels of information needed for input and decisions about the concept. Staff will be invited to participate in concept development and implementation on behalf of the elected officials.

6.6.4 Local Elected Officials

Local elected officials are keenly interested in any Site activities and operations that could potentially impact the health, safety and quality of life of the communities they represent. Therefore, early and frequent contact with city and county officials and their staffs will be offered to address questions and to solicit input concerning the interim end state concept and its implementation.

Site Communications staff will work with neighboring cities and counties to determine how each would prefer to be informed and involved and how often. A variety of mechanisms will likely be used, ranging from individual briefings to full council or commission presentations. City and county staff will be invited to participate in technical work groups throughout both phases of the project.

6.6.5 Public Interest and Citizens Groups

Public interest and citizens groups will likely take a very active role in the interim end state project. Members and staff of the Citizens Advisory Board and the Rocky Flats Local Impacts Initiative have already begun to participate in the development of the interim end state concept, and these stakeholders, as well as others from groups such as the Rocky Flats Cleanup Commission and Environmental Information Network, will be invited and encouraged to join with the various task teams in development of the concept over the next few months. Additionally, recommendations and guidance offered by the Citizens Advisory Board and the Rocky Flats Local Impacts Initiative will help in the development of a publicly acceptable interim end state vision for the Site.

6.6.6 General Public

The general public, for the purposes of this plan, is defined as citizens who may have an interest in receiving information about the Site but who do not want to participate actively in Site decisions. A wide variety of information resources will be available to the general public as described in Section 6.6 above.

6.6.7 Regulators

The U.S. Environmental Protection Agency and the Colorado Department of Public Health and Environment will be extremely involved in the development and implementation of the interim end state project because of their legal and regulatory responsibilities to ensure protection of the environment and public health and safety. As the concept is developed, the Site will work closely with the two regulatory agencies to ensure that health and safety and environmental objectives are met and that project implementation is feasible from a regulatory perspective. The Site and the regulatory agencies will also work together to integrate the interim end state project with other related activities, such as development of the Rocky Flats Cleanup Agreement.

6.6.8 Defense Nuclear Facilities Safety Board

The Site will work closely with the newly designated onsite representative of the Defense Nuclear Facilities Safety Board to keep the Board informed of planned activities. The Site will encourage the Board's participation in technical discussions concerning the concept and the specific tasks involved in its implementation.

6.6.9 News Media

Because of their daily access to hundreds of thousands of Denver area citizens, the news media can be instrumental in providing information to the general public about the interim end state concept. Some local news coverage has already resulted from public presentations of the initial concept, and more coverage will be solicited as the concept develops. Editorial board briefings, interviews, Site tours and news releases will be offered to local and national news media as a means of publicizing plans, ideas and decisions concerning the interim end state project. During Phase II of the project, news media will be invited to witness and to photograph and videotape landmark events, such as the demolition of excess buildings. The Site will also maintain photographs and videotape of significant events to provide to news media as needed.

6.8 CONCLUSION

The Site is committed to providing the resources and opportunities necessary for meaningful stakeholder involvement in the interim end state concept. This involvement is critical for the concept to be one the citizens of Colorado and the U.S. taxpayer will benefit from and can support. Just as stakeholders will participate on work teams for the technical elements of interim end state, stakeholders will work with the Communications team to refine and help implement this Communications and Stakeholder Involvement section of the workplan. By jointly defining and refining stakeholder roles in this and related projects, as well as the key decision points, the interim end state project — all entities involved — will have a much greater opportunity to succeed.

TASK 7: IMPLEMENTATION

Overview

The purpose of this task is to develop the Interim End State (IES) Project Implementation Plan. This task differs from the other technical tasks in that it deals with the "soft", non-technical aspects of the IES Project implementation. In a project as complex as IES, unless the non-technical issues are addressed, a sound technical plan may not be adequately implemented. Issues such as logistics, funding and stakeholders may become barriers unless addressed early in the planning process. The plan will address the following sub-tasks:

7.1 Project Work Logic

7.2 Cash Flow Profile

7.3 Detailed Project Schedule

7.4 Budget Forecasts and Options Analysis

7.5 Skills Mix Analysis and Resource Assessment

7.6 Contracting and Procurement Strategy Activity

7.7 Authorization Bases and Standards Infrastructure

7.8 Strategic Analysis and Strategic Plan Interface

7.9 Systems Modeling and Technology Application

7.10 Workforce Culture Change and Alignment

These sub-tasks cross cut all of the other tasks and therefore it is vital that they be adequately integrated. In many cases, the IES Implementation Plan will address the logic and processes used to reach conclusions rather than the technical details. It will be the job of the Implementing Task Manager to provide a consistent process by which the technical options are screened and evaluated. The Technical Tasks Teams will provide the options and evaluation criteria, the

Implementation Task Team will provide the process by which options are evaluated and then the Technical Task Managers will proceed with the technical baseline based upon the integrated evaluation. The evaluation must be integrated in order that the path selected is the best overall, not just the preferred option for Special Nuclear Material (SNM) Storage or Waste Management, for example. The preferred option must hold together as a compelling proposal from all technical aspects as well as the political, administrative and regulatory points of view.

7.1 Project Work Logic

The Project Work Logic is a key precursor to the follow-on tasks involving estimating, cash flow, detailed schedules and budget strategy and procurement strategy. This sub-task includes the development of the work logic necessary to implement the program from FY-96 through FY-03 with projections through FY-26.

The Project Work Logic is focused on establishing a process by which the technical baselines may be integrated with each other to achieve the preferred overall option. Secondly the Project Work Logic is designed to include the soft aspects of implementation which are critical to the success of the project at all stages.

The first and most important area involves stakeholder participation. In the past, technical decisions were made onsite and presented to the stakeholders for their approval. From the outside it always appeared that Department of Energy (DOE) had made the decisions and all that was left was to "convince the stakeholders" that it was the right one. This involved a certain arrogance on the part of DOE that the stakeholders did not really have any value to add to the process. With the creation of the Rocky Flats Citizen's Advisory Board, the Rocky Flats Local Impacts Initiative and other stakeholder groups, as well as the ever increasing involvement of the major regulators, this premise has proven to be incorrect.

As a result, the Site must present a decision making process rather than a decision. The Project Work Logic attempts to achieve a sound, inclusive process whereby all key inputs are not only welcomed but incorporated as value added up front. This sub-task is closely tied to Task 6 in the area of stakeholder communications. The IES Stakeholder Communications Plan will detail how the stakeholders will be informed of and involved in the planning and implementation of IES.

When the sub-task is complete, a Project Work Logic will be included at the end of this section. This work logic will be prepared by D. Ruscitto with help from the Planning and Integration (P&I) group.

A key question involves whether the work logic should show a proposed technical path or decision trees used to evaluate options and move forward once selection is made? I recommend that the logic be a process flow with decision trees rather than a preferred technical option. Otherwise it appears that we have already chosen. Especially with respect to SNM where there will not be a clear choice until significant further evaluation occurs between a new facility and Building 371 modifications. The general Site culture is to drive ahead with a preferred option rather than establish a logical process up front to identify options and proceed. This is viewed as a barrier to effective implementation. A significant advantage of the process option is that it proves to the stakeholders that Rocky Environmental Technology Site (Site) is serious about their input and that we are striving for a consensus decision. The added benefit is that the

process really will produce the best decision and therefore the likelihood of support and funding is increased.

7.2 Cash Flow Profile

The purpose of this task is to determine the project cash flow profile. The concept of IES is bold and unconventional in the DOE world. The task of funding is further complicated by the possibility for large up-front cash flow requirements in order to offset much larger out year expenses under the current profile. Technically valid and defensible cash flow data are essential to achieving support at DOE. Without crisp background demonstrating long term budget needs on an annual basis, it is unlikely that any additional funding will be made available to support IES. This sub-task involves the development of a Project Cash Flow Profile by fiscal year from 1996 through 2026.

This profile will be developed by D. Ruscitto with support from F&A and all Task Team Managers.

In order to build an accurate cash flow profile certain assumptions must be made in the following areas:

- ***Cleanup standards [How do you know when you are done?]***

- ***Process standards (Authorization bases) [How rigorous do you have to be in getting there?]***

- *Costs and savings associated with mortgage reduction activities. [Are there other ways to alter the cost profile regardless of the technical baseline - Things we should be doing anyway to reduce the mortgage?]*

- *Adjustment of current regulatory milestones and other commitments such as DNFSB 94-1. [Are we free to propose what makes the most sense in spite of current commitments and regulations?]*

- *Proposed integrated technical baseline (Areas of Waste Management, SNM, OU Closure, D&D and Infrastructure).*

These assumptions must be validated in the Work Logic and necessarily flow from the options analysis. There may be a cash flow influence on the preferred option if funding profiles become a critical discriminator.

7.3 Detailed Project Schedule

The purpose of this task is to provide an integrated, resource-loaded schedule which will provide the various levels of detail necessary to effectively manage the project. The top level schedule will fall directly out of the work logic decision process. It must be integrated across all the technical disciplines and then critical path management techniques applied to make the project consistent with originally stated expectations. Since the end of the weapons production mission, Rocky Flats has never been able to put together a meaningful project schedule for even minor projects, let alone one of this magnitude. In fact every major planning and scheduling activity has been a disappointing failure. Part of this is due to the lack of understanding of the value of the scheduling process. Schedules were seen as deliverables in and of themselves rather than merely tools for project management. The other major barrier is a severe lack of scheduling talent at all levels including senior management. The senior Kaiser Hill Planning and Integration Manager position remains vacant and a new hire has not yet been identified.

The path forward is relatively clear:

- An upper level work logic is developed in Sub-Task 7.1.
- An upper level schedule and possible timeline is determined.
- The critical path is identified
- The necessary skills mix is determined (Sub-Task 7.5)
- The schedule is resource loaded
- The resources are leveled
- The critical path is reworked to optimize the schedule

The schedule will be developed by D. Ruscitto with support from P&I with major input and ongoing participation by all Task Team Managers

A key question is whether there is adequate scheduling talent both quantity and capability to produce an integrated, resource loaded master schedule of this magnitude? If not, it must be obtained as soon as possible regardless of the IES since this capability is required in any case.

7.4 Budget Forecasts and Options Analysis

The purpose of this task is to determine the funding profile and justification to achieve the IES in the safest, fastest and most economical fashion. Several funding options should be considered. This sub-task involves the development of a Budget Forecast and Options Analysis. Since the IES involves a radical departure from the current Site funding profiles, a new strategy consistent with the proposed changes must be developed. It is expected that the project will require funding at a greater level than currently planned during the next several fiscal years. It is unlikely that sufficient support can be generated for such a request without credible forecasts and analysis completed well in advance. Fiscal year 1996 and 1997 budgets are already very far advanced and any changes in these years will be doubly difficult. It is assumed that the first fiscal year in which full-blown IES funding can be expected is FY-98.

During FY-96, the Site must focus on reducing the mortgage and conducting tangible risk reduction activities in order to build trust and credibility with decision makers in DOE Headquarters and Congress. This credibility is essential to achieving extra funding in the early IES years. It has already been made clear that the DOE Headquarters (HQ) response will be, "show me what you did with the last two year's budgets and then we'll consider whether to augment it with additional funds." During the FY-97 budget cycle the Site must work to implement as many of the IES principles as possible within the constraints of the appropriation.

A Budget Options Analysis Document shall be prepared to evaluate various potential budget funding profiles and the advantages and disadvantages that the profiles present. The role of unfenced funds, multi-year budgets, Site-wide MSA and single HQ sponsorship are to be evaluated. This deliverable will be prepared by D. Ruscitto with major support from F&A as well as the Technical Task Managers.

Major interfaces include:

- ***DOE Program Representatives at RF and HQ regarding the possible unfencing of funds, MSA, etc.***

- *Congressman Skaggs regarding Congressional restrictions on funding.*

Several barriers impede the ability to achieve single-source funding:

- *Ability to combine capital and expense funds.*

- *Ability to commence multi-year activities with assurance of funding for completion.*

7.5 Skills Mix Analysis and Resource Assessment

The purpose of this task is to determine the contractor skill set required and available to conduct the project. The available versus required skill will be evaluated in order to establish what actions will be required to adjust the Site resource pool. Since the IES involves a change in mission for the Site, it is expected the available skills mix will not entirely support the IES. Strategies will have to be developed that will determine whether and how much retraining, voluntary and involuntary separation, outsourcing and outside hiring will be necessary to support the project. The cost in terms of workforce restructuring benefits is crucial in this effort. A Skills Mix and Resource Assessment Document will be prepared and the data loaded into the Master Schedule for resource leveling and critical path optimization.

This task will be performed by D. Ruscitto with major support from Human Resources, Industrial Relations and the Technical Task Managers.

A key question is what are the ongoing requirements of 3161 in fiscal years 96 and beyond?

Major Interfaces include:

- ***Union relative to new collective bargaining Agreement.***
- ***DOE HQ regarding the applicability of 3161 requirements.***
- ***Congressman. Skaggs regarding workforce issues and 3161***

A major barrier will exist if the Site is not allowed to apply commercial workforce hiring practices (Fluid workforce concept). Additionally, the Collective Bargaining Agreement will be renegotiated during this crucial timeframe and these negotiations will certainly play a pivotal role in determining work rules and worker productivity. Another factor which must be considered is the loss of key personnel due to retirement over the term of the project (Especially plutonium handlers).

7.6 Contracting and Procurement Strategy

The purpose of this task is to determine the contracting and procurement strategy that DOE should employ to achieve the IES in the safest, fastest and most economical fashion. The proposed IES project differs significantly from the current Site baseline and as such, the current Site Integrating Management Contract may not be the most effective contract tool for the Department of Energy to utilize. It is not apparent whether the current Integrating Management Contract provisions are even applicable to the IES. Therefore, this sub-task involves the determination of the optimum government contracting methodology to implement IES. This may involve additional contract reform initiatives designed to share risk and encourage investment or privatization. This activity involves the generation of a Contracting and Procurement Strategy Document. Privatization, out-sourcing and fixed price subcontracting are among the possible mechanisms.

This document will be generated by D. Ruscitto with major support from CED and F&A.

Key questions include:

- *Will the current Integrating Management Contract support IES both in scope of work*
- *What is optimal procurement scheme for selected options?*
- *What work can be outsourced, fixed price subcontracted, etc.?*
- *Can the DOE project acquisition system for capital projects be shortened to support rapid capital construction?*
- *Can the Site be made a single MSA to facilitate project management, funding and procurement?*
- *How will the integrator split up work among existing major subs in light of possible significantly changed work scopes relative to the original proposal and existing subcontracts.*
- *The site's ability to expedite procurement action to support aggressive schedules has never been demonstrated. (Site efficiency issues)*
- *DOE procurement regulations are cumbersome and slow (Bureaucratic issues).*

7.7 Activity Authorization Bases and Standards Infrastructure

The purpose of this task is to determine the optimal process to be used to identify the proper envelopes within which operations will be conducted. Currently there are several DOE-lead standards initiatives in place, as well as several regulatory frameworks. These include DOE/EH's "Necessary and Sufficient Standards Program", the Site's authorization basis Process Improvement Team (PIT), the recently formed Advisory Committee on External Regulation of DOE Nuclear Safety, the Defense Nuclear Facilities Safety Board, the new Nuclear Safety Rules (Price Anderson) and other numerous state and federal regulations (CERCLA, RCRA, CAA, CWA, OSHA, NRC, DOT, NEPA, etc.). The integration of a consistent standards infrastructure is essential to stakeholder approval of the project as well as the ability to safely and quickly perform work. This sub-task involves the determination of the impact of standards on technical option analysis, as well as implementation of the technical baseline. Both nuclear and non-nuclear activities are included. Currently the SITE Authorization Basis PIT plans on delivering their program document in draft in the next 60 days. It must be integrated with IES and made into an integrated, Site-wide Authorization Basis Program Description. This program would then be factored into the cost estimates for the technical baseline.

Key questions include:

- ***Can a clear distinction be drawn between nuclear and non-nuclear activities?***

- ***Can the Site's bias towards bureaucratic work authorization processes (Legacy of resumption) be overcome?***

• *Can commercial operating standards be applied to commercial/industrial project activities without RF infrastructure added?*

Several key interfaces exist and must be pursued:

• *Congressman Skaggs regarding intent of Public Law 102-190.*

• *DOE Environmental Management (EM) representatives for resolution of DOE Orders compliance issues (including 90-2 implementation plans).*

• *DOE EH representatives regarding the Necessary And Sufficient Standards Program.*

• *DNFSB regarding (1) Compliance with Recommendation 90-2 and the Site authorization basis program and (2) Applicability of Public Law 102-190.*

• *Rocky Flats Authorization Basis Process Improvement Team regarding implementation and integration with Site SAR, SWEIS, etc.*

The ability to achieve unified, external consensus and acceptance of the Site authorization basis program will hinge largely on the technical adequacy of the outcome of the PIT as well as the manner in which all the expected detractors are made to feel comfortable with the approach. The Site has traditionally had difficulty integrating multiple standards requirements into a flexible program that ensures public and worker safety and protection of the environment.

7.8 Strategic Analysis and Strategic Plan Interface

The purpose of this task is to identify known and potential barriers to implementation of the IES project. The Site must establish and exploit opportunities and work cooperatively with external stakeholders to achieve consensus. This project necessarily involves the identification of major new strategic issues which must then be integrated into the Site's upper tier planning.

The Site faces a unique mix of technical, political and bureaucratic challenges and opportunities. Much work has already been done to prepare a Site Strategic Plan. A strategic analysis must be conducted as part of the IES project in order to ensure that the proposed strategies can succeed. Stakeholders have traditionally been presented with pre-established paths forward and then been "convinced" why the path was correct. This project must involve stakeholders up front in the options analysis, selection criteria and implementation strategy. This will allow their assistance in overcoming barriers as well as avoiding the creation of new barriers.

In order to broaden the technical horizon of the Site, several strategic workshops will be conducted. Additionally we must conduct a review and evaluation of the existing Strategic Plan and a new IES-focused strategic analysis. This Strategic Analysis Document is an early deliverable, which is key to proceeding forward with the IES. It is expected that the Strategic Plan will be revised as a result. Also included is identification and integration of barriers identified in other tasks. Strategies will be developed to overcome barriers and maximize opportunities and these must be integrated with the stakeholder involvement tasks.

D. Ruscitto will develop the Strategic Analysis and P&I will revise the Site Strategic Plan with stakeholder participation.

Key questions include:

- *How can we be sure the key strategic issues have been addressed?*

- *How will the strategies be devised concurrently with the technical baseline when they are closely linked?*

- *How do we modify the FY-96 and FY-97 budgets to begin working towards IES when they are fixed on the existing Strategic Plan and current budget assumptions?*

Interfaces include:

- *Local Stakeholders for revision of Strategic Plan and interface on new strategic issues.*

- *Influential insiders regarding the strategy for getting IES excepted as a sound path forward.*

- *DOE/RFFO and Kaiser-Hill senior executives for upper level vision and policy.*

- *Stakeholder Task Team for development of stakeholder strategies.*

- *Technical Task Teams for sensitivity to non-technical aspects of consensus on various options and integration of cross-cutting barriers.*

Several barriers currently exist:

• ***Strategic planning on the Site has traditionally been done by a "cast of thousands" over a period of years. It must now be done in a more streamlined fashion while not excluding key stakeholders.***

• ***The attitude that "we've just completed the Strategic Plan and now we want to change it."***

• ***The IES overall path forward requires a drastic shift in pace and direction on a Site that is traditionally slow to accept change.***

7.9 Systems Modeling and Technology Application

The purpose of this task is to ensure that the latest technologies applicable to the IES are identified and incorporated into the technical baseline. One tool that must be effectively utilized is the Site systems engineering model. It's greatest advantage will be for technical Task Managers to optimize their options analysis. The first step was to conduct a joint SNM and D&D workshop in Denver on September 19, 1995. The purpose of the workshop was to encourage "out of the box" thinking by the best technical experts in the country. ***This workshop served as the catalyst for some new and potentially effective options.***

A major barrier is the traditional attitude of "not invented here"

Key questions include:

• ***Is there a mechanism in place for comprehensive searches for applicable technology?***

- ***Is it worthwhile to expand the technical workshops into other areas or more technical detail?***

Interfaces include:

- ***Recognized industry experts for participation in the technical workshop.***

- ***Technical Task Teams for input of options into the systems engineering modeling program.***

- ***Technical Task Teams for input of new technologies not currently in use on the Site which may prove useful.***

7.10 Work Force Culture Change and Alignment

The purpose of this task is to establish and execute a process to engage the Site workforce, both hourly and salaried, in a manner that maximized employee contributions to the success of the IES Project. The IES involves a major change in the way work at the Site is conducted. The Site must rapidly change from an ongoing operations mentality to a closure project mentality. Additionally, the talents of the workforce remain untapped, limiting the scope of advance required to achieve rapid, radical improvements in productivity and initiative.

This sub-task interfaces closely with ongoing employee relations efforts associated with the new contract regarding culture change in the workforce. A plan shall be developed and implemented to explain IES and then rally the Site around the project as a new mission.

An issue paper on the attributes of projects versus operations was developed as a training tool.

A key question is whether the Site workforce can be sufficiently trained and motivated to embrace IES sufficiently to maximize Site productivity?

Interfaces include:

- *Stakeholder Task Team for internal communications with employees.*
- *Employees for training and motivation*
- *Union leadership for aggressive leadership and support.*
- *Nort Salz for Culture Change Team input.*

Barriers include:

- *Ingrained culture of ongoing operations versus the needed project mindset.*
- *Internal mechanisms which keep productivity low and discourage worker input on ways to improve the work process.*