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Immobilized High-Level Waste Interim Storage Alternatives Generation and Analysis and Decision Report

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Abstract: This report presents a study of alternative system architectures to provide onsite interim storage for the immobilized high-level waste produced by the TWRS privatization vendor. It examines the contract and program changes that have occurred and evaluates their impacts on the baseline IHLW interim storage strategy. In addition, this report documents the recommended initial interim storage architecture and implementation path forward.

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Immobilized High-Level Waste Interim Storage Alternative Generation and Analysis and Decision Report

Prepared for the U.S. Department of Energy

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Richland, Washington

Hanford Management and Integration Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Release form.

DECISION ANALYSIS SUMMARY

Problem Statement

Is the previous decision to provide for Phase 1 immobilized high-level waste (IHLW) interim storage via retrofit modification of the Hanford Site Canister Storage Building (CSB) still the preferred architecture given new programmatic changes resulting from establishment of the Phase 1B Tank Waste Remediation System-Privatization (TWRS-P) contract?

Background

Selection of an IHLW interim storage architecture to support the TWRS-P Phase 1 was based on a thorough decision process. The recommended (baseline) Phase 1 architecture was retrofit modification of the existing CSB to render it suitable for IHLW interim storage. Once this decision was approved, a conceptual design for CSB retrofit modifications was completed and the cost estimate was validated by the U.S. Department of Energy. After these activities, several major programmatic developments occurred that could potentially impact baseline architecture implementation. These developments are as follows.

- The start of Phase 1 IHLW production (and coincident start of IHLW interim storage) has slipped from June 2002 to February 2007.
- Phase 1 IHLW production will terminate by February 2018 instead of 2011.
- The Spent Nuclear Fuel (SNF) Program will complete removal of all fuel from the K Basins by December 2003 and complete all fuel post-processing (e.g., sampling and seal-welding) in the CSB by April 2004.
- The conceptual design cost estimate for CSB retrofit modifications is greater than that upon which the original selection decision was based.
- The ^{137}Cs intermediate waste product and non-routine high-level waste product have been eliminated from the Phase 1 IHLW interim storage scope.
- The 3 m tall IHLW canister has been replaced with a 4.5 m tall canister.
- The minimum number of Phase 1 IHLW canisters that interim storage must potentially accommodate has been reduced, but the maximum number is no longer bounded for Phase 1.

The schedule developments, in conjunction with the conceptual design cost estimate increase, are significant enough to warrant a reevaluation of whether the baseline architecture remains the preferred Phase 1 IHLW interim storage architecture from a financial, technical, and logistical perspective. This report provides the results of the reevaluation process and a new recommended path forward.

The purpose of this effort is to reevaluate alternatives for Phase 1 IHLW interim storage to either confirm the baseline architecture (i.e., retrofit modification of the existing CSB) or select a new preferred architecture. Furthermore, the path forward recommended by a newly convened decision board, as well as other aspects of the decision process (i.e., decision methodology, alternative rankings, and decision statement), is documented.

Alternate Architectures

The architectures evaluated in the original Alternative Generation and Analysis (AGA) were evaluated to assess whether recent programmatic developments would have impacted the original AGA evaluation process. Based on the results of this initial activity, several alternate architectures with a reasonable probability of competing successfully with the baseline architecture were identified. Specific alternatives included in the reevaluation are as follows:

- Alternative 1 – Existing CSB (baseline architecture)
- Alternative 2a – Plutonium-Uranium Extraction (PUREX) Plant Retrofit
- Alternative 2b – Fuels and Materials Examination Facility (FMEF) Retrofit
- Alternative 3 – New Construction.

Detailed information was developed for each alternate architecture. This information includes a concept description (e.g., discussion of salient features, required facility modifications, etc.), implementation schedule (e.g., project definition, validation, design, construction, and permitting), and implementation cost estimate. In addition, the influence of ancillary factors, such as facility siting, was explored.

Once the concepts were fully developed, each alternative was assessed with respect to evaluation criteria. The evaluation criteria included schedule risk; unit life-cycle cost; health, safety, and environmental risk; stakeholder confidence; and technical performance.

Alternative Evaluation Conclusions

The following presents essential conclusions of the evaluation.

- Recent programmatic developments with respect to program schedules have resulted in a significant reduction in the overlap between SNF Program operations in the CSB and CSB retrofit construction activities for the IHLW Interim Storage Program.

- While the implementation schedule for Alternative 1 (CSB) can easily support either a February 2005 (TWRS-P 50% probability of success case with a 1-year schedule float) or a February 2006 (TWRS-P 90% probability of success case with a 1-year schedule float) start of operations, the implementation schedules for the other alternatives entail greater risk. The following table summarizes the viability of the implementation schedule for each alternative.

Interim storage implementation schedule	Alternative			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
TWRS-P 50% probability schedule				
Aggressive	Yes	No	Yes	No
Conservative	Yes	No	No	No
TWRS-P 90% probability schedule				
Aggressive	Yes	Yes	Yes	Yes
Conservative	Yes	No	Yes	Yes

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction
TWRS-P = Tank Waste Remediation System-Privatization

In the preceding table, an aggressive implementation schedule is approximately a 50% probability of success for the Interim Storage Program while a conservative implementation schedule is roughly an 80% probability of success. A "yes" designation indicates that the TWRS-P schedule can be supported with at least 1 year of schedule float. A "no" indicates that the schedule cannot be supported or is at risk (less than 1-year schedule float).

- The total project cost (TPC) for alternatives ranges from $67 million to $252 million, with Alternative 2b (FMEF retrofit modifications) being the most cost-effective and Alternative 2a (PUREX Plant retrofit modifications) being the most expensive. The following table summarizes the upper-bound unit life-cycle cost for the alternatives.

- While siting the new construction alternative close to or coupled with the TWRS-P production facility could modestly reduce its cost, this alternative would remain more expensive than existing facility options.

- Health, safety, and environmental risks associated with all the alternatives, except Alternative 2a (PUREX), are judged to be relatively low. Alternative 2a entails moderately higher health, safety, and environmental risks because this alternative would result in increased worker radiation exposures.

- Alternatives 1 (CSB), 2a (PUREX), and 2b (FMEF) are essentially fixed-capacity options (maximum storage capacity of 880, 1,008, and 2,700 IHLW canisters, respectively). Alternative 1 could be further expanded by construction of a fourth vault, but at a modestly higher cost. Being new construction, the capacity expandability of Alternative 3 (New Construction) is inherently greater than that for existing facilities.

	Alternative*			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Minimum order capacity				
Life-cycle cost	$98,295	$275,373	$88,202	$181,865
Capacity	600	600	600	600
Unit life-cycle cost	$164	$459	$147	$303
880-canister capacity				
Life-cycle cost	$110,779	--	--	--
Capacity	880	--	--	--
Unit life-cycle cost	$126	--	--	--
Full capacity				
Life-cycle cost	$139,633	$288,276	$93,163	$259,170
Capacity	1,196	2,700	1,008	1,200
Unit life-cycle cost	$117	$107	$92	$216

**All costs are present value in thousands of dollars.*

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

- An extended 75-year operating life is a reasonable expectation for all alternatives except Alternative 2a (PUREX). Pending the completion of a structural analysis for Alternative 2a, the ability to extend its operating life is less certain.

- Alternatives 1 (CSB) and 3 (New Construction) are relatively mature concepts and an extensive experience base exists upon which to judge their viability.

- Numerous technical issues have yet to be fully addressed for Alternative 2a (PUREX). The most significant are structural suitability of this facility for a long-term (40- to 75-year) mission (i.e., seismic upgrade), degree of canyon decontamination necessary to allow access for retrofit modification construction, and process cell disposition required for final closure.

Based on the preceding considerations, the decision board ranked the alternatives. For each evaluation criterion, each board member ranked the alternatives from 1 to 10. An overall ranking was obtained by numerically averaging all the board members' individual rankings. The following table summarizes the results of this ranking process.

Evaluation criteria	Alternative			
	1 CSB	2a PUREX	2b FMEF	3 New construction
Unit life-cycle cost	10.0	3.3	9.7	4.7
Schedule risk	9.7	3.3	6.7	5.7
ES&H risk	7.7	3.3	9.7	8.7
Stakeholder confidence	10.0	7.0	6.3	4.3
Technical performance	10.0	3.3	6.7	9.7
Total	47.4	20.2	39.1	33.1

CSB = Canister Storage Building
ES&H = environmental, safety, and health
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

<u>Recommendations and Implementation Path Forward</u>

Based on the preceding information, the recommended path forward is as follows.

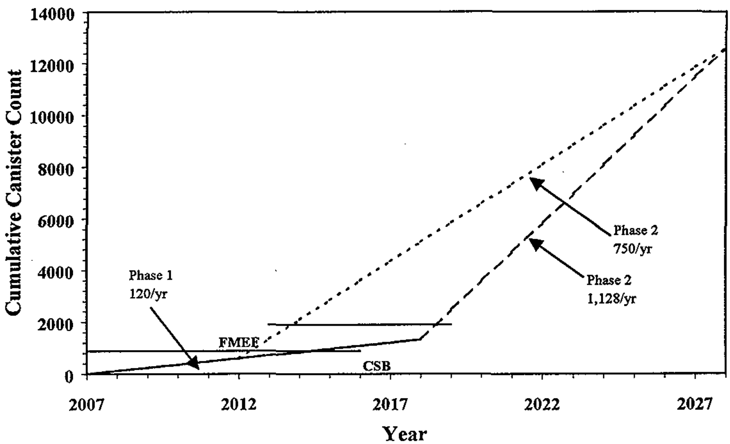
- Continue with the CSB retrofit modification as the baseline.
- Adopt the FMEF retrofit modification as a contingency should storage capacity beyond 880 canisters become necessary during Phase 1 or as a transition into Phase 2.
- Eliminate any further consideration of PUREX Plant retrofit modifications as a potential option for IHLW interim storage.
- Plan for eventual new construction during Phase 2.

The rationale for this approach is that the existing CSB embodies the highest confidence in technical viability and implementation cost for an IHLW interim storage mission. Although its implementation cost is not the lowest, a reasonable probability exists that the cost can be reduced. For example, if the SNF Program completes active use of the CSB by 2004 or shortly thereafter, the existing load-in/load-out area could be used for IHLW receipt. The resultant TPC reduction would be $4 million to $6 million. Additional value engineering efforts directed at items such as storage tube design could potentially further reduce the direct cost by as much as $4 million.

The estimated implementation cost for Alternative 2b is the lowest of any alternative evaluated. The FMEF is relatively young and contains architectural features that closely match those needed for an IHLW interim storage mission. However, the technical viability and stakeholder acceptance of this option have not been fully confirmed. With a modest expenditure of resources (about $150,000), the open technical issues can be addressed via initiation of a more detailed engineering evaluation.

Although the PUREX Plant offers ample storage capacity at a relatively low unit life-cycle cost, its initial estimated implementation cost is high. Moreover, technical viability is much less certain. Substantial resources could be expended to fully assess technical viability, only to conclude that the PUREX Plant is not an acceptable option. Given the uncertain outcome, there would be significant risk associated with adopting the PUREX Plant as the baseline for Phase 1 interim storage.

Even with the use of the existing facilities recommended herein for IHLW interim storage, new construction will eventually become necessary at or near the initiation of Phase 2. As depicted in the following figure, either the CSB or the FMEF can accommodate the storage capacity needed for the Phase 1 minimum order quantity. However, the combined storage capacity of the CSB and FMEF can accommodate only between 10% and 15% of the IHLW canisters produced in Phase 1 and Phase 2 (12,600 IHLW canisters). Although a decision can be deferred for several years, a new construction architecture must ultimately be selected to support the bulk of Phase 2 production. A detailed implementation plan should be prepared to support multi-year work planning related to providing for the Phase 2 interim storage capability.



While new construction alternatives do not compete favorably with existing facilities for the initial Phase 1 period, once they become necessary a West Valley Site-type system (open-bay, rack-storage, forced-air ventilation) seems to exhibits a modest cost advantage. Regardless of new construction architecture selected, siting the interim storage facility near the TWRS-P production facility would not result in any appreciable cost reduction. Coupling the storage facility to the production facility could result in a modest initial capital cost reduction.

Recommended Decision

Retrofit modification of the existing CSB, located in the Hanford Site 200 East Area, is recommended to provide initial interim storage for IHLW canisters (i.e., no change to the current TWRS multi-year work plan baseline). The CSB can provide interim storage for up to 880 IHLW canisters produced during the TWRS-P Phase 1 contract. Future decisions will need to be made relative to providing interim storage capacity in excess of 880 canisters.

Retrofit of the FMEF is an attractive alternative to provide additional storage capacity, either to complete Phase 1 or to initially support Phase 2. The FMEF, located in the Hanford Site 400 Area, could provide storage capacity for up to 1,008 IHLW canisters. To provide the balance of required Phase 2 storage capacity (about 12,000 canisters), new interim storage facilities will need to be constructed in a time-phased manner. Further study is recommended in fiscal year 2000 to confirm the FMEF viability as contingency for Phase 1 or as the initial Phase 2 storage facility, and ascertain the most cost-effective new construction architecture for Phase 2.

Decision Class

This is a Class IV decision because the recommended course of action is to continue with the current Phase 1 interim storage baseline (i.e., retrofit modification of the CSB). A Class II decision is potentially required to implement retrofit modifications of the FMEF because the current TWRS baseline planning entails only new construction, and use of the FMEF may include cost or program impacts to other Hanford Site program elements.

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LIST OF ACRONYMS

AGA	Alternative Generation and Analysis
CSB	Canister Storage Building
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EIS	environmental impact statement
FMEF	Fuels and Materials Examination Facility
HEPA	high-efficiency particulate air
HWVP	Hanford Waste Vitrification Plant
IHLW	immobilized high-level waste
MHM	multi-canister overpack handling machine
PUREX	Plutonium-Uranium Extraction
SCT	shielded canister transporter
SNF	spent nuclear fuel
SRS	Savannah River Site
TPC	total project cost
TWRS-P	Tank Waste Remediation System-Privatization
VROM	very rough order-of-magnitude
WNP-1	Washington Nuclear Plant-1
WVS	West Valley Site

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IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTERNATIVE GENERATION AND ANALYSIS AND DECISION REPORT

1.0 INTRODUCTION

Selection of an immobilized high-level waste (IHLW) interim storage architecture to support Tank Waste Remediation System-Privatization (TWRS-P) Phase 1 was based on a thorough decision process (Calmus 1996a). Initially, several options for interim storage (Phase 1 and Phase 2) were evaluated to assess their technical viability; capital cost; schedule risk; environmental, safety, and health risk; and stakeholder confidence (Calmus 1996b). Three general categories of potential IHLW interim storage architectures were evaluated: building, pad, and bore hole.

Following the alternate architecture evaluation, a decision board convened to select the preferred architecture. The decision board adopted a consensus set of selection criteria, assessed the alternate architectures against the criteria, and ultimately recommended the optimum Phase 1 IHLW interim storage architecture. A decision on a Phase 2 architecture was deferred because insufficient information existed to discriminate among the alternatives and delay would not result in any programmatic impacts.

The recommended Phase 1 architecture was the retrofit modification of the existing Canister Storage Building (CSB) to render it suitable for IHLW interim storage. The Phase 1 IHLW would be stored in CSB Vaults 2 and 3. The recommendation was subsequently approved (Taylor 1997) and a conceptual design was completed (FDNW 1998). Implementation of the baseline architecture (retrofit modification of the CSB) is being conducted under Project W-464.

After the decision process, several major programmatic developments occurred that could potentially impact implementation of the baseline architecture. These developments are as follows.

- The start of Phase 1 IHLW production (and coincident start of IHLW interim storage) has slipped from June 2002 to at least February 2006 (50% probability of success date) and possibly February 2007 (90% probability of success date).
- All Phase 1 IHLW production will terminate by February 2018.
- The Spent Nuclear Fuel (SNF) Program will have completed removal of all fuel from the K Basins by December 2003 and fuel post-processing activities in the CSB will be completed in April 2004.
- The conceptual design cost estimate for CSB retrofit modifications is greater than that upon which the original selection decision was based.
- The ^{137}Cs intermediate waste product and non-routine high-level waste product have been eliminated from the Phase 1 IHLW interim storage scope.

- The 3 m tall IHLW canister has been replaced with a 4.5 m tall canister.

- Although the minimum number of canisters that interim storage must potentially accommodate has been reduced, the maximum number is no longer bounded.

While the Phase 1 IHLW production schedule slip tends to reduce Project W-464 programmatic risk, this is offset by uncertainties in the duration of SNF conditioning activities at the CSB. If SNF conditioning extends beyond April 2004, the SNF Program could impact Project W-464 construction efforts and possibly Phase 1 IHLW receipt at the CSB. The coupling of the SNF Program and Phase 1 IHLW Interim Storage Program has been previously perceived as a source of high programmatic risk (Calmus 1997).

The overall schedule uncertainty, in conjunction with the conceptual design cost estimate, is significant enough to warrant a reevaluation of whether the baseline architecture remains the preferred Phase 1 IHLW interim storage architecture from a financial, technical, and logistical perspective. A reevaluation following major programmatic developments is consistent with good systems engineering practices as prescribed in WHC-SD-WM-SEMP-002, *Tank Waste Remediation System Systems Engineering Management Plan* (Peck 1998). This report provides the results of the reevaluation process.

2.0 OBJECTIVE AND SCOPE

The purpose of this effort is to reevaluate alternatives for Phase 1 IHLW interim storage, thereby providing a basis for a decision that either confirms the baseline architecture (i.e., retrofit modification of the existing CSB) or selects a new preferred architecture. Furthermore, this effort summarizes the decision-process results (i.e., decision methodology, alternative rankings, and decision statement).

To maintain a cost-effective approach, this effort builds on architectural and programmatic evaluations associated with the original Alternative Generation and Analysis (AGA) (Calmus 1996b). The primary focus is to determine whether the original AGA process would have been influenced or invalidated by recent programmatic developments and, if so, identify alternate architectures that may now be more attractive than the baseline architecture.

Specifically, architectures evaluated in the original AGA were assessed to determine if recent programmatic developments would significantly impact the decision process as it was applied to them. Where recent programmatic developments and guidance would influence the definition or application of evaluation criteria, they were adjusted accordingly. Once the influence of recent programmatic developments was determined, alternatives to the baseline architectures were formulated and evaluated.

This task was performed in two phases. The first phase was an assessment of programmatic development impacts and an initial screening (down selection) to identify alternate architectures with a reasonable probability of competing successfully with the baseline architecture. The second phase developed the identified alternatives with respect to technical scope, implementation schedule, and cost. Once the attributes of these alternate architectures were established, they were assessed with respect to evaluation criteria (i.e., schedule risk; life-cycle cost; health, safety, and environmental risk; stakeholder confidence; and technical performance).

The evaluation criteria were essentially the same as used in the original AGA. However, some evaluation criteria adopted in the original AGA were found to be non-discriminators among the different alternatives. When the programmatic developments did not change the non-discriminatory nature of these evaluation criteria, significant resources were not expended to quantify an alternative's attributes relative to the criteria. The evaluation in this case was limited to a qualitative judgment.

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3.0 ALTERNATE ARCHITECTURE FUNCTIONAL CRITERIA

A systems engineering functional decomposition (Smith-Fewell 1996) has identified many performance requirements and constraints that are applicable to IHLW interim storage activities. Also applicable to this activity are detailed design requirements contained within the Design Requirements Document (Calmus 1996c). Of these criteria, only a limited number are relevant to development of acceptable IHLW interim storage concepts (i.e., the degree of specificity is well beyond that which would be relevant to a reevaluation at a conceptual level). The following sections present essential programmatic and technical criteria that are relevant to concept development. Non-relevant programmatic and technical criteria are not listed.

Functions, performance requirements, constraints, and assumptions are used to formulate alternate concepts. A postulated concept, to be acceptable, must generally adhere to these bounding parameters. Evaluation criteria are then used to assess the degree to which a concept provides for IHLW interim storage in an optimum manner relative to the other alternatives.

3.1 FUNCTIONS

Identified IHLW interim storage functions include the following: transport IHLW from the TWRS-P production facility to an interim storage facility; isolate IHLW for an extended period under controlled conditions (i.e., safely store IHLW in an interim storage facility); retrieve IHLW from storage and stage for offsite transportation; and load IHLW into an offsite transportation cask. An additional main function is general support of the IHLW interim storage facility and operations. These functions are unaffected by recent programmatic developments.

3.2 PERFORMANCE REQUIREMENTS

Performance requirements are internally derived criteria. If sufficient justification is developed (e.g., program cost minimization, schedule improvement, etc.), these criteria can be modified. Furthermore, a few of the performance requirements (storage capacity and design life) are inconsistent with current U.S. Department of Energy (DOE) planning guidance. In these instances, an appropriate revision of the performance requirements has been assumed in concept development and evaluation (see Section 3.4).

- Canister Rework: If primary containment (i.e., stainless steel canister shell) is breached during interim storage, the IHLW canister shall be overpacked. An overpacked IHLW canister may violate the repository waste acceptance specification for external dimension and, as such, the overpacked canister shall be addressed under the non-standard waste form clause (DOE-RW 1996).

- Storage Capacity: The IHLW interim storage function (Phase 1 and Phase 2) must be capable of providing interim storage for about 7,650 canisters (at 45% by weight waste oxide loading including silicon and sodium) to 20,260 canisters (at 25% by weight waste oxide loading including silicon and sodium).

- Design Life: The minimum design life shall be 40 years for non-replaceable facility components. A design life less than 40 years is acceptable for replaceable components, but shall be maximized to the extent practical (according to DOE guidance, design life is extended to 75 years as discussed in Section 3.4).

- Maintenance, Operations, and Design Philosophy: The interim storage facility shall be designed to minimize monitoring and maintenance.

- Land Use: A new interim storage facility shall be located in the "squared off" boundaries of the 200 East and West Areas, with the remainder of the Central Plateau that encircles the 200 Areas as a buffer zone. Further, the facility location should be limited to within the present 200 Area boundaries whenever feasible (assumed to be non-mandatory as discussed in Section 3.4).

- Storage Availability: The interim storage facility shall support the scheduled operation of the TWRS-P treatment services.

3.3 CONSTRAINTS

Constraints are externally imposed criteria. In limited instances, modification to or waiver from constraints might be possible, but such an occurrence requires negotiation with external agencies. Regardless of justification, institutional impediments could prevent implementation of an otherwise attractive idea. Therefore, this activity does not assume relaxation of any constraints in concept development and evaluation.

- Facility design shall be based on "as low as reasonably achievable" principles.

- DOE Order 5820.2A (DOE 1988): Facilities that store hazardous (dangerous) waste and mixed waste (containing hazardous and radioactive waste components) are regulated in accordance with the *Resource Conservation and Recovery Act of 1976* and WAC 173-303, "Dangerous Waste Regulations."

- DOE Order 5820.2A, Chapter I, 3.b(2)(a): All new high-level waste handling, transfer, and storage facilities (e.g., tanks, bins, pipelines, and capsules) shall be doubly contained.

- 40 CFR 264.171: If a container holding hazardous waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak, the owner or operator must transfer the hazardous waste from this container to a container that is in good condition or manage the waste in some other way that complies with the requirements of 40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."

- 40 CFR 264.173: A container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.

- WAC 173-303-630(7)(c): Storage areas that store containers holding only wastes that do not contain free liquids, do not exhibit either the characteristic of ignitability or reactivity as described in WAC 173-303-090(5) or (7), and are not designated as F020, F021, F022, F023, F026, or F027, need not have a containment system as described in WAC 173-303-630(7) provided that (1) the storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation, or (2) the containers are elevated or are otherwise protected from contact with accumulated liquids.

- WAC 173-303-630(7)(d): Extremely hazardous waste in containers must be protected from the elements by means of a building or other protective covering that otherwise allows adequate inspection under WAC 173-303-630(6).

3.4 ASSUMPTIONS

The following assumptions are embodied in the development of alternate architectures.

- To provide a minimum level of confidence in the implementation schedule, the Phase 1 IHLW interim storage architecture must be capable of coming online at least 1 year before the start of Phase 1 IHLW production (i.e., by either February 2005 or February 2006).

- The interim storage period is 75 years (according to DOE TWRS Waste Disposal Division planning guidance), although the geologic repository could potentially begin accepting Hanford Site IHLW starting in 2023.

- Tri-Party Agreement (Ecology et al. 1996) Milestones M-90-11, M-90-12, and M-20-56 can be renegotiated as necessary to implement a new Phase 1 IHLW interim storage architecture.

- The minimum Phase 1 interim storage capacity required is 600 4.5 m IHLW canisters (West Valley Demonstration Project canister design).

- The maximum Phase 1 interim storage capacity required is 1,200 IHLW canisters (based on DOE TWRS Waste Disposal Division planning guidance).

- The maximum Phase 1 and Phase 2 interim storage capacity is 12,600 IHLW canisters (upper-bound projection of the heat content for all Phase 1 Hanford Site tank waste).

- For equipment sizing and cost estimating purposes, the aggregate quantity of Phase 1 IHLW product generates 720 kW of decay heat, regardless of the IHLW canister count.

- The IHLW product will continue to be classified as a mixed waste (i.e., contains dangerous/hazardous components and radioactive components) during the period of interim storage and, therefore, this facility must be permitted under the *Resource Conservation and Recovery Act of 1976.*

- Systems, components, and structures required solely for the repository interface (e.g., offsite shipping and re-certification facilities) are assumed to be provided by the Phase 2 Interim Storage Program.

- October 1999 is the earliest that funds could be redirected to pursue an alternate to the baseline (e.g., initiate a detailed engineering evaluation, perform a conceptual design, etc.).

- At least 4 months are required for conceptual design preparation and the conceptual design must be available for an April validation submittal.

- The period between the April validation submittal and authorization of line item funds is at least 18 months.

- For any alternate architecture other than the baseline, preparation of an environmental impact statement (EIS) must be initiated approximately 36 months before the start of construction.

- The land use performance requirement (see Section 3.2) is not mandatory if an alternative is technically viable and cost-effective.

4.0 EVALUATION CRITERIA

The original AGA used a multi-attribute decision analysis (modified Kepner-Trego) to evaluate the various alternate architectures. A multi-attribute decision analysis allows a simultaneous evaluation of proposed alternatives against several major programmatic and technical objectives. The purpose is to establish a ranking among alternatives from most to least desirable.

The evaluation criteria used in the original AGA multi-attribute decision analysis were schedule risk; life-cycle cost; health, safety, and environmental risks; stakeholder confidence; and technical performance. Although review of the evaluation criteria relative to recent programmatic developments did not reveal any impacts with respect to their definition or application in the original AGA, the evaluation criteria have been modified slightly for use in this effort. The review identified that the evaluation logic would be enhanced by minor adjustments to the definitions of some evaluation criteria. Criteria definitions, as used in this evaluation, are summarized as follows.

- Schedule Risk: All viable alternate concepts must support the program schedule. However, some concepts entail less schedule risk. Although many factors can induce schedule risk, an alternative's interdependency on other programs and/or projects is one attribute with significant influence. Alternatives that are not coupled to other program/project schedules are at lower risk. Those alternate concepts that are independent of any other program/project are considered "low risk."

- Unit Life-Cycle Cost: The overall program cost associated with an alternative carries considerable weight in a decision process. Life-cycle cost encompasses design, construction, operation, and decontamination and decommissioning (D&D) of facility(ies) for IHLW interim storage. Because alternatives may entail different storage capacities, the life-cycle cost is normalized on a unit cost basis. Alternate concepts with low unit life-cycle costs are rated favorably relative to this evaluation criterion.

- Health, Safety, and Environmental Risks: All alternatives must furnish a basic degree of public, worker, and environment protection. However, some alternatives may inherently provide a greater degree of protection or risk reduction. For example, alternatives that require construction in radiation zones increase risk, even if the dose consequences are within established guidelines. Those alternate concepts that exhibit a low potential to inflict occupational and public hazards and environmental impacts are considered "low risk."

- Stakeholder Confidence: The confidence of stakeholders in the safety and potential success of an alternative should be considered in the decision process. Confidence is increased by the inclusion of stakeholder values, as determined from efforts such as the Future Site Uses Working Group and Tank Waste Task Force (Drummond 1992 and 1993). This is primarily a desire to locate the IHLW interim storage facility in the Hanford Site 200 East Area. Furthermore, the DOE prefers completion of existing projects over initiation of new projects to demonstrate progress to stakeholders (according to DOE TWRS Waste Disposal Division planning guidance). Alternate concepts that reflect these stakeholder values are, therefore, rated high relative to this criterion.

- Technical Performance: Given the uncertainties associated with the IHLW Interim Storage Program (e.g., maximum Phase 1 storage capacity and time-phased IHLW production rate), an alternative's inherent flexibility and technical risk should be considered in the decision process. Flexibility entails the ability to increase or decrease storage capacity as dictated by system needs, and to lengthen or shorten the storage duration with minimal program cost. Factors influencing technical risk include a concept's complexity and maturity, operability and maintainability aspects, etc. Therefore, alternate concepts that exhibit increased flexibility and reduced technical risk are rated favorably relative to this criterion.

5.0 ORIGINAL ALTERNATE ARCHITECTURES

The original AGA evaluated three general categories of potential IHLW interim storage architectures: building, pad, and bore hole. The building-type interim storage architectures were further subdivided into existing surplus structures and new construction. The specific Phase 1 alternate architectures that were evaluated in the original AGA are as follows.

- Alternative 1a - Existing CSB
- Alternative 1b - Expanded CSB
- Alternative 2a - T Plant
- Alternative 2b - Plutonium-Uranium Extraction (PUREX) Plant
- Alternative 2c - Fuels and Materials Examination Facility (FMEF)
- Alternative 2d - Washington Nuclear Plant-1 (WNP-1) spray pond
- Alternative 3 - CSB modules
- Alternative 4 - NUHOMS*
- Alternative 5a - Dual-stack bore holes
- Alternative 5b - Four-pack bore holes.

Inclusion of the existing CSB (Alternatives 1a and 1b) in the alternate architectures was a logical choice because it was originally designed and partially constructed for the Hanford Waste Vitrification Plant (HWVP) Project. The HWVP was a government-owned, contractor-operated approach for immobilizing Hanford Site tank high-level waste. After constructing the base mat and one wall of the CSB, the HWVP Project was terminated. The HWVP approach was subsequently replaced with the TWRS-P approach. Construction of the CSB continued, however, under the SNF Program as Project W-379. The SNF Program intends to store fuel removed from the K Basins in CSB Vault 1.

Existing structures initially considered encompassed Hanford Site 200 Area canyon facilities (B Plant, T Plant, U Plant, and PUREX Plant), the FMEF, and the WNP-1 spray pond. A historical survey identified that the HWVP Project had evaluated the U Plant and the PUREX Plant for use as the IHLW interim storage facility (Kaiser 1990). The FMEF and WNP-1 spray pond also had been evaluated for an IHLW storage mission (Carlson 1995). Therefore, the multitude of existing-structure options was reduced to a manageable subset of the most promising existing-facility retrofit options (Alternatives 2a through 2d).

Consideration of a new building structure concept was limited to a modular vault-type facility because it represents a mature approach. The vault-type concept (Alternative 3) embodies the general approach dominating IHLW storage worldwide. Facilities based on a vault-type concept are in operation to store IHLW at the Savannah River Site (SRS) in Aiken, South Carolina, and in Great Britain and France.

A historical survey revealed that the HWVP Project had evaluated pad storage for use as the IHLW interim storage facility (Kaiser 1990). An initial survey identified various commercial pad storage systems (Calmus 1996d). The pad system selected for detailed evaluation was the

*NUHOMS is a trademark of Vectra Technologies, Inc.

NUHOMS (Alternative 4) because it has an operational deployment history in SNF storage applications at nuclear power plants. The NUHOMS consists of a concrete pad, concrete bunker, and a steel shielding container (termed a dry shielded container). Each bunker holds a single dry shielded container in which four IHLW canisters are confined. Natural convection is used to cool the NUHOMS.

Bore holes (or dry wells) also had been evaluated by the HWVP Project for IHLW interim storage (Kaiser 1990 and Smith et. al. 1990). Bore holes are essentially storage tubes that are embedded in the ground. The storage tubes are fabricated from non-shrink concrete, but otherwise are similar in concept to storage tubes used in the vault-type alternative (i.e., sealed tube with shield plug).

6.0 INFLUENCE OF PROGRAMMATIC DEVELOPMENTS

Each of the aforementioned alternate architectures was reevaluated to assess whether the recent programmatic developments would have impacted the original AGA evaluation process. The following sections present the assessment results.

6.1 ALTERNATIVE 1A – EXISTING CANISTER STORAGE BUILDING

Review of the original AGA indicated that, with the exception of cost, the evaluation process for this alternative would not have been impacted by recent programmatic developments. The original AGA recognized that coupling of the IHLW Interim Storage Program to the SNF Program created schedule risk. The existing CSB alternative was downgraded with respect to the schedule risk even though, at the time of the evaluation, the SNF Program was expected to be finished with active use of the CSB 1 year before CSB retrofit modifications were to be initiated. Therefore, the recent programmatic developments relative to schedule only confirm the original evaluation process.

The programmatic developments with respect to cost could, however, have potentially impacted the evaluation process. The AGA projected a capital cost (design, procurement, and construction) of $22,932,000 for the existing CSB alternative, which was ultimately selected as the Project W-464 baseline. The Project W-464 conceptual design estimated a total project cost (TPC) of $94,700,000, of which $55,935,000 is capital cost.

To understand the factors that influenced the conceptual design cost, this cost must be adjusted to a basis consistent with the original AGA cost. The original AGA cost estimate did not contain any contingency or contribution to the Hanford Site Allocation Fund. The estimate did not include funds for other project costs (i.e., Hanford Site contractor activities such as environmental permitting, safety analyses, operations readiness reviews, etc.), or for the inter-facility transportation system. The other project costs and onsite transportation system cost were not included in the original AGA cost estimates because they would be common to all alternatives. Finally, the AGA cost estimates are in 1996 dollars with zero escalation.

The conceptual design TPC includes $8,052,000 for other project costs, $12,618,000 for the Hanford Site Allocation Fund, $10,718,000 for contingency, and $4,706,000 for the onsite transportation system. Subtracting these values from the conceptual design TPC reveals the total estimated cost to be $58,562,000.

The conceptual design cost is in 1998 base dollars, escalated to the period of expenditure during the approximately 2 ½-year design-construction effort. Subtracting escalation from the conceptual design values and adjusting to 1996 dollars (2-year depreciation) results in a capital cost of $51,803,000. This capital cost consists of $32,886,000 direct cost (procurement, installation, and construction) and $18,917,000 indirect cost (engineering and project management).

Review of the conceptual design cost estimate and original AGA cost estimate reveals that the major change occurred in the direct cost portion. Indirect costs are reasonably close.

The original AGA direct cost estimate assumed that the load-in/load-out facility and multi-canister overpack handling machine (MHM) supplied by the SNF Program would be available to support IHLW receipt. Because of various technical issues (e.g., physical constraints imposed by the existing structure) and the SNF Program schedule delay, Project W-464 was precluded from using these CSB components. These CSB components would still be in use for SNF activities even after IHLW receipt would need to commence.

A shielded canister transporter (SCT) to replace the MHM and a new load-in/load-out annex were estimated to cost $4,576,000 and $4,409,000, respectively (1996 dollars, no escalation). Subtracting these costs from the $32,886,000 yields a direct cost of $23,901,000. The remaining direct cost differential is attributed to a modest increase in the storage tube procurement cost.

The preceding discussion indicates that the SNF Program schedule was a significant factor in the conceptual design cost estimate insofar as it resulted in increased technical scope for the IHLW Interim Storage Program (i.e., new load-in/load-out annex and SCT). Therefore, recent programmatic developments with respect to the schedule are relevant to the cost of this alternative. The magnitude of the impact is sufficient to warrant reevaluation of the top two to three original AGA alternatives (see Section 7.0).

6.2 ALTERNATIVE 1B – EXPANDED CANISTER STORAGE BUILDING

A sub-option to the existing CSB alternative was to expand the CSB capacity by future construction of additional vaults adjacent to and south of the CSB Vault 3. When the original AGA was prepared, there was some consideration being given to using the CSB Vault 2 for SNF or other storage mission. However, a commitment now exists to reserve CSB Vaults 2 and 3 for the IHLW interim storage mission (Hansen 1996).

In addition, the cost-effectiveness of this option has diminished. After the original AGA was completed, the SNF Program decided to construct the hot conditioning annex adjacent to and south of the CSB Vault 3. The hot conditioning annex was constructed without the necessary footings or pilings that would allow future excavation adjacent to this structure in a relatively cost-effective manner. Furthermore, the Project W-464 conceptual design also identified a need to construct a load-in/load-out annex in this same general area. Given these developments, this alternative does not warrant any further consideration as an explicit alternative. Construction of a fourth CSB vault will be addressed as a capacity flexibility attribute of the existing CSB alternative.

6.3 ALTERNATIVES 2A AND 2B – CANYON FACILITIES

Review of the original AGA indicated that the evaluation process relative to these alternatives would not have been impacted by recent programmatic developments. These alternatives were relatively cost-effective on a direct cost basis. There was a schedule dependency on the D&D activity necessary to facilitate construction of retrofit modification, but this was not perceived in the original AGA to be significant. The overall evaluation of these alternatives was, however, not favorable.

The concepts were judged to be relatively immature, rendering the cost estimates at risk of significant escalation. Furthermore, the technical risk associated with retrofit modification of these contaminated facilities was anticipated to be extremely high. Significant engineering evaluation would be needed to assess whether the structures could qualify for safety class confinement and a positive outcome is not ensured. In addition, the facilities are beyond, or near, the end of their design life and whether these facilities could serve a 40-year, or longer, extended mission was a serious concern.

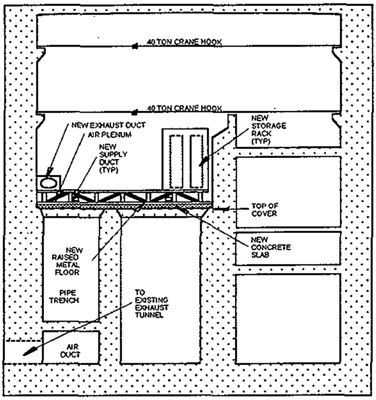
Besides the age of the facilities, there are additional negative technical attributes associated with some existing canyon structures (e.g., B Plant and U Plant). In these facilities, the canyon crane pick height (distance between the canyon cover blocks and maximum crane hook elevation) is only about 8.5 m. With a 4.5 m canister, it would not be possible to traverse over IHLW canisters already emplaced in racks on the canyon deck. If for any reason a canister at the far end of the storage rack needed to be retrieved, it first would be necessary to retrieve those canisters blocking access.

Decommissioning activities have, in some instances, introduced additional complications. The B Plant ventilation upgrade installed via Project W-059 sealed the original cell ventilation pathway (Schwehr 1998). Cell ventilation is now provided via a penetration through the cover block for cell 10. The cell ventilation air discharges into the canyon before being drawn into an exhaust duct that routes it to the new ventilation system located external to B Plant. Exposing essentially clean IHLW canisters to this potentially contaminated air is not an ideal situation. Although this feature could be eliminated during the retrofit modifications, it would increase design complexity and implementation cost.

Crane maintenance is an even greater concern. In B Plant, a mobile crane-maintenance platform is provided to service the canyon crane. The platform is mounted on a short section of the rails at the east end of the canyon and is propelled by driving the wheels with a hand crank mechanism. Access to the platform is provided by a fixed catwalk mounted at the east end of the canyon. Obviously, crane maintenance is intended to be performed with the cell cover blocks in place and all major sources of external radiation removed. Such an operation would not be viable with IHLW canisters in storage atop the cover blocks.

Given the aforementioned technical issues, reevaluation of the existing canyon facilities does not appear promising. However, the cost of these alternatives is sufficiently attractive that *a priori* preclusion from this reevaluation process cannot be justified. To encompass the existing canyon facilities alternatives in the reevaluation process, yet limit the expenditure of resources on less-than-promising options, the alternate architecture is limited to retrofit modification of the PUREX Plant. The PUREX Plant is the youngest of the canyon facilities and previous investigation (Kaiser 1990) suggests that this facility required the least intensive upgrades for an IHLW interim storage mission (see Figure 6-1). Therefore, the PUREX Plant represents the existing canyon facility retrofit alternative with the greatest potential for competing with the baseline architecture.

Figure 6-1. Plutonium-Uranium Extraction Plant Option.



6.4 ALTERNATIVES 2C AND 2D – OTHER SURPLUS FACILITIES

Review of the original AGA indicated that the evaluation process associated with the WNP-1 would not have been impacted by recent programmatic developments. The WNP-1 spray pond capital cost estimate of $271 million was an order-of-magnitude higher than the most cost-effective alternatives. The high cost was not unexpected because the existing WNP-1 spray pond is essentially only four concrete walls and a concrete base mat. All other structural and equipment features necessary for an interim storage mission (e.g., operation deck, storage tubes, cranes, stacks, etc.) would have to be furnished during retrofit modifications.

The WNP-1 spray pond is close to the Columbia River. A prevalent theme in stakeholder values is that nuclear waste should be moved away from, not closer to, the river. Furthermore, the WNP-1 spray pond structure is owned by the Washington Public Power Supply System and its use by the DOE would require entering into a contractual relationship of unknown complexity and potential for success. Therefore, the original AGA conclusion that this alternative is not attractive remains valid.

The original AGA eliminated the FMEF because its estimated storage capacity was insufficient to accommodate even the required Phase 1 storage capacity. This alternative is outside the 200 Area and, therefore, does not satisfy the performance requirement for facility location. An interim storage facility location outside the 200 Area is also contrary to stakeholder values.

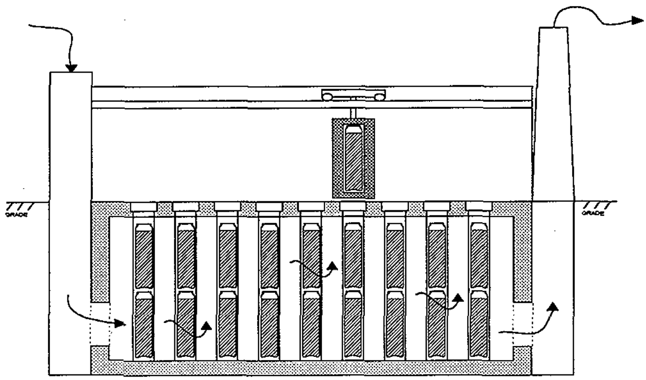
Given the capacity limitation, the original AGA did not determine the scope of retrofit modifications needed for the FMEF to accommodate an interim storage mission. However, the recent programmatic development with respect to minimum Phase 1 storage capacity could render the FMEF as a viable option. Therefore, this alternative warrants consideration in the reexamination effort.

6.5 ALTERNATIVE 3 – NEW FACILITIES

Review of the original AGA indicated that, with the possible exception of cost, the evaluation process would not have been impacted by recent programmatic developments. The capital cost estimate for this architecture was fifth highest and, given that the storage tube design is identical to the existing CSB alternative, it is probably at risk of a modest increase. However, the overall evaluation of this alternative was extremely favorable.

The original new building structure concept was limited to an SNF-type architecture (closed-tube and forced-air ventilation). As depicted in Figure 6-2, cooling is provided by natural convection. Because the storage tubes provide safety class confinement, the ventilation exhaust does not require treatment by high-efficiency particulate air (HEPA) filtration.

Figure 6-2. Spent Nuclear Fuel-Type Concept.



Construction of a new (i.e., green field) Phase 1 IHLW interim storage facility offers some favorable attributes, although the lowest cost may not be one of them. For example, elimination of the onsite transportation system may be possible if the IHLW interim storage facility is located close to the TWRS-P facility. This option could potentially compete more favorably if a cheaper storage approach was developed. Reevaluation of alternate architectures includes new construction based on the other, possibly cheaper, technology approaches identified in the following paragraphs.

Other technology approaches exist that avoid the costly storage tube design associated with the existing CSB. The systems used in France (T7 and EVT7 facilities at the La Hague reprocessing plant) or at the SRS and West Valley Site (WVS) represent such approaches. As depicted in Figure 6-3, the SRS facility is similar to the CSB except cooling is provided by forced-air ventilation and the exhaust is treated by HEPA filtration. Figure 6-4 shows the WVS facility, which is an open-bay, hot-cell concept with forced-air ventilation for cooling and HEPA

Figure 6-3. Savannah River Site-Type Concept.

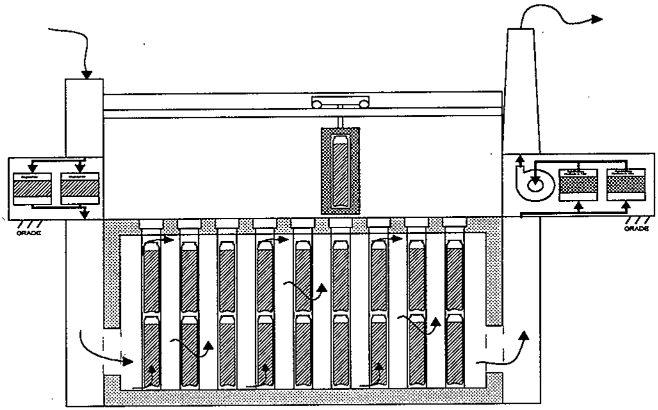
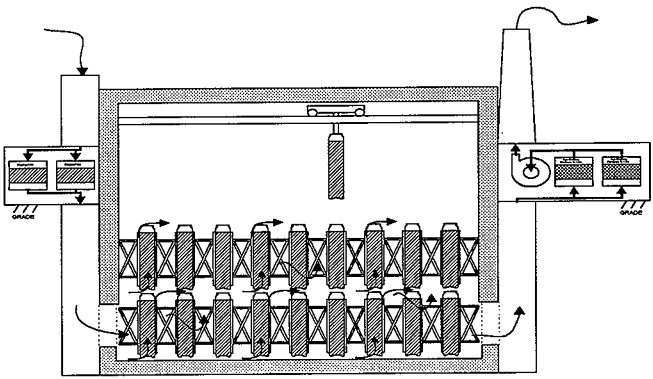


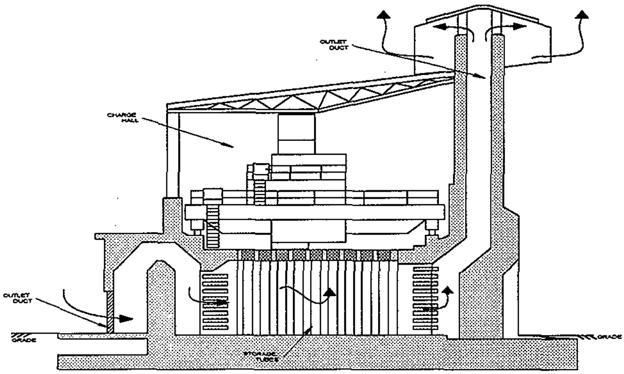
Figure 6-4. West Valley Site-Type Concept.



filtration of the exhaust. In both facilities, safety class confinement is provided by the structure and ventilation system.

Additional variations of these approaches have been used elsewhere. For example, the Fort Saint Vrain facility (Figure 6-5) is similar to the concept adopted for SNF interim storage in the CSB. The only appreciable difference is that the CSB is a below-grade structure while the Fort Saint Vrain facility is above-grade. The available information suggests, however, that the Fort Saint Vrain concept exhibits little to no cost advantage. The Fort Saint Vrain facility is estimated to cost from $21,150 to $31,720 per square meter of storage area (Agarwal et al. 1989). The CSB was estimated to be about $28,560 per square meter of storage area (Calmus 1996b). Given that these are very rough order-of-magnitude (VROM) estimates, the costs are essentially equivalent.

Figure 6-5. Fort Saint Vrain Option.



Similarly, the IHLW interim storage facilities employed in France are a variation of the SNF-type and SRS-type concepts. The EVT7 facility is based on natural convection ventilation with IHLW canisters contained in sealed storage tubes. The T7 facility is based on forced-air ventilation with the IHLW canisters contained in open storage tubes. Because it would be difficult to include the multitude of various storage concepts in the reevaluation effort, the various technologies are generically called the new construction alternative.

Evaluation of these potentially more cost-effective technologies is also important with respect to Phase 2 support. An essential conclusion of the original AGA was that new construction for Phase 2 would eventually be necessary even if the combined capacity (about 8,000 IHLW canisters) of all existing Hanford Site facilities (CSB, PUREX Plant , and B Plant) were dedicated to the IHLW interim storage mission. Although selection of a specific Phase 2 architecture was deferred in the original decision process, an SNF-type facility was assumed for program planning and budgeting purposes.

6.6 ALTERNATIVE 4 – PAD STORAGE

Review of the original AGA indicated that the evaluation process relative to these alternatives would not have been impacted by recent programmatic developments. The technology approach was relatively mature, but needed to be demonstrated for IHLW storage. However, the $132,470,000 total estimated cost was third highest out of the original ten alternatives. Furthermore, this VROM cost estimate was judged to be at risk of significant escalation.

Additionally, pad storage options, such as NUHOMS, are cost-effective for only small quantities of material. The general rule-of-thumb for the breakeven point between pad versus vault storage is about 400 MT of uranium (equivalent to approximately 160 IHLW canisters). This quantity is well below even the projected Phase 1 minimum order quantity of IHLW canisters. Therefore, reevaluation of this alternative does not appear attractive and is not recommended.

6.7 ALTERNATIVES 5A AND 5B – BORE HOLES

Review of the original AGA indicated that the evaluation process would not have been impacted by recent programmatic developments. The bore hole storage alternatives (single-stack and multi-pack) were judged to be extremely immature technical concepts with fairly high capital cost estimates (total estimated cost ranging from $66,056,000 to $169,181,000). Further concept refinement is likely to result in significant cost escalations. For example, protection from precipitation and run off could necessitate installation of a Butler Building* over the bore holes. Detection of the accumulation of liquid in bore holes and its subsequent removal could impose additional design complexities. Land use dedicated solely to the storage function was also relatively high (18,000 m^2 versus 8,000 m^2 for a CSB-type alternative). The land use necessary to accommodate Phase 2 is even larger. Therefore, reevaluation of these alternatives does not appear attractive and is not recommended.

*Butler Building is a trademark of Butler Manufacturing Company.

7.0 ALTERNATIVES FOR REEVALUATION

Review of the original AGA indicated that, in general, recent programmatic developments do not impact the previous evaluation of alternate architectures when considered individually. Programmatic developments related to the SNF Program schedule have, however, impacted the baseline architecture. The impact is reflected in the conceptual design direct cost estimate which is approximately double that projected in the original AGA process. In addition, the reduction in the minimum Phase 1 storage capacity requirement could render retrofit modification of the FMEF a viable option. These facets, if factored into an evaluation among alternatives, may have influenced the overall selection process.

Reevaluation of all the previously identified alternate architectures would not be a worthwhile or efficient endeavor. As determined during the original evaluation process, some alternatives (i.e., pad and bore hole storage) exhibit relatively unfavorable attributes (e.g., high cost or low technical maturity). Any reevaluation of these alternatives would most certainly reach a similar conclusion. Conversely, the Project W-464 conceptual design has exposed potentially significant cost drivers for the previously evaluated new construction option (i.e., SNF-type module). Alternate new construction architectures have been identified that potentially could avoid some of these cost drivers and, therefore, may be more cost-effective.

Following decision board approval of the alternatives to be carried for further evaluation, concept details were developed for each newly identified alternative. This information entails a concept description (e.g., discussion of salient features, required facility modifications, etc.), interim storage implementation schedule (e.g., project definition, validation, design, construction, and permitting) based on both a February 2006 hot startup and a February 2007 hot startup of the IHLW production facility, and parametric capital cost estimate (equipment procurement and construction). Specific alternatives included in the reevaluation are as follows:

- Alternative 1 – Existing CSB (baseline architecture)
- Alternative 2a – PUREX Plant Retrofit
- Alternative 2b – FMEF Retrofit
- Alternative 3 – New Construction.

7.1 ALTERNATIVE DESCRIPTION

While the new construction alternative's storage capacity could be specified such that it would accommodate the entire life-cycle (Phase 1 and Phase 2) quantity of IHLW canisters, this would require an extremely large initial capital expenditure. The original AGA determined that a phased-construction approach provided the optimum balance between minimizing initial capital expenditures and maximizing initial storage capacity. Therefore, the minimum order quantity (600 IHLW canisters) was selected as the capacity basis. This value is equivalent to the first 5 to 6 years of Phase 1 production. A subsequent construction project could accommodate the storage capacity for canisters produced beyond this initial period.

The storage capacity of existing facility alternatives was also fixed at 600 IHLW canisters to avoid biasing their cost relative to the new construction alternatives. The ability to accommodate more than the minimum order quantity was taken into account as a capacity flexibility attribute.

The following provides a conceptual specification for the alternatives selected for reevaluation. Appendix A provides additional details. All alternatives are based on a remote operation and contact maintenance approach for the activities related to removing an IHLW canister from the onsite transportation cask and emplacement into interim storage.

7.1.1 Alternative 1 (Baseline)

This option entails retrofit modification of the CSB Vaults 2 and 3 for an IHLW interim storage mission. The technical scope and capital cost for this option are taken from the Project W-464 conceptual design report (FDNW 1998) with minor adjustment to reduce the storage capacity to 600 canisters (i.e., elimination of 140 storage tubes).

7.1.2 Alternative 2a (Plutonium-Uranium Extraction Plant Retrofit)

This option entails retrofit modification of the PUREX Plant for an IHLW interim storage mission. An essential issue embodied in this alternative is whether the PUREX Plant process cells will be dispositioned for final closure before initiation of retrofit modifications. An additional issue is whether cell disposition will include removal of external radiation sources to the degree that full-time occupational occupancy atop the canyon cover blocks is allowed for decontamination and construction activities. These issues have important ramifications in the cost and implementation schedule developed for this alternative.

Modifications necessary to resolve technical uncertainties, such as possible structural enhancements to the east canyon wall, are not addressed here, but are discussed in Section 8.5.3 as technical risks. However, a reasonable effort was expended to bound the cost of structural upgrades in the cost estimate.

As depicted in Figures 7-1 and 7-2, the IHLW canisters are stored in racks atop the canyon cover blocks. The rack system is similar to that used at the WVS (Connors et al. 1998). Only limited areas of the PUREX Plant will be activated (primarily the canyon area and railroad tunnel). Large areas of the PUREX Plant will remain deactivated, including most operating galleries and office annexes. To effect this option, the following paragraphs describe major upgrades to the PUREX Plant that are known to be required.

Canyon Crane – The 40-ton capacity slave canyon crane is refurbished and reenergized. Refurbishment includes installation of a closed-circuit television on the crane to render it fully remote. The crane also has a new canister grapple that is identical to that used at the WVS. The existing crane maintenance bay, located at the canyon east end, allows for crane maintenance by human entry (i.e., contact maintenance).

Figure 7-1. Plutonium-Uranium Extraction Plant Retrofit (Plan View).

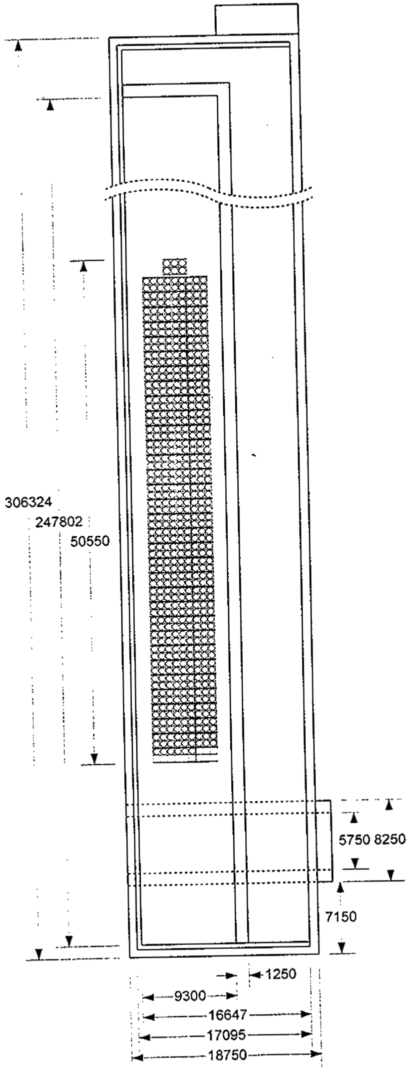
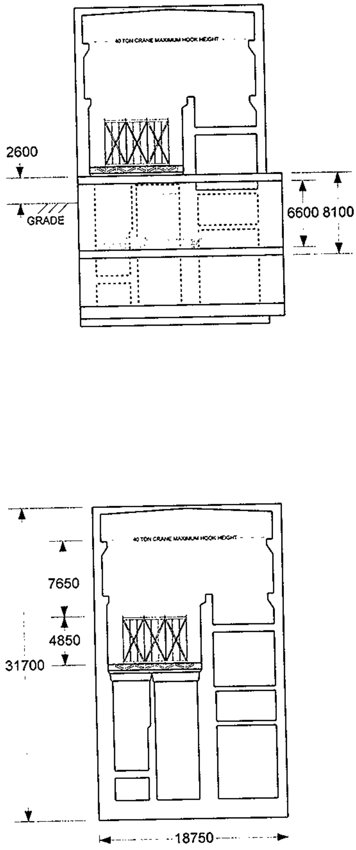


Figure 7-2. Plutonium-Uranium Extraction Plant Retrofit (Section View).



Canyon Floor – A 0.3 m concrete slab is poured over the entire canyon deck (i.e., atop cell cover blocks) to create an impervious seal between the process cells and canyon. A raised steel floor, supported by steel framing, is constructed atop the new concrete slab.

Storage Rack – A storage rack system is installed atop the raised floor. The rack system is similar to the WVS design, but is only one canister high. Thirty-four standard rack modules (18 standard canisters per module) and one overpack rack module (6 overpack canisters per module) are required to accommodate 600 IHLW canisters.

Ventilation System – A new safety class ventilation system is installed to provide the required cooling. The rated capacity of this system is 1,388 m^3/min at standard conditions (temperature and pressure).

The ventilation system includes a new air supply subsystem. The air supply is routed into the canyon where it is distributed into ducts located in the area between the new concrete slab and raised floor (i.e., intake plenum). The raised floor contains ventilation ports positioned below the storage racks. These ports are distributed along the length of the canyon. Air supply ducts distribute the air to these ports. Before its introduction into the canyon, the air is conditioned through a bank of roughing filters to remove particulate matter. The air supply is drawn through an intake stack that is essentially equivalent to that specified in Alternative 1.

The new air supply subsystem (including the intake stack) is mounted on a concrete slab outside the building. The intake filters are enclosed in a Butler-type Building.

A new exhaust duct is installed to rout exhaust air to a new building located external to the PUREX Plant. Housed in this new building are parallel trains of HEPA filters and blowers (primary and redundant). The rated capacity of each train is 1,388 m^3/min at standard conditions (temperature and pressure). The treated air is discharged via a new exhaust stack.

Electrical and Instrumentation – The emergency power system is refurbished and reenergized. New safety class electrical and instrumentation systems are installed to support the new ventilation system.

7.1.3 Alternative 2b (Fuels and Materials Examination Facility Retrofit)

This option entails retrofit modification of the FMEF for an IHLW interim storage mission. As depicted in Figures 7-3 and 7-4, the IHLW canisters are stored in racks located in the Nondestructive Examination Cell. The rack system is similar to that used at the WVS (Connors et al. 1998). To effect this option, the following paragraphs describe major upgrades required to the FMEF.

Cell Crane – A 6-ton capacity crane is installed in the Nondestructive Examination Cell and two 6-ton capacity cranes are installed in the Decontamination Cell. The two cranes in the Decontamination Cell are required because crane maintenance in this cell will be based on personnel access. The redundant crane will allow external radiation sources (i.e., IHLW canisters) to be removed from the cell if the primary crane fails. The cranes have a canister grapple that is identical to that used at the WVS.

Figure 7-3. Fuels and Materials Examination Facility Retrofit (Plan View).

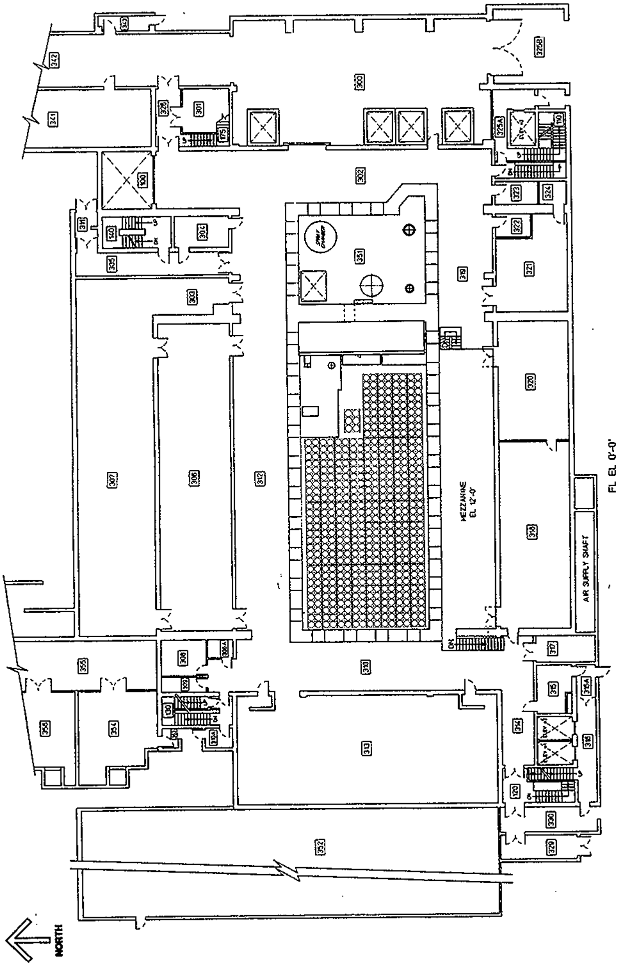
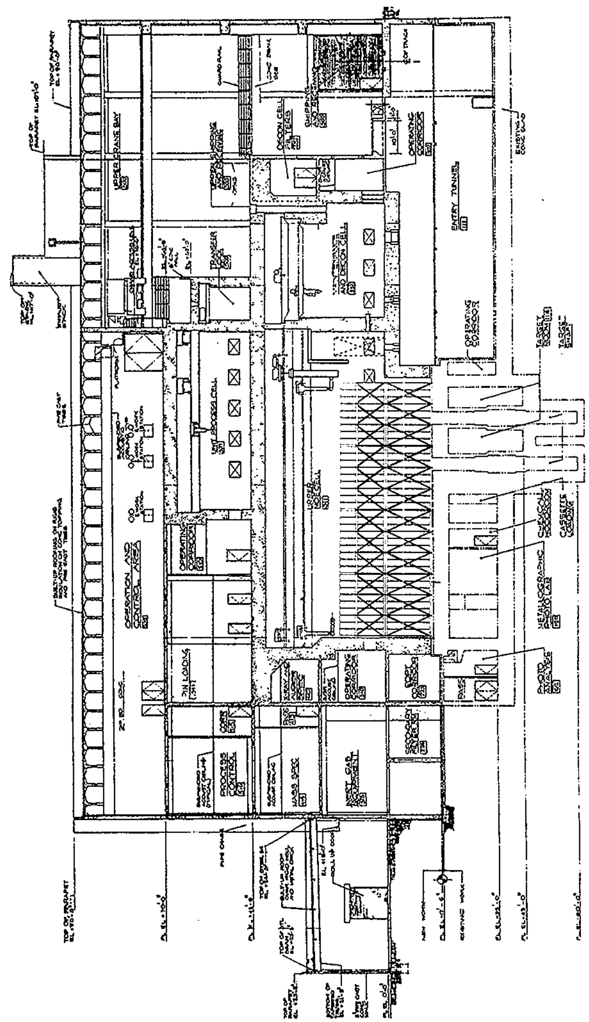


Figure 7-4. Fuels and Materials Examination Facility Retrofit (Section View).



Cask Crane – A 60-ton cask crane is installed in the entry tunnel. This crane provides for transport of the cask from the load-in/load-out hatch in the truck bay to a position below the Decontamination Cell. This crane removes the cask lid, allowing the canister to be extracted into the Decontamination Cell via an existing penetration in the floor.

Crane Maintenance Bay – A crane maintenance bay is installed in the Nondestructive Examination Cell. The existing FMEF design necessitates personnel access for crane maintenance, which would be impossible once IHLW canisters were introduced for storage. The crane maintenance bay is installed at the east wall of the Nondestructive Examination cell, above the floor. This area consists of a carbon steel floor and a shield door, which provides appropriate protection for human entry. A 1.3 m diameter opening must be cut in the floor of the Unit Process Cell, above the new crane maintenance bay, and a shield plug inserted. The opening allows access into this area.

Storage Rack – A storage rack system is installed atop the Nondestructive Examination Cell floor. The rack system is similar to the WVS design, but only part of the system is two canisters high. Twenty-two single-stack rack modules (18 standard canisters per module), 6 dual-stack (36 standard canisters per module), and 1 overpack rack module (6 overpack canisters per module) are required. The lower layer contains 504 canisters and the upper layer contains 96 canisters.

Shield Windows – Two shield windows are installed in existing openings in the Nondestructive Examination Cell west wall. Three shield windows of identical dimensions are installed in existing opening in the Decontamination Cell (north, south, and east walls). The remaining 22 existing shield window penetrations in the Nondestructive Examination Cell and 6 existing shield window penetrations in the Decontamination Cell are sealed with rebar and high-density concrete.

Shield Door – A 1.2 m wide by 6 m high opening is cut in the wall (at floor level) between the Decontamination Cell and the Nondestructive Examination Cell. This opening allows transfer of canisters from the Decontamination Cell into the Nondestructive Examination Cell. To provide for biological shielding during periods of personnel maintenance in the Decontamination Cell, a sliding shield door is installed in the Decontamination Cell.

Transfer Cart – A transfer cart is installed in the Decontamination Cell to effect canister movement between this cell and the Nondestructive Examination Cell.

7.1.4 Alternative 3 (New Construction)

The new construction could be based on any one of three general technologies. These technologies are the SNF-type facility (sealed-tube, natural convection system), the SRS-type facility (open-tube, forced-air ventilation system), and the WVS-type facility (open-bay, forced-air ventilation system). The SRS-type facility and WVS-type facility are predominately used for comparison to the other alternatives because they represent bounding cases (e.g., least and most cost-competitive) for new construction technologies (see Section 7.3). Appendixes A and C present detailed descriptions of new construction based on the other technologies.

7.2 IMPLEMENTATION SCHEDULE

The implementation schedules for the various alternate architectures are provided in Figures 7-5 through 7-11. The figures present schedules for both a February 2005 and a February 2006 start of operations.

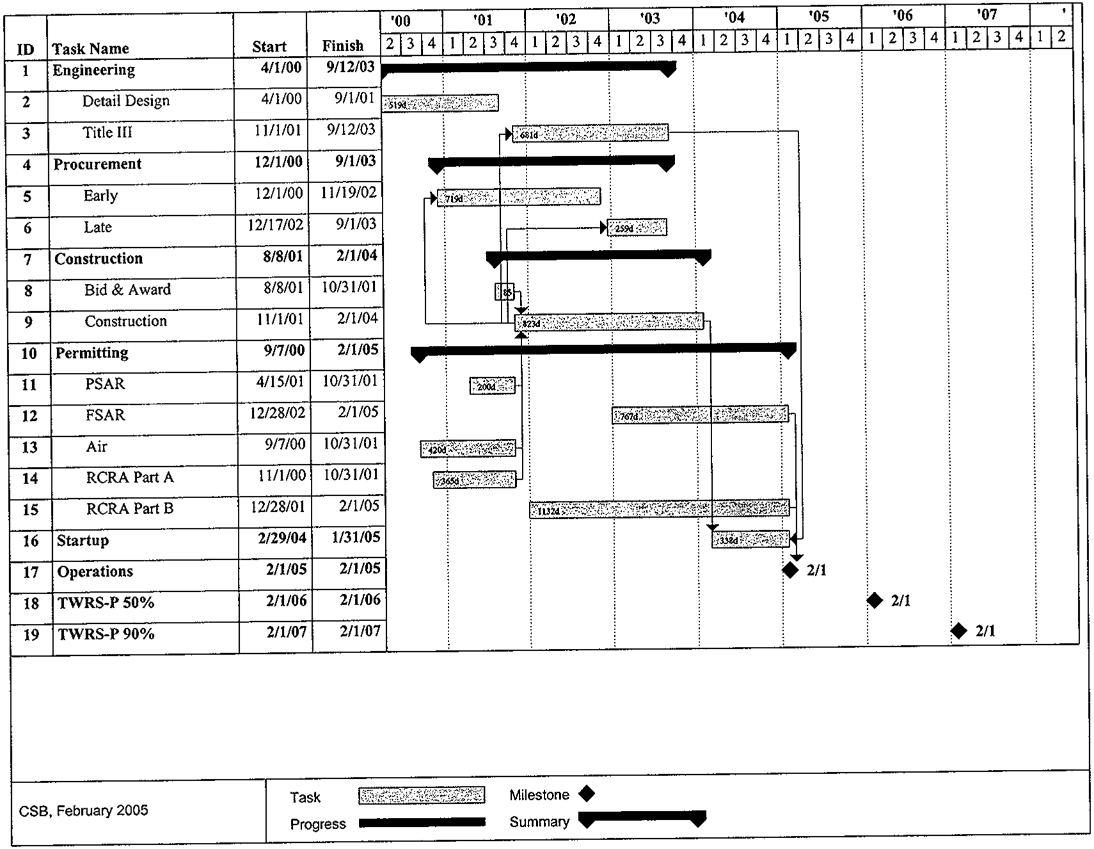
Figure 7-5 is applicable to Alternative 1. Task duration and sequencing are based on the program planning for IHLW interim storage. Although task durations are consistent with the conceptual design report (FDNW 1998), modest adjustments were made to reduce aggressive implementation aspects (e.g., preparation of structural/thermal analyses and procurement packages during an advanced conceptual design before budget authorization). Furthermore, longer task durations are possible for Alternative 1 because this option is further along in the budgeting cycle (i.e., has completed a conceptual design and project validation).

The schedules depicted in Figures 7-6 and 7-7, 7-8 and 7-9, and 7-10 and 7-11 apply to Alternatives 2a, 2b, and 3, respectively. A schedule termed "aggressive" and a second termed "conservative" are presented for each alternative. These two schedules embody lower-bound (shortest reasonable) and upper-bound (longest reasonable) durations for program tasks. For example, detail design could range in duration from 18 to 24 months. An 18-month detail design is consistent with the planning basis assumed for the new SRS storage facility (Gentilucci 1998), whereas a 24-month detail design is consistent with planning for the HWVP (Fluor 1991). Similarly, a 28-month construction is consistent with planning for the HWVP (Fluor 1991), whereas planning for the new SRS storage facility is predicated on a 31-month construction (Gentilucci 1998). Although both schedules are considered reasonable, the conservative schedule entails lower risk than the aggressive schedule.

While unique differences exist among the alternatives, many of the program elements (e.g., project definition, design, procurement, construction, and permitting) are identical. For example, a conservative 36-month process has been included for preparation of an EIS. The new construction options, as well as the PUREX Plant and FMEF retrofit options, are expected to require an EIS separate from that prepared for the TWRS-P.

The dominant schedule constraint for those alternatives that need a conceptual design is the project validation activity. Failure to attain the desired April submittal would shift remaining activities out 1 full year. The other critical path activities are design and construction.

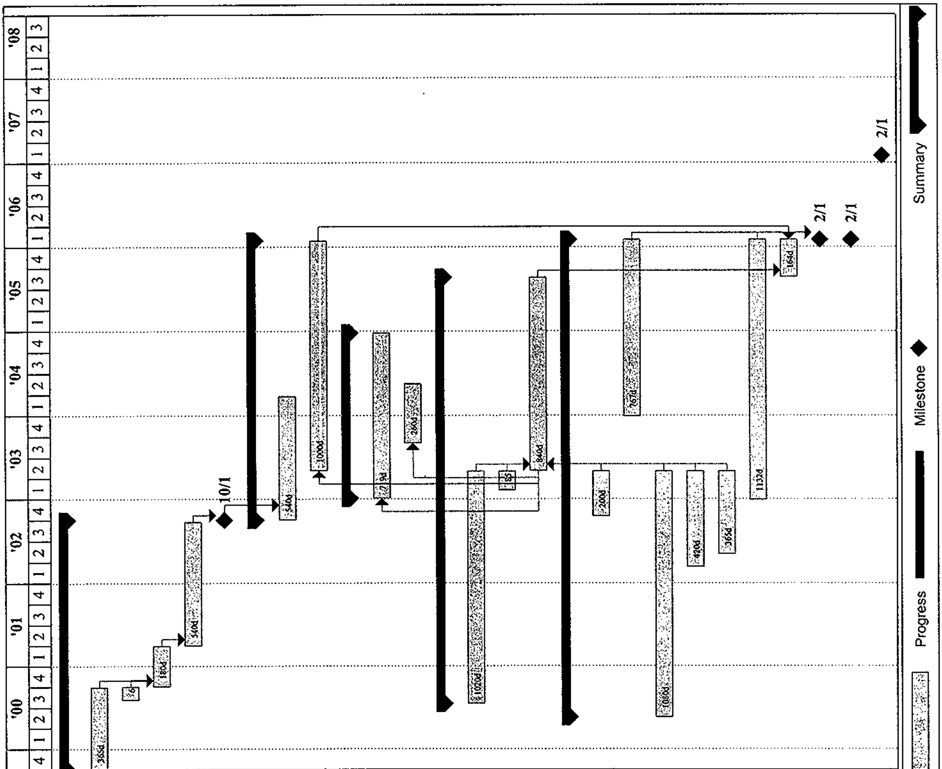
Figure 7-5. Alternative 1, February 2005 Start of Operations.



ID	Task Name	Start	Finish
1	**Engineering**	**4/1/00**	**9/12/03**
2	Detail Design	4/1/00	9/1/01
3	Title III	11/1/01	9/12/03
4	**Procurement**	**12/1/00**	**9/1/03**
5	Early	12/1/00	11/19/02
6	Late	12/17/02	9/1/03
7	**Construction**	**8/8/01**	**2/1/04**
8	Bid & Award	8/8/01	10/31/01
9	Construction	11/1/01	2/1/04
10	**Permitting**	**9/7/00**	**2/1/05**
11	PSAR	4/15/01	10/31/01
12	FSAR	12/28/02	2/1/05
13	Air	9/7/00	10/31/01
14	RCRA Part A	11/1/00	10/31/01
15	RCRA Part B	12/28/01	2/1/05
16	**Startup**	**2/29/04**	**1/31/05**
17	**Operations**	**2/1/05**	**2/1/05**
18	**TWRS-P 50%**	**2/1/06**	**2/1/06**
19	**TWRS-P 90%**	**2/1/07**	**2/1/07**

Figure 7-6. Alternative 2a, Aggressive Schedule.

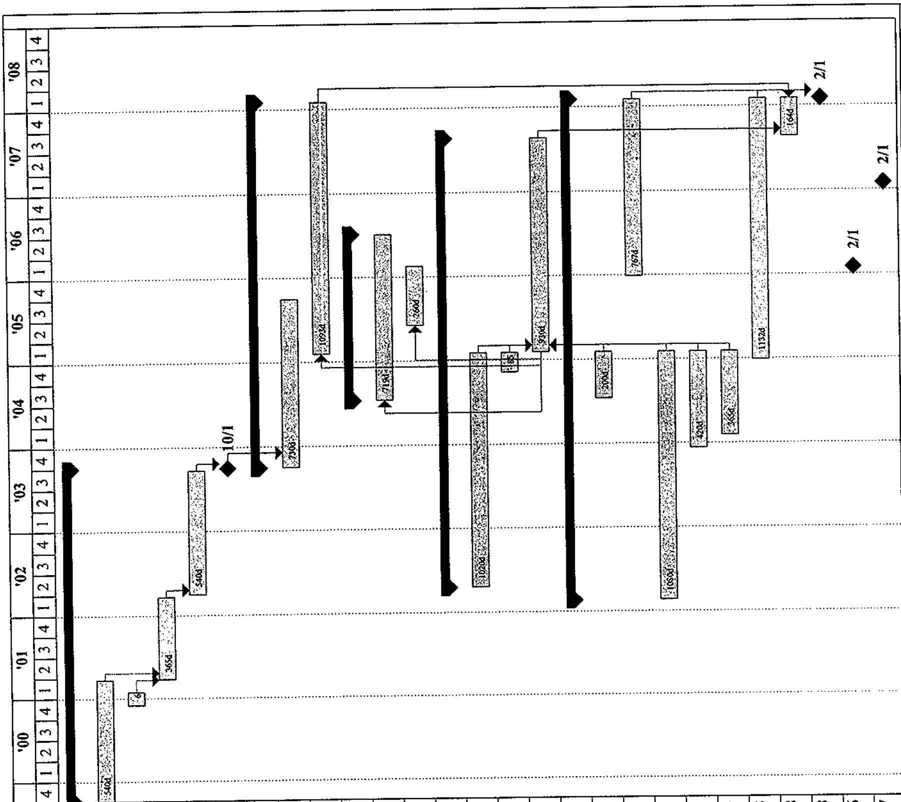
ID	Task Name	Start	Finish
1	**Project Definition**	**10/1/99**	**10/1/02**
2	Structural Evaluation	10/1/99	9/29/00
3	Criteria Definition	8/4/00	10/2/00
4	Conceptual Design	10/3/00	3/31/01
5	Validation	4/1/01	9/22/02
6	Funding Authorization	10/1/02	10/1/02
7	**Engineering**	**10/2/02**	**1/28/06**
8	Detail Design	10/2/02	3/24/04
9	Title III	5/5/03	1/28/06
10	**Procurement**	**1/5/03**	**12/23/04**
11	Early	1/5/03	12/23/04
12	Late	9/2/03	5/18/04
13	**Construction**	**7/19/00**	**8/21/05**
14	Canyon Decon	7/19/00	5/4/03
15	Bid & Award	2/9/03	5/4/03
16	Construction	5/5/03	8/21/05
17	**Permitting**	**5/20/00**	**2/1/06**
18	PSAR	10/17/02	5/4/03
19	FSAR	12/28/03	2/1/06
20	EIS	5/20/00	5/4/03
21	Air	3/11/02	5/4/03
22	RCRA Part A	5/5/02	5/4/03
23	RCRA Part B	12/28/02	2/1/06
24	**Startup**	**8/22/05**	**2/1/06**
25	**Operations**	**2/1/06**	**2/1/06**
26	**TWRS-P 50%**	**2/1/06**	**2/1/06**
27	**TWRS-P 90%**	**2/1/07**	**2/1/07**



PUREX Aggressive Schedule | Task | Progress | Milestone | Summary

Figure 7-7. Alternative 2a, Conservative Schedule.

ID	Task Name	Start	Finish
1	**Project Definition**	**10/1/99**	**10/1/03**
2	Structural Evaluation	10/1/99	3/23/01
3	Criteria Definition	12/1/00	1/29/01
4	Conceptual Design	3/24/01	3/23/02
5	Validation	4/1/02	9/22/03
6	Funding Authorization	10/1/03	10/1/03
7	**Engineering**	**10/2/03**	**1/31/08**
8	Detail Design	10/2/03	9/30/05
9	Title III	2/3/05	1/31/08
10	**Procurement**	**7/18/04**	**7/6/06**
11	Early	7/18/04	7/6/06
12	Late	6/3/05	2/17/06
13	**Construction**	**4/20/02**	**8/21/07**
14	Canyon Decon	4/20/02	2/2/05
15	Bid & Award	11/10/04	2/2/05
16	Construction	2/3/05	8/21/07
17	**Permitting**	**2/19/02**	**2/1/08**
18	PSAR	7/18/04	2/2/05
19	FSAR	12/27/05	2/1/08
20	EIS	2/19/02	2/2/05
21	Air	12/11/03	2/2/05
22	RCRA Part A	2/4/04	2/2/05
23	RCRA Part B	12/27/04	2/1/08
24	**Startup**	**8/22/07**	**2/1/08**
25	**Operations**	**2/1/08**	**2/1/08**
26	**TWRS-P 50%**	**2/1/06**	**2/1/06**
27	**TWRS-P 90%**	**2/1/07**	**2/1/07**



PUREX Conservative Schedule — Task, Progress, Milestone, Summary

Figure 7-8. Alternative 2b, Aggressive Schedule.

ID	Task Name	Start	Finish
1	**Project Definition**	**10/1/99**	**10/1/01**
2	Criteria Definition	10/1/99	11/29/99
3	Conceptual Design	10/1/99	3/28/00
4	Validation	4/1/00	9/22/01
5	Funding Authorization	10/1/01	10/1/01
6	**Engineering**	**10/2/01**	**9/1/04**
7	Detail Design	10/2/01	10/1/02
8	Title III	9/28/02	9/1/04
9	**Procurement**	**5/31/02**	**11/21/03**
10	Early	5/31/02	11/21/03
11	Late	1/26/03	10/12/03
12	**Construction**	**7/5/02**	**3/20/04**
13	Bid & Award	7/5/02	9/27/02
14	Construction	9/28/02	3/20/04
15	**Permitting**	**10/14/99**	**9/1/04**
16	PSAR	3/12/02	9/27/02
17	FSAR	7/28/02	9/1/04
18	EIS	10/14/99	9/27/02
19	Air	8/4/01	9/27/02
20	RCRA Part A	9/28/01	9/27/02
21	RCRA Part B	7/28/01	9/1/04
22	**Startup**	**3/22/04**	**9/1/04**
23	**Operations**	**9/1/04**	**9/1/04**
24	**TWRS-P 50%**	**2/1/06**	**2/1/06**
25	**TWRS-P 90%**	**2/1/07**	**2/1/07**

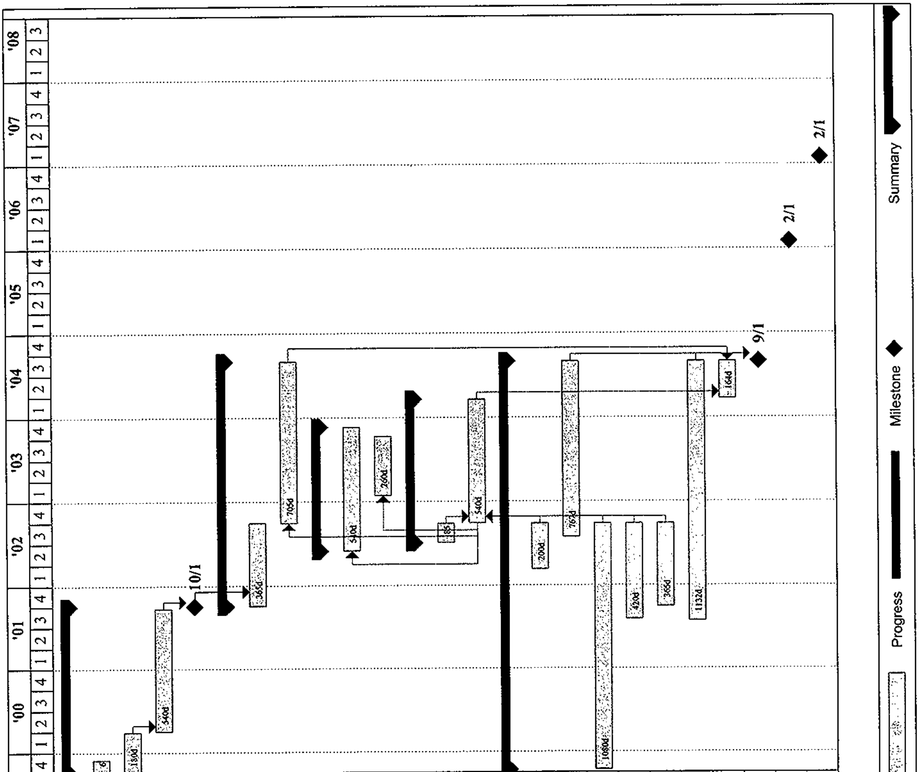


Figure 7-9. Alternative 2b, Conservative Schedule.

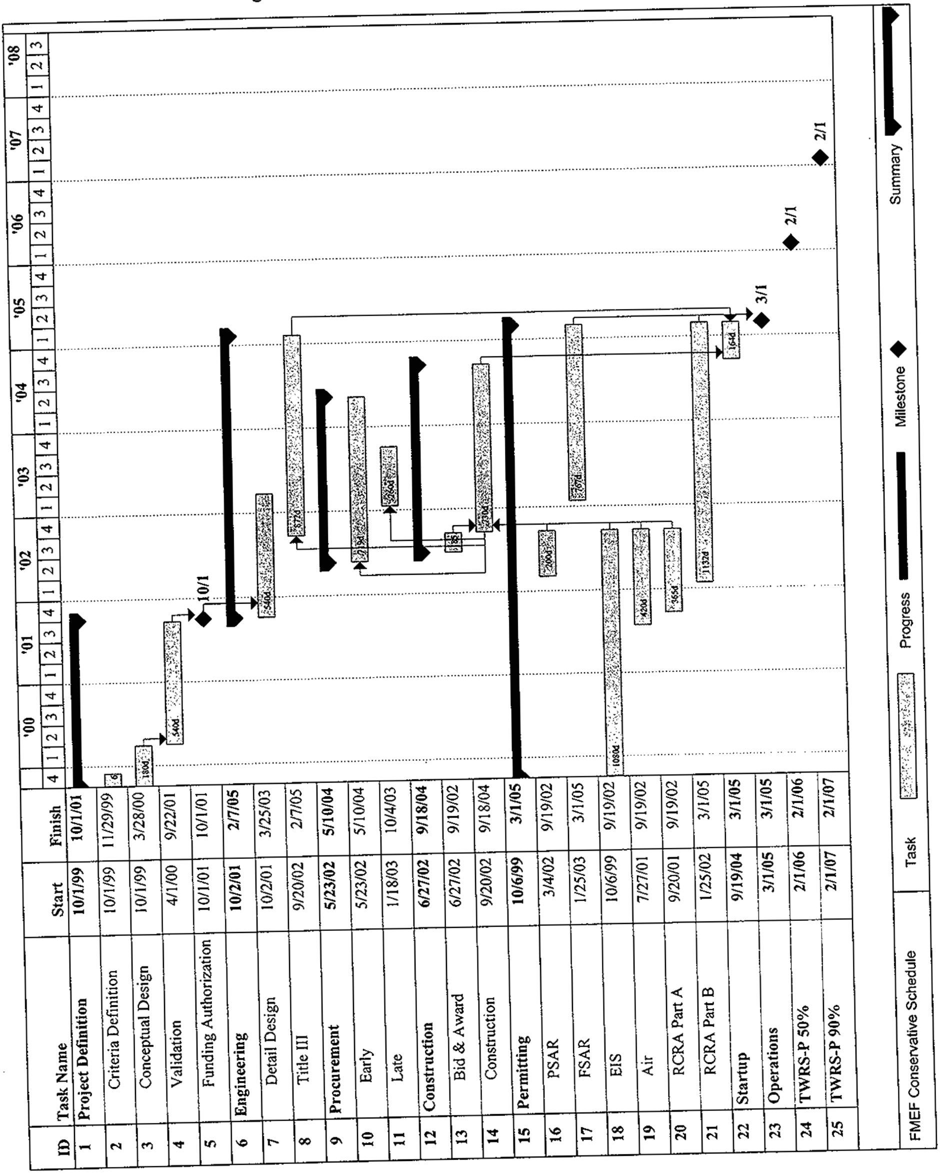


Figure 7-10. Alternative 3, Aggressive Schedule.

ID	Task Name	Start	Finish
1	**Project Definition**	**10/1/99**	**10/1/01**
2	Criteria Definition	10/1/99	11/29/99
3	Conceptual Design	10/1/99	3/28/00
4	Validation	4/1/00	9/22/01
5	Funding Authorization	10/1/01	10/1/01
6	**Engineering**	**10/2/01**	**7/28/05**
7	Detail Design	10/2/01	3/25/03
8	Title III	11/2/02	7/28/05
9	**Procurement**	**7/5/02**	**6/22/04**
10	Early	7/5/02	6/22/04
11	Late	3/2/03	11/16/03
12	**Construction**	**8/9/02**	**2/18/05**
13	Bid & Award	8/9/02	11/1/02
14	Construction	11/2/02	2/18/05
15	**Permitting**	**11/18/99**	**8/1/05**
16	PSAR	4/16/02	11/1/02
17	FSAR	6/27/03	8/1/05
18	EIS	11/18/99	11/1/02
19	Air	9/8/01	11/1/02
20	RCRA Part A	11/2/01	11/1/02
21	RCRA Part B	6/27/02	8/1/05
22	**Startup**	**2/19/05**	**8/1/05**
23	**Operations**	**8/1/05**	**8/1/05**
24	**TWRS-P 50%**	**2/1/06**	**2/1/06**
25	**TWRS-P 90%**	**2/1/07**	**2/1/07**

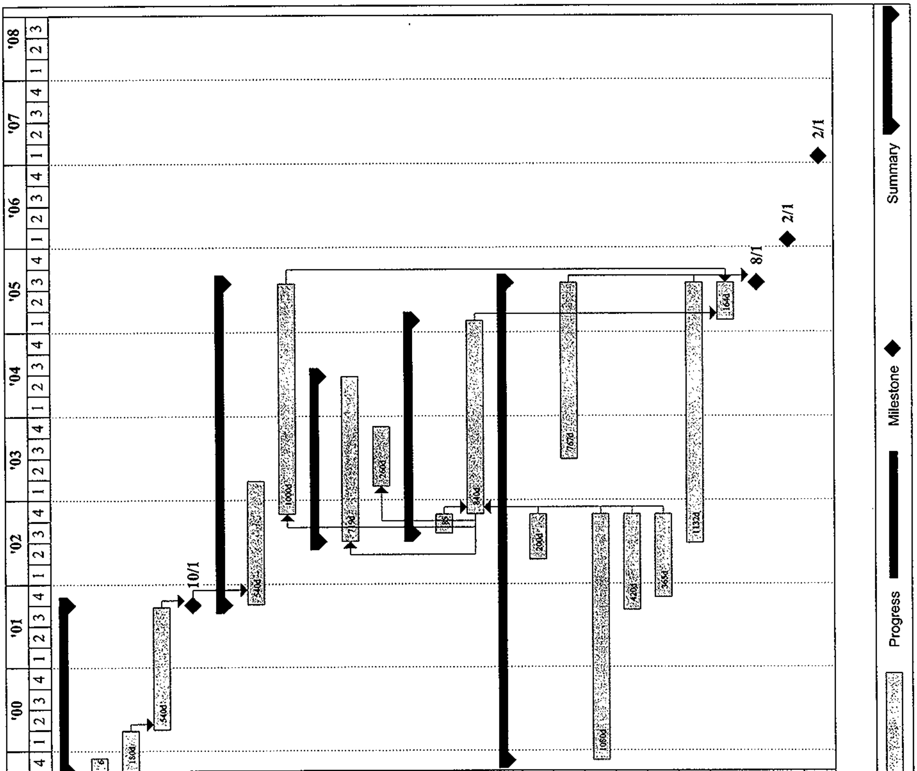
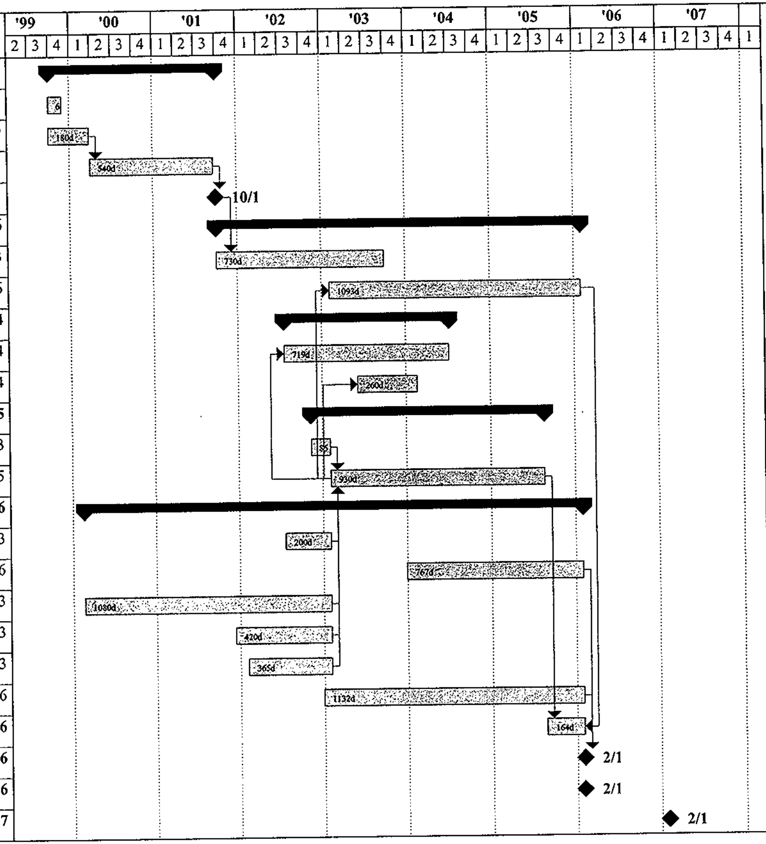


Figure 7-11. Alternative 3, Conservative Schedule.

ID	Task Name	Start	Finish
1	**Project Definition**	**10/1/99**	**10/1/01**
2	Criteria Definition	10/1/99	11/29/99
3	Conceptual Design	10/1/99	3/28/00
4	Validation	4/1/00	9/22/01
5	Funding Authorization	10/1/01	10/1/01
6	**Engineering**	**10/2/01**	**1/31/06**
7	Detail Design	10/2/01	10/1/03
8	Title III	2/4/03	1/31/06
9	**Procurement**	**7/19/02**	**7/6/04**
10	Early	7/19/02	7/6/04
11	Late	6/4/03	2/18/04
12	**Construction**	**11/11/02**	**8/21/05**
13	Bid & Award	11/11/02	2/3/03
14	Construction	2/4/03	8/21/05
15	**Permitting**	**2/20/00**	**2/1/06**
16	PSAR	7/19/02	2/3/03
17	FSAR	12/28/03	2/1/06
18	EIS	2/20/00	2/3/03
19	Air	12/11/01	2/3/03
20	RCRA Part A	2/4/02	2/3/03
21	RCRA Part B	12/28/02	2/1/06
22	**Startup**	**8/22/05**	**2/1/06**
23	**Operations**	**2/1/06**	**2/1/06**
24	**TWRS-P 50%**	**2/1/06**	**2/1/06**
25	**TWRS-P 90%**	**2/1/07**	**2/1/07**



New Construction Conservative Sche | Task | Progress | Milestone | Summary

7.3 COST ESTIMATE

This section provides the estimated cost for the various alternatives. Included are direct cost, total project cost, and unit life-cycle cost. Also discussed are various factors that could potentially influence the cost estimates, such as facility siting.

7.3.1 Direct Cost

The estimated direct costs are based primarily on the cost for similar equipment, components, or structures as extracted from historical Hanford Site cost estimates (e.g., Project W-464, IHLW Interim Storage Facility; Project W-379, SNF Interim Storage Facility; Project W-059, B Plant Ventilation Upgrade; and Project B-595, HWVP). The historical cost estimates were parametrically adjusted to reflect the present cost of equipment, components, or structures specified in Table 7-1. Appendixes B and E provide the details of the direct cost estimate. Table 7-1 summarizes the resultant direct cost estimates.

Table 7-1. Alternative Facility Direct Cost Summary.

Feature	Alternative*			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Lower-bound	$18,364	$56,752	$5,726	$42,766
Upper-bound	$29,686	$106,752	--	$63,943

All costs are in thousands of dollars with no contingency or escalation.

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

The upper-bound estimate for Alternative 1 is taken from the Project W-464 conceptual design report with adjustments for a 600-canister storage capacity (see Appendix E for details). The lower-bound value assumes that various cost savings can be realized. For example, recent programmatic developments regarding schedules have recreated the situation where SNF operations in the CSB will be completed approximately 2 years before IHLW interim storage operations must be initiated. If this situation becomes a reality, it may be possible to use the SNF load-in/load-out facility instead of constructing an additional load-in/load-out annex dedicated for IHLW receipt. Such an occurrence would save at least $4 million in direct cost. Other areas where further engineering could potentially reduce cost include storage tube redesign, optimization of the canister-handling system, shortening the vault stack height, and optimizing the onsite transportation system.

The range for Alternative 2a is a function of the extent to which structural upgrades must be implemented for the PUREX Plant to satisfy seismic qualification. The structural condition of the PUREX Plant is a significant technical uncertainty (see Section 8.5). A previous seismic analysis has already determined that the PUREX Plant east crane maintenance platform would not survive a seismic event exceeding 0.10 g (Dodd 1998). Additional structural upgrades are anticipated, but the full extent will not be known until after structural analyses are completed.

Previous investigation had estimated that structural modifications necessary to seismically upgrade the PUREX Plant could cost from $30 million to $50 million (LaRiviere 1981). This estimate was based on a 0.25-g seismic event. At the current design basis of a 0.35-g seismic event, the structural upgrade cost is estimated at $50 million to $100 million in 1998 dollars.

A range is not provided for Alternative 2b because the scope of retrofit modifications is fairly certain and the cost magnitude is relatively modest. The larger uncertainty is in other cost elements that rollup into TPC (e.g., contingency). Therefore, the range for Alternative 2b is better discussed with respect to TPC.

The range for Alternative 3 is taken from the cost estimates for the various new construction technologies (see Appendix B). From these estimates, the WVS-type facility has the lowest direct cost while the SRS-type facility has the highest direct cost.

7.3.2 Total Project Cost

Based on the direct cost estimates, the TPC was developed for each alternative (see Appendix D for details). The upper-bound TPC for Alternative 1 was taken directly from the conceptual design report (FDNW 1998) with adjustments for a 600-canister storage capacity. A large fraction of the Alternative 1 cost information also was used as a basis for the other options. For example, project integration and other project costs are common to all alternatives. Table 7-2 summarizes the TPCs for alternatives.

Table 7-2. Alternative Total Project Cost Summary.

Cost element	Alternative*			
	1 CSB	2a PUREX	2b FMEF	3c New Construction
Lower bound	$61,814	$151,189	$36,295	$112,634
Upper bound	$82,915	$252,877	$67,404	$164,300

*All costs are in thousands of dollars.

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

Unique to Alternative 2a is a cost termed "preconditioning." The preconditioning cost reflects the effort needed to decontaminate the PUREX Plant canyon to a level that would allow reasonable access for construction of retrofit modifications. Although the Canyon Disposition

Initiative estimated the cost for canyon decontamination, the associated disposition option was subsequently eliminated from further consideration. Therefore, the IHLW Interim Storage Program would be required to bear the canyon decontamination cost if Alternative 2a were implemented.

The Canyon Disposition Initiative estimated U Plant canyon decontamination would cost \$9,088,000 (RL 1998). This value includes \$764,000 for decontamination program management, \$8,159,000 for decontamination, and \$165,000 for contaminated waste disposal. The latter two values were increased by a factor of 1.18 to account for the larger surface area of the PUREX Plant canyon versus the U Plant canyon. This preconditioning cost could increase to \$31,336,000 if it becomes necessary for the IHLW Interim Storage Program to disposition the PUREX Plant process cells. The upper-bound TPC includes this increased cost for process cell dispositioning.

For Alternative 3, engineering was assumed to be 25% of direct cost for the lower-bound case and 30% of direct cost for the upper-bound case. A lump-sum \$16 million engineering cost was assumed for the upper-bound TPC for Alternatives 2a and 2b because these options entail substantial technical uncertainty. However, there is a reasonable possibility that with a modest expenditure the technical uncertainty can be eliminated for the FMEF. Therefore, engineering for the lower-case of Alternative 2b was assumed at 25% of direct cost.

Project management for Alternatives 2a and 2b was based on the conceptual design estimate of \$8,221,000 for Project W-464. For Alternative 2a, an additional \$764,000 was added to cover decontamination program management. For Alternative 3, project management was assumed to be 21% of direct cost for the lower-bound case and 23% of direct cost for the upper-bound case.

Escalation for all alternatives was 5.5% and 7.8% of the engineering and direct costs, respectively. These are the same escalation factors used in the Alternative 1 conceptual design report.

A 50% contingency factor was applied to the engineering and facility costs of Alternatives 2a and 2b because the technical scope of these alternatives entails a significant degree of uncertainty. Substantially more engineering must be performed on these alternatives to resolve unknowns and the engineering results are likely to translate into a direct cost increase. For Alternative 2a, a 35% contingency factor also was applied to the preconditioning cost. The 35% contingency factor for this item was the same as that used in the Canyon Disposition Initiative for canyon decontamination and cell disposition (RL 1998). The contingency for Alternative 3 was 21% of engineering and 23% of direct cost, respectively. These latter contingency factors are consistent with those used in the Alternative 1 conceptual design report.

Site allocation was 30% of engineering and 22% of direct cost for Alternatives 2a through 3. These site allocation factors are consistent with those used in the Alternative 1 conceptual design report. For Alternative 2a, the site allocation cost also includes 22% of the preconditioning cost.

7.3.3 Life-Cycle Cost

To render a suitable basis for comparison of alternatives, life-cycle costs were generated for each alternative. The life-cycle costs were transformed to present value by discounting the various time-phased costs (regardless of type of appropriation or source of funds). This approach is consistent with that prescribed by the DOE for life-cycle asset management (DOE 1996 and DOE 1997). These costs are based on a 7% annual discount rate. Present value costs are indexed to the year detail design is initiated. Escalation between 1998 and the present value index year is neglected. Table 7-3 summarizes the life-cycle costs for alternatives

The life-cycle costs are based on an assumption that active receipt of IHLW canisters will occur over a 13-year period. Once all the Phase 1 IHLW canisters have been emplaced in storage, the facility will require little more than surveillance and occasional maintenance. This passive storage period is assumed to last 62 years.

Table 7-3. Life-Cycle Cost Summary.

Cost element	Alternative[1,2]			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Lower-bound				
Unit cost ($/canister)	$129	$289	$95	$217
Capacity	600	600	600	600
Life-cycle cost	$77,193	$173,685	$57,043	$130,198
Upper-bound				
Unit cost ($/canister)	$164	$459	$147	$303
Capacity	600	600	600	600
Life-cycle cost	$98,295	$275,373	$88,202	$181,865

[1]All costs are in thousands of dollars.
[2]Present value indexed to the start of detail design.

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

Implementing any alternative other than Alternative 1 will require preparation of a conceptual design. This cost is assumed at a fixed $1 million. For Alternative 1, this is already a sunk cost (i.e., expended money that cannot be recouped).

The Project W-464 conceptual design report (FDNW 1998) estimated an annual operation and maintenance cost of $3,424,000. Regardless of the architecture, operation and maintenance activities should be similar for each alternative during the active receipt period. Therefore, the $3,424,000 is assumed for all alternatives. In addition to this cost, those alternatives with an active ventilation system have a higher electrical consumption. The annual cost of this additional electricity is estimated at about $37,000.

Excluding Alternative 2b, the operation and maintenance cost during passive storage is assumed to be 20% of that during active storage (i.e., $684,800). A $1,200,000 operating and maintenance cost is assumed for Alternative 2b based on historical values for FMEF. The higher operating and maintenance cost is justified because, unlike the PUREX option, isolation of the bulk of the FMEF from the IHLW interim storage area is not practical. Therefore, the portion of operation and maintenance costs attributed to support services (e.g., ventilation system, electrical system, etc.) will be higher than that for the other alternatives. An additional $100,000 annual cost is applied to any alternative with an active ventilation system to account for periodic blower maintenance, HEPA filter replacement, etc. In addition, these alternatives consume about $37,000 more electricity annually.

After 75 years, the interim storage facility is assumed to undergo D&D. For Alternative 3, a $15 million D&D cost is assumed. Given that Alternatives 1 and 2a are existing facilities, D&D is a sunk cost (i.e., will have to be expended regardless of whether the alternative is selected for the interim storage mission). Alternative 2b is also an existing facility, but it has never been exposed to radioactive material. Therefore, a $6 million delta D&D cost is assumed.

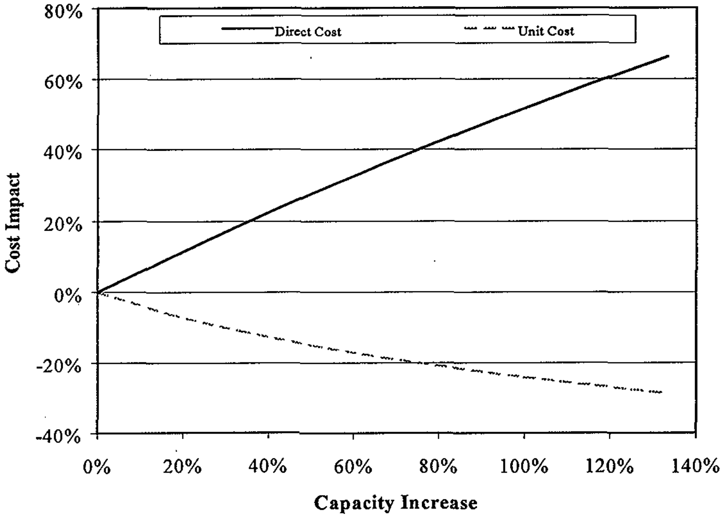
7.3.4 Alternative Capacity

In the preceding discussion, costs for Alternative 1 are based on an 600-canister storage capacity. If the storage capacity were increased to its maximum (880 canisters), the life-cycle cost would increase to a range of from $96,986,000 to $110,779,000. The resultant unit costs would range between $110 and $126 per canister.

Similarly, the new construction alternatives have an essentially unlimited upper capacity. The maximum interim storage capacity could be installed initially or it could be phased in during the life cycle as discrete future projects. Given the multitude of potential initial capacities and implementation strategies, it would not be cost-effective to attempt to quantify the impacts on program cost for every conceivable approach. Therefore, the expanded capacity evaluation was limited to storage for 1,200 canisters. However, general trends for any capacity can be surmised as illustrated below.

Assuming that the direct cost increases to the six-tenths power with capacity, capital costs will increase as the capacity increases relative to the 600-canister storage capacity option. However, the unit cost (storage cost per canister) will decrease, albeit at a lesser rate than capital cost increases (see Figure 7-12).

Figure 7-12. Storage Capacity Influence on Cost.



The existing structure alternatives have a known upper bound. A capacity upgrade could be implemented to increase the existing facilities to their theoretical maximum. For example, the CSB capacity could be expanded by construction of a fourth vault south of and adjacent to the hot conditioning annex. The minimum direct cost for a 158-tube fourth vault is estimated at $12,523,000 (Calmus 1996b). This value does not consider increased excavation costs caused by the hot conditioning annex lacking the footings and pilings necessary to allow excavation next to this safety class structure.

The PUREX Plant canyon capacity could be increased from 600 to 2,700 IHLW canisters by the installation of additional storage racks. Direct cost for the additional racks is $2,908,000. The FMEF capacity could also be upgraded from 600 to 1,008 canisters. Unlike the PUREX Plant, the $860,000 direct cost for this rack upgrade must be included in the initial modification because cell access would be severely restricted after radioactive material is introduced. Neither of the preceding costs include an allowance for an upgrade to the active ventilation system. Therefore, the actual capacity expansion cost could be greater than that depicted herein. However, if the actual average decay heat of IHLW canisters is significantly lower than 1200 W per canister, a ventilation upgrade may not be necessary.

Table 7-4 summarizes the cost of expanding the alternatives to their maximum practical capacity.

Table 7-4. Expanded Capacity Life-Cycle Cost Summary.

Cost element	Alternative[1, 2]			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Lower-bound				
Unit cost ($/canister)	$110	--	--	--
Capacity	880	--	--	--
Life-cycle cost	$96,986	--	--	--
Unit cost ($/canister)	$97	$69	$68	$152
Capacity	1,196	2,700	1,008	1,200
Life-cycle cost	$116,154	$186,589	$65,502	$182,690
Upper-bound				
Unit cost ($/canister)	$126	--	--	--
Capacity	880	--	--	--
Life-cycle cost	$110,779	--	--	--
Unit cost ($/canister)	$117	$107	$92	$216
Capacity	1,196	2,700	1,008	1,200
Life-cycle cost	$139,633	$288,276	$93,163	$259,170

[1]All costs are in thousands of dollars.
[2]Present value indexed to the start of detail design.

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

7.3.5 *New Construction Siting*

Some adjustment to the cost estimate for Alternative 3 would be possible if the IHLW interim storage facility were located near the TWRS-P production facility. For example, an SCT could be used instead of the canister-handling machine. The SCT, which is functionally equivalent to the canister-handling machine, could effect intra-facility transportation (IHLW canister movement within the interim storage facility) and could also provide inter-facility transportation (IHLW canister movement between the TWRS-P production facility and the interim storage facility). This would allow the elimination of a separate onsite transportation system. However, the cost savings would be modest.

The direct cost (fabrication and installation) of the canister-handling machine is estimated to be $1,833,000. This cost is based on the SNF MHM, but excludes design modifications unique to the SNF mission (e.g., cask inerting, cask over-pressurization control, etc.) and reengineering changes that resulted in a significant cost escalation. The cost of the onsite transportation system is approximately $4,374,000 (FDNW 1998). The combined cost is $6,207,000.

The direct cost of the SCT is estimated at \$4,860,000. Comparing this value to that for the canister-handling machine and onsite transportation system would suggest a potential reduction of about \$1,347,000. Such a direct comparison is not, however, appropriate.

The transportation system entails redundant components (i.e., two trailers and two shield casks). If redundancy is necessary for this system, redundant SCTs would also be required. Two SCTs would cost \$9,720,000. Conversely, if one onsite transportation system were adequate, the cost differential between the two approaches becomes essentially equal.

An additional factor that could reduce the cost differential even more is the special roadway requirements associated with the SCT. The SCT can only tolerate a 3% grade, maximum. Furthermore, wheel loading dictates a 0.4 m thick concrete roadway. The cost of this roadway is estimated at \$260/m^2 (Gentilucci 1998). Depending on the distance from the TWRS-P production facility to the location of the IHLW interim storage facility, the roadway cost may be substantial.

The modest potential cost savings associated with SCT inter-site transportation would not be possible for the existing facility alternatives. The distance between the TWRS-P production facility and the interim storage facility precludes use of an SCT for onsite transportation in Alternatives 1 and 2b. Moreover, Alternatives 2a and 2b and a WVS-type new construction require dedicated cell cranes to effect canister emplacement in storage. For the sole mission of interfacility transportation, the SCT has no cost or technical advantage over a trailer and shield cask approach.

An additional reduction in the cost estimate for Alternative 3 may be possible if the IHLW interim storage facility were coupled to the TWRS-P production facility. In this case, some services could be shared by the combined production/storage facility (e.g., load-in/load-out, operations support, and canister handling). Again, the cost reduction would not be sufficient to allow these alternatives to compete with the most cost-effective alternatives.

For example, including in the Alternative 3 cost only those capital items that would be necessary for interim storage (i.e., main storage structure, storage racks, and ventilation system), results in a \$40,337,000 direct cost. The magnitude of potential savings is not sufficient to change a conclusion based on direct cost. Furthermore, this assumes that the common facilities are designed such that they can remain operational even if the production facility is decommissioned (i.e., would not require the production facility to be maintained in a standby condition for the entire interim storage period).

Further modest savings in TPC could possibly be realized through economy-of-scale. For example, a single production/storage facility project would require only one project manager. In addition, the delta increase to engineering or permitting for a combined project may be slightly less than the sum for two independent projects. However, indirect cost tends to increase proportionally with project scope (i.e., direct cost). Therefore, a savings greater than 2% to 5% is highly unlikely.

Potential life-cycle cost savings are also relatively modest. For the case where the interim storage facility is sited relatively close to the TWRS-P production facility, thereby eliminating a dedicated inter-facility transportation system, the cost reduction is insignificant. Essentially no reduction in operation and maintenance staff would be possible. Energy consumption would also be the same.

For the case where the interim storage facility is coupled to the TWRS-P production facility, some staff reduction may be possible. However, even assuming a condition where the TWRS-P production facility operation and maintenance staff can accommodate the interim storage function without a staffing increase, an extensive life-cycle cost reduction is not realized. Once the interim storage facility enters the passive operation phase, the same number of operation and maintenance staff is required for the coupled case as is required for any other alternative. Given the long duration of passive operation (~60 years), these out-year costs tend to dominate overall operation and maintenance costs.

Table 7-5 summarizes the overall influence of interim storage facility siting. The adjacent designation applies to the case where the interim storage facility is a stand-alone structure (i.e., no shared services), but is sited in close proximity to the TWRS-P production facility. The coupled designation applies to the case where the interim storage facility is integrated with the TWRS-P production facility as a contiguous unit. In both cases, the specific new construction interim storage facility architecture (i.e., SNF-type and WVS-type) was selected such that it yielded the most cost-effective implementation with respect to the facility siting attribute.

Table 7-5. New Construction Facility Siting Influence.

	Adjacent	Coupled[2]
Direct cost[1]	$65,199	$40,337
Total project cost[1]	$150,981	$98,188
Unit cost ($/canister)	$279	$176
Capacity	600	600
Life-cycle cost[1,3]	$167,448	$105,454

[1]All costs are in thousands of dollars.
[2]Does not include financing cost added by the privatization contractor.
[3]Present value indexed to the start of detail design.

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8.0 ALTERNATIVE ASSESSMENT

Based on the fully developed concepts, as specified in Section 7.0, each alternative is assessed with respect to the evaluation criteria described in Section 4.0. The following discusses the result of this assessment.

8.1 SCHEDULE RISK

The conceptual design report for Project W-464 presented a schedule that supported a June 2002 start of operations. This schedule contained moderate risk in that detailed structural/thermal analyses and procurement package preparation had to be developed during an advanced conceptual design before budget authorization. With a delay in the start of Phase 1 production (February 2006 or February 2007) these activities could be performed in a more normal manner during detail design, thereby mitigating a source of perceived schedule risk. Even with an increased duration for detailed design, Alternative 1 can easily support a February 2005 or February 2006 start of operations.

As identified in the original AGA, the baseline alternative inherently has increased risk because of its interdependency on the SNF Program. However, recent programmatic developments with respect to program schedules have created the potential for a minimum time period between when the SNF Program completes active use of the CSB and the initiation of CSB retrofit construction for IHLW interim storage. This development significantly reduces the potential for the SNF Program to impact the IHLW Interim Storage Program.

Based on the schedules presented in Section 7.2, Alternative 2a is at risk of supporting the IHLW Interim Storage Program. At best, the aggressive implementation schedule can only support the February 2006 start of operations. The conservative implementation schedule indicates a potential 1- to 2-year schedule delay (earliest start of operations is February 2008).

Although a reasonable effort was expended to estimate task durations, uncertainty relative to the technical scope of several tasks increases schedule risk for Alternative 2a. Current D&D planning for the PUREX Plant does not include cleaning the canyon to levels that would allow reasonable construction access. The time and effort necessary to readjust the program to encompass this activity is uncertain. Further exacerbating the schedule risk is the disposition of process cells. Once a concrete mat is poured on the cover blocks, reasonable access to the PUREX Plant cells will be precluded. This necessitates that the cells be dispositioned for final closure before the IHLW interim storage modifications are initiated. Discussions with Hanford Site staff working on the Canyon Disposition Initiative for the 221-U Facility indicated that actions needed to satisfy the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* for an acceptable closure have not been decided. Indeed, a decision about this aspect is not anticipated until the last quarter of 2001, at the earliest.

A lesser degree of schedule risk exists for Alternative 2b. The aggressive implementation schedule can easily support either a February 2005 or February 2006 start of operations. However, the FMEF can become operational no sooner than March 2005 under the conservative implementation schedule. This provides only an 11-month float before the TWRS-P start of operations (50% probability date).

An additional schedule risk associated with Alternatives 2a and 2b is the potential for a competing program to capture these surplus facilities for its mission. For example, the Immobilized Low-Activity Waste Disposal Program has also evaluated use of existing canyon facilities (Burbank and Klem 1997). The viability of the PUREX Plant for immobilized low-activity waste disposal may be greater than that for IHLW interim storage. Many of the negative attributes envisioned for an IHLW interim storage mission are irrelevant to immobilized low-activity waste disposal (e.g., long-term structural stability, canyon contamination, etc.). In addition, the FMEF has for many years been energetically proposed for numerous missions (most recently the plutonium disposition initiative).

Alternative 3 is also at risk. The aggressive implementation schedule indicates that operations can start no earlier than August 2005, while the conservative implementation schedule indicates that the start of operations may not occur until February 2006. While either schedule could support the TWRS-P 90% probability date, Alternative 3 would be at risk of supporting the TWRS-P 50% probability date.

While the degree of schedule risk depends on the specific date assumed for start of operations, the relative risk among the alternatives can be surmised. Table 8-1 summarizes the schedule risk.

Table 8-1. Implementation Schedule Risk.

Implementation schedule	Alternative			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
TWRS-P 50% probability schedule				
Aggressive	Yes	No	Yes	No
Conservative	Yes	No	No	No
TWRS-P 90% probability schedule				
Aggressive	Yes	Yes	Yes	Yes
Conservative	Yes	No	Yes	Yes

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction
TWRS-P = Tank Waste Remediation System-Privatization

In the preceding table, an aggressive implementation schedule is approximately a 50% probability of success for the Interim Storage Program while a conservative implementation schedule is roughly an 80% probability of success. A "yes" designation indicates that the TWRS-P schedule can be supported with at least 1 year of schedule float. A "no" indicates that the schedule cannot be supported or is at risk (less than 1-year schedule float).

8.2 UNIT LIFE-CYCLE COST

Table 8-2 summarizes the upper-bound unit life-cycle costs for alternatives. This information presents both a fixed-capacity case (minimum order quantity of 600 canisters) and an expanded-capacity case, which represents the physical limitations of existing facility alternatives. In all cases, Alternative 2b (FMEF) is the most cost-effective and Alternative 2a (PUREX) is the most expensive from a total initial investment perspective.

Table 8-2. Unit Life-Cycle Cost Summary (Present Value).

	Alternative*			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Minimum order capacity				
Total project cost	$82,915	$252,877	$67,404	$164,300
Life-cycle cost	$98,295	$275,373	$88,202	$181,865
Capacity	600	600	600	600
Unit life-cycle cost	$164	$459	$147	$303
880-canister capacity				
Total project cost	$92,415	--	--	--
Life-cycle cost	$110,779	--	--	--
Capacity	880	--	--	--
Unit life-cycle cost	$126	--	--	--
Full capacity				
Total project cost	$118,410	$258,103	$68,950	$235,946
Life-cycle cost	$139,633	$288,276	$93,163	$259,170
Capacity	1,196	2,700	1,008	1,200
Unit life-cycle cost	$117	$107	$92	$216

*All costs are present value in thousands of dollars.

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

An important consideration in comparing cost estimates is that the Alternative 1 cost is a conceptual design estimate, whereas the others are VROM estimates. Greater uncertainty is associated with these latter estimates.

An additional consideration in the life-cycle cost for Alternative 2a is the resources necessary to precondition the PUREX Plant canyon/cells. The direct cost estimate for Alternative 2a is predicated on the canyon being decontaminated to the degree necessary to facilitate retrofit construction and the process cells being dispositioned for final closure before retrofit modifications are initiated. While a reasonable effort was made to estimate these costs, the uncertainty is higher than for other cost elements. The uncertainty associated with these costs must be considered in the overall decision process.

Facility siting for the new construction alternatives impart a marginal influence on cost. There are essentially no savings associated with siting the facility adjacent to the TWRS-P production facility (see Table 7-5). Although a modest savings may be possible with coupling the interim storage facility and the production facility, the impact of transferring this scope to the privatization contractor has not been assessed. The potential cost savings could be offset by financing costs associated with privatization.

Although present value is the preferred basis for cost comparisons, it presumes that money has a time-dependant value. In addition, selection of a specific discount value could influence the conclusions. For this reason, a sensitivity analysis of discount rate influence is encouraged (DOE 1997). In general, as the discount rate increases, the influence of end-of-program activities decreases.

The effect of discount rate on conclusions based on present value life-cycle costs can be most easily observed by the use of corresponding constant dollar analysis. Constant dollars do not consider the time-dependent value of money (essentially a 0% discount rate). The upper-bound constant-dollar life-cycle costs for the various alternatives are presented in Table 8-3.

Table 8-3. Unit Life-Cycle Cost Summary (Constant Dollar).

	Alternative*			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Minimum order capacity				
Life-cycle cost	$148,039	$333,708	$178,499	$255,131
Capacity	600	600	600	600
Unit life-cycle cost	$247	$556	$297	$425
880-canister capacity				
Life-cycle cost	$163,922	--	--	--
Capacity	880	--	--	--
Unit life-cycle cost	$186	--	--	--
Full capacity				
Life-cycle cost	$197,148	$358,174	$187,607	$339,973
Capacity	1,196	2,700	1,008	1,200
Unit life-cycle cost	$165	$133	$186	$283

*All costs are constant value in thousands of dollars.

CSB = Canister Storage Building
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

The conclusions drawn from the constant dollar analysis are consistent with those derived from the present value analysis with one exception: Alternative 1 (CSB) is as cost-effective and possibly cheaper than Alternative 2b (FMEF). This is because Alternative 2b has a somewhat higher operating cost, being based on an active ventilation system, and a D&D cost at the end of the program life cycle. Neglecting the discounted value of these program cost elements tilts the cost-benefit relationship toward Alternative 1. Based on a comparison of constant dollar life-cycle costs versus present value life-cycle costs, Alternatives 1 and 2 are very close competitors. This comparison further suggests that a small imprecision in the various elements that comprise life-cycle cost (e.g., operation and maintenance cost, D&D cost, etc.) could affect the observed relationship between these two alternatives.

8.3 HEALTH, SAFETY, AND ENVIRONMENTAL RISK

As observed in the original AGA, differences in health, safety, and environmental risks among alternatives tend to be subtle. The IHLW product is essentially a sealed radioactive source that contains a relatively non-dispersible material. The primary safety and environmental risk is during inter-facility transportation (between the TWRS-P production facility and interim storage facility). Excluding Alternative 2b, this attribute is identical for all potential alternatives. The effort required to fully quantify other minor differences among alternatives would require the expenditure of significant resources to develop detailed accident scenarios and consequences. Such an effort is beyond the scope of this evaluation. Therefore, evaluations with respect to this criterion are limited to qualitative judgements.

Alternative 1 does entail a unique risk insofar as facility safety analyses and hazard assessments must consider the influence of the SNF in storage. However, the SNF hazards have been successfully addressed via a safety analysis conducted by the SNF Program. Furthermore, a preliminary safety evaluation was completed during the conceptual design for Project W-464. The risk, therefore, is not significant.

Construction workers may be subjected to a higher external radiation exposure under Alternatives 1 and 2a. The CSB can be expected to exhibit an external radiation field somewhat higher than natural background, but the dose consequences will be marginal. The dose consequences of Alternative 2a will be more significant. Decontamination of the PUREX Plant canyon to allow for retrofit modification will significantly increase Hanford Site worker exposures.

Maintenance staff in the PUREX Plant may be subjected to a higher, although acceptable, occupational radiation exposure. Residual contamination could necessitate a higher degree of personnel protection (e.g., whites and possibly masks) during contact crane maintenance. However, after retrofit modifications, the PUREX Plant will comply with as low as reasonably achievable principles. Furthermore, crane maintenance will not be a frequent activity (primarily limited to annual preventive maintenance of short-term duration).

Alternative 3 also entails an increased risk to construction workers. A significant fraction of the construction for existing facility alternatives has been completed. New construction will necessitate a larger work force and more extensive construction activities.

8.4 STAKEHOLDER CONFIDENCE

Alternative 2b is not in the Hanford Site 200 East area, contrary to a stakeholder value. All the other alternatives are in the Hanford Site 200 East area. All the alternatives, except Alternative 1, entail abandonment of the current approach for IHLW interim storage. Therefore, Alternative 1 is expected to embody a higher degree of stakeholder confidence than the other alternatives.

8.5 TECHNICAL PERFORMANCE

This section assesses the technical performance for the alternate architectures. Each major sub-element (capacity flexibility, operating life flexibility, and technical risk) is addressed separately.

8.5.1 Capacity Flexibility

Embodied in Alternative 1 is storage capacity for 280 IHLW canisters more than the minimum order quantity, provided both CSB vaults are initially outfitted with a full compliment of storage tubes. Once IHLW canisters are introduced to the vault, the external radiation dose emitted by a partially filled vault would prevent personnel access necessary to install additional tubes. While the hot conditioning annex does not preclude future installation of additional vaults south of the CSB (see Section 6.2), its existence would render the construction more complicated and expensive. Nevertheless, a fourth vault could be constructed either initially or after the initial retrofit modifications were completed. The direct cost for a 158-tube fourth vault is estimated at $12,520,000.

Alternative 2a has physical space (available canyon deck area) for approximately 2,700 IHLW canisters. The additional storage capacity beyond an initial 600 canisters could be installed after initiation of hot operations, but an over-capacity ventilation system must be installed initially. Otherwise, canyon cooling could limit storage capacity. The estimated direct cost of upgrading the storage capacity by 2,100 canisters is $2,908,000.

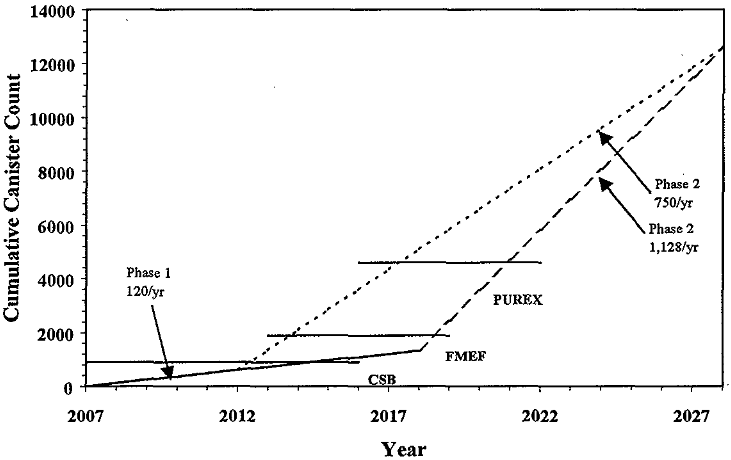
Alternative 2b has the physical space for approximately 1,008 IHLW canisters (assuming they are stacked 2-high). To achieve this capacity flexibility, the necessary rack system must be initially installed. Cell access after hot startup is severely restricted. The estimated direct cost for upgrading the storage capacity by 408 canisters is $806,000.

With appropriate consideration in the initial design/construction effort, the new construction alternative should be expandable in the future. The degree of expandability would be limited only by available land and the practicality of extending the building length. Furthermore, almost any capacity can be embodied in the initial design. The only negative to this latter approach is that the entire capital cost must be invested up-front, rather than as an upgrade later in the life cycle.

The adequacy of these capacities with respect to the overall IHLW interim storage mission can be observed from Figure 8-1. This figure depicts the cumulative total of IHLW canisters as a function of time. This production schedule assumes a 120-canister/year production rate over the entire 11-year Phase 1 period ending in 2018. For Phase 2, a production rate was assumed such that the resultant aggregate IHLW canister count is 12,600 at the end of Phase 2. The specific Phase 2 production rate depends on the date Phase 2 is initiated (i.e., 2012 or 2018).

This overall life-cycle production profile entails some uncertainty. The TWRS-P contract (RL 1996) specifies only a 600-canister minimum order quantity and a 120-canister/year maximum production rate. It is possible that only 600 canisters will be produced in Phase 1, rather than the 1,320 depicted in Figure 8-1. It is also possible that the higher production rate associated with Phase 2 will occur sooner than 2018. However, the overall conclusion remains the same: relatively modest interim storage capacity is needed initially, but the required interim storage capacity will eventually necessitate new construction.

Figure 8-1. Immobilized High-Level Waste Canister Production.



Given no single alternative can accommodate the entire Phase 1 and Phase 2 production, a combination of alternatives is required. The combined capacity of all the existing facility alternatives (about 4,500 canisters) will only accommodate approximately one-third of the total IHLW canisters produced during the TWRS-P life cycle. Therefore, new construction must be included in any combination considered.

Although many permutations are possible, the range of combined alternatives can be bounded by two cases. The first case is based solely on new construction. Several discrete modules, each with a 1,200-canister storage capacity, are brought online in a time-phased manner as needed to accommodate the IHLW production rate. The second case entails implementation of the CSB (Alternative 1) as the initial storage facility. Once the CSB is filled to capacity, the FMEF (Alternative 2b) is brought online. The remaining capacity is provided by construction of new 1,200-canister capacity storage facilities in a time-phased manner. The total life-cycle cost of these cases is depicted in Figures 8-2 and 8-3. The associated total unit life-cycle costs are $75 and $91 per canister, respectively. These figures clearly demonstrate that the use of existing facilities minimizes total life-cycle cost.

Figure 8-2. Canister Storage Building, Fuels and Materials Examination Facility, and New Construction Combination.

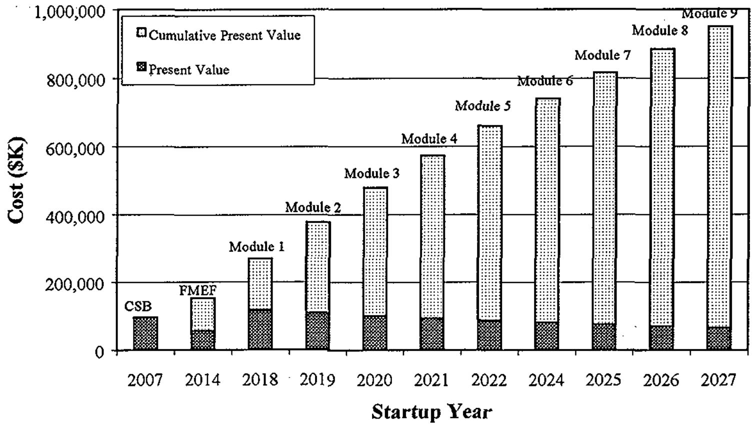
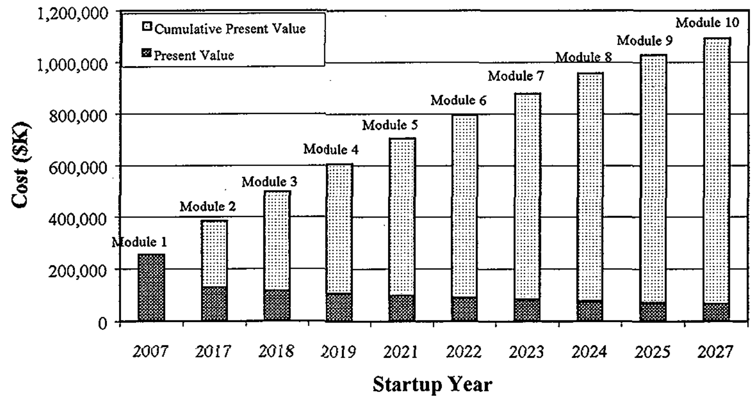


Figure 8-3. New Construction Only Combination.



Ideally, the lowest cost alternative should be the initial storage facility, thereby minimizing the overall life-cycle cost. This was rejected because Alternative 2b (FMEF) is at risk of satisfying schedule constraints. Furthermore, Alternative 2a (PUREX) was excluded from inclusion in the bounding combined-facility analysis because it is the most expensive alternative (from an initial capital investment perspective) and it entails many technical risks, as discussed in Section 8.5.3.

8.5.2 Operating Life Flexibility

Given that Alternatives 1 and 3 are new construction or essentially new construction, an extended 75-year operating life is a reasonable expectation. The FMEF is about 15 years old, but a 75-year operating life after retrofit modification is also a reasonable expectation. If the PUREX Plant is refurbished to the degree necessary to support an extended IHLW interim storage mission, a 75-year operating life is plausible. However, a thorough structural analysis is necessary to confirm this conclusion. Pending the completion of a structural analysis for Alternative 2a, the flexibility to extend operating life to 75 years is believed to entail moderate risk. The operating life flexibility of all other options is anticipated to be high.

8.5.3 *Technical Risk*

Alternatives 1 and 3 are relatively mature concepts. The baseline alternative has undergone a conceptual design and this facet imparts a high degree of technical confidence in its viability. A large body of Hanford Site experience exists, via Projects W-379 and W-464, with which to judge an SNF-type facility. Similarly, the experience base at SRS can be applied to an SRS-type facility. Storage of radioactive material in a shielded, open-bay structure (hot cell) also has an extensive history. This experience base can be applied to a WVS-type facility.

Although the WVS successfully performed a retrofit upgrade of a contaminated hot cell for IHLW interim storage, this experience is only marginally applicable to Alternative 2a. Each existing structure presents a unique set of physical constraints that must be dealt with on a case-by-case basis. Until the retrofit modifications are developed to a high level of specificity (i.e., completion of a conceptual design), significant uncertainty will exist relative to the viability of Alternative 2a.

For Alternative 2a, many issues have yet to be fully addressed. The extent of a PUREX Plant structural analysis necessary to confirm the suitability of this facility for a long-term (40 to 75 years) mission must be performed. The structural analysis may require inspection of the PUREX Plant process cell walls and footings to assess deterioration. Although an extensive preconditioning inspection and structural analysis program has been included in the cost estimate, the magnitude of the effort remains uncertain. Furthermore, if the facility was determined to not be structurally acceptable, insufficient schedule may be available to pursue an alternate option.

A previous seismic analysis has already determined that the PUREX Plant east crane maintenance platform would not survive a seismic event exceeding 0.10 g (Dodd 1998). While structural upgrades could be implemented to address any detected structural deficiency, the resultant cost and schedule impacts could be excessive. The full extent of cost and schedule impacts will not be known, however, until after structural analyses are completed.

An additional consideration in the technical risk associated with Alternative 2a is uncertainty regarding the state in which the PUREX Plant will be turned over to the IHLW Interim Storage Program. After a more extensive evaluation of the effort needed to decontaminate the PUREX Plant canyon, it could be concluded this activity is too complex or costly, or could not be completed in the required time frame. If the PUREX Plant canyon is not decontaminated, a significant schedule delay and/or cost escalation beyond that estimated herein is highly probable. This evaluation does not include the ramifications of construction within a controlled-access radiation zone.

Alternatives 2a and 2b are susceptible to cross-contamination. Under these alternatives, all IHLW canisters are exposed to a common ambient atmosphere. Contamination from a single canister could potentially cross-contaminate the entire inventory of canisters. Should this worst case scenario occur, all the IHLW canisters would require decontamination before being shipped to the repository. This activity would translate into additional cost and possible schedule delays in the future.

Under Alternative 1 cross-contamination is minimized because two canisters, at most, are contained in a sealed storage tube. Contamination from one canister can only migrate to one additional canister. Only those canisters that failed a smear survey would require decontamination before being shipped to the repository. Although this attribute is likely marginal in importance, it is still relevant to technical risk.

Alternative 1 does entail a minor risk because physical attributes of the existing structure could constrain the characteristics (heat load and dose rate) of IHLW canisters accepted for storage. This aspect, although valid, is not anticipated to actually result in a limitation on IHLW receipt. The heat load and dose rate of IHLW canisters are projected to be within the operational envelope for acceptance.

9.0 SUMMARY EVALUATION

Based on the considerations summarized in Section 8.0, the decision board ranked the alternatives. For each evaluation criterion, each board member ranked the alternative from 1 to 10. An overall ranking was obtained by numerically averaging all the board member's individual rankings. Table 9-1 presents the results of this ranking process.

Table 9-1. Alternative Ranking.

Evaluation criteria	Alternative			
	1 CSB	2a PUREX	2b FMEF	3 New Construction
Unit life-cycle cost	10.0	3.3	9.7	4.7
Schedule risk	9.7	3.3	6.7	5.7
ES&H risk	7.7	3.3	9.7	8.7
Stakeholder confidence	10.0	7.0	6.3	4.3
Technical performance	10.0	3.3	6.7	9.7
Total	47.4	20.2	39.1	33.1

CSB = Canister Storage Building
ES&H = Environmental, safety, and health
FMEF = Fuels and Materials Examination Facility
PUREX = Plutonium-Uranium Extraction

The board members engaged in numerous discussions during development of the preceding alternative ranking. These discussions centered on various aspects of the evaluation criteria and the overall ranking process. The following presents key discussion items.

Although the Decision Plan states that the evaluation criteria would be equally weighted, the board members considered an alternate ranking technique using weighted evaluation criteria as a sensitivity analysis. Furthermore, two separate weighting factors were elicited from the board members. The first considered only the Phase 1 mission while the second encompassed total Phase 1 and Phase 2 mission. The resultant ranking of options was essentially the same for the case where the evaluation criteria were equally weighted and the case where the evaluation criteria were weighted on a scale of 1 to 10 by the board.

Although from a unit life-cycle cost perspective Alternative 2b (FMEF) was slightly better than Alternative 1, the board recognized that the respective cost estimates did not possess the same degree of confidence. The Alternative 1 cost estimate is based on a conceptual design estimate. Substantially more engineering is embodied in a conceptual design cost estimate than in a study-basis cost estimate. Therefore, the board ranked Alternative 1 slightly higher than Alternative 2b.

The board viewed schedule risk as the ability to meet or better contractual schedule constraints. Therefore, the ranking closely corresponds to the schedule assessment summarized in Table 8-1.

With respect to ES&H risk, the board recognized that Alternative 2a (PUREX) entails numerous safety risks. Although it would be desirable to quantify the magnitude of these risks, the best that can be defined is a bounding approximation (best case/worst case) for inclusion in the cost estimate. Conversely, a preliminary safety evaluation has been completed for the CSB (Alternative 1). While the board recognized that implementation of any alternative would be constrained by a minimum set of ES&H standards, the aforementioned considerations are reflected in the ranking.

The board consensus was that inter-facility IHLW transportation (i.e., between the production facility and interim storage facility) was not a significant discriminator. Factors such as facility age and location were the more substantial discriminators. In addition, construction activities are inherently hazardous from a worker safety perspective. This facet was included in the ranking of new construction which entails the greatest magnitude of construction activities.

Board concurrence was that stakeholder values were embodied by the major factors of the 200 East Plateau being the preferred interim storage facility location, use of existing facilities (i.e., continuation of an established approach), and avoidance of contaminating new land. Alternative 1 is the only alternative that embodies all these elements. The other alternatives fail one or more of these elements and, therefore, were appropriately downgraded in the ranking.

As identified by the board, a major consideration in the technical performance evaluation was that existing facilities have a larger body of available information upon which to judge their attributes. Although new construction can be view as being unbounded by physical constraints and, therefore, able to yield any required performance, little tangible evidence exists to support this assertion. While this rationale would tend to enhance the technical performance ranking of Alternative 2a (PUREX), the substantial technical issues associated with use of PUREX (e.g., structural upgrade, canyon decontamination, etc.) weighed negatively on its overall ranking.

Technical performance was assessed using two separate perspectives. The first viewed technical performance as a combination of capacity flexibility and operability, as reflected in the cost estimate. The second viewed technical performance as the difficulty of meeting minimum technical requirements (e.g., providing the minimum order storage capacity in the most cost-effective manner). Both methods yielded the same general conclusion that Alternative 1 (CSB) and Alternative 2 (FMEF) were close competitors in providing the best technical performance.

After considerable deliberation, as summarized above, the decision board concluded the following path forward represents the most success oriented and cost-effective approach.

- Proceed with the CSB retrofit modification as the baseline.

- Adopt the FMEF retrofit modification as a contingency should storage capacity beyond 880 canisters become necessary during Phase 1 or as a transition into Phase 2.
- Eliminate any further consideration of PUREX Plant retrofit modifications as a potential option for IHLW interim storage.
- Plan for eventual new construction during Phase 2.

The rationale for recommending this path forward is that the existing CSB embodies the highest confidence in technical viability for an IHLW interim storage mission. Although the implementation cost is not the lowest, a reasonable probability exists that cost can be reduced. For example, if the SNF Program completes active use of the CSB by 2004 or shortly thereafter, the existing load-in/load-out area could be used for IHLW receipt. The resultant TPC reduction would be \$4 million to \$6 million. Additional value engineering efforts directed at items such as storage tube design could potentially further reduce direct cost by as much as \$4 million.

The estimated implementation cost for Alternative 2b is the lowest of any alternative evaluated. The FMEF is a relatively young facility with architectural features that closely match those needed for an IHLW interim storage mission. However, the technical viability of this option has not been fully confirmed. With a modest expenditure of resources, the technical viability of the FMEF can be confirmed via initiation of a more detailed engineering evaluation. By deferring implementation of the FMEF to the latter stages of Phase 1 or the initial stage of Phase 2, the cost benefits of this alternative could be realized without increased programmatic risk. Furthermore, deferral would provide an opportunity to evaluate the use by other programs of FMEF areas not needed to support IHLW interim storage.

Although the PUREX Plant offers ample storage capacity at a low unit life-cycle cost, its initial implementation cost is relatively large. Moreover, technical viability is much less certain. Substantial resources could be expended to fully assess technical viability, only to conclude that the PUREX Plant is not an acceptable option. Given the uncertain outcome, there would be significant risk associated with adopting the PUREX Plant as the baseline for Phase 1 interim storage.

Even with use of the existing facilities recommended herein for IHLW interim storage, new construction will eventually become necessary at or near the initiation of Phase 2. Either the CSB or FMEF can accommodate the storage capacity needed for the Phase 1 minimum order quantity. However, the combined storage capacity of both facilities can accommodate only between 10% and 15% of the 12,600 IHLW canisters produced in Phase 1 and Phase 2. Although a decision can be deferred for several years, a new construction architecture must ultimately be selected to support the bulk of Phase 2 production. A detailed implementation plan should be prepared to support multi-year work planning related to providing for the Phase 2 interim storage capability.

While new construction alternatives do not compete favorably with existing facilities for the initial Phase 1 period, once they become necessary a WVS-type system (open-bay, rack-storage, forced-air ventilation) seems to exhibit a modest cost advantage. Regardless of new construction architecture selected, siting the interim storage facility near the TWRS-P production facility would not result in any appreciable cost reduction, but coupling the storage facility to the production facility may result in a modest initial capital cost reduction.

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APPENDIX A

TECHNICAL BASIS FOR PARAMETRIC COST ESTIMATE

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CONTENTS

LIST OF FIGURES

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APPENDIX A

TECHNICAL BASIS FOR PARAMETRIC COST ESTIMATE

A technical basis for the alternative must be defined before a parametric cost estimate can be performed. The technical basis includes identification of all pertinent systems, structures, and components (e.g., building size, number and capacity of cranes, ventilation capacity, etc.). This appendix describes the technical scope of alternatives upon which the parametric cost estimate was based. All alternatives are based on a remote operation and contact maintenance approach for all activities related to removing an immobilized high-level waste (IHLW) canister from the onsite transportation cask and emplacement into interim storage.

A1.0 EXISTING FACILITY – TECHNICAL DESCRIPTION

Detailed technical scope was developed for two existing facilities. The Plutonium/Uranium Extraction (PUREX) Plant was selected to encompass existing canyon facility alternatives in the reevaluation process, yet limit the expenditure of resources on less-than-promising options. The PUREX Plant represents the existing canyon facility retrofit alternative with the greatest potential for competing with the baseline architecture. In addition, the Fuels and Materials Examination Facility (FMEF) also warrants examination given the programmatic developments with respect to required interim storage capacity for Phase 1. The following provides the technical scope of these alternatives.

A.1.1 ALTERNATIVE 2a – PLUTONIUM-URANIUM EXTRACTION PLANT

This option entails retrofit modification of the PUREX Plant for an IHLW interim storage mission. An essential assumption embodied in this technical description and subsequent parametric cost estimate is that the PUREX Plant process cells will be dispositioned for final closure before initiation of retrofit modifications. In addition, cell disposition will include removal of external radiation to the degree that full-time occupational occupancy atop the canyon cover blocks is allowed for decontamination and construction activities. These assumption have important ramifications in the cost and implementation schedule developed for this alternative.

Modifications necessary to resolve technical uncertainties, such as possible structural enhancements to the east canyon wall, are not addressed in the parametric cost estimate because the technical scope cannot be adequately defined. However, a reasonable effort was undertaken to bound the cost of structural upgrades in the total project cost (see Section 7.3 in the main document). In addition, issues related to unknown structural modifications are identified as technical risks (see Section 8.5.3).

As depicted in Figures A-1 and A-2, the IHLW canisters are stored in racks located atop the canyon cover blocks. The rack system is similar to that used at the West Valley Site (WVS) (Connors et al. 1998). Only limited areas of the PUREX Plant will be activated (primarily the canyon area and railroad tunnel). Large areas of the PUREX Plant will remain deactivated, including most operating galleries and office annexes. To effect this option the following describes major upgrades to the PUREX Plant that are known to be required.

Canyon Crane – The 40-ton capacity slave canyon crane is refurbished and re-energized. Refurbishment includes installation of a closed-circuit television on the crane to render it fully remote. The crane also has a new canister grapple that is identical to that used at the WVS. Crane maintenance will be a contact (manual) activity that is conducted in the existing crane maintenance bay located at the east canyon end. This crane maintenance bay has an existing shield door that can be closed to isolate this area during human entry.

Canyon Floor – A 0.3 m concrete slab is poured over the entire canyon deck (i.e., atop cell cover blocks) to create an impervious seal between the process cells and canyon. The footprint of this concrete slab is 247.8 m long by 9.5 m wide. A raised steel floor with a foot print of 50.6 m long by 9.5 m wide is constructed atop the new concrete slab. The steel floor, supported by steel framing, is approximately 0.6 m high.

Storage Rack – A storage rack system is installed atop the raised floor. The rack system is similar to the WVS design, but is only one canister high. Thirty-four standard rack modules (18 standard canisters per module) and 1 overpack rack module (6 overpack canisters per module) are required to accommodate 600 IHLW canisters.

Ventilation System – A new safety class ventilation system is installed to provided the required cooling. The rated capacity of this system is 1,388 m^3/min at standard conditions (temperature and pressure).

The ventilation system includes a new air supply subsystem. The supply air is routed into the canyon where it is distributed into ducts located in the area between the new concrete slab and raised floor (i.e., intake plenum). The raised floor contains ventilation ports positioned below the storage racks. These ports are distributed along the length of the canyon. Air supply ducts distribute supply air to these ports. Before its introduction into the canyon, the air is conditioned through a bank of roughing filters to remove particulate matter. The air supply is drawn through an intake stack that is essentially equivalent to that specified in the Project W-464 conceptual design report (FDNW 1998).

The new air supply subsystem (including the intake stack) is mounted on a 1.5 m thick concrete slab outside the building. The slab is 31.5 m long by 6.0 m wide. The slab floor space is 189 m^2 and occupies 284 m^3. The intake filters are enclosed in a Butler-type Building with overall dimensions of 31.5 m long by 4.6 m wide by 9.5 m tall. The overall floor space is 145 m^2 and the overall structure occupies 1,377 m^3.

Figure A-1. Plutonium-Uranium Extraction Plant Retrofit (Plan View).

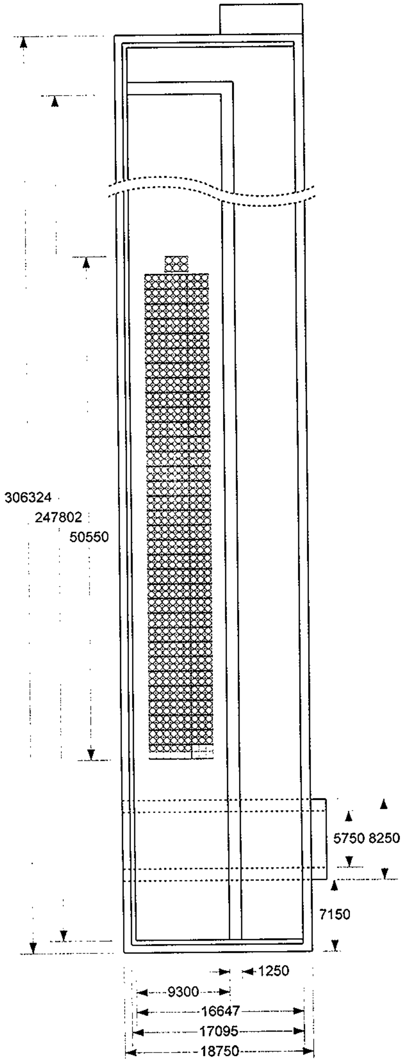
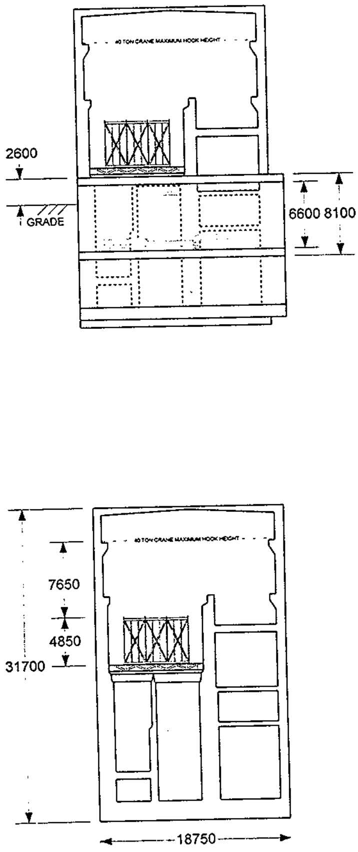


Figure A-2. Plutonium-Uranium Extraction Plant Retrofit (Section View).



A new exhaust duct is installed to rout exhaust air to a new building located external to the PUREX Plant. Housed in this new building are parallel trains of high-efficiency particulate air (HEPA) filters and blowers (primary and redundant). The rated capacity of each train is 1,388 m^3/min at standard conditions (temperature and pressure). The treated air is discharged via a new exhaust stack that is essentially equivalent to that specified in the Project W-464 conceptual design report.

The HEPA filters and blowers are enclosed in a Butler-type Building with overall dimensions of 31.5 m long by 7.5 m wide by 9.5 m tall. The overall floor space is 236 m^2 and the overall structure occupies 2,244 m^3. The exhaust ventilation building sits atop a 1.5 m thick concrete slab. The slab is 31.5 m long by 7.5 m wide. The slab floor space is 236 m^2 and occupies 354 m^3.

Electrical and Instrumentation – The emergency power system is refurbished and reenergized. New safety class electrical and instrumentation systems are installed to support the new ventilation system.

A.1.2 ALTERNATIVE 2b – FUELS AND MATERIALS EXAMINATION FACILITY

This option entails retrofit modification of the FMEF for an IHLW interim storage mission. As depicted in Figures A-3 and A-4, the IHLW canisters are stored in racks located in the Nondestructive Examination Cell. The rack system is similar to that used at the WVS (Connors et al. 1998). To effect this option, the following paragraphs describe major upgrades required to the FMEF.

Cell Crane – A 6-ton capacity crane is installed in the Nondestructive Examination Cell and two 6-ton capacity cranes are installed in the Decontamination Cell. The two cranes in the Decontamination Cell are required because crane maintenance in this cell will be based on personnel access. The redundant crane will allow external radiation sources (i.e., IHLW canisters) to be removed from the cell in the event the primary crane fails. The cranes have a canister grapple that is identical to that used at the WVS.

Cask Crane – A 60-ton cask crane is installed in the entry tunnel. This crane provides for transport of the cask from the load-in/load-out hatch in the truck bay to a position below the Decontamination Cell. This crane removes the cask lid, allowing the canister to be extracted into the Decontamination Cell via an existing penetration in the floor.

Crane Maintenance Bay – A crane maintenance bay with shield door is installed in the Nondestructive Examination Cell to allow for human entry (i.e., contact maintenance). The existing FMEF design necessitates personnel access for crane maintenance, which would not be possible once IHLW canisters were introduced for storage. The crane maintenance bay is installed at the east wall of the Nondestructive Examination cell approximately 12 m above the floor. This area consists of a 0.3 m thick carbon steel floor and a 0.3 m thick shield door. The floor dimensions are 12 m wide by 3 m deep. The shield door is 12 m wide by 4 m high.

Figure A-3. Fuels and Materials Examination Facility Retrofit (Plan View).

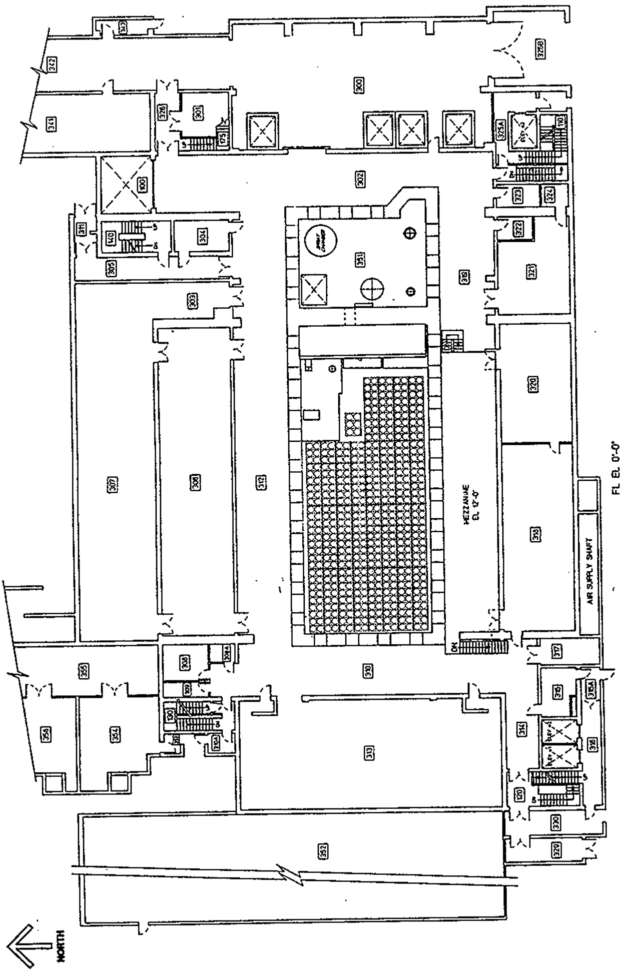
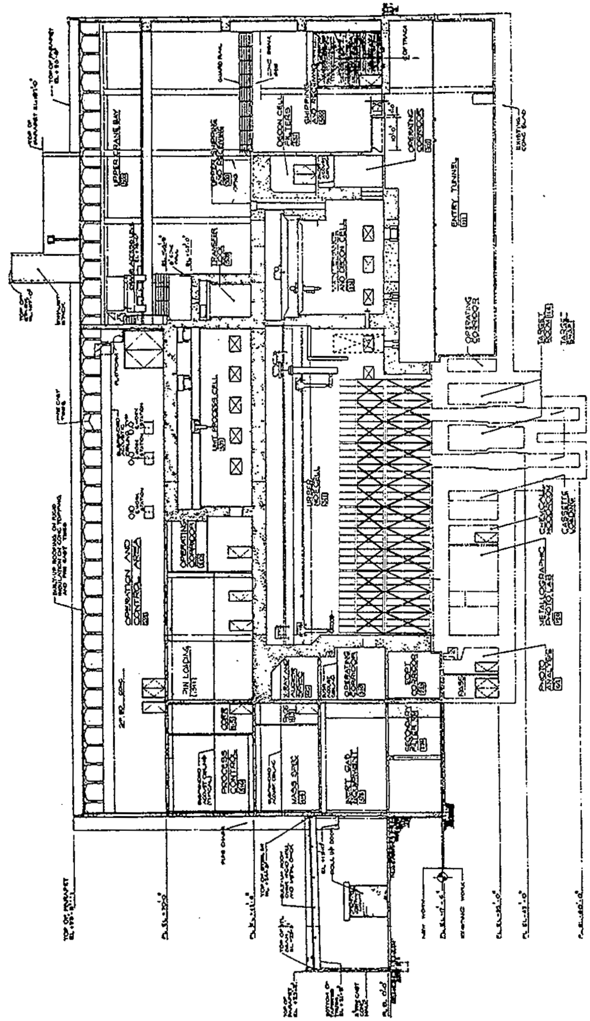


Figure A-4. Fuels and Materials Examination Facility Retrofit (Section View).



Storage Rack – A storage rack system is installed atop the Nondestructive Examination Cell floor. The rack system is similar to the WVS design, but only part of the system is two canisters high. Twenty-two single-stack rack modules (18 standard canisters per module), 6 dual-stack (36 standard canisters per module), and 1 overpack rack module (6 overpack canisters per module) are required. The lower layer contains 504 canisters and the upper layer contains 96 canisters.

Shield Windows – Two 1.2 m by 1 m shield windows are installed in existing openings in the Nondestructive Examination Cell west wall. Three shield windows of identical dimensions are installed in existing opening in the Decontamination Cell (north, south, and east walls).

Shield Door – A 1.2 m wide by 6 m high opening is cut in the wall (at floor level) between the Decontamination Cell and the Nondestructive Examination Cell. This opening allows the transfer of canisters from the Decontamination Cell into the Nondestructive Examination Cell. To provide for biological shielding during periods of personnel maintenance in the Decontamination Cell, a 1.2 m by 6 m sliding shield door is installed in the Decontamination Cell.

Transfer Cart – A transfer cart is installed in the Decontamination Cell to effect canister movement between this cell and the Nondestructive Examination Cell.

Miscellaneous Structural Modifications – A 1.8 m wide by 4.8 m opening is cut in the concrete wall (at the 0-0 elevation level) between the Nondestructive Examination Cell and the operating gallery. This opening allows convenient access to the cell during retrofit construction. At the conclusion of construction, this opening will be sealed with rebar and high-density concrete.

In addition, 22 existing shield window penetrations in the Nondestructive Examination Cell and 6 existing shield window penetrations in the Decontamination Cell must be sealed with rebar and high-density concrete. These openings are 1.3 m wide by 1 m high by 1.3 m deep.

A 1.3 m diameter opening must be cut in the floor of the Unit Process Cell and a 1.3 m thick shield plug inserted. The opening is located above the new crane maintenance bay and allow access into this area.

A2.0 NEW CONSTRUCTION – TECHNICAL DESCRIPTION

Several technology variations are possible for a new construction alternative. These technologies can be grouped into three general categories: Spent Nuclear Fuel-type (SNF-type) facilities, Savannah River Site-type (SRS-type) facilities, and West Valley Site-type (WVS-type) facilities. The SNF-type is a sealed-tube, natural convection system; the SRS-type is a open-tube, forced-air ventilation system; and the WVS-type is an open-bay, forced-air ventilation system. Because neither the open-tube nor the rack storage systems provide safety class confinement, the ventilation exhaust from the SRS-type facility and WVS-type facility require treatment by HEPA filtration. Based on these general categories of interim storage technologies, specific sub-alternatives were developed. The remainder of this appendix provides a detailed description of these alternatives.

The purpose for developing these new construction sub-alternatives was to provide a basis for subsequent preparation of a parametric cost estimate. Once a cost estimate was developed for each type of storage technology, it could be ascertained whether a specific technology afforded any appreciable cost advantage relative to the other new construction technologies.

A.2.1 ALTERNATIVE 3a – SPENT NUCLEAR FUEL-TYPE FACILITY

As depicted in Figures A-5 and A-6, this option entails new construction of an SNF-type facility. Vault cooling is via natural convection. The storage tubes provide safety class confinement. The following describes major components included in this option.

Vault Storage Structure – This structure contains two vaults. Each vault contains 150 standard storage tubes. One vault contains three additional overpack storage tubes. The overall dimensions of the two below-grade vaults (including their intake and exhaust plenums, walls, base mat, operations deck, etc.) are 35.5 m long by 46.3 m wide by 14.3 m tall. The overall floor space is 1,644 m^2 and the overall vault storage structure occupies 23,504 m^3. Each vault has a dedicated intake stack and exhaust stack that are identical to those specified in the Project W-464 conceptual design report.

Load-In/Load-Out Area – This structure is a concrete slab containing a cask transfer pit. The pit is identical to that specified in the Project W-464 conceptual design report for the new load-in/load-out annex (see Drawing ES-W464-MO1 in the conceptual design report [FDNW 1998]). The pit contains a 10-ton crane for removal of the cask lid. The entire structure is enclosed within the Operations Deck Building.

The dimensions of this structure (excluding the above-grade enclosure) are 11.3 m long by 34.6 m wide. The base mat slab is 1.5 m thick concrete. The overall floor space is 391 m^2 and the overall concrete structure occupies 586 m^3. This structure is functionally equivalent to the load-in/load-out annex specified in the Project W-464 conceptual design report.

Figure A-5. Spent Nuclear Fuel-Type Facility (Plan View).

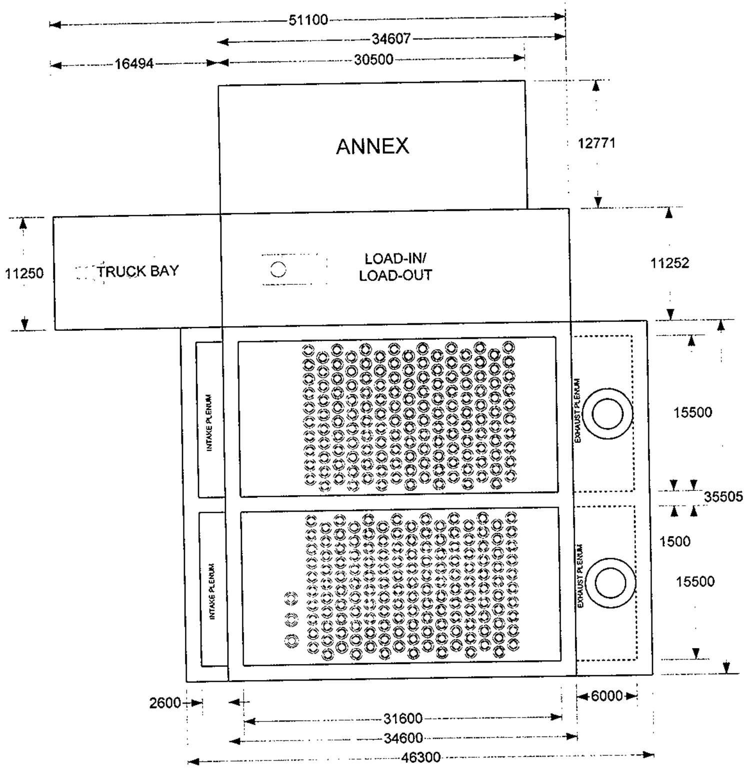
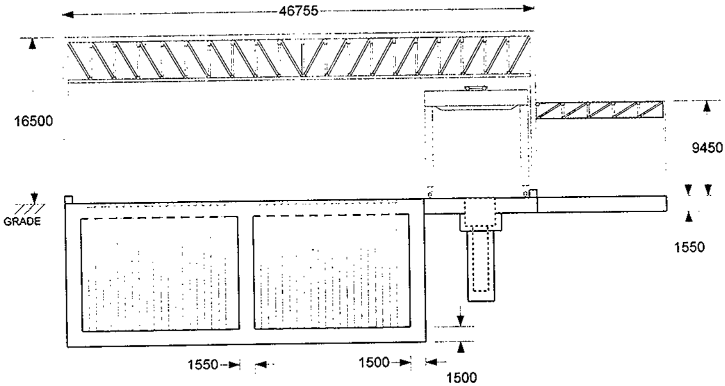
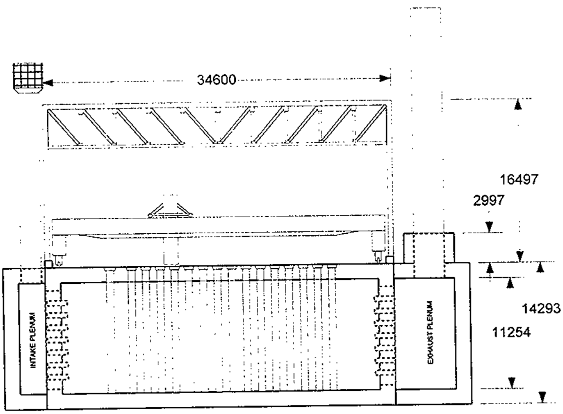


Figure A-6. Spent Nuclear Fuel-Type Facility (Section View).





<u>Cask Crane</u> – Located within the load-in/load-out area is a 60-ton crane with a 10-ton hook. This crane is used to move the cask between the transport trailer and transfer pit. The crane is identical to that specified in the Project W-464 conceptual design report for the new load-in/load-out annex.

<u>Operations Deck Building</u> – Covering the vault operations deck and extending over the load-in/load-out area is a Butler-type Building. The dimensions of this structure are 46.8 m long by 34.6 m wide by 16.5 m tall. The overall floor space is 1,619 m^2 and the overall structure occupies 26,718 m^3. This building is functionally equivalent to the SNF Operations Deck Building.

<u>Canister-Handling Machine</u> – Located within the Operations Deck Building is a crane/shield-cask assembly. This crane effects the movement of IHLW canisters within the building. This assembly is functionally equivalent to the multi-canister overpack handling machine (MHM) procured by the SNF Program.

<u>Truck Bay</u> – This structure is a 1.5 m thick concrete slab covered by a 16.5 m high Butler-type Building. The dimensions of this structure are 11.3 m long by 16.5 m wide by. The overall floor space is 186 m^2. The overall structure occupies 3,356 m^3, with 280 m^3 being the concrete slab and 3,076 m^3 being the above-grade enclosure. This building is functionally equivalent to the SNF truck bay.

<u>Operations Support Annex</u> – This structure is a 1.5 m concrete slab covered by a 9.5 m high Butler-type enclosure. The dimensions of this structure are 12.8 m long by 30.5 m wide. The overall floor space is 390 m^2. The overall structure occupies 4,294 m^3, with 586 m^3 being the concrete slab and 3,709 m^3 being the above-grade enclosure. This building is functionally equivalent to the SNF operations annex.

A.2.2 ALTERNATIVE 3b – SAVANNAH RIVER SITE-TYPE FACILITY

As depicted in Figures A-7 and A-8, this option entails new construction of a Canister Storage Building (CSB) that is similar in concept to that in operation at the SRS. This option is identical to Alternative 3a with the following exceptions. Vault cooling is via forced-air convection. The vault structure (including intake and exhaust plenums) and ventilation system provide safety class confinement. The storage tubes are open and, therefore, do not provide safety class confinement. The following paragraphs describe major components included in this option.

<u>Vault Storage Structure</u> – This structure contains two vaults. Each vault contains 150 standard storage tubes. One vault contains three additional overpack storage tubes. The overall dimensions of the two below-grade vaults (including their intake and exhaust plenums, walls, base mat, operations deck, etc.) are 35.5 m long by 46.3 m wide by 14.3 m tall. The overall floor space is 1,644 m^2 and the overall vault storage structure occupies 23,504 m^3.

Figure A-7. Savannah River Site-Type Facility (Plan View).

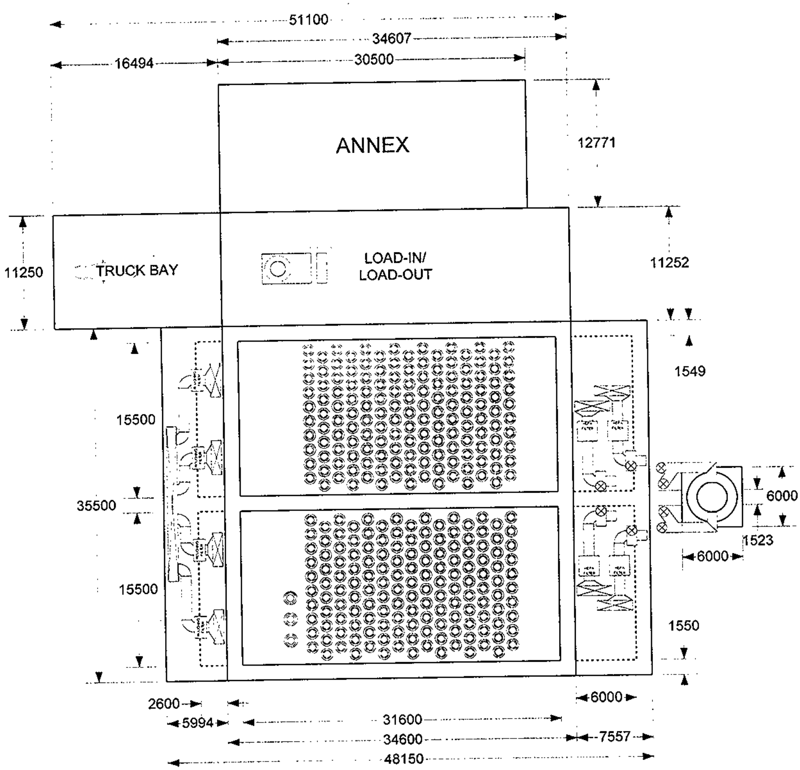
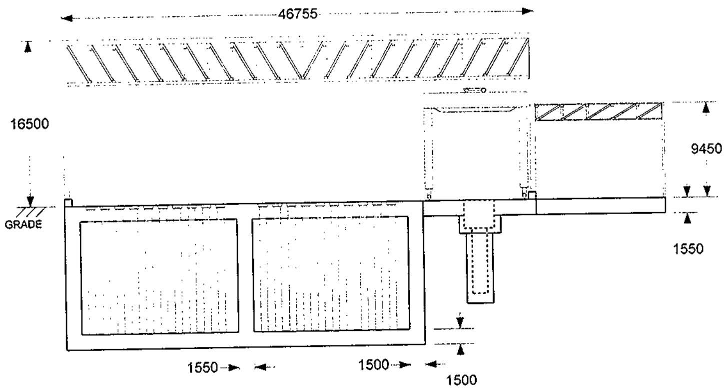
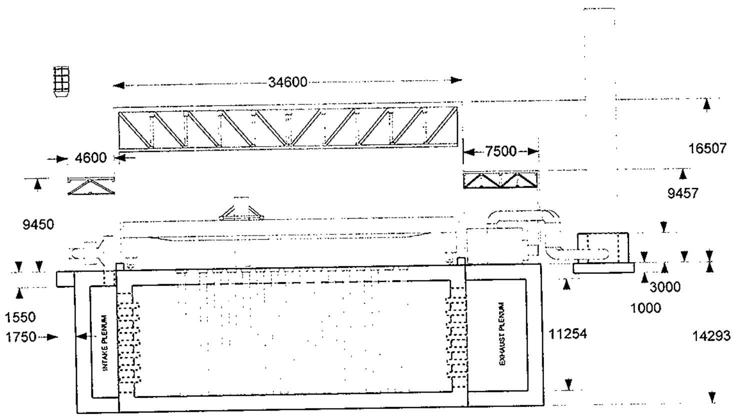


Figure A-8. Savannah River Site-Type Facility (Section View).





Ventilation System – A single intake stack and single exhaust stack serve both vaults because the active ventilation system provides a mechanical motive force to overcome air flow resistance. The stacks are essentially identical to those specified in the Project W-464 conceptual design report.

Atop each intake plenum is a bank of roughing filters to remove particulate matter from the intake air. The intake system capacity (total for both vaults) is 1,388 m^3/min at standard conditions (temperature and pressure). The intake filters are enclosed in a Butler-type Building with overall dimensions of 35.5 m long by 4.6 m wide by 9.5 m tall. The overall floor space is 163 m^2 and the overall vault storage structure occupies 1,551 m^3.

The intake ventilation building and intake stack sit atop a 1.5 m thick concrete slab. The slab is 35.5 m long by 6.0 m wide. The slab floor space is 213 m^2 and occupies 320 m^3.

Atop each exhaust plenum is a bank of HEPA filters and blower. The blower draws exhaust through the HEPA filters to remove particulate matter from the exhaust air, thereby providing safety class confinement. Each vault has two redundant systems (HEPA filter and blower) and the rated capacity of each system is 694 m^3/min at standard conditions (temperature and pressure). The HEPA filters and blowers are enclosed in a Butler-type Building with overall dimensions of 35.5 m long by 7.5 m wide by 9.5 m tall. The overall floor space is 266 m^2 and the overall structure occupies 2,529 m^3.

The exhaust ventilation building sits atop a 1.5 m thick concrete slab. The slab is 35.5 m long by 7.5 m wide. The slab floor space is 266 m^2 and occupies 399 m^3.

Load-In/Load-Out Area – This structure is a concrete slab containing a cask transfer pit. The pit is identical to that specified in the Project W-464 conceptual design report for the new load-in/load-out annex (see Drawing ES-W464-MO1 in the conceptual design report [FDNW 1998]). The pit contains a 10-ton crane for removal of the cask lid. The entire structure is enclosed within the Operations Deck Building.

The dimensions of this structure (excluding the above-grade enclosure) are 11.3 m long by 34.6 m wide. The base mat slab is 1.5 m thick concrete. The overall floor space is 391 m^2 and the overall concrete structure occupies 586 m^3. The structure is functionally equivalent to the load-in/load-out annex specified in the Project W-464 conceptual design report.

Cask Crane – Located within the load-in/load-out area is a 60-ton crane with a 10-ton hook. This crane is used to move the cask between the transport trailer and transfer pit. The crane is identical to that specified in the Project W-464 conceptual design report for the new load-in/load-out annex.

Operations Deck Building – Covering the vault operations deck and extending over the load-in/load-out area is a Butler-type Building. The dimensions of this structure are 46.8 m long by 34.6 m wide by 16.5 m tall . The overall floor space is 1,619 m^2 and the overall structure occupies 26,718 m^3. This building is functionally equivalent to the SNF Operations Deck Building.

Canister-Handling Machine – Located within the Operations Deck Building is a crane/shield cask assembly. This crane effects the movement of IHLW canisters within the building. This equipment is functionally equivalent to the MHM procured by the SNF Program.

Truck Bay – This structure is a 1.5 m thick concrete slab covered by a 16.5 m high Butler-type Building. The dimensions of this structure are 11.3 m long by 16.5 m wide. The overall floor space is 186 m^2. The overall structure occupies 3,356 m^3, with 280 m^3 being the concrete slab and 3,076 m^3 being the above-grade enclosure. This building is functionally equivalent to the SNF truck bay.

Operations Support Annex – This structure is a 1.5 m concrete slab covered by a 9.5 m high Butler-type enclosure. The dimensions of this structure are 12.8 m long by 30.5 m wide. The overall floor space is 390 m^2. The overall structure occupies 4,294 m^3, with 586 m^3 being the concrete slab and 3,709 m^3 being the above-grade enclosure. This building is functionally equivalent to the SNF operations annex.

A.2.3 ALTERNATIVE 3c – WEST VALLEY SITE-TYPE FACILITY

As depicted in Figures A-9 and A-10, this option entails new construction of a CSB that is similar in concept to that in operation at the WVS. This option is based on a hot-cell approach for IHLW canister storage. Cell cooling is via forced-air convection. The cell structure and ventilation system provide safety class confinement. Rather than storage tubes, the IHLW canisters are emplaced in an open-rack assembly. The following paragraphs describe the major components.

Storage Cell Structure – This structure is a single hot cell (shielded canyon). A rack system is provided for storage of 612 standard canisters and 6 overpack canisters. The slight over-capacity was driven by a goal to maintain a rack module configuration identical to that employed at the WVS (Connors et al. 1998).

The overall dimensions of the cell (including its containment/shielding concrete structure) are 44.8 m long by 13.1 m wide by 22.9 m tall. The overall footprint is 587 m^2 and the overall storage cell structure occupies 13,440 m^3. The cell has a single intake stack and a single exhaust stack. The stacks are essentially identical to those specified in Alternative 1.

The cell is divided into three distinct section. The storage area internal dimensions are 30 m long by 8 m wide by 19.8 m tall. The area above the Load-In/Load-Out Cell is 7.3 m long by 8 m wide by 8.5 m tall. This area has a shield plug in its floor that allows IHLW canisters to be extracted from the Load-In/Load-Out Cell, via the canyon crane, into the Storage Cell. At the far end of the cell is a crane maintenance area with dimensions of 4.5 m long by 10 m wide by 3.5 m tall. The crane maintenance area is separated from the Storage Cell by a 10 m wide by 3.5 m tall by 0.3 m thick steel shield door, thereby allowing human entry for contact maintenance.

Figure A-9. West Valley Site-Type Facility (Plan View).

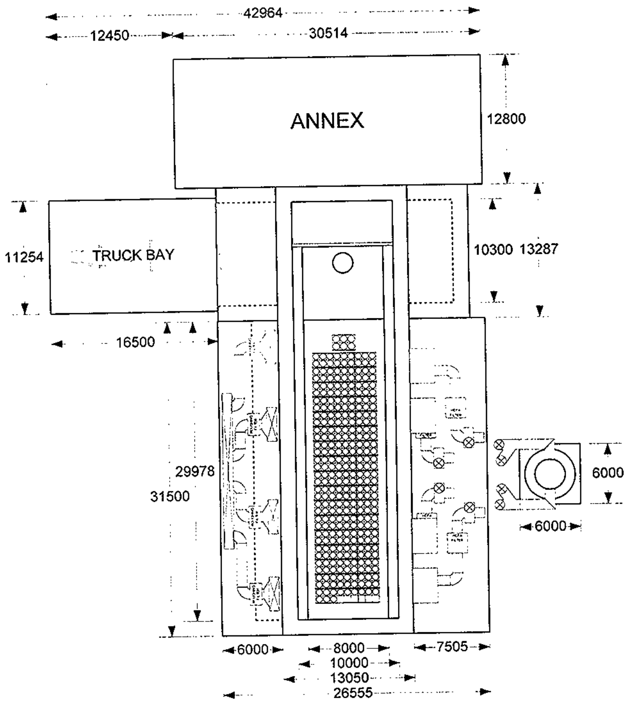
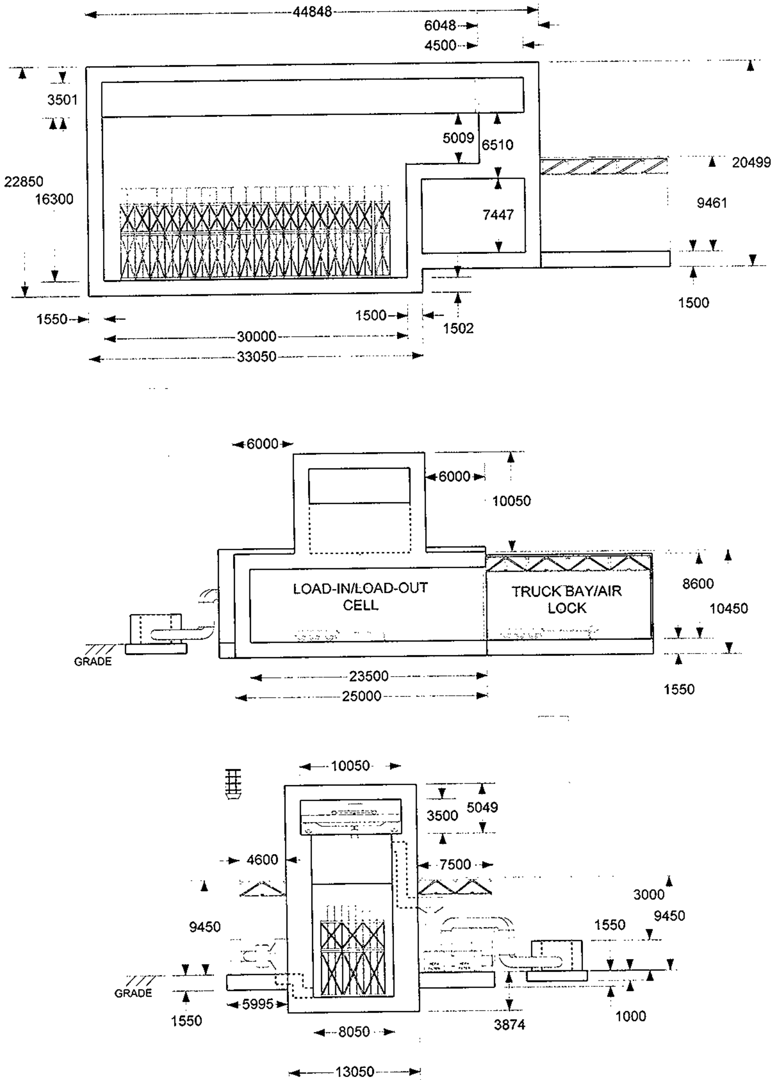


Figure A-10. West Valley Site-Type Facility (Section View).



Ventilation System – Air is introduced into the storage cell via intake ports located along the base of the shield wall. Before introduction, the air is conditioned through a bank of roughing filters to remove particulate matter. The intake system capacity (total for the cell) is 1,388 m^3/min at standard conditions (temperature and pressure). The intake filters are enclosed in a Butler-type Building with overall dimensions of 31.5 m long by 4.6 m wide by 9.5 m tall. The overall floor space is 145 m^2 and the overall structure occupies 1,377 m^3.

The intake ventilation building and intake stack sit atop a 1.5 m thick concrete slab. The slab is 31.5 m long by 6.0 m wide. The slab floor space is 189 m^2 and occupies 284 m^3.

Air is exhausted from the cell via exhaust ports located along the upper portion of the shield wall. A blower draws the exhaust air through a bank of HEPA filters to remove particulate matter from the exhaust air, thereby providing safety class confinement. The cell has two parallel systems and two redundant systems (HEPA filter and blower). The rated capacity of each system is 694 m^3/min at standard conditions (temperature and pressure). The HEPA filters and blowers are enclosed in a Butler-type Building with overall dimensions of 31.5 m long by 7.5 m wide by 9.5 m tall. The overall floor space is 236 m^2 and the overall structure occupies 2,244 m^3.

The exhaust ventilation building sits atop a 1.5 m thick concrete slab. The slab is 31.5 m long by 7.5 m wide. The slab floor space is 236 m^2 and occupies 354 m^3.

Canyon Crane – The canyon crane is a 6-ton hoist mounted atop a motorized trolley. The crane is fully remote with a closed-circuit television that is used for positioning. The canister grapple is identical to that used at the WVS.

Load-In/Load-Out Cell – This structure is a shielded concrete cell. The structure is located beneath the load-in and crane maintenance areas of the Storage Cell.

The dimensions of the horizontal structure (including the shielding/confinement structure) are 13.3 m long by 25.0 m wide by 10.5 m tall. The overall floor space is 333 m^2 and the overall structure occupies 3,491 m^3. The Load-In/Load-Out Cell is separated from the truck bay by a 10 m wide by 8.6 m tall by 0.3 m thick steel shield door.

Truck Bay – This structure is a 1.5 m thick concrete slab covered by an 8.6 m high Butler-type Building. The truck bay serves as an air lock between the environment and the Load-In/Load-Out Cell. The dimensions of this structure are 11.3 m long by 16.5 m wide. The overall floor space is 186 m^2. The overall structure occupies 2,051 m^3, with 280 m^3 being the concrete slab and 1,603 m^3 being the above-grade enclosure. This building is functionally equivalent to the SNF truck bay.

Operations Support Annex – This structure is a 1.5 m concrete slab covered by a 9.5 m high Butler-type enclosure. The dimensions of this structure are 12.8 m long by 30.5 m wide. The overall floor space is 390 m^2. The overall structure occupies 4,294 m^3, with 586 m^3 being the concrete slab and 3,709 m^3 being the above-grade enclosure. This building is functionally equivalent to the SNF operations annex.

A3.0 REFERENCES

Connors, B. J., R. A. Meigs, D. M. Pezzimenti, and P. M. Vlad, 1998, *High-Level Waste Canister Storage, Final Design, Installation, and Testing*, DOE/NE/44139-85, West Valley Nuclear Services, Inc., West Valley, New York.

FDNW, 1998, *Conceptual Design Report for Immobilized High-Level Waste Interim Storage Facility (Phase 1), Project W-464*, HNF-2298, Rev. 1, prepared by Fluor Daniel Northwest, Inc., for Fluor Daniel Hanford, Inc., Richland, Washington.

APPENDIX B

PARAMETRIC COST ESTIMATE

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CONTENTS

LIST OF TABLES

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APPENDIX B

PARAMETRIC COST ESTIMATE

The direct costs were parametrically estimated using the INSITE Construction Model. This computer software was developed by the U.S. Department of Energy, Office of Construction and Capital Projects. The estimated direct costs are based primarily on the cost for similar equipment, components, or structures as extracted from historical Hanford Site cost estimates.

B1.0 MAJOR COST SOURCES

The following identifies major sources of input for the INSITE parametric estimate.

- The Project B-595, Hanford Waste Vitrification Plant, cost estimate (Revision F, July 1991) was used for the main structure cost element. This cost element includes items such as architectural structures; building heating, ventilation, and air conditioning; and electrical and mechanical systems.

- The vault/cell canister cooling system cost was extracted from the Project W-059, B Plant Ventilation Upgrade, cost estimate (Definitive Design Final, October 1998). This cost element includes items such as the exhausters and high-efficiency particulate air filters.

- For items that were essentially equivalent to systems, structures, or components specified for the Spent Nuclear Fuel (SNF) Canister Storage Building (e.g., intake/exhaust stacks, Operations Support Building, truck bay, etc.), the costs were based on either the Project W-464, Immobilized High-Level Waste (IHLW) Interim Storage Facility, cost estimate (Revision 1, October 1998) or the Project W-379, SNF Interim Storage Facility, cost estimate (Conceptual Design, July 1995).

- For specialty items (e.g., open storage tubes or storage racks), the costs were obtained through communications with staff at the West Valley Demonstration Plant, West Valley Site, New York, or the Defense Waste Processing Facility, Savannah River Site, South Carolina.

These cost estimates were parametrically adjusted to reflect the various attributes of the proposed alternatives (e.g., building size and storage capacity, vault/cell cooling capacity, etc.), and escalated to 1998 dollars. Further details of the direct cost estimates are provided in the remainder of this appendix.

B2.0 SUMMARY TECHNICAL SPECIFICATION

Table B-1 provides the summary specification upon which the estimated direct costs are ultimately based.

Table B-1. Alternative Specification Summary.

Feature	Alternative				
	2a PUREX	2b FMEF	3a SNF-type	3b SRS-type	3c WVS-type
Main structure (m^3)	--	59	7,928	7,900	7,765
Major equipment	--	--	--	--	--
• Tubes/plugs	--	--	303	303	--
• Rack modules	35	28	--	--	18
• Canister-handling machine	--	--	1	1	--
• Remote 6-ton crane	--	3	--	--	1
• Refurbished 40-ton crane	1	--	--	--	--
• Steel floor (m^2)	481	--	--	--	--
• Concrete floor (m^2)	2,354	--	--	--	--
• Shield door	--	2	--	--	2
• Shield window	--	5	--	--	--
• 60-ton crane	--	1	--	--	--
• Canister transfer cart	--	1	--	--	--
• Crane maintenance bay (m^2)	--	36	--	--	--
• Overpack station	1	1	--	--	1
Ventilation System	--	--	--	--	--
• Cell/vault cooling (m^3/min)	1,388	--	--	1,388	1,388
• Intake stack	1	--	2	1	1
• Exhaust stack	1	--	2	1	1
Load-in/load-out (m^2)	--	--	391	391	--
• Receiving pit	--	--	1	1	--
• 60-ton crane	--	--	1	1	--
• 10-ton crane	--	1	1	1	--
• Overpack station	--	--	1	1	--
Operations annex (m^2)	--	--	390	390	390
Truck bay (m^2)	--	--	186	186	186
Emergency generator (kW)	150	--	--	150	150

B3.0 SUMMARY FACILITY DIRECT COST

Table B-2 summarizes direct costs resulting from the parametric estimate.

Table B-2. Alternative Facility Direct Cost Summary. (2 sheets)

Feature	Alternative[1]				
	2a PUREX	2b FMEF	3a SNF-type	3b SRS-type	3c WVS-type
Total direct cost	$6,752	$5,726	$62,172	$63,943	$42,766
Major sub-elements					
Main structure[2]	--	$81	$41,718	$46,446	$35,155
Major equipment	$2,398	$5,645	$12,692	$7,831	$3,401
• Tubes/plugs	--	--	$10,859	$5,998	--
• Rack modules	$885	$860	--	--	$911
• Canister-handling machine	--	--	$1,833	$1,833	--
• Remote 6-ton crane	--	$837	--	--	$279
• Refurbished 40-ton crane	$250	--	--	--	--
• Steel floor	$63	--	--	--	--
• Concrete floor	$513	--	--	--	--
• Shield door	--	$856	--	--	$1,525
• Shield window	--	$214	--	--	--
• 60-ton crane	--	$1,575	--	--	--
• Canister transfer cart	--	$323	--	--	--
• Crane maintenance bay	--	$295	--	--	--
• Overpack station	$687	$687	--	--	$687
Ventilation System	$4,317	--	$1,718	$3,584	$3,584
• Cell/vault cooling	$3,457	--	--	$2,725	$2,725
• Intake stack	$305	--	$610	$305	$305
• Exhaust stack	$554	--	$1,108	$554	$554
Load-in/load-out[3]	--	--	$5,457	$5,457	--
• 60-ton crane	--	--	$1,575	$1,575	--
• 10-ton crane	--	--	$279	$279	--
• Overpack station	--	--	$687	$687	--
Operations annex[3]	--	--	$398	$398	$398
Truck bay[3]	--	--	$190	$190	$190
Emergency generator	$38	--	--	$38	$38

Table B-2. Alternative Facility Direct Cost Summary. (2 sheets)

Feature	Alternative[1]				
	2a PUREX	2b FMEF	3a SNF-type	3b SRS-type	3c WVS-type

[1]All costs are in thousands of dollars with no contingency or escalation.
[2]Includes additional cost elements not depicted, such as architectural structure; electrical/mechanical; *heating, ventilation, and air conditioning, etc.*
[3]Includes additional cost elements not depicted, such as concrete slab, metal enclosure, and miscellaneous equipment.

B4.0 BACKUP DETAILS

The following pages provide backup details.

Cost Estimate **ALT 2A**

- [6,713,641] ALT 2A
  - [2,398,002] Major Equipment
    - [884,800] Racks Moduled
    - [250,000] Remote 40-Ton Crane (Refurbish)
    - [63,296] Steel Floor
    - [513,385] Concrete Floor
    - [686,521] Overpack Station
  - [4,315,639] Ventilation System (including slab, enclosure,stacks, and equipment)
    - [3,456,859] Cell/Vault HVAC
    - [304,830] Intake Stack
    - [553,950] Exhaust Stack

Report Settings   Contractor Distribution Report

Reported From: ALT 2A

NOTES:

1.) All features of SUCCESS are functional with this report.
2.) If Level Markups are used they should always be at the lowest level of the PWS Branch
3.) Detail line items should only be placed at the lowest level of a PWS Branch
4.) If a Level is collapsed then the detail will not be grouped nor reported. Completely expand the PWS to produce an accurate report
5.) If a level is distributed the amount will be added to the prime contractor amount
6.) Markup records must be percents and applied to all cost components
7.) The Other1,2,3 cost components are combined in the "Others" column.
8.) Reports are accurate to two decimal places (Productivity up to three decimal places).
9.) Multiple Prime Contractors may be used. The "Prime Contractor" totals will include all prime contractors' work, and the Prime Contractor Markups will be the aggregate markup of all prime contractors.
10.) Up to 10 contractor markups per contractor may be used. and must be percentages (not amounts).

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

CONTRACTOR DISTRIBUTION REPORT

Reported From: ALT 2A

CONTRACTOR	MARK-UP PERCENT	LABOR HOURS	LABOR	MATERIAL	EQUIPMENT	OTHERS	SUBTOTAL	% MARKUP	% DIRECT COST	% TOTAL COST
PRIME CONTRACTOR										
DIRECT COST			$0	$0	$0	$6,713,643	$6,713,643			
TOTAL FOR PRIME CONTRACTOR		0	*$0*	*$0*	*$0*	*$6,[illegible]3,643*	*$6,713,643*		100.00%	100.00%
TOTAL DIRECT COST		0	$0	$0	$0	$6,[illegible]13,643	$6,713,643		100.00%	
TOTAL SUBCONTRACTOR MARKUPS			$0	$0	$0	$0	$0			0.00%
TOTAL COST TO PRIME			$0	$0	$0	$6,[illegible]13,643	$6,713,643			
PRIME CONTRACTOR MARKUP	0.00%		$0	$0	$0	$0	$0			0.00%
TOTAL PROJECT COST			**$0**	**$0**	**$0**	**$6,7[illegible]3,643**	**$6,713,643**			

ANTTONEN LUCAS ASSOCIATES INC

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: *C:\My Documents\ALT 2A.PWS*
10/27/1998

DETAIL REPORT by CSI

Reported From: ALT 2A
Report Total: $6,713,643
Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
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DETAIL REPORT by CSI
Reported From: ALT 2A
Report Total: $6,713,643

Unassigned Items Group

DESCRIPTION		QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
MAJOR EQUIPMENT	U.C. per EACH -->	1			$0	$0	$0	1 $1	1 $1
RACK MODULES UPPER & LOWER (WVS)	U.C. per EACH -->	35			$0	$0	$0	25280 $884,800	25280 $884,800
REFURBISH EXISTING ALLOW	U.C. per EACH -->	1			$0	$0	$0	250000 $250,000	250000 $250,000
STEEL FLOOR	U.C. per -->	5,146			$0	$0	$0	12.3 $63,296	12.3 $63,296
12" CONCRETE SLAB (@550 PER CY)	U.C. per SF -->	25,203			$0	$0	$0	20.37 $513,385	20.37 $513,385
OVERPACK (PIT WELD STATION)	U.C. per EA -->	1			$0	$0	$0	686521 $686,521	686521 $686,521
VENTILATION SYSTEM	U.C. per EACH -->	1			$0	$0	$0	1 $1	1 $1
CELL/VAULT HVAC SYSTEM (W059)	U.C. per EA -->	1			$0	$0	$0	3456859 $3,456,859	3456859 $3,456,859
INTAKE STACK (SNF)	U.C. per EA -->	1			$0	$0	$0	304830 $304,830	304830 $304,830
EXHAUST STACK (SNF)	U.C. per EA -->	1			$0	$0	$0	553950 $553,950	553950 $553,950
TOTAL Unassigned Items Group					$0	$0	$0	$6,713,643	$6,713,643

Number of items in Group: *10*

Percent of Total: *100.00%*

ANTTONEN LUCAS ASSOCIATES INC

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: C:\My Documents\ALT 2A.PWS
10/27/1998

DETAIL REPORT NO.1B

Reported From: ALT 2A

Report Total: $6,713,643

Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV " July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW nterim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), nd cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: ALT 2A
Report Total: $6,713,643

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups ALT 2A						$6,713,643
Major Equipment							Tree Depth= 1					
	U.C. per EACH -->						1		1			1
MAJOR EQUIPMENT		1	1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$2,398,002	$0	$2,398,002	$0	$0	$2,398,002
TOTAL Major Equipment				$0	$0	$0	$2,398,003	$0	$2,398,003	$0	$0	$2,398,003
						Estimate Tree Structure Rollups Major Equipment						$2,398,003
Racks Moduled							Tree Depth= 2					
	U.C. per EACH -->						25280		25280			25280
RACK MODULES UPPER & LOWER (WVS)		35	1.000	$0	$0	$0	$884,800	$0	$884,800	$0	$0	$884,800
TOTAL Racks Moduled				$0	$0	$0	$884,800	$0	$884,800	$0	$0	$884,800
						Estimate Tree Structure Rollups Major Equipment						$2,398,003
Remote 40-Ton Crane (Refurbish)							Tree Depth= 2					
	U.C. per EACH -->						250000		250000			250000
REFURBISH EXISTING ALLOW		1	1.000	$0	$0	$0	$250,000	$0	$250,000	$0	$0	$250,000
TOTAL Remote 40-Ton Crane (Refurbish)				$0	$0	$0	$250,000	$0	$250,000	$0	$0	$250,000
						Estimate Tree Structure Rollups Major Equipment						$2,398,003
Steel Floor							Tree Depth= 2					
	U.C. per -->						12.3		12.3			12.3
STEEL FLOOR		5,146	1.000	$0	$0	$0	$63,296	$0	$63,296	$0	$0	$63,296

DETAIL REPORT NO.1B

Reported From: ALT 2A
Report Total: $6,713,643

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$2,398,003
Steel Floor							Tree Depth= 2					
TOTAL Steel Floor				$0	$0	$0	$63,296	$0	$63,296	$0	$0	$63,296
						Estimate Tree Structure Rollups Major Equipment						$2,398,003
Concrete Floor							Tree Depth= 2					
	U.C. per SF -->						20.37		20.37			20.37
12" CONCRETE SLAB (@550 PER CY)	25,203		1.000	$0	$0	$0	$513,385	$0	$513,385	$0	$0	$513,385
TOTAL Concrete Floor				$0	$0	$0	$513,385	$0	$513,385	$0	$0	$513,385
						Estimate Tree Structure Rollups Major Equipment						$2,398,003
Overpack Station							Tree Depth= 2					
	U.C. per EA -->						686521		686521			686521
OVERPACK (PIT WELD STATION)	1		1.000	$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
TOTAL Overpack Station				$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
						Estimate Tree Structure Rollups ALT 2A						$6,713,643
Ventilation System (including slab, enclosure,stacks,							Tree Depth= 1					
	U.C. per EACH -->						1		1			1
VENTILATION SYSTEM	1		1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: ALT 2A
Report Total: $6,713,643

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups ALT 2A						$6,713,643

Ventilation System (including slab, enclosure,stacks,

Tree Depth= 1

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Subtotal Rollup from Child Levels				$0 $0	$0 $0	$0 $0	$1 $4,315,639	$0 $0	$1 $4,315,639	$0 $0	$0 $0	$1 $4,315,639
TOTAL Ventilation System (including slab, enclosure,stacks, and equipment)				**$0**	**$0**	**$0**	**$4,315,640**	**$0**	**$4,315,640**	**$0**	**$0**	**$4,315,640**

Estimate Tree Structure Rollups
Ventilation System (Including slab, enclosure,stacks, and equipment) $4,315,640

Cell/Vault HVAC

Tree Depth= 2

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
CELL/VAULT HVAC SYSTEM (W059)	U.C. per EA -->	1	1.000	$0	$0	$0	3456859 $3,456,859	$0	3456859 $3,456,859	$0	$0	3456859 $3,456,859
TOTAL Cell/Vault HVAC				**$0**	**$0**	**$0**	**$3,456,859**	**$0**	**$3,456,859**	**$0**	**$0**	**$3,456,859**

Estimate Tree Structure Rollups
Ventilation System (Including slab, enclosure,stacks, and equipment) $4,315,640

Intake Stack

Tree Depth= 2

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
INTAKE STACK (SNF)	U.C. per EA -->	1	1.000	$0	$0	$0	304830 $304,830	$0	304830 $304,830	$0	$0	304830 $304,830
TOTAL Intake Stack				**$0**	**$0**	**$0**	**$304,830**	**$0**	**$304,830**	**$0**	**$0**	**$304,830**

Estimate Tree Structure Rollups
Ventilation System (Including slab, enclosure,stacks, and equipment) $4,315,640

Exhaust Stack

Tree Depth= 2

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
EXHAUST STACK (SNF)	U.C. per EA -->	1	1.000	$0	$0	$0	553950 $553,950	$0	553950 $553,950	$0	$0	553950 $553,950

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: ALT 2A
Report Total: $6,713,643

Estimate Tree Structure Rollups
Ventilation System (Including slab, enclosure,stacks, and equipment) $4,315,640

Exhaust Stack

Tree Depth= 2

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
TOTAL Exhaust Stack				$0	$0	$0	$553,950	$0	$553,950	$0	$0	$553,950

Cost Estimate **ALT 2B**

- [5,726,139] ALT 2 B
  - [80,701] Main Structure
    - [80,700] Miiscellaneous Structural Modifications
  - [5,645,438] Major Equipment
    - [859,700] Racks Moduled
    - [837,000] Remote 6-Ton Crane
    - [855,573] Shield Door
    - [213,820] Shield Window
    - [1,575,000] 60-Ton Crane
    - [322,870] Canister Transfer Cart
    - [294,953] Crane maintenance Bay
    - [686,521] Overpack Station

Report Settings **Contractor Distribution Report**

Reported From: ALT 2 B

NOTES:

1.) All features of SUCCESS are functional with this report.
2.) If Level Markups are used they should always be at the lowest level of the PWS Branch
3.) Detail line items should only be placed at the lowest level of a PWS Branch
4.) If a Level is collapsed then the detail will not be grouped nor reported. Completely expand the PWS to produce an accurate report
5.) If a level is distributed the amount will be added to the prime contractor amount
6.) Markup records must be percents and applied to all cost components
7.) The Other1,2,3 cost components are combined in the "Others" column.
8.) Reports are accurate to two decimal places (Productivity up to three decimal places).
9.) Multiple Prime Contractors may be used. The "Prime Contractor" totals will include all prime contractors' work, and the Prime Contractor Markups will be the aggregate markup of all prime contractors.
10.) Up to 10 contractor markups per contractor may be used. and must be percentages (not amounts).

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

CONTRACTOR DISTRIBUTION REPORT

Reported From: ALT 2 B

CONTRACTOR	MARK-UP PERCENT	LABOR HOURS	LABOR	MATERIAL	EQUIPMENT	OTHERS	SUBTOTAL	% MARKUP	% DIRECT COST	% TOTAL COST
PRIME CONTRACTOR DIRECT COST			$450,000	$1,962,000	$0	$3,314,139	$5,726,139			
TOTAL FOR PRIME CONTRACTOR		0	*$450,000*	*$1,962,000*	*$0*	*$3,314,139*	*$5,726,139*		100.00%	100.00%
TOTAL DIRECT COST		0	$450,000	$1,962,000	$0	$3,314,139	$5,726,139		100.00%	
TOTAL SUBCONTRACTOR MARKUPS			$0	$0	$0	$0	$0			0.00%
TOTAL COST TO PRIME			$450,000	$1,962,000	$0	$3,314,139	$5,726,139			
PRIME CONTRACTOR MARKUP	0.00%		$0	$0	$0	$0	$0			0.00%
TOTAL PROJECT COST			**$450,000**	**$1,962,000**	**$0**	**$3,314,139**	**$5,726,139**			

ANTTONEN LUCAS ASSOCIATES INC

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: *C:\My Documents\ALT 2B.PWS*
10/27/1998

DETAIL REPORT by CSI

Reported From: ALT 2 B
Report Total: $5,726,139
Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI

Reported From: ALT 2 B
Report Total: $5,726,139

Unassigned Items Group

DESCRIPTION	QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
MAIN STRUCTURE	U.C. per EACH --> 1			$0	$0	$0	1 $1	1 $1
Saw cut openings as required	U.C. per Each --> 1			$0	$0	$0	30000 $30,000	30000 $30,000
Concrete for retrofit as required	U.C. per CY --> 78			$0	$0	$0	650 $50,700	650 $50,700
MAJOR EQUIPMENT	U.C. per EACH --> 1			$0	$0	$0	1 $1	1 $1
RACK MODULES UPPER & LOWER (WVS)	U.C. per EACH --> 22			$0	$0	$0	25280 $556,160	25280 $556,160
RACK MODULES UPPER & LOWER (WVS)	U.C. per EACH --> 6			$0	$0	$0	50590 $303,540	50590 $303,540
6 TON BRIDGE CRANE (W464)	U.C. per EA --> 3			25000 $75,000	254000 $762,000	$0	$0	279000 $837,000
Shield Door For Crane Maintenance Bay (HWVP Vit)	U.C. per Each --> 1			$0	$0	$0	762537 $762,537	762537 $762,537
4'x20' Shielding Door (SNF)	U.C. per Each --> 1			$0	$0	$0	93036 $93,036	93036 $93,036
Shielding windows	U.C. per EACH --> 5			$0	$0	$0	42764 $213,820	42764 $213,820
60 TON CRANE (W464)	U.C. per EA --> 1			375000 $375,000	1200000 $1,200,000	$0	$0	1575000 $1,575,000
Canister entry transfer car	U.C. per --> 1			$0	$0	$0	322870 $322,870	322870 $322,870
Crane Maintenance Bay	U.C. per Each --> 1			$0	$0	$0	294953 $294,953	294953 $294,953

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI
Reported From: ALT 2 B
Report Total: $5,726,139

Unassigned Items Group

DESCRIPTION	QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
	U.C. per EA -->						686521	686521
OVERPACK (PIT WELD STATION)	1			$0	$0	$0	$686,521	$686,521
TOTAL Unassigned Items Group				$450,000	$1,962,000	$0	$3,314,139	$5,726,139

Number of items in Group: *14*

Percent of Total: *100.00%*

ANTTONEN LUCAS ASSOCIATES INC

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: C:\My Documents\ALT 2B.PWS
10/27/1998

DETAIL REPORT NO.1B

Reported From: ALT 2 B

Report Total: $5,726,139

Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B

Reported From: ALT 2 B
Report Total: $5,726,139

Estimate Tree Structure Rollup : ALT 2 B

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
												$5,726,139
							Tree Depth= 1					
Main Structure	U.C. per EACH --> 1		1.000	$0	$0	$0	1 $1	$0	1 $1	$0	$0	1 $1
MAIN STRUCTURE				$0 $0	$0 $0	$0 $0	$1 $80,700	$0 $0	$1 $80,700	$0 $0	$0 $0	$1 $80,700
Subtotal Rollup from Child Levels				$0	$0	$0	$80,701	$0	$80,701	$0	$0	$80,701
TOTAL Main Structure												$80,701

Estimate Tree Structure Rollups Main Structure

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
							Tree Depth= 2					
Miiscellaneous Structural Modifications												
Saw cut openings as required	U.C. per Each --> 1		1.000	$0	$0	$0	30000 $30,000	$0	30000 $30,000	$0	$0	30000 $30,000
Concrete for retrofit as required	U.C. per CY --> 78		1.000	$0	$0	$0	650 $50,700	$0	650 $50,700	$0	$0	650 $50,700
				$0	$0	$0	$80,700	$0	$80,700	$0	$0	$80,700
TOTAL Miiscellaneous Structural Modifications												$5,726,139

Estimate Tree Structure Rollups ALT 2 B

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
							Tree Depth= 1					
Major Equipment	U.C. per EACH --> 1		1.000	$0	$0	$0	1 $1	$0	1 $1	$0	$0	1 $1
MAJOR EQUIPMENT				$0 $450,000	$0 $1,962,000	$0 $0	$1 $3,233,437	$0 $0	$1 $5,645,437	$0 $0	$0 $0	$1 $5,645,437
Subtotal Rollup from Child Levels				$450,000	$1,962,000	$0	$3,233,438	$0	$5,645,438	$0	$0	$5,645,438
TOTAL Major Equipment												

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B

Reported From: ALT 2 B
Report Total: $5,726,139

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Racks Moduled							Tree Depth= 2					
RACK MODULES UPPER & LOWER (WVS)	U.C. per EACH -->	22	1.000	$0	$0	$0	25280 $556,160	$0	25280 $556,160	$0	$0	25280 $556,160
RACK MODULES UPPER & LOWER (WVS)	U.C. per EACH -->	6	1.000	$0	$0	$0	50590 $303,540	$0	50590 $303,540	$0	$0	50590 $303,540
TOTAL Racks Moduled				$0	$0	$0	$859,700	$0	$859,700	$0	$0	$859,700
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Remote 6-Ton Crane							Tree Depth= 2					
6 TON BRIDGE CRANE (W464)	U.C. per EA -->	3	1.000	25000 $75,000	254000 $762,000	$0	$0	$0	279000 $837,000	$0	$0	279000 $837,000
TOTAL Remote 6-Ton Crane				$75,000	$762,000	$0	$0	$0	$837,000	$0	$0	$837,000
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Shield Door							Tree Depth= 2					
Shield Door For Crane Maintenance Bay (HWVP Vit)	U.C. per Each -->	1	1.000	$0	$0	$0	762537 $762,537	$0	762537 $762,537	$0	$0	762537 $762,537
4'x20' Shielding Door (SNF)	U.C. per Each -->	1	1.000	$0	$0	$0	93036 $93,036	$0	93036 $93,036	$0	$0	93036 $93,036
TOTAL Shield Door				$0	$0	$0	$855,573	$0	$855,573	$0	$0	$855,573

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: ALT 2 B
Report Total: $5,726,139

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Shield Window							Tree Depth= 2					
	U.C. per EACH -->						42764		42764			42764
Shielding windows		5	1.000	$0	$0	$0	$213,820	$0	$213,820	$0	$0	$213,820
TOTAL Shield Window				**$0**	**$0**	**$0**	**$213,820**	**$0**	**$213,820**	**$0**	**$0**	**$213,820**
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
60-Ton Crane							Tree Depth= 2					
	U.C. per EA -->			375000	1200000				1575000			1575000
60 TON CRANE (W464)		1	1.000	$375,000	$1,200,000	$0	$0	$0	$1,575,000	$0	$0	$1,575,000
TOTAL 60-Ton Crane				**$375,000**	**$1,200,000**	**$0**	**$0**	**$0**	**$1,575,000**	**$0**	**$0**	**$1,575,000**
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Canister Transfer Cart							Tree Depth= 2					
	U.C. per -->						322870		322870			322870
Canister entry transfer car		1	1.000	$0	$0	$0	$322,870	$0	$322,870	$0	$0	$322,870
TOTAL Canister Transfer Cart				**$0**	**$0**	**$0**	**$322,870**	**$0**	**$322,870**	**$0**	**$0**	**$322,870**
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Crane maintenance Bay							Tree Depth= 2					
	U.C. per Each -->						294953		294953			294953
Crane Maintenance Bay		1	1.000	$0	$0	$0	$294,953	$0	$294,953	$0	$0	$294,953

ANTTONEN LUCAS ASSOCIATES INC

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: ALT 2 B
Report Total: $5,726,139

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Crane maintenance Bay							Tree Depth= 2					
TOTAL Crane maintenance Bay				$0	$0	$0	$294,953	$0	$294,953	$0	$0	$294,953
						Estimate Tree Structure Rollups Major Equipment						$5,645,438
Overpack Station							Tree Depth= 2					
OVERPACK (PIT WELD STATION)	U.C. per EA -->	1	1.000	$0	$0	$0	686521 $686,521	$0	686521 $686,521	$0	$0	686521 $686,521
TOTAL Overpack Station				$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521

Cost Estimate **ALT 3A**

- [62,171,790] Alt 3 A
  - [41,717,814] Main Structure
    - [30,591,234] ARC
    - [5,875,158] HVAC
    - [5,251,417] ELMC
  - [12,691,897] Major Equipment
    - [10,859,217] Tubes
    - [1,832,679] CHM
  - [1,717,561] Ventilation System (including slab, enclosure,stacks, and equipment)
    - [609,660] Intake Stack
    - [1,107,900] Exhaust Stack
  - [5,457,150] Load-in/Load-out
    - [1,575,000] Cask Crane
    - [279,000] 10-Ton Crane
    - [686,521] Overpack Station
  - [397,541] Operations Annex
  - [189,828] Truck Bay

Report Settings **Contractor Distribution Report**

Reported From: Alt 3 A

NOTES:

1.) All features of SUCCESS are functional with this report.
2.) If Level Markups are used they should always be at the lowest level of the PWS Branch
3.) Detail line items should only be placed at the lowest level of a PWS Branch
4.) If a Level is collapsed then the detail will not be grouped nor reported. Completely expand the PWS to produce an accurate report
5.) If a level is distributed the amount will be added to the prime contractor amount
6.) Markup records must be percents and applied to all cost components
7.) The Other1,2,3 cost components are combined in the "Others" column.
8.) Reports are accurate to two decimal places (Productivity up to three decimal places).
9.) Multiple Prime Contractors may be used. The "Prime Contractor" totals will include all prime contractors' work, and the Prime Contractor Markups will be the aggregate markup of all prime contractors.
10.) Up to 10 contractor markups per contractor may be used. and must be percentages (not amounts).

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

CONTRACTOR DISTRIBUTION REPORT

Reported From: Alt 3 A

CONTRACTOR	MARK-UP PERCENT	LABOR HOURS	LABOR	MATERIAL	EQUIPMENT	OTHERS	SUBTOTAL	% MARKUP	% DIRECT COST	% TOTAL COST
PRIME CONTRACTOR										
DIRECT COST			$400,000	$1,454,000	$0	$60,317,790	$62,171,790			
TOTAL FOR PRIME CONTRACTOR		0	*$400,000*	*$1,454,000*	*$0*	*$60,317,790*	*$62,171,790*		100.00%	100.00%
TOTAL DIRECT COST		0	$400,000	$1,454,000	$0	$60,317,790	$62,171,790		100.00%	
TOTAL SUBCONTRACTOR MARKUPS			$0	$0	$0	$0	$0			0.00%
TOTAL COST TO PRIME			$400,000	$1,454,000	$0	$60,317,790	$62,171,790			
PRIME CONTRACTOR MARKUP	0.00%		$0	$0	$0	$0	$0			0.00%
TOTAL PROJECT COST			**$400,000**	**$1,454,000**	**$0**	**$60,317,790**	**$62,171,790**			

ANTTONEN LUCAS ASSOCIATES INC.

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: ***C:\My Documents\ALT 3A.PWS***
10/27/1998

DETAIL REPORT by CSI

Reported From: Alt 3 A
Report Total: $62,171,790
Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.),. W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI
Reported From: Alt 3 A
Report Total: $62,171,790

Unassigned Items Group

DESCRIPTION	QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
Main Structure Memo: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate.	U.C. per SF --> 51,677			$0	$0	$0	$5	0 $5
ARC (This includes cost for CSI 03-14)	U.C. per SF --> 51,677			$0	$0	$0	591.97 $30,591,234	591.97 $30,591,234
HVAC	U.C. per SF --> 51,677			$0	$0	$0	113.69 $5,875,158	113.69 $5,875,158
ELMC (Electrical/mechanical) Memo: This cost was developed from a Parametric estimate and transfered to this estimate format.	U.C. per SF --> 51,677			$0	$0	$0	101.62 $5,251,417	101.62 $5,251,417
MAJOR EQUIPMENT	U.C. per EACH --> 1			$0	$0	$0	1 $1	1 $1
STORAGE TUBES & CANISTER OVERPACKS (W464)	U.C. per EA --> 303			$0	$0	$0	3839 $1,163,217	3839 $1,163,217
PROCURE TUBE/PLUG	U.C. per EA --> 303			$0	$0	$0	32000 $9,696,000	32000 $9,696,000
CANISITER HANDLING MACHINE (SNF)	U.C. per EA --> 1			$0	$0	$0	1832679 $1,832,679	1832679 $1,832,679
VENTILATION SYSTEM	U.C. per EACH --> 1			$0	$0	$0	1 $1	1 $1
INTAKE STACK (SNF)	U.C. per EA --> 2			$0	$0	$0	304830 $609,660	304830 $609,660
EXHAUST STACK (SNF)	U.C. per EA --> 2			$0	$0	$0	553950 $1,107,900	553950 $1,107,900
SLAB AND BUILDING STRUCTURE (W464)	U.C. per SF --> 4,207			$0	$0	$0	693.28 $2,916,629	693.28 $2,916,629
60 TON CRANE (W464)	U.C. per EA --> 1			375000 $375,000	1200000 $1,200,000	$0	$0	1575000 $1,575,000

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI
Reported From: Alt 3 A
Report Total: $62,171,790

Unassigned Items Group

DESCRIPTION		QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
	U.C. per EA -->				25000	254000			279000
10 TON BRIDGE CRANE (W464)		1			$25,000	$254,000	$0	$0	$279,000
	U.C. per EA -->							686521	686521
OVERPACK (PIT WELD STATION)		1			$0	$0	$0	$686,521	$686,521
	U.C. per SF -->							94.63	94.63
SLAB AND BUILDING STRUCTURE (HWVP)		4,201			$0	$0	$0	$397,541	$397,541
	U.C. per SF -->							94.63	94.63
SLAB AND BUILDING STRUCTURE (HWVP)		2,006			$0	$0	$0	$189,828	$189,828
TOTAL Unassigned Items Group					**$400,000**	**$1,454,000**	**$0**	**$60,317,790**	**$62,171,790**

Number of items in Group: ***17***

Percent of Total: ***100.00%***

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: C:\My Documents\ALT 3A.PWS
10/27/1998

DETAIL REPORT NO.1B

Reported From: Alt 3 A

Report Total: $62,171,790

Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B

Reported From: Alt 3 A
Report Total: $62,171,790

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Alt 3 A						$62,171,790
Main Structure							Tree Depth= 1					
	U.C. per SF -->											0
Main Structure	51,677		1.000	$0	$0	$0	$5	$0	$5	$0	$0	$5
Memo: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate.												
Subtotal				$0	$0	$0	$5	$0	$5	$0	$0	$5
Rollup from Child Levels				$0	$0	$0	$41,717,809	$0	$*,***,***	$0	$0	$41,717,809
TOTAL Main Structure				$0	$0	$0	$41,717,814	$0	$*,***,***	$0	$0	$41,717,814
Memo: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate.												
						Estimate Tree Structure Rollups Main Structure						$41,717,814
ARC							Tree Depth= 2					
	U.C. per SF -->						591 97		591.97			591.97
ARC (This includes cost for CSI 03-14)	51,677		1.000	$0	$0	$0	$30,591,234	$0	$30,591,234	$0	$0	$30,591,234
TOTAL ARC				$0	$0	$0	$30,591,234	$0	$*,***,***	$0	$0	$30,591,234
						Estimate Tree Structure Rollups Main Structure						$41,717,814
HVAC							Tree Depth= 2					
	U.C. per SF -->						113 69		113.69			113.69
HVAC	51,677		1.000	$0	$0	$0	$5,875,158	$0	$5,875,158	$0	$0	$5,875,158
TOTAL HVAC				$0	$0	$0	$5,875,158	$0	$5,875,158	$0	$0	$5,875,158

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 A
Report Total: $62,171,790

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Main Structure						$41,717,814
ELMC							Tree Depth= 2					
	U.C. per SF -->						101 62		101.62			101.62
ELMC (Electrical/mechanical) Memo: This cost was developed from a Parametric estimate and transfered to this estimate format.		51,677	1.000	$0	$0	$0	$5,251,417	$0	$5,251,417	$0	$0	$5,251,417
TOTAL ELMC				$0	$0	$0	$5,251,417	$0	$5,251,417	$0	$0	$5,251,417
						Estimate Tree Structure Rollups Alt 3 A						$62,171,790
Major Equipment							Tree Depth= 1					
	U.C. per EACH -->						1		1			1
MAJOR EQUIPMENT		1	1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$12,691,896	$0	$*,***,***	$0	$0	$12,691,896
TOTAL Major Equipment				$0	$0	$0	$12,691,897	$0	$*,***,***	$0	$0	$12,691,897
						Estimate Tree Structure Rollups Major Equipment						$12,691,897
Tubes							Tree Depth= 2					
	U.C. per EA -->						3839		3839			3839
STORAGE TUBES & CANISTER OVERPACKS (W464)		303	1.000	$0	$0	$0	$1,163,217	$0	$1,163,217	$0	$0	$1,163,217
	U.C. per EA -->						32000		32000			32000
PROCURE TUBE/PLUG		303	1.000	$0	$0	$0	$9,696,000	$0	$9,696,000	$0	$0	$9,696,000
TOTAL Tubes				$0	$0	$0	$10,859,217	$0	$*,***,***	$0	$0	$10,859,217
303.00 EA		*Level Unit Cost-->*					*$35,839.00*		*$35,839.00*			*$35,839.00*

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 A
Report Total: $62,171,790

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$12,691,897
CHM							Tree Depth= 2					
	U.C. per EA -->						1832679		1832679			1832679
CANISITER HANDLING MACHINE (SNF)		1	1.000	$0	$0	$0	$1,832,679	$0	$1,832,679	$0	$0	$1,832,679
TOTAL CHM				$0	$0	$0	$1,832,679	$0	$1,832,679	$0	$0	$1,832,679
						Estimate Tree Structure Rollups Alt 3 A						$62,171,790
Ventilation System (including slab, enclosure,stacks,							Tree Depth= 1					
	U.C. per EACH -->						1		1			1
VENTILATION SYSTEM		1	1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$1,717,560	$0	$1,717,560	$0	$0	$1,717,560
TOTAL Ventilation System (including slab, enclosure,stacks, and equipment)				$0	$0	$0	$1,717,561	$0	$1,717,561	$0	$0	$1,717,561
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$1,717,561
Intake Stack							Tree Depth= 2					
	U.C. per EA -->						304830		304830			304830
INTAKE STACK (SNF)		2	1.000	$0	$0	$0	$609,660	$0	$609,660	$0	$0	$609,660
TOTAL Intake Stack				$0	$0	$0	$609,660	$0	$609,660	$0	$0	$609,660
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$1,717,561
Exhaust Stack							Tree Depth= 2					
	U.C. per EA -->						553950		553950			553950
EXHAUST STACK (SNF)		2	1.000	$0	$0	$0	$1,107,900	$0	$1,107,900	$0	$0	$1,107,900

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 A
Report Total: $62,171,790

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Ventilation System	*Rollups* Including slab, enclosure,stacks, and equipment)					$1,717,561
Exhaust Stack						Tree Depth= 2						
TOTAL Exhaust Stack				$0	$0	$0	$1,107,900	$0	$1,107,900	$0	$0	$1,107,900
						Estimate Tree Structure Alt 3 A	*Rollups*					$62,171,790
Load-in/Load-out						Tree Depth= 1						
SLAB AND BUILDING STRUCTURE (W464)	U.C. per SF --> 4,207		1.000	$0	$0	$0	693.28 $2,916,629	$0	693.28 $2,916,629	$0	$0	693.28 $2,916,629
Subtotal				$0	$0	$0	$2,916,629	$0	$2,916,629	$0	$0	$2,916,629
Rollup from Child Levels				$400,000	$1,454,000	$0	$686,521	$0	$2,540,521	$0	$0	$2,540,521
TOTAL Load-in/Load-out				$400,000	$1,454,000	$0	$3,603,150	$0	$5,457,150	$0	$0	$5,457,150
						Estimate Tree Structure Load-in/Load-out	*Rollups*					$5,457,150
Cask Crane						Tree Depth= 2						
60 TON CRANE (W464)	U.C. per EA -->	1	1.000	375000 $375,000	1200000 $1,200,000	$0	$0	$0	1575000 $1,575,000	$0	$0	1575000 $1,575,000
TOTAL Cask Crane				$375,000	$1,200,000	$0	$0	$0	$1,575,000	$0	$0	$1,575,000
						Estimate Tree Structure Load-in/Load-out	*Rollups*					$5,457,150
10-Ton Crane						Tree Depth= 2						
10 TON BRIDGE CRANE (W464)	U.C. per EA -->	1	1.000	25000 $25,000	254000 $254,000	$0	$0	$0	279000 $279,000	$0	$0	279000 $279,000

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INNTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B

Reported From: Alt 3 A
Report Total: $62,171,790

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Load-In/Load-out						$5,457,150
10-Ton Crane (Tree Depth= 2)												
TOTAL 10-Ton Crane				$25,000	$254,000	$0	$0	$0	$279,000	$0	$0	$279,000
						Estimate Tree Structure Rollups Load-In/Load-out						$5,457,150
Overpack Station (Tree Depth= 2)												
	U.C. per EA -->						686521		686521			686521
OVERPACK (PIT WELD STATION)		1	1.000	$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
TOTAL Overpack Station				$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
						Estimate Tree Structure Rollups Alt 3 A						$62,171,790
Operations Annex (Tree Depth= 1)												
	U.C. per SF -->						94.63		94.63			94.63
SLAB AND BUILDING STRUCTURE (HWVP)		4,201	1.000	$0	$0	$0	$397,541	$0	$397,541	$0	$0	$397,541
TOTAL Operations Annex				$0	$0	$0	$397,541	$0	$397,541	$0	$0	$397,541
						Estimate Tree Structure Rollups Alt 3 A						$62,171,790
Truck Bay (Tree Depth= 1)												
	U.C. per SF -->						94.63		94.63			94.63
SLAB AND BUILDING STRUCTURE (HWVP)		2,006	1.000	$0	$0	$0	$189,828	$0	$189,828	$0	$0	$189,828
TOTAL Truck Bay				$0	$0	$0	$189,828	$0	$189,828	$0	$0	$189,828

Cost Estimate **ALT 3B**

- [63,943,168] Alt 3 B
  - [46,445,683] Main Structure
    - [34,067,037] ARC
    - [6,537,339] HVAC
    - [5,841,307] ELMC
  - [7,830,868] Major Equipment
    - [5,998,188] Tubes
    - [1,832,679] CHM
  - [3,584,063] Ventilation System (including slab, enclosure,stacks, and equipment)
    - [2,725,282] Cell/Vault HVAC
    - [304,830] Intake Stack
    - [553,950] Exhaust Stack
  - [5,457,150] Load-in/Load-out
    - [1,575,000] Cask Crane
    - [279,000] 10-Ton Crane
    - [686,521] Overpack Station
  - [397,541] Operations Annex
  - [189,828] Truck Bay
  - [38,035] Stand by Generator

Report Settings **Contractor Distribution Report**

Reported From: Alt 3 B

NOTES:
1.) All features of SUCCESS are functional with this report.
2.) If Level Markups are used they should always be at the lowest level of the PWS Branch
3.) Detail line items should only be placed at the lowest level of a PWS Branch
4.) If a Level is collapsed then the detail will not be grouped nor reported. Completely expand the PWS to produce an accurate report
5.) If a level is distributed the amount will be added to the prime contractor amount
6.) Markup records must be percents and applied to all cost components
7.) The Other1,2,3 cost components are combined in the "Others" column.
8.) Reports are accurate to two decimal places (Productivity up to three decimal places).
9.) Multiple Prime Contractors may be used. The "Prime Contractor" totals will include all prime contractors' work, and the Prime Contractor Markups will be the aggregate markup of all prime contractors.
10.) Up to 10 contractor markups per contractor may be used. and must be percentages (not amounts).

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

CONTRACTOR DISTRIBUTION REPORT

Reported From: Alt 3 B

CONTRACTOR	MARK-UP PERCENT	LABOR HOURS	LABOR	MATERIAL	EQUIPMENT	OTHERS	SUBTOTAL	% MARKUP	% DIRECT COST	% TOTAL COST
PRIME CONTRACTOR DIRECT COST			$402,645	$1,489,000	$391	$62,051,133	$63,943,168			
TOTAL FOR PRIME CONTRACTOR		77	*$402,645*	*$1,489,000*	*$391*	*$62,051,133*	*$63,943,168*		100.00%	100.00%
TOTAL DIRECT COST		77	$402,645	$1,489,000	$391	$62,051,133	$63,943,168		100.00%	
TOTAL SUBCONTRACTOR MARKUPS			$0	$0	$0	$0	$0			0.00%
TOTAL COST TO PRIME			$402,645	$1,489,000	$391	$62,051,133	$63,943,168			
PRIME CONTRACTOR MARKUP	0.00%		$0	$0	$0	$0	$0			0.00%
TOTAL PROJECT COST			**$402,645**	**$1,489,000**	**$391**	**$62,051,133**	**$63,943,168**			

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: *C:\My Documents\ALT 3B.PWS*
10/27/1998

DETAIL REPORT by CSI

Reported From: **Alt 3 B**
Report Total: **$63,943,168**
Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI
Reported From: Alt 3 B
Report Total: $63,943,168

Unassigned Items Group

DESCRIPTION	QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
Main Structure	U.C. per SF --> 58,022			$0	$0	$0	$1	0 $1
ARC (This includes cost for CSI 03-14)	U.C. per SF --> 58,022			$0	$0	$0	587.14 $34,067,037	587.14 $34,067,037
HVAC	U.C. per SF --> 58,022			$0	$0	$0	112.67 $6,537,339	112.67 $6,537,339
ELMC (Electrical/Mechanical) Memo: This cost was developed from a Parametric estimate and transfered to this estimate format.	U.C. per SF --> 58,022			$0	$0	$0	100.674 $5,841,307	100.674 $5,841,307
MAJOR EQUIPMENT	U.C. per EACH --> 1			$0	$0	$0	1 $1	1 $1
TUBES & EMBEDS FOR CANISTER SUPPT (GWSB)	U.C. per EA --> 303			$0	$0	$0	2370 $718,110	2370 $718,110
PROCURE PLUGS	U.C. per --> 303			$0	$0	$0	17426 $5,280,078	17426 $5,280,078
CANISITER HANDLING MACHINE (SNF)	U.C. per EA --> 1			$0	$0	$0	1832679 $1,832,679	1832679 $1,832,679
VENTILATION SYSTEM	U.C. per EACH --> 1			$0	$0	$0	1 $1	1 $1
CELL/VAULT HVAC SYSTEM (W059)	U.C. per EA --> 1			$0	$0	$0	2725282 $2,725,282	2725282 $2,725,282
INTAKE STACK (SNF)	U.C. per EA --> 1			$0	$0	$0	304830 $304,830	304830 $304,830
EXHAUST STACK (SNF)	U.C. per EA --> 1			$0	$0	$0	553950 $553,950	553950 $553,950
SLAB AND BUILDING STRUCTURE (W464)	U.C. per SF --> 4,207			$0	$0	$0	693.28 $2,916,629	693.28 $2,916,629
60 TON CRANE (W464)	U.C. per EA --> 1			375000 $375,000	1200000 $1,200,000	$0	$0	1575000 $1,575,000

IMMOBILIZED HIGH-LEVEL W/ STE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI
Reported From: Alt 3 B
Report Total: $63,943,168

Unassigned Items Group

DESCRIPTION	QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
	U.C. per EA -->			25000	254000			279000
10 TON BRIDGE CRANE (W464)	1			$25,000	$254,000	$0	$0	$279,000
	U.C. per EA -->						686521	686521
OVERPACK (PIT WELD STATION)	1			$0	$0	$0	$686,521	$686,521
	U.C. per SF -->						94.63	94.63
SLAB AND BUILDING STRUCTURE (HWVP)	4,201			$0	$0	$0	$397,541	$397,541
	U.C. per SF -->						94.63	94.63
SLAB AND BUILDING STRUCTURE	2,006			$0	$0	$0	$189,828	$189,828
	U.C. per EA -->	76.923	EELER3	2644.705	35000	390.669		38035.374
Generator set, dsl eng, xfr sw&fuel tank, 150 KW, incl btry,chgr, muf	1	77		$2,645	$35,000	$391	$0	$38,035
TOTAL Unassigned Items Group		**77**		**$402,645**	**$1,489,000**	**$391**	**$62,051,133**	**$63,943,168**

Number of items in Group: *19*

Percent of Total: *100.00%*

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE .LTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: *C:\My Documents\ALT 3B. 'WS*
10/27/1998

DETAIL REPORT NO.1B

Reported From: Alt 3 B

Report Total: $63,943,168

Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cos from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model us d scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE / LTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 B
Report Total: $63,943,168

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Main Structure						*Estimate Tree Structure Rollups* Alt 3 B						$63,943,168
							Tree Depth= 1					
Main Structure	U.C. per SF --> [illegible],022		1.000	$0	$0	$0	$1	$0	$1	$0	$0	0 $1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$46,445,683	$0	$*,***,***	$0	$0	$46,445,683
TOTAL Main Structure				$0	$0	$0	$46,445,683	$0	$*,***,***	$0	$0	$46,445,683

Memo: This cost was developed from a Parametric estimate. The bas[illegible] case used the Canister Storage Bldg from The HWVP REV " " July, 1991 estimate.

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
ARC						*Estimate Tree Structure Rollups* Main Structure						$46,445,683
							Tree Depth= 2					
ARC (This includes cost for CSI 03-14)	U.C. per SF --> 5[illegible].022		1.000	$0	$0	$0	587.14 $34,067,037	$0	587.14 $34,067,037	$0	$0	587.14 $34,067,037
TOTAL ARC				$0	$0	$0	$34,067,037	$0	$*,***,***	$0	$0	$34,067,037

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
HVAC						*Estimate Tree Structure Rollups* Main Structure						$46,445,683
							Tree Depth= 2					
HVAC	U.C. per SF --> 5[illegible].022		1.000	$0	$0	$0	112.67 $6,537,339	$0	112.67 $6,537,339	$0	$0	112.67 $6,537,339
TOTAL HVAC				$0	$0	$0	$6,537,339	$0	$6,537,339	$0	$0	$6,537,339

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 B
Report Total: $63,943,168

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Estimate Tree Structure Rollups Main Structure												$46,445,683
ELMC — Tree Depth= 2												
U.C. per SF -->							100.674		100.674			100.674
ELMC (Electrical/Mechanical)	5[illegible],022		1.000	$0	$0	$0	$5,841,307	$0	$5,841,307	$0	$0	$5,841,307
Memo: This cost was developed from a Parametric estimate and transfered to this estimate format.												
TOTAL ELMC				$0	$0	$0	$5,841,307	$0	$5,841,307	$0	$0	$5,841,307
Estimate Tree Structure Rollups Alt 3 B												$63,943,168
Major Equipment — Tree Depth= 1												
U.C. per EACH ->							1		1			1
MAJOR EQUIPMENT	1		1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$7,830,867	$0	$7,830,867	$0	$0	$7,830,867
TOTAL Major Equipment				$0	$0	$0	$7,830,868	$0	$7,830,868	$0	$0	$7,830,868
Estimate Tree Structure Rollups Major Equipment												$7,830,868
Tubes — Tree Depth= 2												
U.C. per EA -->							2370		2370			2370
TUBES & EMBEDS FOR CANISTER SUPPT (GWSB)	303		1.000	$0	$0	$0	$718,110	$0	$718,110	$0	$0	$718,110
U.C. per -->							17426		17426			17426
PROCURE PLUGS	303		1.000	$0	$0	$0	$5,280,078	$0	$5,280,078	$0	$0	$5,280,078
TOTAL Tubes				$0	$0	$0	$5,998,188	$0	$5,998,188	$0	$0	$5,998,188

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$7,830,868
CHM							Tree Depth= 2					
	U.C. per EA -->						1832679		1832679			1832679
CANISITER HANDLING MACHINE (SNF)		1	1.000	$0	$0	$0	$1,832,679	$0	$1,832,679	$0	$0	$1,832,679
TOTAL CHM				$0	$0	$0	$1,832,679	$0	$1,832,679	$0	$0	$1,832,679
						Estimate Tree Structure Rollups Alt 3 B						$63,943,168
Ventilation System (including slab, enclosure,stacks,							Tree Depth= 1					
	U.C. per EACH ->						1		1			1
VENTILATION SYSTEM		1	1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$3,584,062	$0	$3,584,062	$0	$0	$3,584,062
TOTAL Ventilation System (including slab, enclosure,stacks, and equipment)				$0	$0	$0	$3,584,063	$0	$3,584,063	$0	$0	$3,584,063
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$3,584,063
Cell/Vault HVAC							Tree Depth= 2					
	U.C. per EA -->						2725282		2725282			2725282
CELL/VAULT HVAC SYSTEM (W059)		1	1.000	$0	$0	$0	$2,725,282	$0	$2,725,282	$0	$0	$2,725,282
TOTAL Cell/Vault HVAC				$0	$0	$0	$2,725,282	$0	$2,725,282	$0	$0	$2,725,282
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$3,584,063
Intake Stack							Tree Depth= 2					
	U.C. per EA -->						304830		304830			304830
INTAKE STACK (SNF)		1	1.000	$0	$0	$0	$304,830	$0	$304,830	$0	$0	$304,830

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 B
Report Total: $63,943,168

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)												$3,584,063
Intake Stack — Tree Depth= 2												
TOTAL Intake Stack				$0	$0	$0	$304,830	$0	$304,830	$0	$0	$304,830
Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)												$3,584,063
Exhaust Stack — Tree Depth= 2												
	U.C. per EA -->						553950		553950			553950
EXHAUST STACK (SNF)		1	1.000	$0	$0	$0	$553,950	$0	$553,950	$0	$0	$553,950
TOTAL Exhaust Stack				$0	$0	$0	$553,950	$0	$553,950	$0	$0	$553,950
Estimate Tree Structure Rollups Alt 3 B												$63,943,168
Load-in/Load-out — Tree Depth= 1												
	U.C. per SF -->						693.28		693.28			693.28
SLAB AND BUILDING STRUCTURE (W464)	4,207		1.000	$0	$0	$0	$2,916,629	$0	$2,916,629	$0	$0	$2,916,629
Subtotal				$0	$0	$0	$2,916,629	$0	$2,916,629	$0	$0	$2,916,629
Rollup from Child Levels				$400,000	$1,454,000	$0	$686,521	$0	$2,540,521	$0	$0	$2,540,521
TOTAL Load-in/Load-out				$400,000	$1,454,000	$0	$3,603,150	$0	$5,457,150	$0	$0	$5,457,150
Estimate Tree Structure Rollups Load-in/Load-out												$5,457,150
Cask Crane — Tree Depth= 2												
	U.C. per EA -->			375000	1200000				1575000			1575000
60 TON CRANE (W464)		1	1.000	$375,000	$1,200,000	$0	$0	$0	$1,575,000	$0	$0	$1,575,000

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 B
Report Total: $63,943,168

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Estimate Tree Structure Rollups Load-In/Load-out												$5,457,150
Cask Crane (Tree Depth= 2)												
TOTAL Cask Crane				$375,000	$1,200,000	$0	$0	$0	$1,575,000	$0	$0	$1,575,000
Estimate Tree Structure Rollups Load-In/Load-out												$5,457,150
10-Ton Crane (Tree Depth= 2)	U.C. per EA -->			25000	254000				279000			279000
10 TON BRIDGE CRANE (W464)	1		1.000	$25,000	$254,000	$0	$0	$0	$279,000	$0	$0	$279,000
TOTAL 10-Ton Crane				$25,000	$254,000	$0	$0	$0	$279,000	$0	$0	$279,000
Estimate Tree Structure Rollups Load-In/Load-out												$5,457,150
Overpack Station (Tree Depth= 2)	U.C. per EA -->						686521		686521			686521
OVERPACK (PIT WELD STATION)	1		1.000	$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
TOTAL Overpack Station				$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
Estimate Tree Structure Rollups Alt 3 B												$63,943,168
Operations Annex (Tree Depth= 1)	U.C. per SF -->						94.63		94.63			94.63
SLAB AND BUILDING STRUCTURE (HWVP)	4,201		1.000	$0	$0	$0	$397,541	$0	$397,541	$0	$0	$397,541
TOTAL Operations Annex				$0	$0	$0	$397,541	$0	$397,541	$0	$0	$397,541

ANTTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 B
Report Total: $63,943,168

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Truck Bay						*Estimate Tree Structure Rollups* Alt 3 B						$63,943,168
							Tree Depth= 1					
SLAB AND BUILDING STRUCTURE	U.C. per SF --> 2,006		1.000	$0	$0	$0	94.63 $189,828	$0	94.63 $189,828	$0	$0	94.63 $189,828
TOTAL Truck Bay				$0	$0	$0	$189,828	$0	$189,828	$0	$0	$189,828
Stand by Generator						*Estimate Tree Structure Rollups* Alt 3 B						$63,943,168
							Tree Depth= 1					
Generator set, dsl eng, xfr sw&fuel tank, 150 KW, incl btry,chgr, muf	U.C. per EA --> 1	76.923 77	EELER3 1.000	2644.705 $2,645	35000 $35,000	390.669 $391	$0	$0	38035.374 $38,035	$0	$0	38035.374 $38,035
TOTAL Stand by Generator		77		$2,645	$35,000	$391	$0	$0	$38,035	$0	$0	$38,035

B-54

Cost Estimate **ALT 3C**

- [42,766,031] Alt 3 C
  - [35,155,348] Main Structure
    - [28,779,394] ARC
    - [3,380,672] HVAC
    - [2,995,280] ELMC
  - [3,401,216] Major Equipment
    - [910,620] Racks Moduled
    - [279,000] Remote 6-Ton Crane
    - [1,525,074] Shield Door
    - [686,521] Overpack Station
  - [3,584,063] Ventilation System (including slab, enclosure,stacks, and equipment)
    - [2,725,282] Cell/Vault HVAC
    - [304,830] Intake Stack
    - [553,950] Exhaust Stack
  - [397,541] Operations Annex
  - [189,828] Truck Bay
  - [38,035] Stand by Generator

Report Settings **Contractor Distribution Report**

Reported From: Alt 3 C

NOTES:
1.) All features of SUCCESS are functional with this report.
2.) If Level Markups are used they should always be at the lowest level of the PWS Branch
3.) Detail line items should only be placed at the lowest level of a PWS Branch
4.) If a Level is collapsed then the detail will not be grouped nor reported. Completely expand the PWS to produce an accurate report
5.) If a level is distributed the amount will be added to the prime contractor amount
6.) Markup records must be percents and applied to all cost components
7.) The Other1,2,3 cost components are combined in the "Others" column.
8.) Reports are accurate to two decimal places (Productivity up to three decimal places).
9.) Multiple Prime Contractors may be used. The "Prime Contractor" totals will include all prime contractors' work, and the Prime Contractor Markups will be the aggregate markup of all prime contractors.
10.) Up to 10 contractor markups per contractor may be used. and must be percentages (not amounts).

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

CONTRACTOR DISTRIBUTION REPORT

Reported From: Alt 3 C

CONTRACTOR	MARK-UP PERCENT	LABOR HOURS	LABOR	MATERIAL	EQUIPMENT	OTHERS	SUBTOTAL	% MARKUP	% DIRECT COST	% TOTAL COST
PRIME CONTRACTOR DIRECT COST			$27,645	$289,000	$391	$42,448,995	$42,766,031			
TOTAL FOR PRIME CONTRACTOR		77	*$27,645*	*$289,000*	*$391*	*$42,448,995*	*$42,766,031*		100.00%	100.00%
TOTAL DIRECT COST		77	$27,645	$289,000	$391	$42,448,995	$42,766,031		100.00%	
TOTAL SUBCONTRACTOR MARKUPS			$0	$0	$0	$0	$0			0.00%
TOTAL COST TO PRIME			$27,645	$289,000	$391	$42,448,995	$42,766,031			
PRIME CONTRACTOR MARKUP	0.00%		$0	$0	$0	$0	$0			0.00%
TOTAL PROJECT COST			**$27 645**	**$289,000**	**$391**	**$42,448,995**	**$42,766,031**			

ANNTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: C:\My Documents\ALT 3C.PWS
10/27/1998

DETAIL REPORT by CSI

Reported From: Alt 3 C
Report Total: $42,766,031
Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost rom SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-(59 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Val:ey Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI

Reported From: Alt 3 C
Report Total: $42,766,031

Unassigned Items Group

DESCRIPTION	QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
	U.C. per SF -->							0
Main Structure	24,269			$0	$0	$0	$2	$2
	U.C. per SF -->						1185.85	1185.85
ARC (This includes cost for CSI 03-14)	24,269			$0	$0	$0	$28,779,394	$28,779,394
	U.C. per SF -->						139.3	139.3
HVAC	24,269			$0	$0	$0	$3,380,672	$3,380,672
	U.C. per SF -->						123.42	123.42
Electrical/Mechanical Memo: This cost was developed from a Parametric estimate and transfered to this estimate format.	24,269			$0	$0	$0	$2,995,280	$2,995,280
	U.C. per EACH -->						1	1
MAJOR EQUIPMENT	1			$0	$0	$0	$1	$1
	U.C. per EACH -->						50590	50590
RACK MODULES UPPER & LOWER (WVS)	18			$0	$0	$0	$910,620	$910,620
	U.C. per EA -->			25000	254000			279000
6 TON BRIDGE CRANE (W464)	1			$25,000	$254,000	$0	$0	$279,000
	U.C. per Each -->						762537	762537
Shield Door (HWVP Vit)	2			$0	$0	$0	$1,525,074	$1,525,074
	U.C. per EA -->						686521	686521
OVERPACK (PIT WELD STATION)	1			$0	$0	$0	$686,521	$686,521
	U.C. per EACH -->						1	1
VENTILATION SYSTEM	1			$0	$0	$0	$1	$1
	U.C. per EA -->						2725282	2725282
CELL/VAULT HVAC SYSTEM (W059)	1			$0	$0	$0	$2,725,282	$2,725,282
	U.C. per EA -->						304830	304830
INTAKE STACK (SNF)	1			$0	$0	$0	$304,830	$304,830
	U.C. per EA -->						553950	553950
EXHAUST STACK (SNF)	1			$0	$0	$0	$553,950	$553,950
	U.C. per SF -->						94.63	94.63
SLAB AND BUILDING STRUCTURE (HWVP)	4,201			$0	$0	$0	$397,541	$397,541

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT by CSI

Reported From: Alt 3 C
Report Total: $42,766,031

Unassigned Items Group

DESCRIPTION		QTY	Hrs	Crew	LABOR	MATERIAL	EQUIPMENT	OTHERS	TOTAL
	U.C. per SF -->							94.63	94.63
SLAB AND BUILDING STRUCTURE (HWVP)		2,006			$0	$0	$0	$189,828	$189,828
	U.C. per EA -->		76.923	EELER3	2644.705	35000	390.669		38035.374
Generator set, dsl eng, xfr sw&fuel tank, 150 KW, incl btry,chgr, muf		1	77		$2,645	$35,000	$391	$0	$38,035
TOTAL Unassigned Items Group			**77**		**$27,645**	**$289,000**	**$391**	**$42,448,995**	**$42,766,031**

Number of items in Group: *16*

Percent of Total: *100.00%*

ANNTONEN LUCAS ASSOCIATES INC.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS
PROJECT FILE LOCATION: C:\My Documents\ALT 3C.PWS
10/27/1998

DETAIL REPORT NO.1B

Reported From: Alt 3 C

Report Total: $42,766,031

Project Note: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate. The INSITE MODEL also used cost from SNF (Canister Storage Bldg. July 21, 1995 est.), W464 (Immobilized HLW Interim Storage System Vault 2 &3), W-059 (B-Plant Canyon Ventilation Upgrade), GWSB (Glass Waste Storage Bldg.#2 1991 est.), and cost from West Valley Nuclear Services. The Model used scale of economies and escalated cost to 1998 dollars.

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B

Reported From: Alt 3 C
Report Total: $42,766,031

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Alt 3 C						$42,766,031
Main Structure							Tree Depth= 1					
Main Structure	U.C. per SF -->	24,269	1.000	$0	$0	$0	$2	$0	$2	$0	$0	0 $2
Subtotal				$0	$0	$0	$2	$0	$2	$0	$0	$2
Rollup from Child Levels				$0	$0	$0	$35,155,345	$0	$*,***,***	$0	$0	$35,155,345
TOTAL Main Structure				$0	$0	$0	$35,155,348	$0	$*,***,***	$0	$0	$35,155,348

Memo: This cost was developed from a Parametric estimate. The base case used the Canister Storage Bldg from The HWVP REV "F" July, 1991 estimate.

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Main Structure						$35,155,348
ARC							Tree Depth= 2					
ARC (This includes cost for CSI 03-14)	U.C. per SF -->	24,269	1.000	$0	$0	$0	1185.85 $28,779,394	$0	1185.85 $28,779,394	$0	$0	1185.85 $28,779,394
TOTAL ARC				$0	$0	$0	$28,779,394	$0	$*,***,***	$0	$0	$28,779,394

Memo: Tfhe Parametric for ARC has been adjusted to reflect similar volume of concrete and associated cost extracted from ALT3b.

LEVEL	QTY	Hrs.	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Main Structure						$35,155,348
HVAC							Tree Depth= 2					
HVAC	U.C. per SF -->	24,269	1.000	$0	$0	$0	139.3 $3,380,672	$0	139.3 $3,380,672	$0	$0	139.3 $3,380,672
TOTAL HVAC				$0	$0	$0	$3,380,672	$0	$3,380,672	$0	$0	$3,380,672

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B
Reported From: Alt 3 C
Report Total: $42,766,031

LEVEL	QTY	Hrs	Crew/Prod/Fact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Estimate Tree Structure Rollups Main Structure												$35,155,348
ELMC — Tree Depth= 2												
U.C. per SF -->							123.42		123.42			123.42
Electrical/Mechanical	24,269		1.000	$0	$0	$0	$2,995,280	$0	$2,995,280	$0	$0	$2,995,280
Memo: This cost was developed from a Parametric estimate and transfered to this estimate format.												
TOTAL ELMC				**$0**	**$0**	**$0**	**$2,995,280**	**$0**	**$2,995,280**	**$0**	**$0**	**$2,995,280**
Estimate Tree Structure Rollups Alt 3 C												$42,766,031
Major Equipment — Tree Depth= 1												
U.C. per EACH -->							1		1			1
MAJOR EQUIPMENT	1		1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$25,000	$254,000	$0	$3,122,215	$0	$3,401,215	$0	$0	$3,401,215
TOTAL Major Equipment				**$25,000**	**$254,000**	**$0**	**$3,122,216**	**$0**	**$3,401,216**	**$0**	**$0**	**$3,401,216**
Estimate Tree Structure Rollups Major Equipment												$3,401,216
Racks Moduled — Tree Depth= 2												
U.C. per EACH -->							50590		50590			50590
RACK MODULES UPPER & LOWER (WVS)	18		1.000	$0	$0	$0	$910,620	$0	$910,620	$0	$0	$910,620
TOTAL Racks Moduled				**$0**	**$0**	**$0**	**$910,620**	**$0**	**$910,620**	**$0**	**$0**	**$910,620**

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

DETAIL REPORT NO.1B

Reported From: Alt 3 C
Report Total: $42,766,031

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Major Equipment						$3,401,216
							Tree Depth= 2					
Remote 6-Ton Crane	U.C. per EA -->			25000	254000				279000			279000
6 TON BRIDGE CRANE (W464)		1	1.000	$25,000	$254,000	$0	$0	$0	$279,000	$0	$0	$279,000
TOTAL Remote 6-Ton Crane				$25,000	$254,000	$0	$0	$0	$279,000	$0	$0	$279,000
						Estimate Tree Structure Rollups Major Equipment						$3,401,216
							Tree Depth= 2					
Shield Door	U.C. per Each -->						762537		762537			762537
Shield Door (HWVP Vit)		2	1.000	$0	$0	$0	$1,525,074	$0	$1,525,074	$0	$0	$1,525,074
TOTAL Shield Door				$0	$0	$0	$1,525,074	$0	$1,525,074	$0	$0	$1,525,074
						Estimate Tree Structure Rollups Major Equipment						$3,401,216
							Tree Depth= 2					
Overpack Station	U.C. per EA -->						686521		686521			686521
OVERPACK (PIT WELD STATION)		1	1.000	$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
TOTAL Overpack Station				$0	$0	$0	$686,521	$0	$686,521	$0	$0	$686,521
						Estimate Tree Structure Rollups Alt 3 C						$42,766,031
							Tree Depth= 1					
Ventilation System (including slab, enclosure,stacks,	U.C. per EACH -->						1		1			1
VENTILATION SYSTEM		1	1.000	$0	$0	$0	$1	$0	$1	$0	$0	$1

DETAIL REPORT NO.1B
Reported From: Alt 3 C
Report Total: $42,766,031

LEVEL	QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
						Estimate Tree Structure Rollups Alt 3 C						$42,766,031
Ventilation System (including slab, enclosure,stacks,						Tree Depth= 1						
Subtotal				$0	$0	$0	$1	$0	$1	$0	$0	$1
Rollup from Child Levels				$0	$0	$0	$3,584,062	$0	$3,584,062	$0	$0	$3,584,062
TOTAL Ventilation System (including slab, enclosure,stacks, and equipment)				$0	**$0**	**$0**	**$3,584,063**	**$0**	**$3,584,063**	**$0**	**$0**	**$3,584,063**
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$3,584,063
Cell/Vault HVAC						Tree Depth= 2						
	U.C. per EA -->						2725282		2725282			2725282
CELL/VAULT HVAC SYSTEM (W059)	1		1.000	$0	$0	$0	$2,725,282	$0	$2,725,282	$0	$0	$2,725,282
TOTAL Cell/Vault HVAC				$0	**$0**	**$0**	**$2,725,282**	**$0**	**$2,725,282**	**$0**	**$0**	**$2,725,282**
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$3,584,063
Intake Stack						Tree Depth= 2						
	U.C. per EA -->						304830		304830			304830
INTAKE STACK (SNF)	1		1.000	$0	$0	$0	$304,830	$0	$304,830	$0	$0	$304,830
TOTAL Intake Stack				$0	**$0**	**$0**	**$304,830**	**$0**	**$304,830**	**$0**	**$0**	**$304,830**
						Estimate Tree Structure Rollups Ventilation System (including slab, enclosure,stacks, and equipment)						$3,584,063
Exhaust Stack						Tree Depth= 2						
	U.C. per EA -->						553950		553950			553950
EXHAUST STACK (SNF)	1		1.000	$0	$0	$0	$553,950	$0	$553,950	$0	$0	$553,950

DETAIL REPORT NO.1B

IMMOBILIZED HIGH-LEVEL WASTE INTERIM STORAGE ALTS.
PARAMETRIC ESTIMATE
COGEMA ENGINEERING CORP.
RON B. CALMUS

Reported From: Alt 3 C
Report Total: $42,766,031

Estimate Tree Structure Rollups
Ventilation System (Including slab, enclosure,stacks, and equipment) — $3,584,063

LEVEL		QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Tree Depth= 2													
Exhaust Stack					$0	$0	$0	$553,950	$0	$553,950	$0	$0	$553,950
TOTAL Exhaust Stack													$42,766,031

Estimate Tree Structure Rollups
Alt 3 C

LEVEL		QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Tree Depth= 1													
Operations Annex	U.C. per SF -->	4,201		1.000	$0	$0	$0	94.63 $397,541	$0	94.63 $397,541	$0	$0	94.63 $397,541
SLAB AND BUILDING STRUCTURE (HWVP)					$0	$0	$0	$397,541	$0	$397,541	$0	$0	$397,541
TOTAL Operations Annex													$42,766,031

Estimate Tree Structure Rollups
Alt 3 C

LEVEL		QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Tree Depth= 1													
Truck Bay	U.C. per SF -->	2,006		1.000	$0	$0	$0	94.63 $189,828	$0	94.63 $189,828	$0	$0	94.63 $189,828
SLAB AND BUILDING STRUCTURE (HWVP)					$0	$0	$0	$189,828	$0	$189,828	$0	$0	$189,828
TOTAL Truck Bay													$42,766,031

Estimate Tree Structure Rollups
Alt 3 C

LEVEL		QTY	Hrs	Crew/ProdFact	LABOR	MATERIAL	EQUIPMENT	OTHERS	TAXES	DIRECT COST	SUB M/U	PRIME M/U	TOTAL
Tree Depth= 1													
Stand by Generator	U.C. per EA -->	1	76.923 77	EELER3 1.000	2644.705 $2,645	35000 $35,000	390.669 $391	$0	$0	38035.374 $38,035	$0	$0	38035.374 $38,035
Generator set, dsl eng, xfr sw&fuel tank, 150 KW, incl btry,chgr, muf			77		$2,645	$35,000	$391	$0	$0	$38,035	$0	$0	$38,035
TOTAL Stand by Generator													

RACK MODULES

Per conversations with Mr. Steve Barnes, West Valley Nuclear Services, the canister storage rack for their chemical process cell cost $500K. This value is the delivery cost in 1994 dollars. The rack assembly consist of 11 modules. Each module can contain 36 3.0-m canisters (canisters stacked two high).

A module consists of an upper and lower module. Although the upper module is only about 1/2 the height of the lower module, the cost differential is expected to be insignificant. There would be some reduction in materials cost, but fabrication labor would be roughly the same.

The modules are seismically qualified.

11 upper + lower modules

$\left(\frac{\$500K}{22 \text{ modules}}\right)$ = $22,727/module ≅ $23K (1994 dollars)
25,280 / 556,370 (98 DOLLARS)

Alternative 2 (PUREX Upgrade) requires 34 single-stack modules (standard 4-m canisters) and one overpack module. Although the overpack module is smaller than the standard item, it is a one time fabrication. Setup costs must all be charged against the single rack, whereas with the standard rack these cost can be ammortized over 53 assemblies. Therefore, assume the overpack cost is identical to the standard rack cost.

Alternative 2

(35)($23K) = $805,000
35 25,280 = 885,140 = 1998 $

Alternative 3c (WVS-Type facility) requires 17 standard rack modules (dual-stack 4-m canisters) and one overpack rack. Given that these racks are dual-stack designs, the module cost (upper and lower) is $46K.

Alternative 3c

(18)($46K) = $828,000
18 50,590 = 910,630 = 1998 $

Both cost estimates are 1994 dollars.

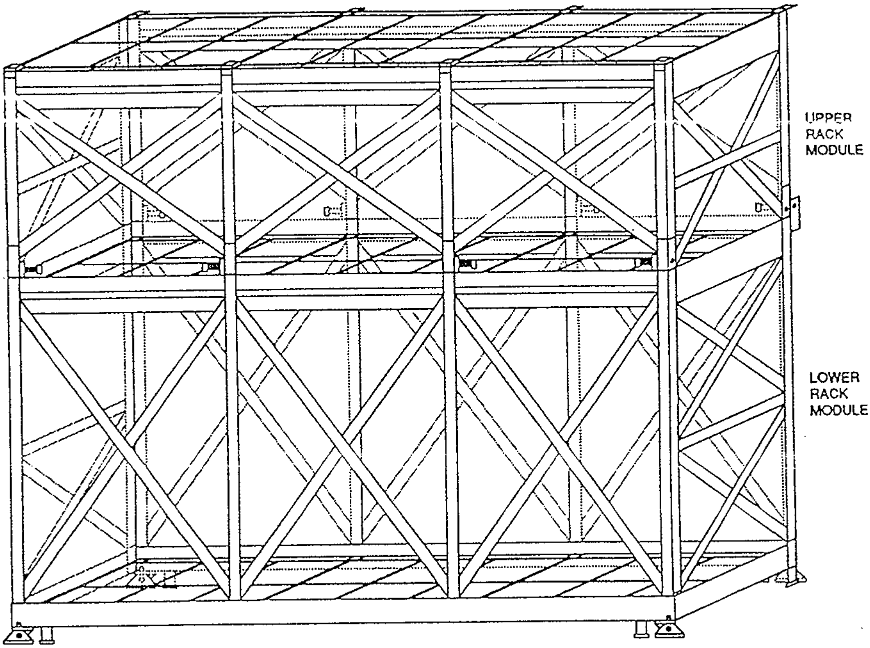

Figure 10. Assembly of Lower and Upper Rack Modules

GLASS WASTE STORAGE BUILDING COST INFORMATION

NOTE: All data is presented on a direct cost basis. Appropriate factors would have to be used as multipliers to obtain project based costs.

Tubes

Basis 1991 cost data for #2 GWSB

2,288.54 Tubes and Embeds = $3,890,767 is equivalent to about $1700 per canister support.

Vault Ventilation

Basis 1991 cost data for #2 GWSB

Summations of costs that appear to be part of the vault ventilation equal approximately $2,000,000.

This includes the mechanical cost of the fans, HEPA systems and dampers but does not include any electrical, piping or instrumentation. Fans cost = $30,000 each and HEPA's = $205,000 each.

SCT ROAD COSTS

Basis 1991 cost data for #2 GWSB

The direct cost for 1200 cubic yards of the 15 inch thick pad with 100#RS = $414,678.

This equates to 2880 square yards of area or equivalent to $144 per square yard or $16 per square foot. Note: This does not include the compaction cost nor the 7" of cement stabilized aggregate. A more appropriate cost might be $24 per square foot.

DWPF STORAGE FACILITY COST

NOTE: The GWSB cost is not linear with storage capacity because of access requirements for end positions. The variability in requirements over the years makes comparisons difficult. The following data needs to be considered in that light.

Basis 1986 cost data for #1 GWSB

Direct cost basis: $22,000,000 (21M for Bldg. And 1M for site work) = $612 per square foot of operating area.

Basis 1991 cost data for #2 GWSB

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APPENDIX C

FRENCH TECHNOLOGIES

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APPENDIX C

FRENCH TECHNOLOGIES

Several technology variations are possible for a new construction alternative. These technologies can be grouped into three general categories: Spent Nuclear Fuel-type (SNF-type) facilities, Savannah River Site-type (SRS-type) facilities, and West Valley Site-type (WVS-type) facilities. The SNF-type is a sealed-tube, natural convection system; the SRS-type is a open-tube, forced-air ventilation system; and the WVS-type is an open-bay, forced-air ventilation system. Because neither the open-tube nor the rack storage systems provide safety class confinement, the ventilation exhaust from an SRS-type facility and a WVS-type facility require treatment by high-efficiency particulate air (HEPA) filtration.

Although the French storage facility technologies are bounded by the aforementioned general categories, information on their technical scope and costs were provided by Eurisys Services Corporation (SGN). This information is summarized in this appendix as a cross-check to the parametric estimates presented in Appendix B for new construction.

The T7 storage facility provides for immobilized high-level waste (IHLW) canister interim storage at the reprocessing plant at La Hague, France. The EVT7 is an extension to the T7 facility (i.e., supplements the storage capacity of the T7 storage facility). The EVT7 presently includes one two-vault module. The EVT7 storage capacity can be enhanced by future construction of three additional modules (two vaults per module). Additional details of these facilities, as provided by SGN, are presented below.

C1.0 ALTERNATIVE 3d – T7 FACILITY

The T7 facility consists of two main features: a canister storage building containing 4 storage vaults, and a ventilation building containing air inlets and outlets, filters, and exhaust fans. The total storage capacity of the four vaults is 3,600 French-canisters. The French-canister has a maximum height of 1.338 m and a maximum external diameter of 0.456 m (internal glass volume of about 0.2 m^3). The equivalent capacity for a 4.5 m canister (0.61 m diameter with a 1.15 m^3 internal glass volume) is about 626 (3,600 * 0.2 / 1.15).

A forced-air ventilation system (412,000 m^3/h capacity) provides for canister cooling. An open-ended storage tube allows the cooling air to directly contact the external canister surface. To prevent residual contamination from being discharged to the environment, the exhaust is treated by HEPA filtration. However, in an emergency, such as loss of electrical power, ventilation would be via natural convection. Operation in a natural convection mode necessitates that the HEPA filters be by-passed.

Because a French-canister can generate up to 3.3 kW of decay heat, the vault walls are provided with extensive thermal shielding to protect the concrete. Cooling air passes between the thermal shielding and the concrete structure (vault walls and upper slab) before being discharged into the vault internal for canister cooling purposes.

The T7 storage facility is estimated to cost 467 million French Franc in 1998 currency. The following presents the cost breakdown.

• Engineering:	27%
• Storage equipment:	16%
• Mechanical equipment and piping:	7%
• Instrumentation and control:	8%
• Electrical:	5%
• Structural:	22%
• Vault ventilation (including stack):	12%
• Temporary facilities:	3%

The engineering includes conceptual design, detail design, procurement, installation, mechanical acceptance, and cold start-up. The cost does not include licensing, site preparation, construction consumables, or operation and maintenance.

C2.0 ALTERNATIVE 3e – EVT7 FACILITY

The EVT7 facility consists of four main features: a canister storage building containing two storage vaults, a transfer vehicle reception lock, a utilities building, and an electrical transformer building. The total storage capacity of the two vaults is 4,320 French canisters. The French canister has a maximum height of 1.338 m and a maximum external diameter of 0.456 m (internal glass volume of about 0.2 m^3). The equivalent capacity for a 4.5 m canister (0.61 m diameter with a 1.15 m^3 internal glass volume) is about 752 (4,320 * 0.2 / 1.15).

A natural convection system provides for canister cooling. The storage tubes are a sealed-end design. Because cooling air never directly contacts the external canister surface, HEPA filtration of the exhaust is not required.

Given a French canister can generate up to 3.3 kW of decay heat, the vault walls are provided with extensive thermal shielding to protect the concrete. Cooling air passes between the thermal shielding and the concrete structure (vault walls and upper slab) before being discharged into the vault internal for canister cooling purposes. Each individual storage tube is also provided with thermal shielding. The cooling air travels between the thermal shielding and the external storage tube surface.

The EVT7 storage facility is estimated to cost 460 million French Franc in 1998 currency. The following presents the cost breakdown.

• Engineering:	29%
• Storage equipment:	18%

- Mechanical equipment and piping: 8%
- Instrumentation and control: 7%
- Electrical: 5%
- Structural: 23%
- Vault ventilation (including stack): 5%
- Temporary facilities: 3%
- Miscellaneous: 2%

The engineering includes conceptual design, detail design, procurement, installation, mechanical acceptance, and cold start-up. The cost does not include licensing, site preparation, construction consumables, or operation and maintenance.

C3.0 DIRECT COST ESTIMATE SUMMARY

The cost information for the French technologies was not in a format that could be input into the parametric cost estimate. However, a reasonable direct cost estimate was obtained through the use of assumed scaling factors. First, the costs provided by SGN were converted to U.S. dollars (5.712 French Franc per dollar). The resultant cost for the T7 facility (620-canister capacity) is $81,755,703 and the EVT7 facility (752-canister capacity) is $80,532,213.

To adjust the cost for a 600-canister capacity, the structural cost was assumed to be a function of the capacity ratio to the 6/10th power [i.e., $(600/626)^{0.6}$ or $(600/752)^{0.6}$]. Furthermore, to account for the lower storage tube count and elimination of thermal shielding, the storage equipment and ventilation system costs were assumed to be a linear function of the storage capacity ratio. All other direct costs remained constant. The engineering cost was subtracted from the total because it is an indirect cost. Table C-1 summarizes the results.

Table C-1. French Alternative - Facility Direct Cost Summary. (2 sheets)

Cost element	Alternative*			
	3d T7		3e EVT7	
	626-canister capacity	600-canister capacity	752-canister capacity	600-canister capacity
Total cost	$81,758	--	$80,532	--
Engineering	$22,075	--	$23,354	--
Direct cost	$59,683	$58,282	$57,178	$51,088
Storage equipment	$13,081	$12,538	$14,496	$11,566
Mechanical	$5,723	$5,723	$6,443	$6,443
Instrumentation & control	$6,541	$6,541	$5,637	$5,637
Electrical	$4,088	$4,088	$4,027	$4,027
Structural	$17,987	$17,535	$18,522	$16,175
Ventilation	$9,811	$9,404	$4,027	$3,213

Table C-1. French Alternative - Facility Direct Cost Summary. (2 sheets)

Cost element	Alternative*			
	3d T7		3e EVT7	
	626-canister capacity	600-canister capacity	752-canister capacity	600-canister capacity
Temporary Facilities	$2,453	$2,453	$2,416	$2,416
Miscellaneous	--	--	$1,611	$1,611

*All costs are in thousands of dollars with no contingency or escalation.

APPENDIX D

LIFE-CYCLE COST ESTIMATE

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APPENDIX D

LIFE-CYCLE COST ESTIMATE

Based on the direct cost estimates, the total project cost (TPC) and life-cycle cost (LCC) was developed for each alternative. The base case referred to herein is the TPC and LCC that result from the direct cost estimates taken from the Project W-464 conceptual design report (CDR) for Alternative 1 and Appendix B for Alternatives 2 through 3. In addition, several variations from the base case are provided. These additional cases are as follows:

- Equal Capacity Case: All alternatives are based on a 600-canister storage capacity except Alternative 1 (Canister Storage Building [CSB]). The direct cost of Alternative 1 is taken from the Project W-464 CDR and is predicated on an 880-canister storage capacity. This case adjusts the direct cost of Alternative 1 to reflect a 600-canister storage capacity.

- Equal Capacity, 50% Confidence Case: This case is identical to the equal capacity case except direct costs have been revised to reflect potential cost savings. The cost savings are plausible, but entail a higher risk of eventual cost overruns.

- Equal Capacity, 80% Confidence Case: This case is identical to the equal capacity case except direct costs have been revised to eliminate any high-risk cost elements (i.e., suspect cost elements are increased to a level that is judged to minimize risk of an eventual cost overrun).

- Expanded Capacity Case: This case entails increasing the storage capacity of existing facilities to their physical limit. New construction alternatives are increased to a 1,200-canister storage capacity, which is a reasonable limit to what can be contained within a single continuous structure.

- Expanded Capacity, 50% Confidence Case: This case is identical to the expanded capacity case except direct costs have been revised to reflect potential cost savings. The cost savings are plausible, but entail a higher risk of eventual cost overruns.

- Expanded Capacity, 80% Confidence Case: This case is identical to the expanded capacity case except direct costs have been revised to eliminate any high-risk cost elements (i.e., suspect cost elements are increased to a level that is judged to minimize risk of an eventual cost overrun).

- Alternative 1 50% and 80% Confidence Case: This case is identical to the base case for Alternative 1 (880-canister storage capacity). The 50% confidence value assumes various cost reductions can be realized through value engineering (e.g., use of the spent nuclear fuel load-in/load-out annex).

D1.0 COST ESTIMATE ASSUMPTIONS

The following lists the various assumptions embodied in the TPC and LCC estimates for the various cases. The base case assumptions are valid for all other cases unless otherwise stated.

Base Case

- Alternative 1 (CSB) TPC, LCC, and all sub-elements taken from Project W-464 CDR
- Preconditioning: Alternative 2a (Plutonium-Uranium Extraction [PUREX]) cost taken from canyon decontamination estimate for U Plant
- Alternative 4 (Coupled) taken from Alternative 3c (West Valley Site [WVS-type]) direct cost with elimination of shared systems, structures, and components (remote 6-ton crane at $279,000, two shield doors at $1,525,000, operations annex at $398,000, truck bay at $190,000, and emergency generator at $38,000)
- Onsite Transportation:
  - Zero for Alternative 4
  - $4 million for all other alternatives
- Engineering:
  - $16 million for under Alternatives 2a and 2b (Fuels and Materials Examination Facility [FMEF])
  - 25% of total direct cost for all other alternatives
- Project Management:
  - For Alternative 2a, CDR value plus $764,000 to account for increased scope from preconditioning
  - CDR value for Alternative 2b
  - 21% of direct cost for all other alternatives
- Escalation: Same percentage as CDR for all alternatives
- Contingency:
  - For Alternative 2a, 50% of facility direct and engineering, 23% of transport direct, and 35% of preconditioning

  - For Alternative 2b, 50% of facility direct and engineering, and 23% of transport direct

  - For all other alternatives 23% of total direct and 21% of engineering (same percentage as CDR)

- Site Allocation: 22% of total direct and 30% of engineering (same percentages as CDR) for all alternatives

- Project Integration: Same value as CDR

- Other Project Cost: Same value as CDR plus $1.3 million for *National Environmental Policy Act of of 1969* (NEPA) documentation

- Conceptual Design:

  - Zero for Alternative 1 (sunk cost)
  - $1 million for all other alternatives

- Active Operation Period:

  - 5-year duration for first 600 canisters plus additional years up to capacity at 120 canisters per year

  - $3,424,000 per year operation and maintenance cost plus $3,000 per year electrical usage (same value as CDR) for all natural convection ventilation alternatives

  - $3,424,000 per year operation and maintenance cost plus $37,000 per year electrical usage for all forced-air ventilation alternatives

- Passive Storage Period:

  - 75 years less active operation duration

  - $1.2 million per year operation and maintenance cost for Alternative 2b (FMEF)

  - $685,000 per year operation and maintenance cost plus $3,000 per year electrical usage for alternatives with natural convection ventilation

  - $785,000 per year operation and maintenance cost plus $37,000 per year electrical usage for alternatives with forced-air ventilation (increased value reflects additional maintenance on ventilation system)

- Decontamination and Decommissioning:
  - Zero for Alternatives 1 (CSB) and 2a (PUREX) (sunk cost)
  - $6 million for Alternative 2b (FMEF)
  - $15 million for all other alternatives.

Equal Case

- For Alternative 1, facility direct cost revised by elimination of 140 standard storage tubes/plugs ($5.1 million savings).

Equal Case – 50% Confidence

- For Alternative 1, CDR facility direct cost revised to elimination of new load-in/load-out annex ($5,885,000), 20% reduction in exhaust stack ($221,000), replacement of shielded canister transporter with a canister-handling machine ($3,027,000), reduction in storage tubes/plugs from 880 to 600 ($5,108,000), and 20% reduction in remaining storage tubes/plugs ($2,189,000)

- For Alternative 2a:

  - $5 million added for preconceptual design structural evaluation
  - $50 million added to facility cost for structural upgrades

- For Alternative 2b:

  - Engineering reduced to 25% of facility direct cost (presumes positive results from preconceptual design structural evaluation)

  - $150,000 added for preconceptual design structural evaluation

- For Alternative 3 (New Construction), cost taken from Alternative 3c (WVS-type), Base Case

- For Alternative 4 (Coupled), cost taken from Base Case with engineering reduced from 25% to 23% and project management reduced from 21% to 19%, 50% reduction in project integration and other project costs, and zero operation and maintenance cost during active operation.

Equal Case – 80% Confidence

- For Alternative 1, same as cost for Equal Case
- For Alternative 2a:
  - Preconditioning cost increase taken from canyon decontamination and process cell disposition estimate for U Plant (with 18% increase to account for larger canyon/cell size)
  - $5 million added for preconceptual design structural evaluation
  - $100 million added to facility cost for structural upgrades
  - Project management is the CDR value ($8,221,000) plus $2,292,000 to account for increased scope from preconditioning
- For Alternative 2b, same cost for Base Case with $200,000 added for preconceptual structural evaluation
- For Alternative 3 (New Construction), cost taken from Alternative 3c (Savannah River Site ([SVS-type]), Base Case, with engineering increase from 25% to 30% of direct cost and project management increase from 21% to 23% of direct cost
- For Alternative 4 (Coupled), cost taken from Base Case with engineering increase from 25% to 30% of direct cost and project management increase from 21% to 23% of direct cost.

Expanded Case

- For Alternative 1, facility direct cost revised to include a 158-tube fourth vault
- For Alternative 2a, facility direct revised to include storage racks for 2,700 canisters
- For Alternative 2b, facility direct revised to include storage racks for 1,008 canisters
- For Alternative 3 (New Construction), facility direct cost revised using the 6/10th approximation ($C_{1,200} = C_{600} * (1,200/600)^{0.6}$).

Expanded Case – 50% Confidence

- For Alternative 1, CDR facility direct cost revised to eliminate new load-in/load-out annex ($5,885,000), 20% reduction in exhaust stack ($221,000), replacement of shielded canister transporter with a canister-handling machine ($3,027,000), reduction in storage tubes/plugs from 880 to 600 ($5,108,000), and 20% reduction in remaining storage tubes/plugs ($2,189,000)

- For Alternative 2a:
  - $5 million added for preconceptual design structural evaluation
  - $50 million added to facility cost for structural upgrades
- For Alternative 2b:
  - Engineering reduced to 25% of facility direct cost (presumes positive results from preconceptual design structural evaluation)
  - $150,000 added for preconceptual design structural evaluation
- For Alternative 3 (New Construction), cost taken from Alternative 3c (WVS-type), Expanded Case
- For Alternative 4 (Coupled), cost taken from Base Case with engineering reduced from 25% to 23% and project management reduced from 21% to 19%, 50% reduction in project integration and other project costs, and zero operation and maintenance cost during active operation.

Expanded Case – 80% Confidence

- For Alternative 1, same as cost for Expanded Case
- For Alternative 2a:
  - Preconditioning cost increase taken from canyon decontamination and process cell disposition estimate for U Plant (with 18% increase to account for larger canyon/cell size)
  - $5 million added for preconceptual design structural evaluation
  - $100 million added to facility cost for structural upgrades
  - Project management is the CDR value ($8,221,000) plus $2,292,000 to account for increased scope from preconditioning
- For Alternative 2b, same cost for Base Case with $200,000 added for preconceptual structural evaluation
- For Alternative 3 (New Construction), cost taken from Alternative 3c (SRS-type), Expanded Case, with engineering increase from 25% to 30% of direct cost and project management increase from 21% to 23% of direct cost
- For Alternative 4 (Coupled), cost taken from Base Case with engineering increase from 25% to 30% of direct cost and project management increase from 21% to 23% of direct cost.

Alternative 1, 50% and 80% Confidence Case

- For Alternative 1, 50% Confidence Case the CDR facility direct costs are revised to reflect elimination of the new load-in/load-out annex ($5,885,000), a 20% reduction in exhaust stack ($221,000), replacement of shielded canister transporter with a canister-handling machine ($3,027,000), and 20% reduction in storage tubes/plugs ($2,189,000)

- For Alternative 1, 80% Confidence Case same as cost for Base Case.

D2.0 COST ESTIMATE SUMMARIES

The following tables provide the summary TPC and LCC estimates for the various cases. Present values are based on a 7% annual discount rate and are indexed to the year detail design is initiated. Escalation between 1998 and the present value index year is neglected. Constant dollar values do not consider the time value of money (i.e., essentially a 0% annual discount rate).

Table D-1. Alternative Cost Summary (Present Value).

	Alternative*									
	1 CSB		2a PUREX		2b FMEF		3 New Construction		4 Coupled	
Cost confidence level	50%	80%	50%	80%	50%	80%	50%	80%	50%	80%
600-canister capacity										
Structural evaluation	$0	$0	$5,000	$5,000	$150	$200	$0	$0	$0	$0
Conceptual design	$0	$0	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Total project cost	$61,814	$82,915	$151,189	$252,877	$36,295	$67,404	$112,634	$164,300	$89,855	$102,143
Operating cost	$15,379	$15,379	$16,496	$16,496	$19,571	$19,571	$16,496	$16,496	$6,197	$6,197
D&D	$0	$0	$0	$0	$28	$28	$69	$69	$69	$69
Life-cycle cost	$77,193	$98,295	$173,685	$275,373	$57,043	$88,202	$130,198	$181,865	$97,121	$109,409
Capacity	600	600	600	600	600	600	600	600	600	600
Unit life-cycle cost	$129	$164	$289	$459	$95	$147	$217	$303	$162	$182
880-canister capacity										
Structural evaluation	$0	$0	--	--	--	--	--	--	--	--
Conceptual design	$0	$0	--	--	--	--	--	--	--	--
Total project cost	$78,622	$92,415	--	--	--	--	--	--	--	--
Operating cost	$18,364	$18,364	--	--	--	--	--	--	--	--
D&D	$0	$0	--	--	--	--	--	--	--	--
Life-cycle cost	$96,986	$110,779	--	--	--	--	--	--	--	--
Capacity	880	880	--	--	--	--	--	--	--	--
Unit life-cycle cost	$110	$126	--	--	--	--	--	--	--	--
Full capacity										
Structural evaluation	$0	$0	$5,000	$5,000	$150	$200	$0	$0	$0	$0
Conceptual design	$0	$0	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Total project cost	$94,930	$118,410	$156,415	$258,103	$44,339	$68,950	$159,466	$235,946	$132,961	$148,354
Operating cost	$21,224	$21,224	$24,173	$24,173	$22,985	$22,985	$22,155	$22,155	$4,515	$4,515
D&D	$0	$0	$0	$0	$28	$28	$69	$69	$69	$69
Life-cycle cost	$116,154	$139,633	$186,589	$288,276	$68,502	$93,163	$182,690	$259,170	$138,544	$153,938
Capacity	1,196	1,196	2,700	2,700	1,008	1,008	1,200	1,200	1,200	1,200
Unit life-cycle cost	$97	$117	$69	$107	$68	$92	$152	$216	$115	$128

*All costs are present value in thousands of dollars.
D&D = decontamination and decommissioning.

Table D-2. Alternative Cost Summary (Constant Dollar).

	Alternative*									
	1 CSB		2a PUREX		2b FMEF		3 New Construction		4 Coupled	
Cost confidence level	50%	80%	50%	80%	50%	80%	50%	80%	50%	80%
600-canister capacity										
Structural evaluation	$0	$0	$5,000	$5,000	$150	$200	$0	$0	$0	$0
Conceptual design	$0	$0	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Total project cost	$61,814	$82,915	$151,189	$252,877	$36,295	$67,404	$112,634	$164,300	$89,855	$102,143
Operating cost	$65,124	$65,124	$74,831	$74,831	$103,895	$103,895	$74,831	$74,831	$57,711	$57,711
D&D	$0	$0	$0	$0	$6,000	$6,000	$15,000	$15,000	$15,000	$15,000
Life-cycle cost	$126,938	$148,039	$232,020	$333,708	$147,340	$178,499	$203,465	$255,131	$163,566	$175,854
Capacity	600	600	600	600	600	600	600	600	600	600
Unit life-cycle cost	$212	$247	$387	$556	$246	$297	$339	$425	$273	$293
880-canister capacity										
Structural evaluation	$0	$0	--	--	--	--	--	--	--	--
Conceptual design	$0	$0	--	--	--	--	--	--	--	--
Total project cost	$78,622	$92,415	--	--	--	--	--	--	--	--
Operating cost	$71,506	$71,506	--	--	--	--	--	--	--	--
D&D	$0	$0	--	--	--	--	--	--	--	--
Life-cycle cost	$150,129	$163,922	--	--	--	--	--	--	--	--
Capacity	880	880	--	--	--	--	--	--	--	--
Unit life-cycle cost	$171	$186	--	--	--	--	--	--	--	--
Full capacity										
Structural evaluation	$0	$0	$5,000	$5,000	$150	$200	$0	$0	$0	$0
Conceptual design	$0	$0	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Total project cost	$94,930	$118,410	$156,415	$258,103	$44,339	$68,950	$159,466	$235,946	$132,961	$148,354
Operating cost	$78,738	$78,738	$94,071	$94,071	$111,457	$111,457	$88,207	$88,207	$53,787	$53,787
D&D	$0	$0	$0	$0	$6,000	$6,000	$15,000	$15,000	$15,000	$15,000
Life-cycle cost	$173,668	$197,148	$256,486	$358,174	$162,946	$187,607	$263,493	$339,973	$202,748	$218,141
Capacity	1,196	1,196	2,700	2,700	1,008	1,008	1,200	1,200	1,200	1,200
Unit life-cycle cost	$145	$165	$95	$133	$162	$186	$220	$283	$169	$182

*All costs are constant value in thousands of dollars.
D&D = decontamination and decommissioning.

Table D-3. Base Case.

2/7/99 16:16	CSB	PUREX	FMEF	CSB-Type	SRS-Type	WVS-Type	T7	EVT7	Local	Coupled
Base Case	1	2a	2b	3a	3b	3c	3d	3e	3f	4
Total Constant Dollar	163,922	162,160	178,299	235,100	248,433	203,465	236,412	211,563	232,239	171,899
Present Value	110,779	103,825	88,002	170,308	175,166	130,198	163,145	146,772	167,448	105,454
Ranking	8	8	10	2	1	6	2	4	2	8
Capacity	880	600	600	600	600	600	600	600	600	600
Unit Cost	126	173	147	284	292	217	272	245	279	176
PRESENT VALUE	110,779	103,825	88,002	170,308	175,166	130,198	163,145	146,772	167,448	105,454
Subtotal Initial Cost	92,415	87,329	68,404	154,841	158,602	113,634	146,581	131,305	151,981	99,188
Structural Evaluation	0	0	0	0	0	0	0	0	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Project Cost	92,415	86,329	67,404	153,841	157,602	112,634	145,581	130,305	150,981	98,188
Subtotal Operating Cost	18,364	16,496	19,571	15,398	16,496	16,496	16,496	15,398	15,398	6,197
Subtotal Active Receipt	14,033	10,409	10,409	10,306	10,409	10,409	10,409	10,306	10,306	111
O&M (Active Receipt)	14,029	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	0
Electrical (Active Receipt)	4	111	111	8	111	111	111	8	8	111
Subtotal Passive Storage	4,331	6,086	9,161	5,092	6,086	6,086	6,086	5,092	5,092	6,086
O&M (Passive Storage)	4,325	5,812	8,887	5,072	5,812	5,812	5,812	5,072	5,072	5,812
Electrical (Passive Storage)	6	274	274	20	274	274	274	20	20	274
Upgrades	0	0	0	0	0	0	0	0	0	0
D&D	0	0	28	69	69	69	69	69	69	69
TASK DURATIONS										
Discount Rate	7%									
Design	2	2	2	2	2	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	7	5	5	5	5	5	5	5	5	5
O&M (Passive Storage)	68	70	70	70	70	70	70	70	70	70
Year of Upgrade	0	0	0	0	0	0	0	0	0	0
INITIAL COST	92,415	87,329	68,404	154,841	158,602	113,634	146,581	131,305	151,981	99,188
Structural Evaluation	0	0	0	0	0	0	0	0	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Project Cost	92,415	86,329	67,404	153,841	157,602	112,634	145,581	130,305	150,981	98,188

Table D-3. Base Case.

2/7/99 16:16	CSB	PUREX	FMEF	CSB-Type	SRS-Type	WVS-Type	T7	EVT7	Local	Coupled
Base Case	1	2a	2b	3a	3b	3c	3d	3e	3f	4
Total Estimated Cost	81,201	73,795	54,870	141,307	145,068	100,099	133,047	117,771	138,447	85,654
Capital Cost	55,935	46,071	34,321	97,157	99,743	68,824	91,478	80,975	95,191	58,892
Direct Cost	39,168	20,948	10,100	66,546	68,317	47,140	62,656	55,462	65,199	40,337
Preconditioning	0	9,822	0	0	0	0	0	0	0	0
Structural Upgrade	0	0	0	0	0	0	0	0	0	0
Facility	34,794	6,752	5,726	62,172	63,943	42,766	58,282	51,088	65,199	40,337
On-site Transportation	4,374	4,374	4,374	4,374	4,374	4,374	4,374	4,374	0	0
Indirect Cost	16,767	25,123	24,221	30,611	31,426	21,684	28,822	25,513	29,992	18,555
Engineering	8,546	16,000	16,000	16,637	17,079	11,785	15,664	13,866	16,300	10,084
Project Management	8,221	9,123	8,221	13,975	14,347	9,899	13,158	11,647	13,692	8,471
Escalation	3,533	2,518	1,670	6,119	6,282	4,335	5,761	5,100	5,995	3,709
Contingency	10,597	15,802	11,852	18,450	18,941	13,070	17,371	15,377	18,076	11,183
Site Allocation	11,136	9,404	7,028	19,581	20,102	13,871	18,437	16,320	19,185	11,869
Project Integration	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162
Other Project Cost	8,052	9,372	9,372	9,372	9,372	9,372	9,372	9,372	9,372	9,372
Environmental	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735
NEPA		1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
Safety	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228
Quality Assurance	127	127	127	127	127	127	127	127	127	127
Startup	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963
ANNUAL COST	4,111	4,283	4,698	4,114	4,283	4,283	4,283	4,114	4,114	859
Active Receipt Total	3,425	3,461	3,461	3,427	3,461	3,461	3,461	3,427	3,427	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	3,424	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	3	37	37	37	3	3	37
Passive Storage Total	686	822	1,237	688	822	822	822	688	688	822
O&M (Passive Storage)	685	785	1,200	685	785	785	785	685	685	785
Electrical (Passive Storage)	1	37	37	3	37	37	37	3	3	37
UPGRADES	0	0	0	0	0	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000

Table D-4. Equal Capacity Case.

2/7/99 16:26	CSB	PUREX	FMEF	CSB-Type	SRS-Type	WVS-Type	T7	EVT7	Local	Coupled
Equal Case	1	2a	2b	3a	3b	3c	3d	3e	3f	4
Total Constant Dollar	148,039	162,160	178,299	235,100	248,433	203,465	236,412	211,563	232,239	171,899
Present Value	98,295	103,825	88,002	170,308	175,166	130,198	163,145	146,772	167,448	105,454
Ranking	9	8	10	2	1	6	2	4	2	8
Capacity	600	600	600	600	600	600	600	600	600	600
Unit Cost	164	173	147	284	292	217	272	245	279	176
PRESENT VALUE	98,295	103,825	88,002	170,308	175,166	130,198	163,145	146,772	167,448	105,454
Subtotal Initial Cost	82,915	87,329	68,404	154,841	158,602	113,634	146,581	131,305	151,981	99,188
Structural Evaluation	0	0	0	0	0	0	0	0	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Project Cost	82,915	86,329	67,404	153,841	157,602	112,634	145,581	130,305	150,981	98,188
Subtotal Operating Cost	15,379	16,496	19,571	15,398	16,496	16,496	16,496	15,398	15,398	6,197
Subtotal Active Receipt	10,301	10,409	10,409	10,306	10,409	10,409	10,409	10,306	10,306	111
O&M (Active Receipt)	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	10,298	0
Electrical (Active Receipt)	3	111	111	8	111	111	111	8	8	111
Subtotal Passive Storage	5,078	6,086	9,161	5,092	6,086	6,086	6,086	5,092	5,092	6,086
O&M (Passive Storage)	5,072	5,812	8,887	5,072	5,812	5,812	5,812	5,072	5,072	5,812
Electrical (Passive Storage)	7	274	274	20	274	274	274	20	20	274
Upgrades	0	0	0	0	0	0	0	0	0	0
D&D	0	0	28	69	69	69	69	69	69	69
TASK DURATIONS										
Discount Rate	7%									
Design	2	2	2	2	2	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	5	5	5	5	5	5	5	5	5	5
O&M (Passive Storage)	70	70	70	70	70	70	70	70	70	70
Year of Upgrade	0	0	0	0	0	0	0	0	0	0
INITIAL COST	82,915	87,329	68,404	154,841	158,602	113,634	146,581	131,305	151,981	99,188
Structural Evaluation	0	0	0	0	0	0	0	0	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Table D-4. Equal Capacity Case.

2/7/99 16:26	CSB	PUREX	FMEF	CSB-Type	SRS-Type	WVS-Type	T7	EVT7	Local	Coupled
Equal Case	1	2a	2b	3a	3b	3c	3d	3e	3f	4
Total Project Cost	82,915	86,329	67,404	153,841	157,602	112,634	145,581	130,305	150,981	98,188
Total Estimated Cost	71,701	73,795	54,870	141,307	145,068	100,099	133,047	117,771	138,447	85,654
Capital Cost	49,712	46,071	34,321	97,157	99,743	68,824	91,478	80,975	95,191	58,892
Direct Cost	34,060	20,948	10,100	66,546	68,317	47,140	62,656	55,462	65,199	40,337
Preconditioning	0	9,822	0	0	0	0	0	0	0	0
Structural Upgrade	0	0	0	0	0	0	0	0	0	0
Facility	29,686	6,752	5,726	62,172	63,943	42,766	58,282	51,088	65,199	40,337
On-site Transportation	4,374	4,374	4,374	4,374	4,374	4,374	4,374	4,374	0	0
Indirect Cost	15,652	25,123	24,221	30,611	31,426	21,684	28,822	25,513	29,992	18,555
Engineering	7,431	16,000	16,000	16,637	17,079	11,785	15,664	13,866	16,300	10,084
Project Management	8,221	9,123	8,221	13,975	14,347	9,899	13,158	11,647	13,692	8,471
Escalation	3,072	2,518	1,670	6,119	6,282	4,335	5,761	5,100	5,995	3,709
Contingency	9,221	15,802	11,852	18,450	18,941	13,070	17,371	15,377	18,076	11,183
Site Allocation	9,696	9,404	7,028	19,581	20,102	13,871	18,437	16,320	19,185	11,869
Project Integration	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162
Other Project Cost	8,052	9,372	9,372	9,372	9,372	9,372	9,372	9,372	9,372	9,372
Environmental	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735
NEPA		1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
Safety	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228
Quality Assurance	127	127	127	127	127	127	127	127	127	127
Startup	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963
ANNUAL COST	4,111	4,283	4,698	4,114	4,283	4,283	4,283	4,114	4,114	859
Active Receipt Total	3,425	3,461	3,461	3,427	3,461	3,461	3,461	3,427	3,427	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	3,424	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	3	37	37	37	3	3	37
Passive Storage Total	686	822	1,237	688	822	822	822	688	688	822
O&M (Passive Storage)	685	785	1,200	685	785	785	785	685	685	785
Electrical (Passive Storage)	1	37	37	3	37	37	37	3	3	37
UPGRADES	0	0	0	0	0	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000

Table D-5. Equal Capacity, 50% Confidence Case.

2/7/99 16:34	CSB	PUREX	FMEF	New Const	Coupled
Equal Case (50%)	1	2a	2b	3c	4
Total Constant Dollar	126,938	232,020	147,340	203,465	163,566
Present Value	77,193	173,685	57,043	130,198	97,121
Ranking	8	1	10	4	7
Capacity	600	600	600	600	600
Unit Cost	129	289	95	217	162
PRESENT VALUE	77,193	173,685	57,043	130,198	97,121
Subtotal Initial Cost	61,814	157,189	37,445	113,634	90,855
Structural Evaluation	0	5,000	150	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000
Total Project Cost	61,814	151,189	36,295	112,634	89,855
Subtotal Operating Cost	15,379	16,496	19,571	16,496	6,197
Subtotal Active Receipt	10,301	10,409	10,409	10,409	111
O&M (Active Receipt)	10,298	10,298	10,298	10,298	0
Electrical (Active Receipt)	3	111	111	111	111
Subtotal Passive Storage	5,078	6,086	9,161	6,086	6,086
O&M (Passive Storage)	5,072	5,812	8,887	5,812	5,812
Electrical (Passive Storage)	7	274	274	274	274
Upgrades	0	0	0	0	0
D&D	0	0	28	69	69
TASK DURATIONS					
Discount Rate	7%				
Design	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	5	5	5	5	5
O&M (Passive Storage)	70	70	70	70	70
Year of Upgrade	0	0	0	0	0
INITIAL COST	61,814	157,189	37,445	113,634	90,855
Structural Evaluation	0	5,000	150	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000

Table D-5. Equal Capacity, 50% Confidence Case.

2/7/99 16:34	CSB	PUREX	FMEF	New Const	Coupled
Equal Case (50%)	1	2a	2b	3c	4
Total Project Cost	61,814	151,189	36,295	112,634	89,855
Total Estimated Cost	50,600	138,655	23,761	100,099	83,588
Capital Cost	35,920	96,071	14,746	68,824	57,279
Direct Cost	22,738	70,948	10,100	47,140	40,337
Preconditioning	0	9,822	0	0	0
Structural Upgrade	0	50,000	0	0	0
Facility	18,364	6,752	5,726	42,766	40,337
On-site Transportation	4,374	4,374	4,374	4,374	0
Indirect Cost	13,182	25,123	4,646	21,684	16,942
Engineering	4,961	16,000	2,525	11,785	9,278
Project Management	8,221	9,123	2,121	9,899	7,664
Escalation	2,051	6,428	929	4,335	3,665
Contingency	6,156	15,802	5,114	13,070	11,018
Site Allocation	6,473	20,354	2,972	13,871	11,626
Project Integration	3,162	3,162	3,162	3,162	1,581
Other Project Cost	8,052	9,372	9,372	9,372	4,686
Environmental	1,735	1,735	1,735	1,735	867
NEPA		1,320	1,320	1,320	660
Safety	3,228	3,228	3,228	3,228	1,614
Quality Assurance	127	127	127	127	63
Startup	2,963	2,963	2,963	2,963	1,481
ANNUAL COST	4,111	4,283	4,698	4,283	859
Active Receipt Total	3,425	3,461	3,461	3,461	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	37	37
Passive Storage Total	686	822	1,237	822	822
O&M (Passive Storage)	685	785	1,200	785	785
Electrical (Passive Storage)	1	37	37	37	37
UPGRADES	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000

Table D-6. Equal Capacity, 80% Confidence Case.

2/7/99 16:43	CSB	PUREX	FMEF	New Const	Coupled
Equal Case (80%)	1	2a	2b	3b	4
Total Constant Dollar	148,039	333,708	178,499	255,131	175,854
Present Value	98,295	275,373	88,202	181,865	109,409
Ranking	10	1	10	5	9
Capacity	600	600	600	600	600
Unit Cost	164	459	147	303	182
PRESENT VALUE	98,295	275,373	88,202	181,865	109,409
Subtotal Initial Cost	82,915	258,877	68,604	165,300	103,143
Structural Evaluation	0	5,000	200	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000
Total Project Cost	82,915	252,877	67,404	164,300	102,143
Subtotal Operating Cost	15,379	16,496	19,571	16,496	6,197
Subtotal Active Receipt	10,301	10,409	10,409	10,409	111
O&M (Active Receipt)	10,298	10,298	10,298	10,298	0
Electrical (Active Receipt)	3	111	111	111	111
Subtotal Passive Storage	5,078	6,086	9,161	6,086	6,086
O&M (Passive Storage)	5,072	5,812	8,887	5,812	5,812
Electrical (Passive Storage)	7	274	274	274	274
Upgrades	0	0	0	0	0
D&D	0	0	28	69	69
TASK DURATIONS					
Discount Rate	7%				
Design	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	5	5	5	5	5
O&M (Passive Storage)	70	70	70	70	70
Year of Upgrade	0	0	0	0	0
INITIAL COST	82,915	258,877	68,604	165,300	103,143
Structural Evaluation	0	5,000	200	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000
Total Project Cost	82,915	252,877	67,404	164,300	102,143

Table D-6. Equal Capacity, 80% Confidence Case.

2/7/99 16:43	CSB	PUREX	FMEF	New Const	Coupled
Equal Case (80%)	1	2a	2b	3b	4
Total Estimated Cost	71,701	240,343	54,870	151,766	89,609
Capital Cost	49,712	168,975	34,321	104,525	61,716
Direct Cost	34,060	142,462	10,100	68,317	40,337
Preconditioning	0	31,336	0	0	0
Structural Upgrade	0	100,000	0	0	0
Facility	29,686	6,752	5,726	63,943	40,337
On-site Transportation	4,374	4,374	4,374	4,374	0
Indirect Cost	15,652	26,513	24,221	36,208	21,379
Engineering	7,431	16,000	16,000	20,495	12,101
Project Management	8,221	10,513	8,221	15,713	9,278
Escalation	3,072	12,021	1,670	6,470	3,820
Contingency	9,221	23,332	11,852	19,641	11,597
Site Allocation	9,696	36,015	7,028	21,130	12,476
Project Integration	3,162	3,162	3,162	3,162	3,162
Other Project Cost	8,052	9,372	9,372	9,372	9,372
Environmental	1,735	1,735	1,735	1,735	1,735
NEPA		1,320	1,320	1,320	1,320
Safety	3,228	3,228	3,228	3,228	3,228
Quality Assurance	127	127	127	127	127
Startup	2,963	2,963	2,963	2,963	2,963
ANNUAL COST	4,111	4,283	4,698	4,283	859
Active Receipt Total	3,425	3,461	3,461	3,461	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	37	37
Passive Storage Total	686	822	1,237	822	822
O&M (Passive Storage)	685	785	1,200	785	785
Electrical (Passive Storage)	1	37	37	37	37
UPGRADES	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000

Table D-7. Expanded Capacity Case.

2/7/99 16:49	CSB	PUREX	FMEF	CSB-Type	SRS-Type	WVS-Type	T7	EVT7	Local	Coupled
Expanded Case	1	2a	2b	3a	3b	3c	3d	3e	3f	4
Total Constant Dollar	197,148	186,626	187,407	316,880	330,112	263,493	302,410	269,884	317,334	212,147
Present Value	139,633	116,729	92,963	244,266	249,309	182,690	221,607	197,270	244,720	147,943
Ranking	7	9	10	1	1	5	3	4	1	7
Capacity	1,196	2,700	1,008	1200	1200	1200	1200	1200	1200	1200
Unit Cost	117	43	92	204	208	152	185	164	204	123
PRESENT VALUE	139,633	116,729	92,963	244,266	249,309	182,690	221,607	197,270	244,720	147,943
Subtotal Initial Cost	118,410	92,555	69,950	222,925	227,085	160,466	199,383	175,929	223,380	143,360
Structural Evaluation	0	0	0	0	0	0	0	0	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Project Cost	118,410	91,555	68,950	221,925	226,085	159,466	198,383	174,929	222,380	142,360
Subtotal Operating Cost	21,224	24,173	22,985	21,272	22,155	22,155	22,155	21,272	21,272	4,515
Subtotal Active Receipt	17,608	20,478	15,723	17,655	17,831	17,831	17,831	17,655	17,655	191
O&M (Active Receipt)	17,604	20,259	15,555	17,641	17,641	17,641	17,641	17,641	17,641	0
Electrical (Active Receipt)	5	219	168	14	191	191	191	14	14	191
Subtotal Passive Storage	3,615	3,696	7,262	3,617	4,324	4,324	4,324	3,617	3,617	4,324
O&M (Passive Storage)	3,610	3,529	7,045	3,603	4,129	4,129	4,129	3,603	3,603	4,129
Electrical (Passive Storage)	5	166	217	14	195	195	195	14	14	195
Upgrades	0	0	0	0	0	0	0	0	0	0
D&D	0	0	28	69	69	69	69	69	69	69
TASK DURATIONS										
Discount Rate	7%									
Design	2	2	2	2	2	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	10	12	8	10	10	10	10	10	10	10
O&M (Passive Storage)	65	63	67	65	65	65	65	65	65	65
Year of Upgrade	0	0	0	0	0	0	0	0	0	0
INITIAL COST	118,410	92,555	69,950	222,925	227,085	160,466	199,383	175,929	223,380	143,360
Structural Evaluation	0	0	0	0	0	0	0	0	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Table D-7. Expanded Capacity Case.

2/7/99 16:49	CSB	PUREX	FMEF	CSB-Type	SRS-Type	WVS-Type	T7	EVT7	Local	Coupled
Expanded Case	1	2a	2b	3a	3b	3c	3d	3e	3f	4
Total Project Cost	118,410	91,555	68,950	221,925	226,085	159,466	198,383	174,929	222,380	142,360
Total Estimated Cost	107,196	79,021	56,416	209,391	213,551	146,932	185,849	162,395	209,846	129,826
Capital Cost	73,824	48,979	35,181	143,969	146,829	101,025	127,782	111,656	144,282	89,263
Direct Cost	51,691	23,856	10,960	98,609	100,568	69,195	87,522	76,477	98,823	61,139
Preconditioning	0	9,822	0	0	0	0	0	0	0	0
Structural Upgrade	0	0	0	0	0	0	0	0	0	0
Facility	47,317	9,660	6,586	94,235	96,194	64,821	83,148	72,103	98,823	61,139
On-site Transportation	4,374	4,374	4,374	4,374	4,374	4,374	4,374	4,374	0	0
Indirect Cost	22,133	25,123	24,221	45,360	46,261	31,830	40,260	35,179	45,459	28,124
Engineering	11,278	16,000	16,000	24,652	25,142	17,299	21,881	19,119	24,706	15,285
Project Management	10,855	9,123	8,221	20,708	21,119	14,531	18,380	16,060	20,753	12,839
Escalation	4,663	2,746	1,737	9,067	9,247	6,362	8,048	7,032	9,087	5,622
Contingency	13,994	17,256	12,282	27,339	27,882	19,184	24,265	21,203	27,399	16,951
Site Allocation	14,715	10,041	7,216	29,016	29,592	20,361	25,753	22,503	29,079	17,990
Project Integration	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162	3,162
Other Project Cost	8,052	9,372	9,372	9,372	9,372	9,372	9,372	9,372	9,372	9,372
Environmental	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735	1,735
NEPA		1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
Safety	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228	3,228
Quality Assurance	127	127	127	127	127	127	127	127	127	127
Startup	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963
ANNUAL COST	4,111	4,283	4,698	4,114	4,283	4,283	4,283	4,114	4,114	859
Active Receipt Total	3,425	3,461	3,461	3,427	3,461	3,461	3,461	3,427	3,427	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	3,424	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	3	37	37	37	3	3	37
Passive Storage Total	686	822	1,237	688	822	822	822	688	688	822
O&M (Passive Storage)	685	785	1,200	685	785	785	785	685	685	785
Electrical (Passive Storage)	1	37	37	3	37	37	37	3	3	37
UPGRADES	0	0	0	0	0	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000

Table D-8. Expanded Capacity, 50% Confidence Case.

2/7/99 17:01	CSB	PUREX	FMEF	New Const	Coupled
Expanded Case (50%)	1	2a	2b	3c	4
Total Constant Dollar	173,668	256,486	162,946	263,493	202,748
Present Value	116,154	186,589	68,502	182,690	138,544
Ranking	6	1	10	1	5
Capacity	1,196	2,700	1,008	1200	1200
Unit Cost	97	69	68	152	115
PRESENT VALUE	116,154	186,589	68,502	182,690	138,544
Subtotal Initial Cost	94,930	162,415	45,489	160,466	133,961
Structural Evaluation	0	5,000	150	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000
Total Project Cost	94,930	156,415	44,339	159,466	132,961
Subtotal Operating Cost	21,224	24,173	22,985	22,155	4,515
Subtotal Active Receipt	17,608	20,478	15,723	17,831	191
O&M (Active Receipt)	17,604	20,259	15,555	17,641	0
Electrical (Active Receipt)	5	219	168	191	191
Subtotal Passive Storage	3,615	3,696	7,262	4,324	4,324
O&M (Passive Storage)	3,610	3,529	7,045	4,129	4,129
Electrical (Passive Storage)	5	166	217	195	195
Upgrades	0	0	0	0	0
D&D	0	0	28	69	69
TASK DURATIONS					
Discount Rate	7%				
Design	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	10	12	8	10	10
O&M (Passive Storage)	65	63	67	65	65
Year of Upgrade	0	0	0	0	0
INITIAL COST	94,930	162,415	45,489	160,466	133,961
Structural Evaluation	0	5,000	150	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000

Table D-8. Expanded Capacity, 50% Confidence Case.

2/7/99 17:01	CSB	PUREX	FMEF	New Const	Coupled
Expanded Case (50%)	1	2a	2b	3c	4
Total Project Cost	94,930	156,415	44,339	159,466	132,961
Total Estimated Cost	83,716	143,881	31,805	146,932	126,694
Capital Cost	57,654	98,979	21,921	101,025	86,817
Direct Cost	40,369	73,856	10,960	69,195	61,139
Preconditioning	0	9,822	0	0	0
Structural Upgrade	0	50,000	0	0	
Facility	35,995	9,660	6,586	64,821	61,139
On-site Transportation	4,374	4,374	4,374	4,374	0
Indirect Cost	17,285	25,123	10,961	31,830	25,678
Engineering	8,808	16,000	2,740	17,299	14,062
Project Management	8,477	9,123	8,221	14,531	11,616
Escalation	3,641	6,656	1,008	6,362	5,554
Contingency	10,929	17,256	5,652	19,184	16,700
Site Allocation	11,492	20,991	3,225	20,361	17,622
Project Integration	3,162	3,162	3,162	3,162	1,581
Other Project Cost	8,052	9,372	9,372	9,372	4,686
Environmental	1,735	1,735	1,735	1,735	867
NEPA		1,320	1,320	1,320	660
Safety	3,228	3,228	3,228	3,228	1,614
Quality Assurance	127	127	127	127	63
Startup	2,963	2,963	2,963	2,963	1,481
ANNUAL COST	4,111	4,283	4,698	4,283	859
Active Receipt Total	3,425	3,461	3,461	3,461	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	37	37
Passive Storage Total	686	822	1,237	822	822
O&M (Passive Storage)	685	785	1,200	785	785
Electrical (Passive Storage)	1	37	37	37	37
UPGRADES	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000

Table D-9. Expanded Capacity, 80% Confidence Case.

2/7/99 17:16	CSB	PUREX	FMEF	New Const	Coupled
Expanded Case (80%)	1	2a	2b	3b	4
Total Constant Dollar	197,148	358,174	187,607	339,973	218,141
Present Value	139,633	288,276	93,163	259,170	153,938
Ranking	8	1	10	2	7
Capacity	1,196	2,700	1,008	1200	1200
Unit Cost	117	107	92	216	128
PRESENT VALUE	139,633	288,276	93,163	259,170	153,938
Subtotal Initial Cost	118,410	264,103	70,150	236,946	149,354
Structural Evaluation	0	5,000	200	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000
Total Project Cost	118,410	258,103	68,950	235,946	148,354
Subtotal Operating Cost	21,224	24,173	22,985	22,155	4,515
Subtotal Active Receipt	17,608	20,478	15,723	17,831	191
O&M (Active Receipt)	17,604	20,259	15,555	17,641	0
Electrical (Active Receipt)	5	219	168	191	191
Subtotal Passive Storage	3,615	3,696	7,262	4,324	4,324
O&M (Passive Storage)	3,610	3,529	7,045	4,129	4,129
Electrical (Passive Storage)	5	166	217	195	195
Upgrades	0	0	0	0	0
D&D	0	0	28	69	69
TASK DURATIONS					
Discount Rate	7%				
Design	2	2	2	2	2
Construction	2.58	2.58	2.58	2.58	2.58
O&M (Active Receipt)	10	12	8	10	10
O&M (Passive Storage)	65	63	67	65	65
Year of Upgrade	0	0	0	0	0
INITIAL COST	118,410	264,103	70,150	236,946	149,354
Structural Evaluation	0	5,000	200	0	0
Conceptual Design	0	1,000	1,000	1,000	1,000

Table D-9. Expanded Capacity, 80% Confidence Case.

2/7/99 17:16	CSB	PUREX	FMEF	New Const	Coupled
Expanded Case (80%)	1	2a	2b	3b	4
Total Project Cost	118,410	258,103	68,950	235,946	148,354
Total Estimated Cost	107,196	245,569	56,416	223,412	135,820
Capital Cost	73,824	171,883	35,181	153,869	93,543
Direct Cost	51,691	145,370	10,960	100,568	61,139
Preconditioning	0	31,336	0	0	0
Structural Upgrade	0	100,000	0	0	0
Facility	47,317	9,660	6,586	96,194	61,139
On-site Transportation	4,374	4,374	4,374	4,374	0
Indirect Cost	22,133	26,513	24,221	53,301	32,404
Engineering	11,278	16,000	16,000	30,170	18,342
Project Management	10,855	10,513	8,221	23,131	14,062
Escalation	4,663	12,248	1,737	9,524	5,790
Contingency	13,994	24,786	12,282	28,913	17,577
Site Allocation	14,715	36,652	7,216	31,106	18,910
Project Integration	3,162	3,162	3,162	3,162	3,162
Other Project Cost	8,052	9,372	9,372	9,372	9,372
Environmental	1,735	1,735	1,735	1,735	1,735
NEPA		1,320	1,320	1,320	1,320
Safety	3,228	3,228	3,228	3,228	3,228
Quality Assurance	127	127	127	127	127
Startup	2,963	2,963	2,963	2,963	2,963
ANNUAL COST	4,111	4,283	4,698	4,283	859
Active Receipt Total	3,425	3,461	3,461	3,461	37
O&M (Active Receipt)	3,424	3,424	3,424	3,424	0
Electrical (Active Receipt)	1	37	37	37	37
Passive Storage Total	686	822	1,237	822	822
O&M (Passive Storage)	685	785	1,200	785	785
Electrical (Passive Storage)	1	37	37	37	37
UPGRADES	0	0	0	0	0
D&D	0	0	6,000	15,000	15,000

Table D-10. Alternative 1 50%/80% Confidence Case.

2/7/99 17:22	CSB	CSB
CSB 50% and 80%	1	1
Total Constant Dollar	150,129	163,922
Present Value	96,986	110,779
Ranking	10	1
Capacity	880	880
Unit Cost	110	126
PRESENT VALUE	96,986	110,779
Subtotal Initial Cost	78,622	92,415
Structural Evaluation	0	0
Conceptual Design	0	0
Total Project Cost	78,622	92,415
Subtotal Operating Cost	18,364	18,364
Subtotal Active Receipt	14,033	14,033
O&M (Active Receipt)	14,029	14,029
Electrical (Active Receipt)	4	4
Subtotal Passive Storage	4,331	4,331
O&M (Passive Storage)	4,325	4,325
Electrical (Passive Storage)	6	6
Upgrades	0	0
D&D	0	0
TASK DURATIONS		
Discount Rate	7%	7%
Design	2	2
Construction	2.58	2.58
O&M (Active Receipt)	7	7
O&M (Passive Storage)	68	68
Year of Upgrade	0	0
INITIAL COST	78,622	92,415
Structural Evaluation	0	0
Conceptual Design	0	0

Table D-10. Alternative 1 50%/80% Confidence Case.

2/7/99 17:22	CSB	CSB
CSB 50% and 80%	1	1
Total Project Cost	78,622	92,415
Total Estimated Cost	67,408	81,201
Capital Cost	42,142	55,935
Direct Cost	27,846	39,168
Preconditioning	0	0
Structural Upgrade	0	0
Facility	23,472	34,794
On-site Transportation	4,374	4,374
Indirect Cost	14,296	16,767
Engineering	6,075	8,546
Project Management	8,221	8,221
Escalation	3,533	3,533
Contingency	10,597	10,597
Site Allocation	11,136	11,136
Project Integration	3,162	3,162
Other Project Cost	8,052	8,052
Environmental	1,735	1,735
NEPA		
Safety	3,228	3,228
Quality Assurance	127	127
Startup	2,963	2,963
ANNUAL COST	4,111	4,111
Active Receipt Total	3,425	3,425
O&M (Active Receipt)	3,424	3,424
Electrical (Active Receipt)	1	1
Passive Storage Total	686	686
O&M (Passive Storage)	685	685
Electrical (Passive Storage)	1	1
UPGRADES	0	0
D&D	0	0

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APPENDIX E

PROJECT W-464 COST ESTIMATE

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APPENDIX E

PROJECT W-464 COST ESTIMATE

The cost estimates for Alternative 1, Canister Storage Building (CSB), were based exclusively on values contained in the Project W-464 conceptual design report (FDNW 1998). This cost information is summarized in this appendix.

E1.0 DIRECT COST

Table E-1 summarizes the direct cost for Project W-464. These costs are in 1998 dollars and do not contain escalation or contingency.

Table E-1. Project W-464 Facility Direct Cost Summary.

Feature	Cost[1]
Total direct cost	$34,794
Major sub-elements	
Main structure[2]	$5,590
Major equipment	$20,914
• Tubes/plugs	$16,054
• Shielded canister transporter	$4,860
Ventilation System	$1,718
• Intake stack	$610
• Exhaust stack	$1,108
Load-in/load-out[3]	$6,572
• 60-ton crane	$1,575
• 10-ton crane	$279
• Overpack station	$687

[1]All costs are in thousands of dollars with no contingency or escalation.
[2]Includes additional cost elements not depicted, such as architectural structure; electrical/mechanical; heating, ventilation, and air conditioning, etc.
[3]Includes additional cost elements not depicted, such as concrete slab, metal enclosure, and miscellaneous equipment.

E2.0 TOTAL PROJECT COST

Table E-2 summarizes the total project cost as extracted from the Project W-464 conceptual design report. Sub-elements to any given next-highest cost elements are indented immediately below that cost element (e.g., engineering and project management rollup to indirect cost; capital cost, project integration, and other project cost rollup to total estimated cost; etc.).

Table E-2. Project W-464 Total Project Cost Summary.

Cost element	Estimated cost*
Total project cost	$92,415
Total estimated cost	$81,201
Capital cost	$55,935
Direct cost	$39,168
Facility	$34,794
Onsite transportation	$4,374
Indirect cost	$16,767
Engineering	$8,546
Project management	$8,221
Escalation	$3,533
Contingency	$10,597
Site allocation	$11,136
Project integration	$3,162
Other project cost	$8,052
Environmental	$1,735
Safety	$3,228
Quality assurance	$127
Startup	$2,963

*All costs are in thousands of dollars.

E3.0 REFERENCES

FDNW, 1998, *Conceptual Design Report for Immobilized High-Level Waste Interim Storage Facility (Phase 1), Project W-464*, HNF-2298, Rev. 1, prepared by Fluor Daniel Northwest, Inc., for Fluor Daniel Hanford, Inc., Richland, Washington.

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