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Department of Energy
Washington, DC 20585

September 20, 1999

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DNF SAFETY BOARD

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW
Suite 700
Washington, D.C. 20004

Dear Mr. Chairman:

This is in response to your letter dated July 8, 1999, which transmitted your staff's issue report dated June 15, 1999. The Department remains committed to meeting the November 2000 fuel movement date and a swift, safe completion of the Hanford Spent Nuclear Fuel Project (SNFP). This was reemphasized recently in Revision 1 of the Implementation Plan for the Remediation of Nuclear Materials in the Defense Nuclear Facilities Complex (Recommendation 94-1) which was conditionally accepted by the Defense Nuclear Facilities Safety Board on January 28, 1999. The response to your staff's issue report is summarized in the enclosure.

An independent team of experts conducted an extensive review of the SNFP during the month of May 1999 to evaluate whether the project has a sound technical, cost, and schedule basis (copy enclosed). The Review Team concluded that a strong and effective management team is in place, that considerable progress has been made in baseline management and project controls, and that the cost baseline is achievable. There are, however, significant schedule risks. Our assessment is that the contributing issues are within the control of the project management team and a concerted effort is being made to resolve them expeditiously in order to meet the November 2000 fuel movement date.

I am encouraged that the SNFP is in constant communication with your staff through weekly teleconferences, periodic video conferences, and meetings at the site. This close communication should ensure that your staff is kept intimately informed not only on project accomplishments but also on current and emerging technical issues and their resolutions. This form of communication benefitted SNFP.

The Department appreciates the Defense Nuclear Facilities Safety Board's continued interest in the Hanford Spent Nuclear Fuel Project. We will continue to keep your staff informed of the Project status. If you have any further questions, please contact me or have a member of your staff contact Randall Kaltreider of my staff at 301-903-4259.

Sincerely,

James M. Owendoff

for Carolyn L. Huntoon
Assistant Secretary for
Environmental Management

Enclosure

cc:
M. Whitaker, S-3.1

SEPARATION

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ENCLOSURE

TOPIC: South Loadout Pit Cask Drop

Issue: An independent review of the Cask Drop calculations determined that an unrestrained drop of the Multi-Canister Overpack (MCO) cask into the SLOP would damage the floor-to-wall joint, resulting in unacceptable high basin water leakage rates.

Status:

Initial Approach: An expedited review of possible solutions to this problem led to two parallel paths: (1) conduct a probabilistic risk assessment to ascertain whether a cask drop would or would not be a credible occurrence and (2) modify the design of the Cask Loadout System Immersion Pail Structure to mitigate the consequences of a drop through a combination of hydraulic damping and impact absorption. DOE directed the contractor to proceed with the modified design option.

The conceptual design of the modified Immersion Pail System (IPS) has been completed and the definitive design is expected to be completed by end September 1999. The modified design will resolve all the technical issues identified by the DNFSB staff.

Current Position: Recognizing that the design modification, if implemented, would consume almost all the schedule contingencies that were built into the baseline, the Spent Nuclear Fuel (SNF) Project was considering, as an alternate, a risk-based approach. The contractor has evaluated the potential initiating events associated with the drop scenario and has proposed corrective actions and emergency response measures that would allow acceptance of the risk. These include:

- install approximately 5 inches of crushable foam in the bottom of the load out pit to mitigate low drops;
- complete a fault tree analysis and make additional improvements in defense-in-depth features, procedures, training, conduct of operations, etc. in order to minimize the probability of a drop; and
- ensure a standby emergency plan and capability are in place to stop any potential leakage immediately following a drop.

The contractor is planning to contract with the Navy Crane Center of Excellence to obtain advice on any additional preventive or mitigative measures that could be adopted.

The DOE has accepted the alternate proposal for the K-West Basin and is currently reviewing the path forward for the K-East Basin. The local and State regulators have been briefed and their concurrences have been received for the K-West Basin. This decision will restore part of the schedule contingency and strengthen the prospect of meeting the November 2000 start of fuel removal commitment.

Note: The modified IPS design will be completed as planned and maintained as a backup.

TOPIC: Safety Analysis Report (SAR) Preparation

Issue: The Safety Analysis Report development and approval have fallen behind schedule. The delay in resolving technical issues, completing the various analyses in a technically acceptable and timely manner, and other quality and process related issues have been some of the contributing factors. The current situation has been recognized as one that has the potential to impact the Project schedule. Additionally, the delays in safety analysis documentation could negatively impact procedure development, training, and operational readiness review preparations.

Background: The risks associated with the conversion of phased SARs to final SARs were long recognized. However, the Project pursued the phased SAR approach to support the "fast-track" classification of the SNF Project without enforcing appropriate risk management measures. Additionally, the process of conducting safety analysis and design/engineering in parallel contributed to inconsistencies between the SARs and design documentation for the Cold-Vacuum Drying Facility, Multi-Canister Overpacks and the Canister Storage Building. The lack of adequate quality checks as well as deficient interface with relevant documents caused other content related problems. The above conditions presented a significant challenge to the SAR developers and those organizations engaged in the review, comment resolution, and approval process.

Status: The Project has initiated a number of measures over the past six months to re-engineer the SAR development, review, and approval process. These include organizational realignments, process enhancements, and quality improvements.

Changes have been made in the contractor's organization as well as DOE–RL's SNF Project organization to assign dedicated positions with specific responsibilities that will be focused on bringing the SARs to a satisfactory closure. The contractor has brought in Westinghouse Safety Management Solutions (WSMS) to coordinate the SAR effort and provide assistance in the strengthening overall management in this area. WSMS has previously provided similar services to Savannah River and Hanford and has extensive experience in integration of engineering and design, and SAR development, review, and approval processes.

A senior management oversight board has been established to provide a mechanism for facilitating resolution of SNF Project issues. The SAR review expectations have been clearly established and communicated and the interface between the design team, the SAR development and review groups, operations, and project management have been significantly strengthened. The FSAR schedules have been revised by breaking the logic tie between the DOE-RL Safety Evaluation Reports (SERs) and procedure development and training. This will enhance the activities associated with procedure development, personnel training, and preparations for Operational Readiness Reviews/Assessments.

TOPIC: **Quality Assurance Requirements for The MCO**

Issue: Applicability of the Quality Assurance Document (QARD), RW-0333P, for the Hanford Spent Nuclear Fuel Project has not been fully established and, consequently, its implementation has been inconsistent. The QARD, developed by Office of Civilian Radioactive Waste Management (OCRWM), is intended to apply to disposal of DOE spent fuel and high-level waste in the proposed geological repository at Yucca Mountain. The procurement contract for the Multi-Canister Overpacks (MCOs) has recently been issued and the fabrication of the associated Fuel Baskets is expected to begin in a few months time. The question has been raised as to whether the QARD should be enforced for these procurement/fabrication activities and, if enforced, what benefit will be derived, and its impact on the Project cost and schedule.

Status: From the beginning of the Project, it has been an SNF Project policy to avoid actions that would prohibit possible final disposal of the Hanford SNF to a geological repository.

The MCOs are being procured to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III (N-Stamped). It has been verbally agreed to by OCRWM that the Quality Assurance requirements of the above referenced Standard are equivalent to the RW-0333P. This agreement is based on the understanding that the Project will implement appropriate measures to ensure that the selected supplier implements its Quality Assurance program.

The Project has proposed to adopt the Code of Federal Regulation 10 CFR 830.120, Quality Assurance, for the fabrication of the Baskets. The Office of Environmental Management (EM) and OCRWM have raised the question whether the Baskets perform a safety function and, if so, should they be governed by RW-0333P in order to comply with the Project policy as stated above. The Project believes that the assumptions for criticality control as reflected in the current analyses have significant built-in conservatism and a more realistic analysis would most likely demonstrate that even under the worst condition the Baskets do not serve a safety function. This approach is presently being discussed with EM and OCRWM and a decision whether a new analysis would be needed for resolving this issue is expected shortly. Every effort will be made to ensure that the November 2000 start of fuel removal date is not be impacted by the resolution of this issue.

TOPIC: **Defective Welds in Integrated Water Treatment System (IWTS) Piping**

Issue: On May 27, 1999, the SNF Project identified a welding problem with the IWTS piping. Following this discovery, the ongoing installation activities associated with the IWTS were put on hold to determine the full extent of the problem.

Status: An extensive program was instituted to inspect all welds in the installed piping sections and in the piping sections that had not been installed. The noted imperfections were recorded on non-conformance reports and repairs were made where appropriate. An independent team of experts, in accordance with the provisions of applicable piping code (ASME B31.1), evaluated those imperfections which were not repaired and, determined them to be acceptable. The remaining installation activities were completed in time to meet the non-enforceable Tri-Party Agreement Milestone for completing construction of K-West IWTS by June 30, 1999.

Chem-Nuclear (CNSI), the prime vendor, is completing a root cause analysis associated with this finding. The welding was performed by Carolina Fabricators, a sub-vendor under CNSI.

The other equipment supplied by Chem-Nuclear (CNSI) was procured under ASME Section VIII (Vessels) program. The vessels, including the knockout pots, filter vessels, and settlers were inspected during fabrication by CNSI and Fluor Daniel Hanford (FDH) source inspectors. The inspection included welding procedures and processes, materials and dimensions, and verifications of welder certifications. Deficiencies noted during these inspections were documented and reworked, repaired, rejected, and/or accepted as is, in accordance with the supplier's or FDH corrective action program as applicable. Upon delivery to the site, receipt inspections were also performed on each vessel by FDH and site Acceptance Inspectors and found acceptable.

TOPIC: **Fuel Retrieval System (FRS) Primary Cleaning Machine (PCM)**

Issue: Delay in the delivery of the Primary Cleaning Machine (PCM) threatens the completion of the FRS installation at the K-West Basin. The PCM, a newly designed and one-of-a-kind equipment, was scheduled to be delivered to the site by April 30, 1999 to support a July 31, 1999 completion schedule for the construction and installation of the K-West Fuel Retrieval System. However, during the acceptance testing at the factory, the PCM wash basket split-bearing failed repeatedly as a result of excessive wear and galling.

Status: An independent team was assembled to analyze the original design and recommend modifications to resolve the problem. This team reviewed the existing PCM bearing design and test data, identified fundamental design problems, developed a modified split-bearing design (hybrid journal), and recommended a phased testing program to validate the redesign. These recommendations have been accepted and the original requirement to have a split shaft (a stainless steel screen drum) design, which contributed to the excessive wear and galling of the bearing, has been accommodated in the new wash basket and bearing design. The design changes reflect features of a fuel washing machine design that has been operating successfully at a Sellafield plant. Elements of the new design are as follows:

- DEVA metal surface in bearing cups (sintered metal with 6% graphite)
- Full journal at the drive peg to eliminate forces acting on basket halves and
- Split-journal inboard to allow a lower basket to be removed.

The PCM bearing design modifications and the factory acceptance testing were completed and the new PCM was delivered on August 30, 1999. The PCM will be installed in early September 1999, to support the September 27, 1999, revised schedule for completion of the FRS installation.

TOPIC: Design and Design Review

Issue: Following the recent issue associated with failure of the PCM, as originally designed, to pass the factory tests, a generic issue has been raised related to the quality of original design effort and the level of independent design review.

Status: Considering that all major equipment has been designed and delivered and installed or is in the process of being delivered and installed, the Project is formalizing plans for a phased start-up initiative which advances several FY00 and FY01 activities into an early FY00 time frame. The DNFSB members were briefed on this initiative during their trip to the site in July 1999. Among a number of significant benefits, this initiative is aimed at testing out equipment and processes under actual conditions which will allow early identification of problems, if any, and implementation of any modifications to support the Project schedule.

Additionally, a baseline change request for assessment of design verification was approved on July 14, 1999. The assessment will cover each sub-project under the Spent Nuclear Fuel Project and is intended to verify that all design reviews have been performed consistent with procurement requirements. Specifically, the assessment will address the following steps for each sub-project:

- verify that sub-project functions and requirements are satisfied;
- verify that design baseline documents are defined and under configuration management;
- review upper tier requirements and design verification documentation to assess the overall adequacy of the sub-project design verification activities; and
- perform reviews, as necessary, to provide confidence in the adequacy and technical quality of design and verification/validation activities.

The above assessments will be completed prior to the issue of the appropriate safety evaluation reports.

TOPIC: FRS Load Cells

Issue: During a review by the Board's staff of the FRS design, the Project was unable to provide justification for the deletion of load cells previously identified as necessary to verify scrap and fuel weights in the loaded baskets. This information may be needed to provide material accountability and to ensure that the reactive surface area is bounded by the safety analysis.

Status: The FRS Telescoping Stiff Back (TSB) Grapple System is utilized to transfer loaded fuel and scrap baskets from the K-Basins into MCO baskets. The design of this Grapple System has always included an integral load cell that is accurate to +/- 0.5%. In addition, calibrated test weights are provided in the process table to calibrate the load cell as required. The TSB grapple provides a local and remote read out for the load cell indication.

TOPIC: **Other Design Issues**

Issue:

(a) While the Cold Vacuum and Drying (CVD) sub-project indicated in February 1999 that it will upgrade the ventilation system fan and power supply to meet safety-significant requirements, the Project had not identified the installation location for the stand-by diesel generator as of May 1999.

(b) The CVD review team identified inconsistencies in the ventilation design and design documentation needed to support the issuance of air quality permits.

(c) The CVD review team identified the need to conduct reliability, availability, and maintainability analysis for the CVD to verify that the operational requirements for throughput during the processing campaign can be met.

Status:

(a) On May 26, 1999 the CVD project approved the Design Change Notice (DCN) that added the standby diesel generator to the facility design. This DCN was incorporated into the CVD FSAR prior to submittal to DOE for review and approval. The generator will be located approximately 100 feet northwest of the CVD building.

(b) The inconsistencies between the design of the ventilation system and the associated design documentation are being corrected. A Notice of Construction for the CVD was approved by the Washington State Department of Health (WDOH) and an update was submitted to the WDOH on June 15, 1999.

(c) The project has implemented the following measures to ensure that the reliability, availability and maintainability of the CVD facility are consistent with the throughput requirements:

- Although the CVD has a limited operating life requirement of three years, most of the equipment was designed with a lifetime of at least 10 years. In addition, component selection included buying reliable parts from qualified vendors with high quality industrial standards and good reputation. NQA-1 quality programs were also imposed, as required, on the off-site fabrication vendors.
- The operating environment of the CVD is relatively mild with low radiation doses anticipated. The facility was designed in a way that equipment can be easily removed and replaced.
- Where the process is critical or for items that need higher maintenance, redundancy is provided even if not required by the safety analysis.

In addition to the normal design, testing and validation process that any sub-project of the SNF Project goes through, the CVD has conducted a comprehensive (more than a year) testing program, First Article, of the process equipment. The First Article Testing program helped the helped train operators, validated the assumptions on drying performance and the ones used by the thermal analysis models.

The spare parts list for CVD will be based on input from the First Article Testing lessons learned, the start-up testing program, Vendor's recommendations, and considerations affecting reliability, availability and maintainability found in previous Failure Mode Effects and Criticality Analyses including off-normal analyses conducted by the project with input from Engineering, Safety and Operations.

TOPIC: Funding for Rescheduled Activities & Overall Impact on Project

Issue: Project activities are increasingly being rescheduled to future dates, sometimes into the next fiscal year, using deviation notices to resolve technical issues and support other critical path activities. There is a concern that these activities may not be fully funded in the out years and may have a negative impact on the overall project schedule.

Status: Due to constraints in the FY 1999 SNF Project funding, some work activities have been moved into FY 00. A number of schedule and work adjustments had to be made also to resolve the technical issues that came up during the current fiscal year. These adjustments were made to ensure that the November 2000 start of fuel movement date is maintained. The contractor has made and continues to make considerable progress in the area of baseline management and project controls and it is fully expected that these rescheduled work activities will be conducted within the FY 00 budget.

SEPARATION

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Baseline Review

of the

Richland Spent Nuclear Fuel Project

June 1999

U.S. Department of Energy

Office of Environmental Management

Office of Project Management

BASELINE REVIEW FINAL REPORT
RICHLAND SPENT NUCLEAR FUEL PROJECT

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Acronyms

ABU	Acceptance for Beneficial Use
ASME	American Society of Mechanical Engineers
BCR	Baseline Change Request
BOE	Basis of Estimate
BRB	Baseline Review Board
CAPN	Cost Account Project Number
CARs	Corrective Action Requests
CAT	Construction Acceptance Testing
CCB	Change Control Board
CCD	Contractor Critical Decision
CD	Critical Decision
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COA	Code of Accounts
COCS	Common Occupational Classification System
CSB	Canister Storage Building
CVD	Cold Vacuum Drying
DESH	Duke Engineering and Services, Hanford, Inc.
DNFSB	Defense Nuclear Facilities Safety Board
DNs	Deviation Notices
DOE	Department of Energy
DOE-EM	DOE Office of Environmental Management
DOE-RL	DOE Richland Operations Office
DRs	Deficiencies Reports
EAC	Estimates at Completion
ECN	Engineering Change Notices
EH-2	Office of the Deputy Assistant Secretary for Oversight
EH-10	Office of Enforcement and Investigation
EM	Environmental Management
EM-5	Proposed Office of Project Management
EPA	Environmental Protection Agency
EPC	Engineer, Procure, Construct
FAT	Factory Acceptance Testing
FDH	Fluor Daniel Hanford Company
FEB	Facility Evaluation Board
FRS	Fuel Retrieval System
FSAR	Final Safety Analysis Report
gpm	gallons per minute
HEPA	High Efficiency Particulate Air (Filters)
HPB	High Probability Baseline
HWVP	High-Level Waste Vitrification Project

Acronyms (cont.)

IC	Integrating Contractor
ISA	Interim Storage Area
IWTS	Integrated Water Treatment System
M&I	Management and Integration
M&O	Management and Operations
MCO	Multi-canister overpack
MHM	MCO Handling Machine
MOU	Memorandum of Understanding
MSA	Management Self Assessment
NCRs	Nonconformance Reports
NQA-1	Nuclear Quality Assurance-1
NRC	Nuclear Regulatory Commission
NSNFP	National Spent Nuclear Fuel Project
NTS	Noncompliance Tracking System
OCRWM	Office of Civilian Radioactive Waste Management
OTP	Operational Test Procedures
ORPS	Occurrence Reporting and Processing System
ORR	Operational Readiness Review
PAI	Professional Analysis, Inc.
PAT	Pre-operational Acceptance Testing
PCBs	Polychlorinated biphenyls
PEP	Project Execution Plan
PM&I	Project Management and Integration
PMP	Project Management Plan
PNNL	Pacific Northwest National Laboratory
POA	Plan of Action
QA	Quality Assurance
QAP	Quality Assurance Program
QARD	*Quality Assurance and Requirements Document*
QIP	Quality Improvement Process
RAM	Reliability, Availability and Maintainability
RMP	Risk Management Plan
S/RIDS	System/Requirements Identification Documents
SADs	Safety Analysis Documents
SARP	Safety Analysis Report for Packaging
SARs	Safety Analysis Reports
SER	Safety Evaluation Report
SFS	Site Fabrication Services
SNF	Spent Nuclear Fuel
SWO	Stop Work Orders

Acronyms (cont.)

TPC	Total Project Cost
TSRs	Technical Safety Requirements
TWRS	Tank Waste Remediation System
USQ	Unreviewed Safety Question
WBS	Work Breakdown Structure

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EXECUTIVE SUMMARY

A baseline review of the Richland Spent Nuclear Fuel (SNF) Project was conducted by the Office of Project Management at the request of James M. Owendoff, Acting Assistant Secretary for Environmental Management, Department of Energy (DOE). The SNF Project will move over 100,000 SNF elements (2100 metric tons) from the Hanford K Basins to long-term interim dry storage. The project involves removing the spent fuel from the basins and cleaning the fuel elements, loading the elements into multi-canister overpacks (MCOs) and casks, drying the elements in a Cold Vacuum Drying Facility, placing the canisters in long term storage in a Canister Storage Building (CSB), and removing and treating the K Basin sludge and debris removal and treatment.

The total project cost is presently estimated to be approximately $1.72 billion. Several major Tri-Party Agreement (TPA) Milestones are imposed, including "Initiate removal of K West Basin spent nuclear fuel on November 30, 2000," "Initiate removal of K East Basin spent nuclear fuel on November 30, 2001," "Complete removal of all K East Basin spent nuclear fuel on December 31, 2003," and "Complete removal of spent nuclear fuel, sludge, debris, and water at DOE's K Basins on July 31, 2007."

The purpose of the review was to assure that the project has a sound technical, cost and schedule basis, and a high probability of success. The review focused on the progress in implementing the new resource loaded critical path schedule, and the management team and controls established by the DOE Richland Operations Office (DOE-RL) and Fluor Daniel Hanford (FDH) to manage to project. The scope of the review included the project cost, schedule, technical scope, management and associated project risks. The high-level technical approach was not a part of the review because it had been previously addressed.

An eighteen member team conducted the review at the Hanford site from May 17 to May 27, 1999. Members of the Review Team were chosen for their expertise in design, construction, operations, and management of nuclear projects worldwide.

The Review Team concluded that:

- A strong and effective DOE and contractor management team is in place;
- Considerable progress is evident in the area of baseline management and project controls;
- The cost baseline of $1.72 billion is achievable, assuming there is no significant extension of the overall project schedule; and
- Considerable schedule risk is present, especially in meeting the November 2000 commence fuel retrieval date, since there is no schedule contingency remaining.

Specific, notable risks that may affect the November 30, 2000 milestone, and the recommendations for addressing those risks, are summarized below.

Risk 1: Safety Analysis Reports

Delays in the development (by FDH) and approval (by both FDH and DOE) of the Safety Analysis Reports (SARs) required to complete the SNF Project will have significant impacts on the development of procedures, training of operations staff, and the start-up and eventual operations of the facilities and processes required to move the SNF out of the K Basins. This Review Team has not determined the root cause(s) for the problems noted in the SAR process. However, it is apparent to the Review Team that the current process is not working in an efficient or optimal fashion and, unless the process is improved, the current schedule is very much at risk.

Recommendation

Re-engineer the SAR development and approval process to increase its effectiveness. This recommendation is an ACTION ITEM identified by the Review Team and is assigned to the DOE-RL manager for immediate attention and action.

As the SAR process is evaluated and improved, the following should be considered:

- Root causes should be identified, including causes that reflect problems in design, reviews and verifications, safety analysis, configuration control, quality assurance, or adherence to DOE Orders and requirements.
- The risks that exist while the fuel remains in the K Basins needs to be balanced against the safety risks related to fuel removal operations.
- Except for storage at the CSB, the SNF systems and processes will only operate for a period of approximately three years as opposed to the normal operational life of nuclear facilities.
- A graded application of the DOE requirements may be appropriate for the development and approval of SARs. Such a graded application must address the differences in interpretations that FDH and DOE-RL have concerning the DOE safety order and "Nuclear Regulatory Commission Equivalency" requirements.

The DOE Project Manager and the FDH Project Director should place special emphasis on the development and approval of the remaining SAR documents to ensure that these efforts are carried out efficiently, and are not permitted to delay important project efforts.

Risk 2: Transition to Operations

The SNF Project is not prepared to commence operations. Although this is to be expected given the current status of the project, significant risks were apparent to the Review Team. The Review Team noted that:

- Project components have not yet been operated as a full system. Until such operation begins, it is impossible to fully envision all potential problems that may be encountered during start-up.

- The Project has experienced difficulties in recruiting and hiring the staff needed for operations, and, in the near term, to support start-up and the Operational Readiness Reviews (ORRs).

- The boundaries for the ORRs are not adequately defined. This is potentially a significant issue given that new systems are being installed in an old facility and integrated with existing systems and components.

- The planned durations for the ORRs [and the Management Self Assessment (MSA)], and corrective actions resulting therefrom, appear too short when compared to the experience of comparable DOE projects.

Recommendations

- Develop a comprehensive plan for accomplishing the transition from construction to operations. This recommendation is an ACTION ITEM identified by the Review Team and is assigned to the FDH Project Director for immediate attention and action.

- Streamline the hiring process for operations personnel. This recommendation should be accomplished through the collaborative efforts of both DOE-RL and FDH management.

- Plan for early fuel movements in the basins in order to "burn-in" the systems that will be used for fuel movement operations. This recommendation should be accomplished through the collaborative efforts of both DOE's Spent Nuclear Fuels Project Division and the FDH Spent Nuclear Fuel Project Team.

Risk 3: Organization Changes

Disruptions to organizational continuity could impact the ability of the project to meet the November 30, 2000 milestone. The project has experienced significant and repetitive changes to key management positions in recent years. At this time it appears that a suitable and qualified team is in place and stability in the project organization may be more important than changes to address perceived organizational weaknesses or deficiencies.

Recommendation

Focus on stabilizing the project organization and minimize the affects of organizational changes, especially for key positions. This should be an overriding objective of both DOE-RL and FDH management.

Risk 4: Quality Assurance Standards for Baskets and Multi-Canister Overpacks

Uncertainty related to the applicability of the RW-0333P Quality Assurance (QA) standard for the fuel baskets and MCOs could impact procurements and subsequent deliveries of these critical components. This risk is especially important at this time since the procurement action for the MCOs is now underway and an award is imminent. If resolution of this issue is not accomplished prior to the contract being awarded, and the direction then differs from the assumed basis for the contract award, there may be significant schedule and cost impacts.

Recommendation

Resolve the RW-0333P QA issue for the MCOs and fuel baskets prior to procurement. This will require DOE's Office of Environmental Management (EM) to make a decision, based on the best available information, and provide appropriate direction to the Project Team.

Risk 5: Quality Assurance Corrective Actions

The effect of the QA problems identified by DOE, and the likelihood of a resulting Compliance Order, may have an adverse impact on the project schedule. It is possible that the required corrective actions may result in delays for various project activities. There is also a risk of delay due to welding quality issues.

Recommendation

Plan for accomplishing required corrective actions within the constraints of the current project schedule. FDH project management should identify work-arounds and contingent approaches as appropriate to maintain the current schedule to the maximum extent possible.

Post-2000 Risks

In addition to the above risks that may impact on the November 30, 2000 milestone, there are many risks and uncertainties that could affect the project's ability to complete all fuel movements by December 2003 as required by the TPA. These include the implementation of a first-of-a-kind system on a production basis, the radiological conditions in K East Basin, the unproven design for the water treatment system, and the Reliability, Availability, and Maintainability (RAM) of the overall system.

Recommendations

- Re-examine the overall system RAM and operational efficiency. The SNF Project team should consider augmenting system capability where appropriate and possible if such a need is identified by the RAM analysis.
- Enhance the planning (and level of detail thereof) for those project activities required after the November 30, 2000 milestone including opportunities for both cost and schedule savings related to sludge removal and disposal operations. The FDH project management team should begin such planning in the very near term, so as to maximize the usefulness of these plans.

Finally, the Review Team wishes to thank all SNF Project personnel for their cooperation and openness that helped to make this review a success. It is believed that implementation of the recommendations resulting from this review should enhance the possibility for project success.

1.0 Introduction

1.1 Background

On the DOE Hanford site, a large inventory (2100 metric tons) of special nuclear materials in the form of SNF resides in the K East and K West fuel basins located within a few hundred yards of the Columbia River. The K Reactor's basins were designed and built in the early 1950s. Their structural integrity is in question and a breach in the fuel basins could lead to radioactive contamination of the Columbia River.

The Defense Nuclear Facilities Safety Board (DNFSB) assessed and prepared a report on the large inventory of special nuclear material and radioactive waste at the U.S. defense nuclear complex. Their report, DNFSB/TECH-1, *Plutonium Storage Safety at Major Department of Energy Facilities* (April 14, 1994) served as a basis for DNFSB's Recommendation 94-1, *Improved Schedule for Remediation* (May 26, 1994). This recommendation called for DOE *to establish expeditiously a program to characterize, stabilize, and provide for safe long-term interim storage of this residue of the nation's nuclear weapons program.* Recommendation 94-1 was accepted by the Secretary of Energy in August 1994; DOE submitted an acceptable Implementation Plan to the DNFSB in February 1995.

The Richland SNF Project is scheduled for completion in FY 2007 at a total estimated cost of $1.72 billion. It will result in the dry storage of SNF, currently stored in the K Basins along with miscellaneous fuel stored at other Hanford locations, in a newly designed CSB, located on the Hanford plateau in the 200 East Area. Enforceable milestone M-34-16 calls for the initial removal of K West Basin SNF by November 30, 2000.

Since the approval of the project, there has been a change in prime contractors and major subcontractors at Hanford, along with a shift from a Management and Operations (M&O) to a Management and Integration (M&I) acquisition strategy. This change in management approaches, coupled with designing, constructing, and eventually operating a first-of-a-kind, one-of-a-kind project, resulted in substantial schedule deferrals and increases in total estimated project costs. As a result, there have been numerous project reviews and assessments to recommend changes in the management processes and to revise the project costs and schedules.

1.2 Charge to the DOE Committee

On April 26, 1999, James M. Owendoff, Acting Assistant Secretary of Energy for Environmental Management, requested that the Director, Proposed Office of Project Management (EM-5), organize and lead an independent EM review of the Hanford SNF Project (see Appendix A). *The purpose of the review is to assure that this project has a sound technical, cost, and schedule basis, and has a high probability of success.* The charge to the Review Team also called for assessing the implementation of the new resource-loaded critical path schedule, assessing the management controls established by DOE-RL and FDH, and assessing site management's ability to manage and track the project baseline.

1.3 Membership of the Committee

The independent review team consisted of 18 multidisciplinary core members from DOE/EM and DOE's Office of Environment, Safety, and Health; the Federal Energy Technology Operations Center; the Idaho Operations Office; the Oakland Field Office; and private sector contractors. Appendix B contains individual core team members and brief biographies of their backgrounds related to this review. The team consisted of specialists with the following expertise:

- Cost and schedule experience on complex engineering projects and nuclear facilities including SNF handling processes.
- Experience in SNF handling systems, transportation systems, and storage/disposal facilities.
- Nuclear operations and facilities startup experience.
- Project risk factors evaluation including performance, financial and regulatory factors.
- QA implementation on major nuclear projects.
- Safety Analyst experience in major nuclear construction and operating facilities.
- Major project management experience in the private sector and/or DOE nuclear design, construction and operating experience.

1.4 The Assessment Process

The baseline review was organized around two types of sub-teams: six system/component-specific sub-teams directed toward selected work breakdown structure (WBS) activities and six cross-cutting sub-teams. The teams and their respective foci are given in Table 1-1.

Table 1-1. Review Team and Members

Sub-Teams	Members
System/Component-Specific Sub-Teams	
1. Debris, Sludge and Water Removal	Bixby*, Pepson
2. Fuel Retrieval and Basin Modifications	Burritt*, Cloud
3. Baskets, Multi-Canister Overpacks, Cask Transportation	Gannon*, Lahoti
4. Cold Vacuum Drying System	Cloud*, Poor
5. Integrated Water Treatment System	Pepson*, Poor
6. Canister Storage Building, Interim Storage Area 200 East, Operations and Maintenance/Other	Gupta, Lahoti, Williams*
Cross-Cutting Sub-Teams	
1. Cost	Gruber*, Konopnicki**
2. Schedule	Klemkowski, Scango*, Gannon, Williams
3. Risk	Abell*, Pepson
4. Management and Integration	Barry*, Bixby, Konopnicki**, Scango, Gruber
5. Safety	Guzy*, Hsieh
6. QA/QC, Operational Readiness Reviews	Gannon, Vaughan*

*Sub-Team Leader **Review Committee Chair

Each review sub-team met with the assigned DOE and FDH management and/or cognizant project staff members to review and discuss the overall status and issues for their specific assigned focus area. Generally, the interviews and document reviews conducted by the sub-teams addressed the following areas:

- Status of the work activities as related to design, construction, construction testing, pre-operational testing, and operations and maintenance;
- Technical and compliance requirements including the status of the Final Safety Analysis Report (FSAR);
- Reasonableness of assumptions regarding the scope of work;
- Integration of work with other systems and tasks;
- Project management;
- Project/systems risks;
- Project/systems readiness reviews;
- Definition of deliverables, completion of specific activities, and alternative approaches and work-around plans;

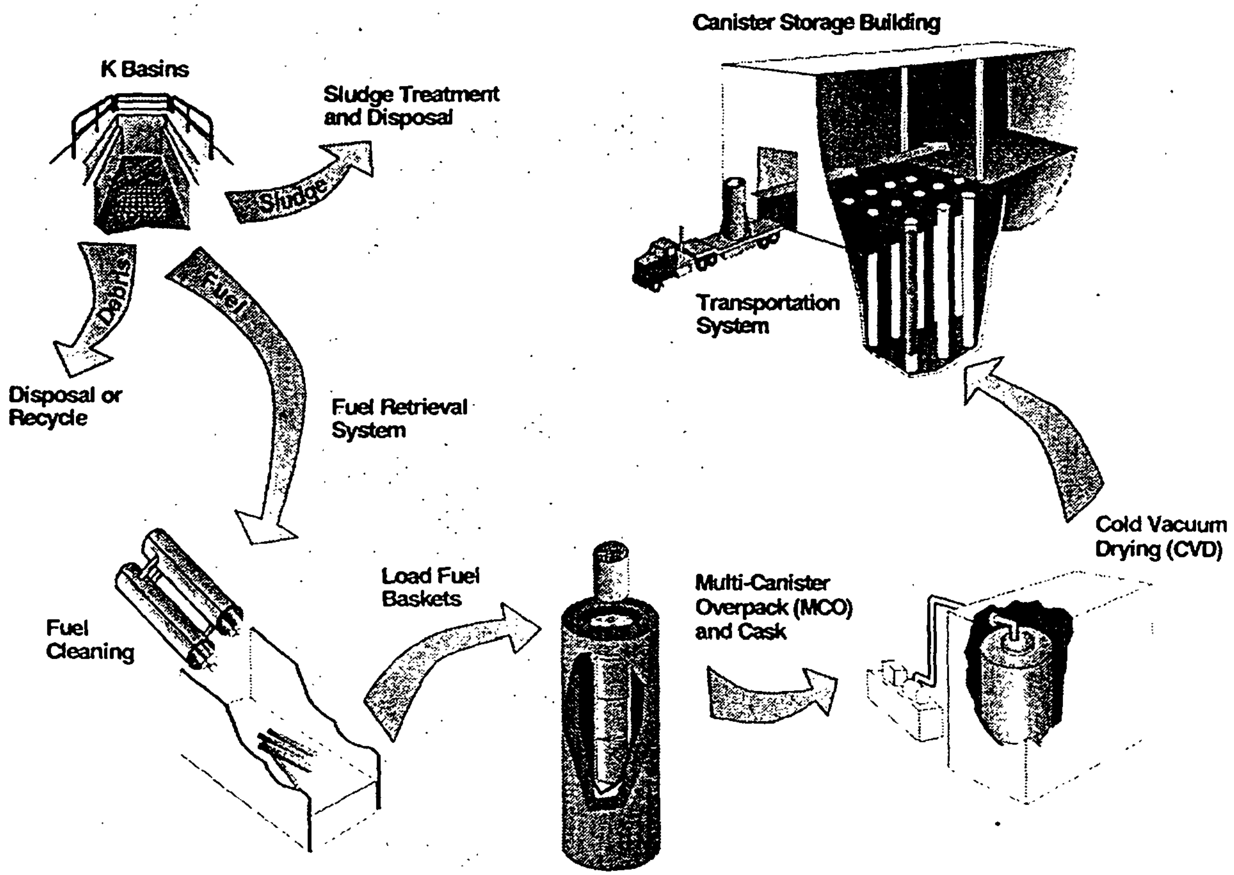
- Evaluation of the project WBS;
- Estimating methodologies used;
- Assumptions used to develop cost and schedule baselines;
- Evaluation of the project critical path;
- Areas of risk and uncertainty in present cost and schedule estimates;
- Risks associated with major milestones and risk mitigation plans;
- Acquisition and contracting strategy for major project activities;
- Baseline management and change control process; and
- Performance Management and Control System.

The documents reviewed and the personnel interviewed are given in Appendices C and D, respectively.

2.0 Project Overview

The 2100 metric tons of SNF will be removed from the K West and K East fuel basins and safely transported to an interim fuel storage facility located in the 200 East Area on the Hanford site. The Richland SNF Project process is depicted in Figure 2-1.

Figure 2-1. Spent Nuclear Fuel Project Process



Brief descriptions of the major systems and processes are discussed below. Photographs and illustrations of selected process components, systems and facilities are given in Appendix E.

Fuel Retrieval System (FRS)

At the fuel basins, the cap is removed from the spent fuel canisters and the spent fuel is cleaned on a specially designed and constructed fuel washing station.

2. Process Staging Area

3. Spent Fuel Canister Decapping Station (K West only)

4. Primary Cleaning Station

5. Process Table/Secondary Cleaning and MCO Basket Load Station with bridge-mounted remotely operated manipulators

6. MCO Basket Queue Station

While most of the fuel is expected to be in good shape and will be placed in normal fuel baskets, some of the fuel will be damaged or broken. That fuel is referred to as scrap and is placed in special scrap baskets.

From the queue, the fuel baskets are transferred into the MCOs.

Integrated Water Treatment System (IWTS)

This system treats the water generated by fuel cleaning operations containing particulate and soluble contaminants by processing through settling tanks followed by sand filter vessels and ion exchange modules. The IWTS is comprised of the following process components:

1. Three submerged pumps that take debris and sludge from the canister decapping station, the down draft table, and the primary wash system;

2. A knockout pot for removal of debris and particulate;

3. Ten settling tanks for removal of sludge;

4. Three filter vessels containing sand, garnet, and coarse sand to remove particulate material; and

5. Three ion exchange modules for removal of soluble contaminants.

The IWTS will operate at a 320 gallons per minute (gpm) throughput rate.

MCO Loadout and Cask Transportation System

3.0 Technical System Evaluations

3.1 Fuel Retrieval and K Basin Facility Upgrades

3.1.1 Summary

The fuel retrieval and K Basin facility upgrade projects consist of essentially similar facility construction and modifications for the K West and K East Basins. The conditions in the two basins differ significantly. K East received spent nuclear fuel from the Hanford N Reactor first, beginning in 1975. The fuel was placed in open top storage canisters, and significant fuel degradation is in evidence. K East was not drained and refurbished before fuel storage began, so a ring of cesium fission product had been deposited as sort of a "bathtub ring" around the pool, although later, the water level in the pool was lowered and the walls were partially coated with epoxy. The fuel in K West is stored in closed containers and the basin was drained, cleaned, and epoxy coated before fuel storage began.

Radiologically, the two situations differ significantly. For example, in the areas where some of the modification work must be performed and where some of the operations will occur, the background general area whole body radiation dose rate in K East is two to 10 times higher than in K West. Compared to K West, K East has a higher basin water activity and a higher probability of loose surface contamination leading to operations in the basin water creating airborne radioactive contamination.

Early on, a decision was made to perform the construction and modifications, and subsequently remove spent fuel from K West first. While this decision may be questioned from the standpoint that the most degraded fuel is not removed first, it permits the new systems to be constructed and tested in a relatively benign environment. Also, the lessons learned, if recognized and properly applied, should have a significant positive impact on the cost, schedule, and radiological consequences of construction and operation in K East.

Currently, the SNF Project expects to complete the FRS in K West in accordance with the baseline schedule. Modifications to K East, with minor exceptions, are scheduled to begin in FY 2000.

There is some concern about the ability to smoothly transition from construction to operation because of difficulties encountered in hiring operators.

3.1.2 Technical Scope

The FRS consists of a number of major sub-elements. These include:

- A fuel canister decapper (K West only);
- A primary fuel cleaning machine;
- A stuck fuel station;

- A process table for sorting and reloading fuel;
- An MCO basket queue ;
- A manipulator system, TV cameras, and control equipment; and
- A telescoping stiffback, an MCO basket stiffback grapple, and an empty MCO basket grapple.

The basin facility upgrades include such things as potable water upgrades, compressed air upgrades, K West immersion pail installation and cask fitups, transfer crane upgrades, MCO loading system, fire protection upgrades, and the like.

3.1.2.1 Findings

Fuel Retrieval System

Except for the manipulator, televisions, and associated control systems, the equipment for the FRS is not off-the-shelf, but was specially designed and built for this purpose. The FRS is a single production line where the failure of any piece of equipment can shut the line down. There is a spare set of manipulators, and there are spare parts for other components, but there are no other entire spare equipment available except for the equipment destined for installation in K East.

The FRS equipment appears to be robust and simple in design. Failure analyses have been performed, and provisions for correcting failures without removing equipment from the basin pools have been made.

The sorting table, manipulators, television systems, and control systems have been in operation in a building in the 300 Area for about a year. This has allowed optimization of the sorting table design, and "burn-in" of the manipulators and control system. Prior to installation in K West, the manipulators were disassembled, inspected, and overhauled.

Operation of the decapper has been proven underwater at the 300 Area facility.

The primary fuel cleaning machine, perhaps the most complicated equipment after the manipulators, is still being manufactured and will not arrive until June 1999. This machine has experienced some development problems, and some redesign has been necessary. Currently, an issue related to bearing design and wear is being resolved. The machine has been tested underwater at the manufacturer's facility.

While FRS components have been operated and tested, the FRS has not been operated as a system outside the basin.

At present, there are no unresolved safety issues. The final SAR has not been submitted by the contractor to the government for review.

All permits have been issued.

K Basin Facility Upgrades

The K West loading crane was significantly modified and upgraded. It was turned over from construction to operations before it was thoroughly tested. The crane would not operate properly, and investigation revealed a hardware problem that had been masked by a software work-around. The crane has experienced down time in order to remedy the problem.

Reanalysis of a cask drop incident showed that assumptions about the strength of the basin wall-to-floor joint were incorrect. This resulted in design changes and hardware modifications to one component of the cask loadout system which consumed most of the schedule float through the beginning of fuel offload.

3.1.2.2 Assessment

Fuel Retrieval System

The technical scope of the FRS is adequate. The fact that the FRS is a single-line operation where a single failure can interrupt the fuel retrieval operation mandates that the system be fully tested as early as possible in order to wring out system deficiencies.

Proof of operation of the FRS in K West prior to operation in K East will be beneficial with regard to cost, schedule, and radiological considerations. The lessons learned during construction and installation in K West must be applied to the K East FRS basin construction and operation.

K Basin Facility Upgrades

The technical scope of the K Basin facility upgrades are adequate. The late modifications to solve the cask drop mitigation issue could potentially delay the start of K West fuel retrieval operations.

The more restrictive radiological conditions that exist in K East mandate that lessons learned during construction operations in K West be analyzed and applied to K East construction.

3.1.2.3 Recommendations

1. Operate the FRS as a system as soon as practical in order to ensure that it operates properly as a system and to "burn-in" individual components.

2. Utilize lessons learned from K West during construction of the FRS and modification of the facilities in K East. As much prefabrication as possible should be done outside the basin building.

3. Expedite and monitor modifications necessitated by the cask drop reanalysis in order to prevent delay in the start of K West fuel retrieval operations.

3.1.3 Cost

3.1.3.1 Findings

Fuel Retrieval System

The Tri-Party Agreement date for the completion of the FRS is July 31, 1999, and the Baseline Schedule completion date is July 7, 1999. The project expects to make the baseline completion date, but to do so the work is proceeding on a two-shift schedule, five days a week, with Saturday work occurring periodically. This has resulted in higher-than-planned fabrication and installation costs.

K Basin Facility Upgrades

Costs for K Basin facility upgrades are higher than baselined, principally because of the extra efforts and the need to retain craft personnel on-site longer, while the dropped cask mitigation effort is underway.

3.1.3.2 Assessment

For both sub-projects, the Estimates at Completion (EAC) remain unchanged. This may be unrealistic for the following reasons:

- The small amount of work remaining at K West is insufficient to establish enough savings to recover much of the overrun.
- The costs for construction and installation in K East may end up being higher than planned because of the more restrictive radiological conditions.

3.1.3.3 Recommendations

1. Closely monitor the costs to complete the work in K West. Issue a Baseline Change Request (BCR) as required.
2. Re-evaluate the cost of performing the same work in K East.

3.1.4 Schedule and Funding

3.1.4.1 Findings

Fuel Retrieval System

The FRS has not been operated as a system. Because most of the components are specially designed, interoperability issues may not surface until the FRS is installed and tested as a system. The effect of potential problems on the schedule is not known at this time.

K Basin Facility Upgrades

- Modifications to the cask handling equipment to ensure that it is adequate to meet established design requirements of limiting basin damage in the event of a load drop are projected to consume most of the available float in the schedule.

- Problems with the 32-ton crane, which occurred after turnover to operations, has impacted its availability and could affect the schedule of completion of facility upgrades.

- The schedule durations for installation of facility upgrades in K East are similar to K West, although the radiological conditions in K East are far more restrictive.

3.1.4.2 Assessment

- The schedule delays associated with K West Basin facility upgrades may not affect the fuel movement date of November 30, 2000, but there is little float left in the schedule. The completion of the FRS in K West should meet the baseline schedule date and the TPA milestone.

- The schedule for work on these systems in K East may not be realistic because of the relatively more adverse radiological conditions.

3.1.4.3 Recommendations

1. Closely monitor the progress of the activities associated with mitigating the cask drop problem. Promptly initiate corrective action to resolve problems to prevent further delays.

2. Carefully evaluate (in light of more adverse radiological conditions) the schedules for K East facility modifications and the installation of the FRS in K East. Apply lessons learned in K West to K East.

3.1.5 Management

3.1.5.1 Findings

There are a number of management issues that affect the completion and operation of these two systems. In addition to problems relating to SAR approvals and operations staffing discussed elsewhere in this report, the Review Team has the following concerns:

- Radiological conditions in K East could potentially increase cost, extend schedule, and cause radiological incidents.

- Operation of the FRS has not been proven. Some of the FRS components have been operated under simulated operating conditions.

- The current baseline schedule provides for overlap between the fuel retrieval operations in K West and K East.

3.1.5.2 Assessment

The conditions in K East Basin are such that the general area background dose rate is higher than for K West, and the potential for loose surface contamination and airborne contamination are higher in K East than in K West. This creates situations that affect productivity:

- The higher dose rate means that personnel will have to be rotated throughout the year as they receive their maximum allowed annual radiation dose.

- The potential for loose surface contamination means that workers will have to wear anti-contamination clothing. This takes time to put on and take off, and is uncomfortable and restrictive. Workers will be less productive.

- The potential for airborne contamination means that the workers will have to wear respiratory protection during certain operations. This further restricts their productivity, particularly in hot weather.

The fact that workers will rotate from the job as they reach their annual radiation exposure limit means that the workforce may be less experienced. This could further reduce productivity and will enhance the potential for radiological incidents.

Most of the FRS components have been individually tested, but system testing under actual conditions has not occurred. There has been no opportunity to train operators on the actual system. This training will occur during operational testing.

The current baseline schedule shows about a one year overlap between the start of fuel retrieval operations in K East and the completion of fuel retrieval operations in K West. The total time for fuel retrieval in both basins is about three years. During the overlap, the operator force for fuel retrieval and basin system operations will have to be doubled, and the number of operators for other operations in the SNF may have to be increased. This approach incurs the cost of hiring and training two sets of operators, and raises the question of what to do with the K West operators when their task is finished.

The current approach is to have each basin supply one loaded MCO every other day. The remainder of the SNF system is sized to accommodate one loaded MCO every day (simultaneous K East and K West fuel retrieval). If the efficiency of fuel retrieval operations could be increased to the point that fuel retrieval in K East did not start until the operations in K West were completed, the total number of operator personnel would be reduced and the remainder of the systems would be more efficiently staffed.

3.1.5.3 Recommendations

1. Reduce the amount of time a worker spends in the radiation or radiological controlled area by job planning, prefabrication, and mockup training, where applicable.

2. Review both the skill and radiological training provided to the workforce. Job-specific radiological training must be provided to the craft workers.

3. Consider using additional temporary shielding where practical.

4. Carefully consider cost and schedule impacts of the adverse working conditions.

5. Establish "early fuel processing" as a goal. Early fuel movement involves operating the FRS up to MCO loading and will afford the opportunity to train operators on system operation and to determine and correct any operability problems.

6. Closely monitor the rate of fuel retrieval after operations begin in K West, and if practical, the rate should be increased so that the overlap in fuel retrieval operations is eliminated.

3.2 Baskets/Multi-Canister Overpack (MCO)/Casks Transportation

3.2.1 Summary

Procurement and acceptance of the MCOs, fuel baskets, and transportation casks are critical to meeting the November 2000 start date for moving fuel from K West Basin. Since the five transportation casks have been delivered to the site and are undergoing acceptance testing, the Review Team focused on the status of the MCO and basket procurements. Particular attention was paid to the Project Manager's identification and management of risks concerning the procurement, fabrication, delivery, and acceptance of these critical pieces of hardware. While the total effectiveness of managing these risks will not be fully demonstrated until all the MCOs and baskets are delivered to the project, it is apparent that efforts to date are having a positive affect.

3.2.2 Technical Scope

This technical area includes the following:

- WBS 1.03.01.02.20.17: MCO Acquisition (Design/Modification/Construction) – Includes acquisition of systems and equipment needed for all work activities including definition, design, procurement, construction, testing, and turnover to operations of the MCO and the MCO baskets. End item deliverables include MCO fabrication, MCO Topical Safety Report, Critical Decision 3 for MCO fabrication, and complete fabrication and delivery of all the required MCOs.

- WBS 1.03.01.02.20.18: Cask Transportation System (Design/Modification/Construction) – Includes the acquisition and systems and equipment for five cask/conveyance systems and the two immersion pail systems and MCO loading systems. End item deliverables included cask/transportation performance design and performance testing, cask fabrication, preparation of the Safety Analysis Report for Packaging (SARP), and cask operations equipment acceptance testing.

3.2.2.1 Findings

<u>MCOs and Baskets</u>

Discussions with the MCO and Basket Project Manager revealed that a significant amount of effort has been put forth to reduce the costs of the MCOs and baskets. Since the expected costs of the required 400 MCOs is $29 million, or approximately $72,500 each, and $27 million for the required 2170 baskets, or approximately $12,442 each, communications with potential vendors for both is considered prudent. An example of such communications is the September 1998 project-sponsored Lessons Learned session. This session facilitated discussions between project personnel and DynCorp Site Fabrication Services personnel to develop a list of recommendations and areas of improvement for the fabrication of the MCO baskets.

DynCorp was contracted in December 1997 to fabricate 30 MCO fuel and scrap baskets. These baskets were to be fabricated to the QA requirements of the Office of Civilian Radioactive Waste Management's (OCRWM's) RW-0333P, *Quality Assurance and Requirements Document (QARD)*, as well as 10 CFR Part 830.120, the DOE Rule for Quality Assurance. However, a number of issues surfaced during their fabrication.

For example, according to a DOE-RL assessment of the OCRWM QARD implementation, DynCorp's implementation of the QARD requirements and 10 CFR Part 830.120 was unsuccessful. Areas specifically identified in this assessment were non-conformance identification, the implementation of resolution processes, and the development and maintenance of quality records. Also there were two work stoppages imposed by the DOE Acceptance Inspectors for material receipt and cleaning procedure violations. Finally, the cost for these baskets significantly exceeded the budget and the schedule was exceeded by almost two months.

As a result of these overruns, and in the interest of producing the next 2170 baskets in a more cost- and schedule-efficient manner, the project determined that a Lessons Learned session would be beneficial. The outcome of the session was significant. Approximately 40 recommendations were identified, as was an overall Action Plan that has resulted in a $10 million savings to the project. Savings have been realized within three major areas: collar material change, basket design changes, and deletion of a requirement for a closure weld volumetric examination. This has resulted in the production man-hour estimate per basket being reduced from 172 man-hours per basket to 42 man-hours per basket. Subsequently, the requirement to meet the OCRWM QARD was deleted, although this still needs to be resolved.

A potential issue, discussed at length with the MCO and Basket Project Manager, was whether the MCOs and baskets should be designed and fabricated to the specifications of the OCRWM QARD. The MCO procurement package, now out for bid, requires that MCOs meet the American Society of Mechanical Engineers (ASME) Code, Section III, N-Stamp and Nuclear Quality Assurance - 1 (NQA-1) industry requirements. The MCO baskets must also meet ASME, Section III and NQA-1 but not N-Stamp requirements. Neither is required to meet the OCRWM QARD requirements. The quality levels for the MCOs and baskets were established based on a number of discussions and correspondence with the National Spent Nuclear Fuel Program (NSNFP) and OCRWM. For example, in late 1997 the MCO design was sent to OCRWM for review to determine if any fundamentals regarding deep repository disposal had been missed. To date, no response from OCRWM has been received, although numerous inquiries were made by the site through DOE Headquarters. Also, two letters from the Richland Assistant Manager for Waste Management in November 1998, again raised the issue for resolution. The position of DOE-RL in these letters was that the procurement and fabrication of the MCO does not fall under the quality program specified in the QARD. This conclusion was based primarily on the fact that the MCO is not on the OCRWM Q-List and that the MCOs will be procured and fabricated in accordance with 10 CFR Part 830.120, as required by the SNF Project Systems/Requirements Identification Documents (S/RIDS), and thus will meet the NQA-1 QA Standards.

In support of this position, the NSNFP issued a memorandum, dated April 2, 1999, to the OCRWM QA Manager advising that the National Program supports the project's position that the MCO Request for Proposal should continue to require implementation of NQA-1 and not RW-0333P. Closure of this issue with OCRWM has not been accomplished.

It was discovered through discussions with DOE-RL and project personnel that a "Team Approach" has been established for the fabrication of the baskets at DynCorp's Site Fabrication Services (SFS) facilities that will directly apply the FDH QA program. This should alleviate a number of QA issues identified above, such as records management and the identification of non-conformances.

However, there remains the risk of producing the baskets in the SFS fabrication shop utilizing a QA program that shop personnel are not accustomed to using in a production mode. It was learned that the SFS shop has traditionally been used for research and development fabrication services and not in a production mode that is required by the basket fabrication task. In addition, application of a rigorous QA program such as NQA-1 has not been applied at the SFS shop before. Thus, there is concern as to whether SFS can fabricate some five baskets per day, for 2.5 years, while meeting NQA-1 requirements. There is no history to support that it can. However, the production schedule is based on a five-day per week, one shift per day operation, so there is room for contingency actions, if needed, but at a cost. (See Section 9.0, Quality Assurance, for additional discussion on this issue.)

Also reviewed with the MCO and Basket Project Manager was Fiscal Year Production versus Funding Profile for the MCOs and baskets. This spreadsheet was generated, in conjunction with potential MCO vendors and DynCorp, to maximize production of both the MCOs and baskets and to forecast the budget needs for the procurements. Discussions with the potential vendors resulted in a forecast of peak production of MCOs of 16 per month and approximately 100 baskets per month. At these rates the baseline schedule for fuel movement starting in November 2000 can be supported. However, these production rates require additional funding of $4.5 million (increase from $6.5 million to $11.0 million) in FY 2000 with the outyear funding requirements being reduced proportionally. Discussions with the Manager found that he has prepared a BCR requesting this additional level of funding for FY 2000. The Project Manager is holding this request until the FY 2000 budget is better understood.

During the review it was learned that the Project Manager was requested by DOE-RL to prepare an estimate of the cost/schedule impacts of implementing RW-0333P QARD requirements to the MCOs and/or the baskets. The results of this review were not available for this report. However, it was learned from the MCO and Basket Project Manager that there is confidence that the QARD requirements can be applied to the fabrication of the baskets with only minor impacts to the basket production schedule while still supporting the fuel movement milestone. However, accomplishment of this will require additional funding in both FY 1999 and FY 2000 (amount not determined) and that the decision to apply the QARD must be made before early July 1999. No additional data were available for review to support or refute this position.

One final area of risk is the expected delay in the final issuance, by FDH, and DOE-RL approval of the MCO Topical Report. This report is equivalent to the safety analysis report for the facilities/operations; however, since the MCO is transported through a number of facilities (e.g., Basins, CVD, and CSB) the safety analysis is consolidated in this one report. Approval by DOE-RL, scheduled for June 24, 1999, is critical to the award of the MCO procurement, scheduled for July 30, 1999. Information received subsequent to the site visit indicates that disposition of DOE-RL comments by FDH will be delayed almost four months, and will subsequently delay submission of the report, and approval by DOE-RL by at least four months. This FSAR preparation, review, and approval issue is further discussed in Section 6.0, Schedule and Funding, and Section 8.0, Safety.

Transportation Casks

All five of the needed transportation casks have been delivered to the site and are currently proceeding through checkout and acceptance. Preparation of the Revision 0 Procedures for cask transport is underway and is scheduled to be completed October 21, 1999. No issues were identified during the review of information concerning the casks.

3.2.2.2 Assessment

The procedure for fabricating and procuring both the MCOs and the baskets is well defined. Actions by the MCO and Basket Project Manager to date are noteworthy and should ensure that quality levels and delivery schedules for both of these critical items are met. However, with regard to fabricating the baskets in DynCorp SFS facilities, a fabrication shop with no history of implementing a NQA-1 program in a high production mode, there is concern that production schedules and incentives may override the QA program procedures and instructions. In addition, the issue of applying the RW-0333P QARD requirements to these items needs to be resolved. Actions by the project, DOE-RL, and the NSNFP, have not forced resolution of this issue. The project proceeds at some risk with the procurement of the MCOs and baskets until this issue is resolved.

3.2.2.3 Recommendations

1. Continue to solicit a position from the OCRWM on the implementation of the QARD requirements on the fabrication of MCOs and/or baskets. It is suggested that involvement by the NSNFP and DOE-EM Headquarters be involved to force resolution. The Review Team supports the project's current QA requirements for procuring these products.

2. Actively monitor the implementation of NQA-1 at SFS by DynCorp. While it is believed the FDH QA program is sound, implementation in a high-production, schedule demanding environment could force shortcuts and work-arounds that jeopardize the QA documentation requirements. Monitoring should include active audits and surveillance programs that ensure NQA-1 implementation.

3.2.3 Cost

3.2.3.1 Findings

The most recent review of the sub-project Basis of Cost Estimate Book for acquiring the MCOs and baskets (WBS 1.03.01.02.20.17) and the BCRs for 1998 and 1999, found consistency with the baselines being managed by the manager. The total cost for the WBS through the latest BCR, dated March 16, 1999, is $85.266 million. The "to go" costs (FY 1999 through FY 2003) total $71.336 million, or approximately 84 percent. This includes approximately $29.96 million for the fabrication of the MCOs and $26.66 million for the fabrication of the baskets. The balance of the $71.34 million is for Title III design, tooling, receipt and inspection services, the MCO Topical Report, project management, spare parts, and fabrication support.

3.2.3.2 Assessment

Review of the Basis of Cost Estimate for the MCOs and the baskets found it to be complete, thorough, and well founded. The basis of the estimates for the MCOs and the baskets are derived from the fixed-price contracts for the three non-production MCOs by Oregon Iron Works and the 30 baskets produced by DynCorp with modifications as suggested by ongoing communications with potential vendors and DynCorp. The manager of these procurements is commended for his, and his staff's, efforts in communicating with the potential MCO vendors and DynCorp through such vehicles as the Lessons Learned session, referenced above. These actions are considered adequate and appropriate.

3.2.3.3 Recommendations

None. Adequate cost control measures are in place for these procurements.

3.2.4 Schedule and Funding

3.2.4.1 Findings

Procurement of the MCOs and baskets are being monitored by a detailed Primavera® schedule system.[1] While none of the activities within the WBS are on the current critical path, the delivery of the MCOs and baskets is being managed as a critical activity by the project management team. Award of the contract for the MCOs is scheduled for July 30, 1999, with fabrication to begin October 1, 1999 (FY 2000) and end in September 2002. Basket fabrication is on the same schedule.

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[1]Primavera Project Planner is a registered trademark of Primavera Systems, Inc.

As stated above, expected production rates have been discussed with potential MCO vendors and with DynCorp (for the baskets). These rates build up quickly, as suggested by the vendors to avoid repetitive shop setup costs, and remain constant through completion of fabrication. As discussed in Section 3.2.2.1, the continued delay in resolution of MCO Topical Report comments and DOE-RL approval is a risk to both procurements.

3.2.4.2 Assessment

As acknowledged by the MCO and Basket Project Manager, there are several remaining risks with the procurement of these items. Obviously, award of the MCO contract within the next two months will reveal whether there is a schedule or funding problem. The potential schedule problem deals with the production rates assumed for both the MCOs and the baskets. Project control and procurement actions, e.g., incentive contracting, available to the project for the fabrication of the baskets at DynCorp in Richland should alleviate delivery problems for the baskets. However, award of the "best value," fixed-price contract for the MCOs is riskier with less controls. While the project has done all it believes can be done to reduce the risks for such a procurement, the risk of not meeting production requirements remains. However, the production schedule for the MCOs, approximately one MCO every 11 hours, for 2.5 years, is based on one eight-hour shift per day, five days per week. Likewise, as stated above, the production schedule for the baskets has room for contingency actions. Continued delay in the resolution of issues, and DOE-RL approval, of the MCO Topical Report is of concern. This is addressed on a project-wide basis in Section 6.0.

3.2.4.3 Recommendations

None. The MCO and Basket Project Manager has adequate schedule and funding controls in place.

3.2.5 Management

3.2.5.1 Findings

The management of the procurement of the MCOs and baskets is the responsibility of the MCO and Basket Project Manager who reports to the Construction Projects Manager, a direct report to the Project Director. Interviews with the MCO and Basket Project Manager found him to be very knowledgeable and competent about his areas of responsibility. Discussions regarding his understanding of the authority and procurement tools available to him indicated he is very experienced in these types of procurements and the potential risks to the overall success of the project. His acknowledgment and concern over such risks as the N-Stamp requirement for the MCOs; the potential QA requirements issue; the production rate versus QA requirements for the baskets; and the DOE-RL approval of the MCO Topical Report, indicate his clear understanding of the importance of meeting the delivery schedules and quality requirements for both the MCOs and the baskets.

3.2.5.2 Assessment

The management of the procurement and delivery of the MCOs and baskets is excellent. These managers' actions and attention to date have saved time and money; clearly they intend to maintain this level of attention throughout the procurement and delivery periods. Their attention to the above-described risks should minimize any affect that procurement and delivery would have on the fuel movement start milestone and the successful movement of the fuel.

3.2.5.3 Recommendations

Continue to actively force settlement of the application of the QARD QA requirements on the fabrication of the MCOs and/or baskets.

3.3 Integrated Water Treatment System (IWTS)

3.3.1 Summary

The IWTS is critical to meeting the November 2000 start date for moving fuel from K West Basin. The water treatment system receives contaminated water from the fuel decapping and cleaning operations and removes radionuclides and other particulate matter. Since the treated water is returned to the basin, effective operation of this system is critical from both a worker safety and water clarity perspective—the latter, of course, being very important for the operators to observe, and robotically move the fuel. Under the present project design, any shutdown in the IWTS will cause the fuel removal process to shut down.

The IWTS poses a high project risk from an operational perspective (i.e., will the current design work effectively?) as would be expected from a first-of-a-kind operation with a single failure of any one of the key components causing a complete system shutdown. Further discussion of operational risk is provided under Section 3.3.2.

3.3.2 Technical Scope

3.3.2.1 Findings

The principal operations of the IWTS are as follows: knockout pot; ten 20-inch tube settlers; sand filters; and the ion exchange modules. A polishing filter design for additional water clarification has been completed. If needed, this filter would be installed upstream of the ion exchange modules.

Current design specifications require a throughput of 320 gpm, 24 hours a day, 328 days per year (95 percent availability).

Minimal sampling characterization data exists for the fuel particulate that will be generated from K West fuel cleaning. The tables in Appendix F provide the contractor's predictions for the K West water treatment parameters. These estimates are the basis for the K West IWTS equipment design.

There is a separate IWTS for K West and for K East. The K West installation is scheduled for completion by June 21, 1999—completion of K East is scheduled for February 2001 (see Section 3.3.4 for schedule information).

The IWTS Project Manager is not aware of any outstanding safety concerns—either the safety issues have been resolved or there is an agreed-upon path forward.

Water treatment, to date, at K Basins has consisted of ion exchange and sand filters. The settlers used to remove sludge particles are new unit operations to K Basins water treatment.

Instrumentation for IWTS does not currently include continuous monitoring for water clarity, nor hydrogen concentrations in vent piping above the tube settlers, and in the head space above the sand filters. Conductivity will continue to be used as a surrogate for radionuclide concentrations exiting the IWTS.

On the final day of the SNF Project review, an issue arose regarding weld imperfections in piping to be used in the IWTS. Specifically, in making modifications to flanged fittings, the contractor Project Team visually identified several welds that had penetration flaws. The Project Manager had started the process of questioning the piping supply contractor relative to the cause of the welding imperfections, and the implications for the other equipment (including the tube settlers) supplied by this same fabrication company. To date 35 of 55 welds inspected have been found to be defective. The impact on the IWTS installation and November 2000 fuel move schedule is not presently known.

3.3.2.2 Assessment

The K West IWTS is a high project risk. It is quite possible that operational problems with IWTS will delay project schedules and result in higher costs due to future needed IWTS modifications. Specifically, particulate designed to be removed after a few minutes of retention time in the settlers may not settle out. If this happens and there are significant amounts of sludge, then downstream sand filters and ion exchange units will plug and/or operate inefficiently, causing radiation and clarity problems. Depending on the nature of the problem, the proposed polishing filter may not help at all. Smaller particles could worsen the sand filter problem prior to the downstream polishing filter. Backwashing to unplug the sand filters can be done; however, this would interrupt spent fuel movement processing. The current design requires that IWTS be operational 95 percent of the time.

The heart of the problem is that the design specifications are first-of-a-kind (e.g., the canisters have not been cleaned before, and the exact type and size of particles that will be generated from the cleaning process is far from certain). Additionally, the entire system can be shutdown by a single failure of a key component, and all elements require radiation shielding.

To clarify, the above concern is not to reflect negatively on the contractor Project Team—rather, the concern relates directly to the complexity and prototypical nature of moving the spent fuel. The Project Team has already successfully handled a number of high-risk project issues and is taking steps to manage this risk. First, the Project Team had the vendor perform testing on a surrogate waste; this testing was successful. The risk mitigation strategy also includes early design of a polishing filter that could resolve water clarity problems. Also, the contractor intends to incorporate lessons learned from K West into the K East design and fabrication, which will significantly help minimize overall project cost/schedule risks.

Relative to the weld imperfections in the IWTS pipe, there is a possibility that resolution of this issue, including additional piping examinations/modifications, could result in some schedule delay. Project impacts, if any, will need to await the outcome of communications with the piping supply company.

As with most high-risk projects, risk mitigation is not likely to solve all the problems. Senior management needs to be informed that this could be a bottleneck, and additional funding could be required to resolve treatability issues.

3.3.2.3 Recommendations

1. Continue the risk mitigation strategy to expedite operational testing and plan for a polishing filter.

2. Given the high degree of uncertainty associated with the design specifications of the water from the fuel cleaning operation, there are numerous additional risk mitigation measures that the Review Team recommends the Project Team consider including:

    - On start-up of fuel retrieval, move only canisters that appear to be in good condition. Available fuel characterization information indicates the K West fuel is in worse condition than expected and could generate significant amounts of sludge.

    - On start-up of fuel cleaning, use water volumes well below design to establish IWTS performance efficiency.

    - Investigate cleaning approaches that use substantially less water overall (i.e., question whether the current fuel washing approach is too conservative).

    - Re-evaluate the possibility of using a large settling tank.

    - Coordinate with TWRS (if not previously done) on similar work with settling and filtration. In particular, some information indicates that iron hydroxide particulate might be significant, and these particles are known to be difficult to settle out. The TWRS design has substantial settling capacity (in the day range) to solve filtration problems.

    - Because frequent backwashing may be required, re-evaluate the workability of the sand filter backwash system.

    - The Project Team is doing some work with flocculating agents; it is recommended that the Project Team continue this effort.

3. Evaluate improvements to the instrumentation system. Specifically:

    - Explore instrumentation that would provide continuous input on the clarity of water exiting the IWTS. Such instrumentation may reduce water clarity problems in the basin water by providing early warning of the need to backwash the filtration systems.

- The conductivity surrogate for radionuclide content may need to be re-calibrated in light of the fact that the composition and concentrations of waste exiting the IWTS is likely to be significantly different than the historical re-circulated K Basin water.

- Assess the need for continuous monitoring of hydrogen concentrations in the vent piping above the tube settlers, and in the head space above the sand filter media. Hydrogen accumulation is a significant safety concern, and such monitoring may be needed as part of hazard mitigation.

3.3.3 Cost

The baseline cost for the IWTS is $38.6 million. Of this amount, $27 million is capital dollars. The Project Manager stated that the planned funding is sufficient for the current scope of work.

The funding for this WBS is through construction, including acceptance testing and pre-operational testing. As noted above, if significant modifications are needed, additional funding will be required.

The Review Team has no recommendations at this time.

3.3.4 Schedule and Funding

3.3.4.1 Findings

Construction completion of the K West IWTS is scheduled for June 21, 1999. The impact of the recent finding of weld imperfections in the IWTS pipe is not known. There are a couple of risks relating to maintaining overhead crane availability and installing the air sparger system that includes High Efficiency Particulate Air (HEPA) filters. Risk mitigation primarily involves staffing extra shifts to complete construction.

The June 21, 1999 date for completion of the K West IWTS has 50 days of float relative to November 2000. The float reflects available time between pre-operational testing and the time operator cold testing needs to begin on IWTS.

3.3.4.2 Assessment

With regard to IWTS construction and pre-operational testing, there are no significant schedule risks. As noted earlier, the project risks are related to operational concerns (i.e., design viability), not construction.

3.3.4.3 Recommendations

None. The Project Manager has already taken appropriate steps for ensuring the IWTS meets schedule dates for construction and pre-operational testing. The Review Team has no further recommendations.

3.3.5 Management

The Review Team has identified no management concerns with the IWTS sub-project. The Project Manager is experienced, very knowledgeable in baseline cost and schedule details, and focused on identified key project risks particularly on meeting the major milestone—initiate removal of SNF in November 2000.

The Review Team has no recommendations at this time.

3.4 Cold Vacuum Drying Facility

3.4.1 Summary

The sub-team for the CVD Facility sub-project focused on the overall scope, budget, schedule, and management team associated with the CVD Facility and associated internal and external interface functions key to facility completion and successful operations. A review was conducted of the fuel movement process and how the CVD Facility is intended and designed to support the critical mission to remove fuel from the K Basins. The sub-team discussed the sub-project with the Project Manager, Facilities Projects Manager, Operations Manager, and several high-level FDH support managers whose organization is critical to the overall success of the CVD Facility. The review focus was on the overall feasibility of schedule and budget completion within the baseline parameters. The team also reviewed work to complete for operational start-up. Several recommendations in this section relate directly to the findings associated with this part of the review.

The major issue identified by the sub-team involved the schedule to obtain qualified operations personnel to support the testing and start-up of the facility and process. It is noted that the follow-on activities through start-up and operations will require specific attention to ensure all change impact issues are identified early. Sufficient management attention is crucial to support the operability of the facility once fuel is ready to be received and processed. There is also a concern that the CVD Facility, when operating, will be unable to meet the fuel loadout rate from the K Basins, especially when both K East and K West are loading and transporting the MCOs.

3.4.2 Technical Scope

The CVD Facility functions as an interim step in the overall fuel movement process that vacuum dries the fuel placed in the MCOs loaded directly at the K Basins. The CVD Facility will be used to remove free water from the SNF loaded and transported from the K West and K East fuel storage basins and to vacuum dry the fuel before it is transported to the CSB for interim storage.

3.4.2.1 Findings

The CVD Facility is a critical component in support of the overall fuel movement process. This facility is required to status the K Basin fuel to a dry condition that will allow conditions to exist that will support the interim and long term storage of the MCOs and the contained spent fuel.

The CVD Facility is a one-of-a-kind processing facility that uses a relatively standard vacuum process to evacuate water from the MCOs.

The FDH Project Team was able to provide this Review Team with a draft copy of Appendix E of the *CVD Facility Design Report, Final Safety Analysis Report (FSAR) Draft* scheduled to be submitted to DOE on June 6, 1999 and delayed until July to incorporate FDH revisions. The SARs must be submitted and reviewed in a timely manner.

Immediate and constant attention must be given to the remaining fabrications of skid components for technical and scope clarifications.

The scope verification plan is critical to the operator understanding of the system.

The overall interface between the CVD Facility operations and the MCOs is critical to the project.

It was noted during the review process that the amount of equipment (bays) supplied and installed in the CVD Facility may be insufficient to meet the fuel transfer cycles once full production is underway in both basins. The CVD Facility has five bays that can be equipped with complete drying systems. However, it is not currently planned to equip all bays under this project. The project has developed a basis for and reached a decision to use three bays in the CVD Facility to provide adequate processing capacity.

3.4.2.2 Assessment

The overall assessment of the technical scope includes the inherent complexity of the vacuum drying process and the ability of the system as a whole to function as intended while meeting the schedule to support the critical cycle time to support other elements of the fuel retrieval and interim storage cycle. The Review Team believes that the project scope is sound and will function as intended as long as adequate interface activities are continued with the vendors and the project and operational start-up procedures and programs are developed and reviewed soon.

The process used for vacuum drying is also used in industry and should not carry a high level of operability risk; however, the mechanics of the attachment to the MCOs and the training required to effectively and safely operate the system creates a concern that must be addressed and satisfied in the near-term continuation of the construction and operations start-up activities for the facility.

The timely review and issuance of comments for the SAR is critical to the overall fuel movement process, and sufficient attention must be given to the review and comment resolution of this document by both FDH and DOE to support the follow-on activities involving hot operations of the CVD Facility.

The drying process selected is not anticipated to provide significant operability problems due to the availability of skid-mounted process units and spare bays provided for additional production capabilities in the future if needed.

However, there may be a major risk to the overall fuel movement process and operations associated with the *actual* drying time for the canisters in the CVD Facility. If drying times are extended to 72 hours or more, and the basins can produce an MCO a day to the CVD Facility, there may not be enough bays equipped at the CVD Facility to handle all the MCOs that will be loaded and ready for processing. With the limitation on the number of casks and the anticipated drying time including transportation from the K Basins and transportation to the CSB, it may be necessary to equip additional bays to satisfy the schedule of the fuel transfer cycle, if actual processing times warrant the change.

3.4.2.3 Recommendations

1. Perform continuous and intense review of the process and interface requirements for the operations through start-up to ensure operability parameters are addressed.

2. All Project Team members must focus on the timely preparation, review, and resolution of comments associated with the SAR. This is a very high-risk activity that can significantly affect fuel transfer activities.

3. Review the production cycle for the fuel transfers and ensure that adequate bays in the CVD Facility are equipped to take care of the MCOs delivered from the K Basins in an effort to meet fuel movement milestones. Review the cycle of the drying process as it pertains to the fuel movement schedule and revisit the number of bays to equip at the CVD Facility and also the total number of transfer casks and trailers that may be required when the basin retrieval operation is at its peak with both K West and K East loading and processing fuel.

3.4.3 Cost

3.4.3.1 Findings

The CVD Facility is nearing the end of construction and is starting into the operations and maintenance phase of the sub-project. The FY 2000 through FY 2005 budget for operations addresses the need to obtain and train personnel and prepare the project for conducting full-scale operations.

The team reviewed the current Baseline Cost Estimate for the CVD Facility including procurements in process and remaining construction activities. The CVD Facility construction and start-up WBS 1.03.01.02.20.41 includes only a small portion of the overall remaining SNF Project budget.

FDH has recently completed a bottom-up review of all ongoing contractual and procurement actions and has identified most of the outstanding change orders and claims with the construction subcontractors and outside vendors associated with the CVD Facility. This action further minimizes the risk for continuous cost growth from the fixed-price contractors as they continue toward completion of their contracts.

3.4.3.2 Assessment

The cost estimate is realistic for the programmed remaining work associated with the sub-project. The risks are primarily associated with the operations activities that are obviously inherent throughout the project. Based on the cost trends to date and a thorough review of the work to complete, it is anticipated that the overall risk for cost increase for the CVD Facility construction and procurement phase is minimal since most of the construction contracts are definitized and the major procurement orders are in place with options for additional equipment. It is noted that these near-term activities require full-time management attention and overview to ensure on-time deliveries and installation of the processing equipment.

The Review Team looked at the design/construction costs and operations costs separately and, based on the status to date, there may be a need for additional funding to be allocated to start-up and transition to ensure that the transition is adequately staffed with experienced personnel to support the start-up of operations. The range of risk for the start-up and operations is much higher for this project phase primarily because the variables associated with staffing and developing procedures that will require a dedicated transition effort to accomplish in the time frame allotted. FDH should recognize that this transitional effort and integration activity could require additional staffing and engineering overview as this phase of the project proceeds to the turnover phase of operations. The sub-team concluded that the cost estimate for the upcoming operations activities (WBS 1.03.01.02.25.41) appears to be understated. There does not appear to be adequate funding for the facility engineering and maintenance support requirement and the initial training and operation requirement.

3.4.3.3 Recommendations

1. Continue to keep all outstanding change orders and contract modifications current for the completion of the CVD.

2. Review all ongoing procurements for the process equipment and ensure that there are sufficient allowances for engineering resources to support the technical issues that will arise with the off-site fabricators currently under contract to provide the remaining equipment skids to the project. The project must maintain a focus on continuing the review and overview process currently in place by FDH.

3. Evaluate the near-term costs associated with ramp-up and transition from construction to operations. A detailed review of these activities needs to be accomplished to ensure the project that adequate resources and management attention are provided in a timely manner.

3.4.4 Schedule and Funding

3.4.4.1 Findings

The review of the schedule was completed at various levels including Level III.

FDH has organized a full-scale prototype facility on the Hanford site for the CVD system and fuels removal system. This prototype, which includes the process equipment and safety equipment including a cask/MCO connection unit, has served as a valuable learning and training tool for the overall project and in particular the CVD Facility itself. These mock-up units will be used during preparation of maintenance and operations procedures as well as operator and start-up training and will have a positive impact on the maintenance of the start-up schedule. This facility should be regularly maintained and updated to the current system's configuration as the project nears the operational phase.

3.4.4.2 Assessment

The schedule and funding allowances are adequate for completing the CVD Facility sub-project. A review of the CVD activities on the critical path show that only the skid procurement activities in process could potentially affect the overall project in the near term. However, there is a significant concern regarding the schedule of activities for the start-up and operational functions that must be addressed soon. The organization and team must address this situation immediately to coincide with the planning of the maintenance and operations organization.

The risk associated with schedule growth lies primarily in the turnover phase of the CVD Facility sub-project. In order to support the schedule for operational transfer, it will be necessary to ensure that personnel, procedures, and training programs to support start-up are available in a timely manner.

Overall, the CVD Facility is performing the necessary activities to support the fuel transfer milestone. The Review Team noted that many of the activities associated with the construction WBS could potentially affect facility start-up if constant overview and attention is not provided during their final stages of fabrication and construction. Items such as completion and final testing along with the completion of off-site fabrication are critical to the facility's ultimate operation. The FDH Project Team appears to understand the priorities for these activities and is aware of the need to continue to manage the construction subcontractors and fabricators to meet their current contractual completion dates.

3.4.4.3 Recommendations

1. Continue to assess the CVD Facility schedule by incorporating the actual experiences and lessons learned for the CVD Facility and related facilities, and integrating other key factors that could affect completion.

3.4.5 Management

3.4.5.1 Findings

FDH was aware of the project status and of the major risk areas associated with the various sub-projects. The direct line management team for the CVD Facility sub-project had an excellent knowledge of the detail requirements for successfully completing the facility and the process.

FDH has an integration and interface group that reviews the key interfaces with the other sub-projects associated with the SNF Project. The Review Team found that this activity has not been giving adequate attention to the CVD Facility project. It was noted that the project and the FDH management team have now identified this activity as a critical component of the management of the project and have now increased the involvement of Project Team members to address this issue. The CVD Facility project has issued a Design Verification and Validation Plan that defines current and planned activities to be performed in support of the CVD Facility. This plan provides for a closure of the CVD Facility definitive design phase and a path forward for the final validation and start-up testing of the CVD process. This is one of the most critical activities on the entire SNF Project to support fuel transfers.

The construction and operations departments have prepared and executed a Memorandum of Understanding (MOU) that delineates the coordination efforts and responsibilities of each group as they continue to work towards acceptance of the systems and facility and final turnover to operations.

3.4.5.2 Assessment

The FDH project management team, including DOE-RL interface and overview personnel, were acutely aware of the critical and complex aspects of the SNF Project. The focus of the team was impressive, including the team members' in-depth knowledge of the upcoming potential risks and the proposed programs and actions to adequately manage the known and unknown risks. The external interface awareness was particularly noticeable and supported by knowledgeable and competent personnel who were focused on the wide range of outside variables (i.e., other fuels) that are programmed to utilize the interim storage process managed by the SNF Project.

Thus, the overall management of FDH, including its direct interface with DOE-RL, is sound and complements the overall objectives of the SNF Project. FDH has the necessary qualified and committed management personnel to successfully execute this project through start-up and operations. However, there are some concerns that the interfaces for start-up are not getting the project management attention necessary to minimize the risk associated with interface delays during the transition from construction to operations.

Operations must become involved in the CVD Facility process as soon as possible. It is imperative that the operations involvement begin immediately and transition from the project to operations is smooth. It is even suggested that the operations group provide shift managers and/or operations personnel to start witnessing the construction acceptance testing and operational testing to become familiar with the system. It will also be necessary to provide sufficient design authorities and cognizant engineers to support the testing and start-up phase of this sub-project.

The major emphasis of the management team should be to ensure that key personnel continue with the support of the overall project through final construction acceptance testing and operational start-up. The MOU document and agreement should address the staffing support that can be provided by the project and the overlapping involvement of the construction team to support start-up, operational testing, and full operation of the production facility.

This Review Team has some recommendations to support the CVD Facility management structure to ensure that the facility is on-line to support the planned fuel movement milestone. It is important to use the dedication and experience of the current management team to enhance the critical transition phases in the future.

3.4.5.3 Recommendations

As the CVD Facility nears completion of construction and focuses on final acceptance testing and start-up, it becomes absolutely necessary to address some of the key issues normally addressed during this phase of any project to ensure adequate attention and overview is brought to the forefront. Following are some key recommendations that will support the timely start-up of operations activities, certainly the key issue for final system operability.

1. Review the overall sharing of personnel between the Construction and Operations organizations. The construction group must provide support to help facilitate the transition into operations.

2. Continue with the overall FDH management assessment planning exercise to ensure that the necessary qualified personnel are available to support completion of the CVD Facility to start development of the MSA, and to prepare for the upcoming and critical ORR and operations activities.

3. Develop a comprehensive plan for engineering to support the assignment of the design authority and cognizant engineers to support the CVD Facility turnover and start-up operations.

4. Continue to enhance the configuration management program and use the program in field training of the operations group as the project nears operational readiness, particularly in the CVD Facility area.

5. Assign technical representatives to contracts to continue the support and monitoring of the in-process procurements and fabrications including future procurements associated with the process equipment.

6. Assign a specific interface team that would include design authorities, cognizant engineers, operations personnel and project personnel to review the internal interface requirements associated with the CVD Facility. This team could also support and include some members of the procedure development and start-up team who offer knowledge of the overall systems and operations. This is a very critical scope and operability activity, but seems to lack focus throughout the project.

7. Assemble and develop the operations organization as soon as possible as well as the engineering support for the transition from construction to operations. FDH should review the current staffing for the sub-project and select some of the existing qualified and experienced personnel to continue with the project through start-up and operational readiness reviews. While planning and assembling the operations team, consideration must be given to provide adequate time to train and indoctrinate the workers both in core and process-specific operations training.

8. Develop an integration team to review system operability and verify that interferences and operational problems are eliminated. FDH should develop these teams immediately and include the necessary experienced Project Team members to support this critical planning and integration function.

9. Begin developing a transition team to prepare operational and control procedures as soon as all vendor data are available, to develop the organization that will operate the CVD Facility.

3.5 Canister Storage Building (Design/Modification/Construction)

3.5.1 Summary

The Review Team for the CSB focused on the overall scope, cost, schedule, and management issues for the above WBS element. The status and overall issues were discussed with the FDH CSB Manager and his staff. The persons contacted were aware of the issues and the required activities associated with work scope. Most of the focus is on near-term activities leading to the TPA milestone of fuel movement by November 2000.

The construction of the CSB and activities associated with this WBS were estimated to be approximately 85-90 percent complete with the remaining items to be completed in the remainder of FY 1999 and FY 2000. Most of the remaining work includes conducting acceptance testing and procurement action for tube plugs and impact limiters (absorbers). The tube plugs will be filled with concrete. Present requirements include the need to have all plugs and bottom impact limiters (absorbers) in place prior to the start of fuel loading in the CSB. It is assumed that bids can be awarded this summer for design activities and release for fabrication October 1, 1999, with receipt of the FY 2000 funding.

SAR completion is a limiting condition for the start-up. Recent reviews of the SAR for this facility have resulted in approximately 1,000 comments. The only identified major issue is resolving the potential eccentric drop of the MCO and the recovery from this accident. The present path forward is to analyze and document the technical basis to resolve this issue without an actual hardware change.

Other than the SAR issues, it is assumed that turnover and start-up will be relatively simple as systems are being turned-over as they are completed.

3.5.2 Technical Scope

The technical scope for the CSB includes the following activities: manage, define, select site, design, fabricate, procure, startup and test, deliver, obtain approvals and permits, and accept the Canister Storage Facilities, systems, and equipment needed to stage and store SNF. Also, the scope includes operational and design documentation, safety analyses, independent technical review, and stakeholder involvement.

The CSB is a reinforced concrete vault structure with storage tubes to be used for MCOs holding K Basins SNF and other Hanford fuel. The CSB provides safe interim storage of irradiated fuel at Hanford. The design life of the CSB is 40 years.

The CSB is built on a mat foundation which was initiated as part of the High-Level Waste Vitrification Project (HWVP). The superstructure and the roof are built per the HWVP drawings modified as necessary to meet the SNF requirements. The CSB is 60 feet tall and has a subsurface storage depth of 40 feet to house the MCOs. There are three vaults in the CSB. Vault One will be used to store K Basin fuel. There are 220 embeds in the deck to accommodate the storage tubes, which hold two MCOs each. The second and third vaults are to be partially prepared for optional storage of TWRS glass canisters.

3.5.2.1 Findings

The construction of the CSB building itself is essentially complete. Overall the project is about 85-90 percent complete. The MCO MHM bridge crane and turret are installed and pre-operational acceptance tests are being performed on the equipment and instrumentation. Placement of 220 tube assemblies in Vault One is complete.

The CSB SAR is drafted but has not been approved by DOE. There were approximately 1,000 comments to resolve. There is one major issue with MCO drop analysis as discussed in Section 3.5.1. The MCOs fabrication contract is expected to be awarded by July 1999. There will be significant impact on the fuel movement date if the MCO drop test analysis issue is not resolved. Also, there will likely be fuel shipment schedule impact if the resolution requires equipment modification.

3.5.2.2 Assessment

The CSB project has made substantial progress, however, issues with SAR approval remain. The acceptance tests on MHM are being performed. Final welding of the 220 tube assemblies is dependent on SAR drop test issue resolution.

3.5.2.3 Recommendations

Involve senior managers to get the needed decisions on SAR in a timely manner. FDH needs to provide the SAR and all supporting documentation supporting its claim that the drop test analysis of the MCO is adequate and that all other credible scenarios have been considered and mitigation plans are in order. (See additional discussion in Section 8.0, Safety.)

3.5.3 Cost

3.5.3.1 Findings

There were cost increases in FY 1999 due to the following reasons: 1) MOWAT construction settlement for past change orders; 2) tube fabrication; 3) concrete refractory; 4) crash gate work; 5) additional safety analysis for the crash gates; and 6) other miscellaneous work. Some work was deferred to FY 2000 and includes crash gates superstructure, insulating concrete, tube plugs, and other miscellaneous items. The increases in cost, deferred work, and savings realized due to competitive process are outlined in BCR SNF-1999-059.

3.5.3.2 Assessment

The cost increases in FY 1999, the cost of the deferred work in FY 2000, and the savings realized due to the competitive process will not result in any net change to the baseline.

3.5.3.3 Recommendations

None.

3.5.4 Schedule and Funding

3.5.4.1 Findings

The procurement action to acquire the tube plugs and impact limiters (absorbers) is underway. After receipt at the site the tube plugs must be filled with concrete. Present requirements include the need to have all plugs and bottom impact absorbers in place prior to start of fuel loading in the CSB. It is assumed that bids can be awarded this summer for design activities and released for fabrication October 1, 1999. The plugs for the tubes need to be in place by October 1, 2000.

3.5.4.2 Assessment

It appears that the biggest risk to the CSB WBS is to ensure that all the plugs are delivered by October 1, 2000. The assumption of being able to proceed to full fabrication on October 1, 1999 may not be achievable if the funding and budget authority is not available on the first day of fiscal year 2000.

3.5.4.3 Recommendations

1. Work closely with the plug contractor and monitor the progress of plug delivery.

2. Evaluate 'work-arounds' for fabrication of tube plugs and impact absorbers in the event that funding is not readily available.

3.5.5 Management

3.5.5.1 Findings

There are no high-level management issues related to the CSB except those related to resolution of the SAR. The FSAR approval date of May 26, 1999 has now been missed. DOE approval of the FSAR for the CSB requires resolution of over 1,000 comments. The most significant of these is the eccentric fuel drop of the MCO. Timely approval is required to not impact the fuel movement TPA milestone of November 2000. (See Section 6, Schedule and Funding; Section 7, Project Management and Integration; and Section 8, Safety, for further discussion of this SAR issue.)

3.5.5.2 Assessment

Near-term resolution of all SAR comments is not considered to be likely. High-level management attention is essential for timely resolution of issues and approval of the CSB FSAR so as to not impact the November 2000 fuel movement milestone.

3.5.5.3 Recommendations

Resolution of SAR issues and timely approval of the SAR are critical to the success of this project. The DOE-RL, DOE Headquarters, and contractor senior managers need to assist the SNF Project in resolving these issues in a timely manner. (See Section 8.0.)

3.6 Balance of Plant/Min-Safe Operations & Maintenance

3.6.1 Summary

The Review Team for the Operations and Maintenance activities focused on the overall scope, cost, schedule, and management issues for the above WBS elements.

The status and general issues were discussed with the FDH Operations Manager and several of his staff, as well as discussions with sub-project managers. These areas were also reviewed by other sub-teams for their assigned technical or cross-cutting areas. Persons contacted were aware of the issues and required activities associated with the work scopes. Most of the focus is on near-term activities leading to the TPA milestone of movement of fuel by November 2000.

Critical issues associated with these WBS elements and fuel movement include:

1. Availability of staffing, which includes the hiring of an adequate staff to perform turn-over transition and operations, obtaining necessary security clearances, both general and job-specific training, and early participation in SAR reviews and other activities that the operators will be ultimately responsible.

2. Updating of documentation to support the current plan for facility operations, which includes revision to the WBS breakout. This will require re-evaluating the cost and funding profile.

3.6.2 Technical Scope

SNF operations includes four separate WBS elements: 1) WBS 2.10.20, K Basin (Minimum Safe Operations); 2) WBS 2.15.20, K Basin Transition; 3) WBS 2.25.19, Common Operations; and 4) WBS 3.20.30, Canister Storage Building. WBS element 4.30.60, 200 Area Interim Storage Area (ISA) Operations, and WBS element 2.25.41, CVD Facility Operations, are addressed with the discussion of the respective facilities elsewhere in this report.

3.6.2.1 Findings

K Basin Minimum Safe Operations (WBS 2.10.20) is intended to include those items for minimum safe operations. However, there are a number of items within the WBS that fund ongoing operational activities that exceed minimum items needed for compliance. The M&I contractor plans to revise and submit for approval a revision of the lower WBS elements for this work area and other Operations and Maintenance work areas to include some recent additional requirements (mostly related to increased safety requirements) and remove items from this "Minimum Safe Operations" account that can not be truly defended as this type of activity. Removed items would be placed in other accounts, where it is believed they are still needed. The plan is for these items to be prioritized. The available funding levels would determine which task activities would actually be accomplished with lower priorities being deferred or deleted.

Recently, there has been a change in operations philosophy involving the need for early participation of operators in SAR activities, system test and start-up, and ORRs. Under this philosophy, the need for additional staff at this time is critical. The previous base staffing assumptions, included in the *SNF Operational Staffing Plan*, dated December 31, 1998, was to have the staffing and organizational structures in place early enough to support the ORR process. If there was insufficient time for providing enough Chief Operators, they were to be augmented with exempt staff. The current planning for operational organization and staffing is outlined in a draft revision to the Project Execution Plan (PEP) and will be discussed in more detail in a Staffing Plan revision.

The M&I contractor is attempting to staff-up in the area of operations and maintenance. However, due to the delays in obtaining clearances and completing required training, it takes approximately six months before the employee can begin work. There is an additional problem of attracting qualified staff to the site because of the unappealing physical location, lack of food service availability, unattractive salary and other incentives, and lack of availability of transportation services.

3.6.2.2 Assessment

A major concern, in all areas, is the availability of trained and qualified staff to support the transition and turnover and the performance of operational activities. The Review Team agrees with the revised philosophy of staffing-up now to provide facility and operations staff to support current and ongoing activities. The plan to revise the WBS structure and contents to align with current planning for operations is appropriate and should continue.

3.6.2.3 Recommendations

See Management Section 3.6.5.

3.6.3 Cost

3.6.3.1 Findings

These WBS items include both continuing operating costs for existing facilities and operating costs associated with newly constructed facilities. The total costs for these WBS elements remaining to be spent is approximately $468 million. The ongoing annual costs from FY 1999 though FY 2003 range from $56 to $90 million per year. There is a current effort to revise WBS elements and reduce costs where appropriate.

There are increased costs from those planned and in the baseline due to increased nuclear safety requirements and the increased use of consultants rather than internal employees. There are approximately 125 contracted employees included in operations, training, and procedures development. Efforts are also underway to evaluate costs and establish a priority list of reduction items in this WBS.

3.6.3.2 Assessment

Costs have increased over the baseline estimates in several areas due to increased nuclear safety requirements – including increased costs for SAR preparation and the higher costs associated with using subcontract personnel instead of site employees. The total impact of these increases along with scope reviews and efforts at cost reduction will be assessed with a revision to the baseline documents in the area of Operations and Maintenance that will be submitted for approval. Some of the lower priority items may need to be deferred.

3.6.3.3 Recommendations

See Management Section 3.6.5.3.

3.6.4 Schedule and Funding

3.6.4.1 Findings

It is difficult to obtain qualified personnel in the facility operations area in a timely manner.

3.6.4.2 Assessment

The need for having facility and operations staff on-board early is well justified. The time required to hire, obtain needed security clearances, and train employees is approximately six months. This does not support the currently identified need to have staff on-board in a timely manner. DOE-specific approvals or waivers may be required, particularly in the area of security clearances.

3.6.4.3 Recommendations

See Management Section 3.6.5.3.

3.6.5 Management

3.6.5.1 Findings

As expected, newer members of the management staff have been working to implement their individual organizational and performance expectations. However, current baseline planning and WBS items do not clearly represent the revisions that work instructions are undergoing. The WBS is planned to be revised prior to the end of the fiscal year and will include organizational responsibilities, revised technical scopes, and updated costs and schedules. While the organization and work performance will be shifted between WBS accounts, the actual scope of work to be performed should remain essentially the same. Management personnel in this area of review are qualified and have a solid grasp of the issues involved.

3.6.5.2 Assessment

The proposed management approach appears appropriate for the work to be performed and for implementing responsibilities and controls. There is a plan for establishing a succinct list of minimum activities for operations and a prioritized listing of remaining items.

Impediments in hiring may affect the transition of the systems to operations and there are currently a number of impediments to hiring operations personnel:

- The hiring of operators this year is limited by contingency availability.
- Operators must be determined eligible for security clearances before the hiring process is completed. This may cause delays of three months or more in hiring an individual.
- Administrative delays caused by the FDH hiring practices add delays in bringing personnel on board.
- The remoteness of and conditions at the site make the working conditions unattractive to many personnel. The K Basins are located over 35 miles from Richland. Each person must provide for his or her own transportation. This is expensive and adds about 1½ hours in commute time to the work day. There are no cafeteria or food sources provided at the site other than machines and an occasional mobile canteen.

It was reported that it takes six months from the time a requisition is prepared for an operator until the person is on board and is minimally trained. The current lack of sufficient operations personnel has several ramifications:

- Operations personnel are not sufficiently involved in the startup of equipment and systems.

- Permanent operations personnel are not sufficiently involved in preparation of operating and maintenance procedures. This function is being done by consultants and temporary personnel.

3.6.5.3 Recommendations

1. Accomplish the WBS revisions to realign current Operations and Maintenance work and planning in a timely manner so the remainder of the project activities can be organized. These revisions need to capture lessons learned, increased safety or other changed requirements for operations, as well as inclusion of Value Engineering or other similar processes to improve schedule and work efficiency and reduce costs.

2. Obtain management support for resolution of the issue of timely availability of qualified operations and facility staffs to support the start of fuel movement. Management should consider the following items:

    - Investigate the possibility of obtaining additional funding now for operator hiring.

    - Evaluate the process for obtaining security clearances with the intent of accelerating the process. Do not delay the hiring process pending eligibility for clearance. If a person is hired and is later determined ineligible for clearance, reassign that person to an area where a clearance is not needed. Also, revisit the requirement for security clearances for operator personnel.

    - Ensure that FDH hiring authorities thoroughly understand the urgency of the need to staff-up the SNF Project and provide the support necessary.

    - Consider steps to offset the undesirable features caused by the remoteness of the site by providing transportation to the site; providing worker incentives, such as bonuses for remaining on the project until completed; and providing hot meal services.

If a change in site regulations is required for the above, the contractor should request that the government make the change.

3.7 200 Area Interim Storage Area (ISA)

3.7.1 Summary

The Review Team for the 200 Area ISA activities focused on the overall scope, cost, and schedule and management issues for the following WBS elements:

- Design and construction of three storage pads, installing a fence and lighting around the 200 Area ISA; making access road improvements, and constructing a warehouse (WBS 1.03.01.04.10.60)

- Site-wide SNF Project fuel movement of various Richland sites to the 200 Area ISA (WBS 1.03.01.04.20.60)

- Surveillance and maintenance of 200 Area ISA during the period the SNF is being received from various Hanford areas (WBS 1.03.01.04.30.60)

Currently, the baselines for these WBSs are reasonable and there are no major risks associated with the scope, cost, and schedule. There are no specific management issues involved in this sub-project.

3.7.2 Technical Scope

The scope of work of the Design/Construct 200 Area (ISA) sub-project consists of design, procurement, installation, construction, and testing of all work in the 200 Area ISA, including fencing and lighting, access road improvements, and 200 Area ISA Warehouse (approximately 4000 square feet).

The site-wide SNF (Design/Move Fuel to 200 ISA and Operations/Maintenance 200 ISA) includes:

- Transfer SNF located at 324 Building, Fast Flux Test Facility, and the 400 Area ISA to dry cask storage at the 200 Area ISA.

- Transfer Pressurized Water Reactor Core 2 SNF from T Plant to the CSB in Trans Nuclear – Westinghouse Hanford Company casks.

- Acquire canisters/drying capability for Pressurized Water Reactor Core 2 SNF.

- Transfer sodium-bonded Fast Flux Test Facility SNF to Argonne National Laboratory - West.

- Initiate design of repackaging cell for Low Level Burial Grounds /Plutonium Finishing Plant SNF.

- Receive Light Water Reactor SNF from the 324 Building at the 200 Area ISA and provide Fast Flux Test Facility SNF transloading capability at CBS.

- Develop Safety Authorization basis; perform startup activities and readiness assessments for receipt and storage of site-wide SNF at 200 Area ISA and CSB.

- Provide Surveillance and Maintenance of 400 Area TRIGA Fuel.

- Fund SNF Operations Project to conduct surveillance and maintenance at 200 Area ISA to comply with Nuclear Regulatory Commission nuclear safety equivalency requirements.

3.7.2.1 Findings

The construction of three concrete storage pads (Nuclear Regulatory Commission equivalency) is complete. The fencing, lighting, and access roads are scheduled in FY 1999 and the warehouse construction is scheduled in FY 2000. The 90 percent design package for the remaining work scope activities is ready for review.

Moving the SNF Project fuel from various Hanford areas to the 200 Area ISA will be conducted per prior experience in nuclear fuel handling, when nuclear fuel was transferred from Building 308 to the 400 Area ISA. No major risks or delays are anticipated at this time.

3.7.2.2 Assessment

The construction schedule of the facilities is achievable unless any unforeseen circumstances take place. The SAR of 200 Area ISA is Annex D to SNF Preliminary Safety Analysis Report (PSAR). Pressurized Water Reactor Core 2 SNF will require modification to the CSB SAR.

Coordination of SNF movement activities with the fuel transferring sites is the key for keeping the project within cost and schedule.

3.7.2.3 Recommendations

Resolve the issues related to the CSB SAR expeditiously. (See Recommendations in Section 8 of this report.)

3.7.3 Cost

3.7.3.1 Findings

The construction work in 200 Area ISA will be accomplished through fixed-price contract in FY 1999 and FY 2000.

The baseline cost for fuel management and movement to 200 Area ISA is based on the site experience in moving the fuel from Building 308 to the 400 Area ISA. The surveillance and maintenance cost at 200 Area ISA is based on the site experience of surveillance maintenance at 400 Area ISA.

A radiation shield analysis for MCO procurement by this sub-project was conducted and will be finalized in the next two weeks. It is probable that no additional shielding will be required and the procurement of those MCOs will be added to the MCOs procured for K Basin. With use of the MCOs, rather than another storage container, expected savings are approximately $200K. A BCR to that effect will be submitted by FDH to DOE-RL shortly.

3.7.3.2 Assessment

The Basis of Estimate (BOE) documentation of the baseline contains the basis of estimate for 200 Area ISA construction activities, SNF Project fuel movement from various Hanford areas to the 200 Area ISA and its surveillance and maintenance.

The baseline construction cost for the rest of the work to be conducted in FYs 1999 and 2000 seems to be reasonable. Cost estimates for fuel management, movement, and surveillance and maintenance are based on the site's prior experience of moving fuel and surveillance and maintenance. This cost basis seems appropriate and reasonable.

3.7.3.3 Recommendations

None

3.7.4 Schedule and Funding

3.7.4.1 Findings

The TPA commitment of May 31, 1999, to transfer SNF from the 324 Building "B Cell" to 200 Area ISA has been renegotiated to November 30, 2000, by change request M-89-98-03, approved on November 07, 1998. The construction of the 200 Area ISA will be completed in FY 2000. The SNF Project fuel transfer from various Richland sites to 200 Area ISA will be completed in FY 2004. After the completion of SNF fuel relocation from various sites to 200 Area ISA, the 200 Area ISA will be transferred to Project WM 02 for surveillance and maintenance and further completion of program activities.

3.7.4.2 Assessment

There are no major schedule issues at this time with the 200 Area ISA sub-project. The Review Team does not see a major risk to meeting the revised TPA milestone. This sub-project supports other site-wide SNF activities that may affect the schedule of its activities. The project managers monitor the coordination and schedule issues in weekly critical path meetings.

3.7.4.3 Recommendations

None.

3.7.5 Management

3.7.5.1 Findings

A separate Project Management Plan (PMP) exists for the 200 Area ISA. This PMP is tied to the higher level SNF PEP. This PMP will be revised by the end of the year to reflect all the necessary changes in the sub-project after the contract arrangements between FDH and Duke Engineering and

Services Hanford, Inc. (DESH) are finalized. The Readiness Assessment for starting operations in 200 Area ISA will be completed after construction activities in the area are complete.

Due to limited operations activities at 200 Area ISA and the limited availability of operators from the Fast Flux Test Facility (as a result of slow down of operations in that area), the sub-project manager expects no difficulty in carrying out the operations per baseline requirements.

3.7.5.2 Assessment

No unusual management issues exist.

3.7.5.3 Recommendations

None.

3.8 Debris, Sludge, Water Removal and Deactivation

3.8.1 Summary

This section discusses the retrieval and disposition of debris, sludge and pool water from K East and K West Basins and the relationship of these activities to deactivating the facilities following fuel removal. Some sludge and debris removal will occur during fuel removal. However, the bulk of sludge and debris removal will occur in 2004 after fuel is removed from the basins. The debris removal activities involve the disposition of empty fuel cans, fuel racks that held the fuel cans, process equipment and related material that will result from the fuel removal operations.

The current baseline for sludge removal consists of those tasks necessary to remove the sludge from the K East Basins and prepare it for disposition in the Tank Farms. Samples of sludge from the K East Basins indicate the presence of polychlorinated biphenyls (PCBs) and uranium with particle sizes in excess of 10 microns. This has added to the complexity of the treatment process. The current costs to retrieve, condition, and dispose of the sludge could increase from the current estimate of $76.9 million to $150 million. Alternatives are under evaluation by a senior level team consisting of DOE-RL, EPA, and representatives from the Hanford Project Management Team. A formal recommendation is expected that will propose that the sludge be retrieved, packaged, and shipped to the Hanford T Plant located in the 200 Area for storage and that the sludge be treated as part of the inventory of remote handled transuranic waste under the aegis of the Waste Management Program. The proposal to DOE-RL is expected by mid-June 1999.

In parallel with debris and sludge removal, work during the period FY 2004 and FY 2007 will concentrate on preparing the facility for turnover to the Environmental Restoration Program managed by Bechtel Hanford, Inc. (Bechtel). End-point criteria have not been finalized and will define the "types" of debris that will be removed by the SNF Project and those that will be removed at a later date. It is expected, however, that prior to turnover, the water in the basins will be removed, shipped by truck to the on-site Liquid Effluent Treatment Facility for treatment, and discharged into the soil.

3.8.2 Technical Scope

The Debris, Sludge, Water Removal and Deactivation sub-projects are represented by the following six WBS elements:

Debris Removal Project (During Fuel Movement) - WBS 02.25.16: This sub-project is focused on cleaning and removing empty canisters and general debris **prior** to fuel processing and removal. K Basin debris is defined as any object larger than 0.25 inch in any one dimension (DOE/RL-99-25 105 K Basins 1998 Debris Report). Debris removal is already underway in support of equipment and system installation in the K East and K West Basins.

Debris Removal Project (Design/Modification/Construction) - WBS 02.20.16: The scope concentrates on the disposition of over 6500 empty fuel cans, the 1560 fuel racks that hold the fuel cans, fuel handling equipment and material that will remain after fuel removal operations. The current approach is to cut, package and dispose as solid waste in the on-site Environmental Restoration Disposal Facility.

Sludge Retrieval/Removal Project - WBS 02.30.50: This sub-project consists of the activities associated with collecting sludge at K Basins. The primary focus is on the removal of 50 cubic meters of sludge in the K Basins. Approximately 45 cubic meters is located in the K East Basins. All the sludge will be consolidated in the settling basin (known as the "weasel pit"). This is separate movement from the sludge that will come from the knockout and settling tanks from both basins during fuel cleaning which amounts to a total of about four cubic meters. The scope of this activity is tied to the chemical characteristics of the sludge such as pyrophoricity (spontaneously igniting in air) and uranium particle size. The quantity of sludge and the ability to retrieve this material is an area of uncertainty that needs to be addressed as the baseline is being revised.

Sludge Treatment Project - WBS 02.30.51: This sub-project consists of the activities necessary to treat the 50 cubic meters of sludge from the K Basins. The current baseline covers the design, fabrication, installation, and testing and turnover of the Sludge Treatment System and the TWRS Receiving Station to accept the treated sludge and the Intersite Transportation System to deliver the sludge to TWRS.

Water Removal Project - WBS 02.50.70: This sub-project covers the removal, treatment and disposal of the 2.4 million gallons of water in the K Basins following fuel, debris and sludge removal.

Deactivation 100K Area Facilities – WBS 02.50: This sub-project covers those necessary activities after fuel removal that are required prior to turnover to the Environmental Restoration Program at Hanford. This work will be governed by the agreement on end-point criteria developed between the SNF Project and the Environmental Restoration Program managed by Bechtel.

3.8.2.1 Findings

The work associated with the Debris Removal after Fuel Removal, Sludge Retrieval and Treatment and Water Removal sub-projects is under evaluation due to the addition of the Deactivation work scope (WBS 02.50, 02.50.10 and 02.50.16) to the SNF Project in April 1998. This scope was added to envelop all the work associated with the TPA Milestone M-34 since the focus is minimizing effluent releases outside of K Basin. An additional $133.5 million was added to the baseline to reflect this additional scope. This was a rough order of magnitude estimate based on previous Hanford deactivation work.

FDH and Bechtel are currently negotiating end-point criteria now that deactivation is included in the SNF Project scope. The baseline technical scope and strategy for these activities are currently being reworked and a new BCR will be available at the end of calendar year 1999.

The 1996 analysis of K East Basin sludge identified PCB quantities as high as 220 parts per million. In addition, because of the requirements from the Tank Farm related to criticality, pyrophoricity, and gas generation, coupled with requirements related to particle size (i.e., nothing over 10 microns could be added to the tanks), a small acid dissolution process would need to be developed to treat the sludge. This has led to a revision in the approach to treat the sludge. Without this revision, the cost to the SNF Project for retrieving, treating, and disposing of the sludge is projected to double from the current $76.9 million estimate.

Alternate studies were established and have been conducted by the SNF Project to determine the most cost-effective method to process the sludge. These studies were rejected by FDH as too costly. A Senior Advisory Team comprised of FDH, DOE, and EPA was formed. The proposed plan for the sludge will be to package, ship, and store the material at T Plant.

The current approach calls for sludge removal from the K East Basin after fuel removal.

A site-wide system engineering assessment has been performed that indicates that including the treatment of the sludge material with other similar material on the Hanford site offers major opportunities for SNF Project savings.

The retrieval, packaging, and disposal of the debris and water rely on technology that has already been proven at Hanford.

3.8.2.2 Assessment

The current approach to link the end of fuel removal with deactivation is both technically sound and cost-effective. However, the net result is that there is very little detail in the level of planning beyond the end of fuel removal in FY 2004.

The application of a site-wide systems engineering approach has led to the plan to treat the sludge like other materials at Hanford, such as sludges and transuranic soils retrieved from the reactors being decommissioned by the Environmental Restoration Program and similar remote handled transuranic wastes retrieved from old burial trenches. These materials are currently being managed by the DOE-RL Waste Management organization. The plan is to include this material in the scope of a remote handled transuranic waste management plan scheduled to be submitted to the regulators in June 2000. EPA, the lead regulator for the SNF Project, has been involved in this new approach and endorses it.

3.8.2.3 Recommendations

1. Obtain DOE endorsement of the proposed approach, which holds the Waste Management organization responsible for special material like the PCB-contaminated sludge. This approach could potentially save up to half of the remaining $47 million allocated for the sludge treatment work.

2. Initiate planning to better define the period between end of fuel removal and turnover to the Bechtel managed Environmental Restoration Program. Based on lessons from PUREX, B Plant and N Basin cleanout, the SNF Project could reduce the schedule by a year at a savings of $35 million.

3.8.3 Cost

The total project cost for these WBS elements is $107 million. If the deactivation costs are included, the total costs are $240.5 million. Costs through FY 1998 are $15.9 million. The FY 1999 budget including deactivation is $4 million.

3.8.3.1 Findings

The cost basis for the debris removal during fuel removal is defined in the existing BOE documents supporting the current Baseline.

The cost basis for water removal and treatment is not documented in a Basis of Estimate. A report has been prepared that delineates the approach and the associated cost.

The cost basis for the removal of the sludge in the K Basins is currently defined and documented in the BOE.

The costs to accomplish the new sludge treatment approach (i.e., the site-wide option to include SNF sludge with other Richland transuranic wastes) have not yet been estimated and documented.

The FDH Transition Projects organization and not the SNF Project organization have prepared the BOE for the Deactivation Projects' WBS. The BOE for this work can be characterized as an order of magnitude estimate based on previous deactivation work at the Hanford site.

3.8.3.2 Assessment

Except for the WBS associated with Debris Removal during Fuel Movement, a detailed "bottom up" cost estimate is not available. Greater detail will be developed during the next six months and will be reflected in a BCR, which is scheduled to be submitted in December 1999. It is anticipated that major expenditures will not occur until 2001.

The SNF Project organization has not developed estimates that it "owns" for the deactivation work.

The outyear work plans should reflect cost savings once the baseline is changed to reflect a shift from sludge treatment to sludge transportation and storage at T Plant.

The budget for the Deactivation Projects covers four years and totals $133 million. Hanford experience (e.g., PUREX and B Plant) indicate that the scheduled duration and budget may be high.

3.8.3.3 Recommendations

1. Assess and incorporate the lessons learned at B Plant and N Basins in an effort to reduce the outyear schedule and associated cost after fuel removal.

2. Assess whether K West Basin Deactivation can be accelerated by a year at a reduced cost.

3.8.4 Schedule and Funding

Other than ongoing Debris Removal to support preparations for fuel removal, major work in these sub-projects is not scheduled to start until 2001.

3.8.4.1 Findings

Detailed integrated schedules below Level 3 do not exist for the period from end of fuel removal to turnover to the Bechtel managed Environmental Restoration Program.

3.8.4.2 Assessment

A clear definition of the schedule and cost will not be available for evaluation until December 1999.

3.8.4.3 Recommendations

None

3.8.5 Management

3.8.5.1 Findings

The management of this work is done under the direction of the FDH SNF Project organization responsible for site-wide interfaces and systems engineering except for the current debris disposal operations, which are essentially complete.

3.8.5.2 Assessment

The management of these elements has had the net benefit of identifying solutions that could potentially reduce costs for the SNF project. However, because this work is five years away, it does not have the same management attention that current spent fuel efforts have. The formulation of a new direction for the treatment of the sludge is being developed with the stakeholders and the lead regulator, EPA.

3.8.5.3 Recommendations

None.

4.0 Project Risk Management

4.1 Summary

The chartered activities of the Review Team include an assessment of the SNF Project Risk Management Program and identification of risks that could have significant impact on the project baselines.

Active risk management can significantly decrease the likelihood of unanticipated cost overruns, schedule delays, and compromises in system quality. A focused and disciplined approach to risk management provides the benefits of avoidance of surprises, high value activity/task definition, and ultimately increased project success. A risk is the result of any event or occurrence, whether internally or externally driven, that will adversely impact the ability to complete the project within stated technical/scope, schedule and cost objectives. Risk management is a structured, formal, and disciplined approach to determine and control risks. It includes processes concerned with planning, identifying, analyzing and responding to potential risks. The key elements of risk management, against which the SNF Project is evaluated, are shown in Figure 4-1. A description of each of the key elements is given in Appendix G.

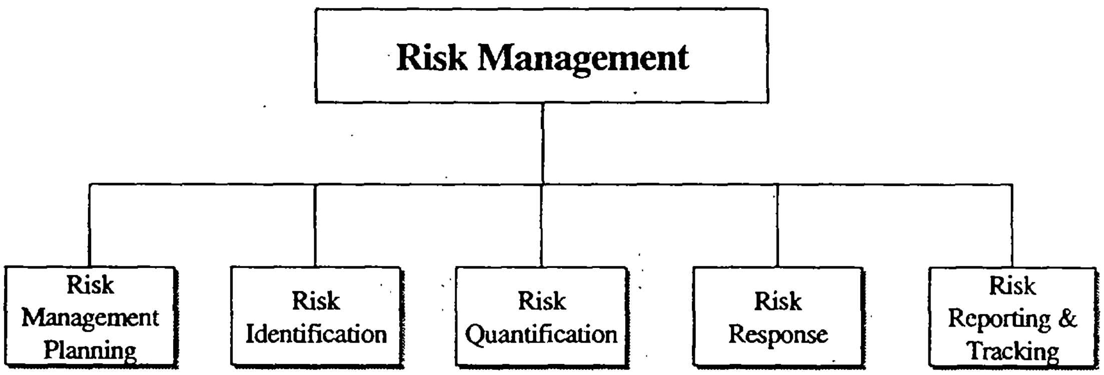


Figure 4-1. Key Elements of Risk Management

The SNF Project Team has clearly demonstrated the implementation of several elements of risk management. Significant emphasis on risk identification, defining the likelihood of occurrence, tracking and reporting risks, assigning responsible persons for closure, and factoring the schedule or cost impacts into the project baselines was obvious. The "living" risk database and contingency analysis development are well documented, visible, and used by the Project Team. What was not evident was the project plan or "process" describing the inputs, controls, supports, and outputs to ensure a consistently applied methodology of risk management. Also, the Review Team identified several risks which need to be further evaluated by the SNF Project Team.

Aggressive risk management is an ongoing process and should continue to be performed throughout the life of the project.

4.2 Findings

Significant effort was initially invested by the SNF Project Team to identify project risks during the period of time when the project baseline was being re-evaluated (circa 1998). The SNF Project Team contracted the services of both Pacific Northwest National Laboratory (PNNL) and Newport News Nuclear, Inc., for the purpose of getting independent assessments and inputs on potential project risks, the impact on cost, schedule, and scope, and other relevant aspects of risk. The compilation of all the initial risks were then reviewed by project management to distill the risks down to the significant ones. Risk handling strategies and associated costs and implementation schedules were used as inputs to contingency analysis.

The SNF Project Team maintains four categories of risks which reside in the risk database maintained by the Project Control organization. These four categories are identified as "New," "Open," "Avoided," and "Realized." The "Avoided" or "Realized" risks are carried within the database for reference purposes but no further activity is required. The risks included in the current baselines and contingency analysis are referred to as the "Open" risks and are tracked in the database. Risks identified subsequent to the current baseline approval are categorized as "New" risks and likewise are tracked. The SNF Project Team formally reviews the "Open" and "New" risks on a quarterly basis. The risk database is revised via change control.

The SNF Project Team indicated that there is no documented plan or implementing procedures on risk management. Specifically, the inputs, outputs, support resources, and controls of managing risk elements were not always evident. Some of the inputs, e.g., the risk database and technical issues, were evident. Likewise, outputs, e.g., the risk database revisions, contingency analysis, and BCRs, were readily apparent.

Finally, organizational and functional responsibility for the risk management process was not obvious. A review of organization charters did not clearly identify the leadership responsibilities for the process. Based on the interviews of Project Team members, it was clear that risk management is used and its value is known. The Project Control organization came as close as any to being functionally responsible for the process due to the acknowledged links between risks and baselines. The Systems Engineering Management Plan (HNF-SD-SNF-SEMP-001) implies that the Systems Engineering organization is responsible.

4.3 Assessment

The Review Team focused on two areas relating to SNF Project risk management. These areas were:

a) The risk management process employed by the SNF Project Team; and

b) Risks with potentially significant impacts on the project baselines.

4.3.1 Assessment of Risk Management Processes

The SNF Project risk management approach (process) was evaluated against the standard elements of risk management. The findings are discussed above. The Review Team's assessment of each of the key elements are as follows:

Risk Management Planning: No formal risk management plan or implementing procedures exist delineating the inputs, controls, resource supports, or outputs of the risk management process.

Risk Identification: A database of identified risks exists and is updated quarterly by the Project Team. Sometimes the risk statement contains a description of potential consequences and sometimes it does not. For clarity, the consequences of an identified risk should be stated separately. The "Open" risks are also stated in the contingency analysis portion of the baseline.

Risk Quantification: The likelihood of occurrence (probability) for each identified risk was stated in the risk database; however, the consequences (impacts) associated with each risk are seldom called out. In addition, it is unclear how or which risks are considered significant enough to assign risk handling strategies, incorporate in contingency analysis, and assign responsible organizations to close out. A graded approach to managing risks is both cost-effective and practical.

Risk Response: The methods and/or activities to prevent, mitigate, accept, reduce or transfer the identified risks are inconsistently described in the risk database and contingency analysis.

Risk Reporting and Tracking: The risk database produced and regularly reviewed by the SNF Project Team, has most but not all of the information necessary. The stated consequences (impacts) and the level of significance those consequences have (e.g., negligible, marginal, significant, critical) are not readily apparent nor is the overall "risk level" (e.g., High, Moderate, Low) declared in the database. Additional fields in the database would fix this.

The inputs used by the Review Team to evaluate the risk management process included an in-depth review of SNF Project documentation, interviews with SNF Project Team personnel, and interactive group meetings.

From a "risk management process" standpoint it was determined that many elements exist to varying degrees of detail and consistency. The lack of a formal documented risk management program and project team training in risk management may be a contributing factor to why the Review Team identified some potentially significant risks not formally identified and documented by the SNF Project Team. Project Team personnel may have differing views or levels of understanding with respect to risk management without the benefit of a structured set of guidelines or procedures for implementation.

4.3.2 Assessment of Risks

The Review Team was organized into two types of teams, i.e., system/component-specific teams and crosscutting sub-teams directed toward selected WBS activities. The result of this approach provided an effective means to review and evaluate risks considered by the Review Team to have the most significant impacts on the project baselines. The risks with potentially significant impact on the SNF Project baselines are presented in Table 4-1. In addition, possible mitigating factors and positive attributes noted by the Review Team are also shown. The implications of associated cost, and/or schedule impacts, are discussed in Sections 3.0, 5.0, and 6.0, respectively.

4.4 Recommendations

The recommendations developed as a result of the review of SNF risk management activities are provided below.

1. Develop and document a Risk Management Plan (RMP) and implementing procedure(s). The impetus for this recommendation lies in the fact that the SNF Project is large, complex and still has many challenges ahead. The SNF Project Team has the right mindset regarding risk, i.e., they make every effort to manage it (risk) so it does not manage them. They understand the value of early and frequent risk analysis, and how it "connects" to day-to-day, as well as long-term, planning strategies. Without a tangible roadmap for formally managing risk, the best intentions may not suffice.

   The Review Team developed a SNF Project Risk Management Business Model (Figure 4-2) for guidance to the SNF Project Team in developing a RMP. The business model identifies possible inputs, supports, controls, and outputs needed to consistently and effectively manage project risks. The items proposed on the business model were identified during the course of the Review Team's assessment. Documenting the specific elements needed in the business model by the SNF Project will essentially contain the ingredients needed for the RMP and any implementing procedures.

   To further facilitate the SNF Project Team's effort, an outline of a risk management plan is provided in Appendix G.

2. The SNF Project Team is encouraged to further evaluate the risks identified in Table 4-1 to develop appropriate risk responses, and factor these into the project activities as deemed appropriate.

Table 4-1. Risks with Potentially Significant Impact on the SNF Project Baselines

Assessed Area	Risk Number	Risk Statement
Fuel Removal System (FRS)	FRS-1	Changing Requirements
	FRS-2	Affect of RAD conditions in K East
	FRS-3	Availability of SARs when needed
	FRS-4	Staffing ramp-up is behind plan
	FRS-5	FRS is first-of-a-kind and has not been tested
	FRS-6	Cask drop driven modifications - challenge schedule
	FRS-Value Engineering	Reduce parallel operations of K West/K East
Canister Storage Building (CSB) & Interim Storage Area (ISA)	CSB-1	Lack of approved SAR Consequence: if facility fix needed, there will be construction delay
	Positive	Except for SAR risk (cask drop), construction completion schedule and cost has minimal risk
Multiple Canister Overpack (MCO)	MCO-1	Implementation of NQA-1 quality requirements for the baskets at DynCorp's fabrication shop facility
	MCO-2	Resolution of whether RW0333P are to be applied to baskets and/or MCOs
	MCO-3	Lack of DOE-RL approval of MCO Topical Report (FSAR)
	Positive	• Industry involvement in baskets and MCOs • Lessons learned process used • Good project management • Using commercial fuel standards
Integrated Water Treatment System (IWTS)	IWTS-1	Unproven first-of-a-kind Basis: Unknown settling characteristics Unknown feed stream Single failure Never operated High volume plan (320 gpm) 24-hour operation required (95%) Defective welds (issue surfaced too late to be included in review)
	Positive	• Will use lessons learned for K East • Good project management
Cold Vacuum Drying (CVD)	CVD-1	FSAR being re-issued
	CVD-2	Transition from construction to operation Basis: Staffing/Training
	CVD-3	Actual drying process may be longer than anticipated
	CVD-4	Impact to construction/equipment due to fabrication design or vendor performance
	Positive	316/300 Area full scale prototype and checkout system. Usable for training and procedures.

Assessed Area	Risk Number	Risk Statement
Operations (OPS)	OPS-1	Ability to provide staff in a timely manner
	OPS-2	Ability to train and qualify personnel in needed timeframe
Debris/Sludge/ Water Removal (DSW)	DSW-1	Sludge treatment costs may vary
	DSW-2	Deactivation costs/schedule not fully defined
	Positive	Examples of sludge from site systems for transuranic waste
Schedule (SCHED)	SCHED-1	Staff ramp-up behind plan
	SCHED-2	Availability of funding to support staff-up and procurement
	SCHED-3	Planning and schedule for activities beyond November 2000 are minimal
Project Management and Integration (PM&I)	PMI-1	Resolution of SAR will not be complete in timeframe needed Consequence: Cost/Schedule impacts
	PMI-2	Operations and Engineering staffing short-falls
	PMI-3	Potential project organizational changes
	Positive	• Good job developing baseline • Good effective management team in place • Excellent project management systems in general
Quality Assurance/ Quality Control (QA/QC)	QA/QC-1	Delays due to potential Corrective Actions resulting from compliance orders
Operations Readiness Review (ORR)	ORR-1	Boundaries for ORR scope are not well defined
	ORR-2	Durations for corrective actions for the MSA, and two ORRs are insufficient

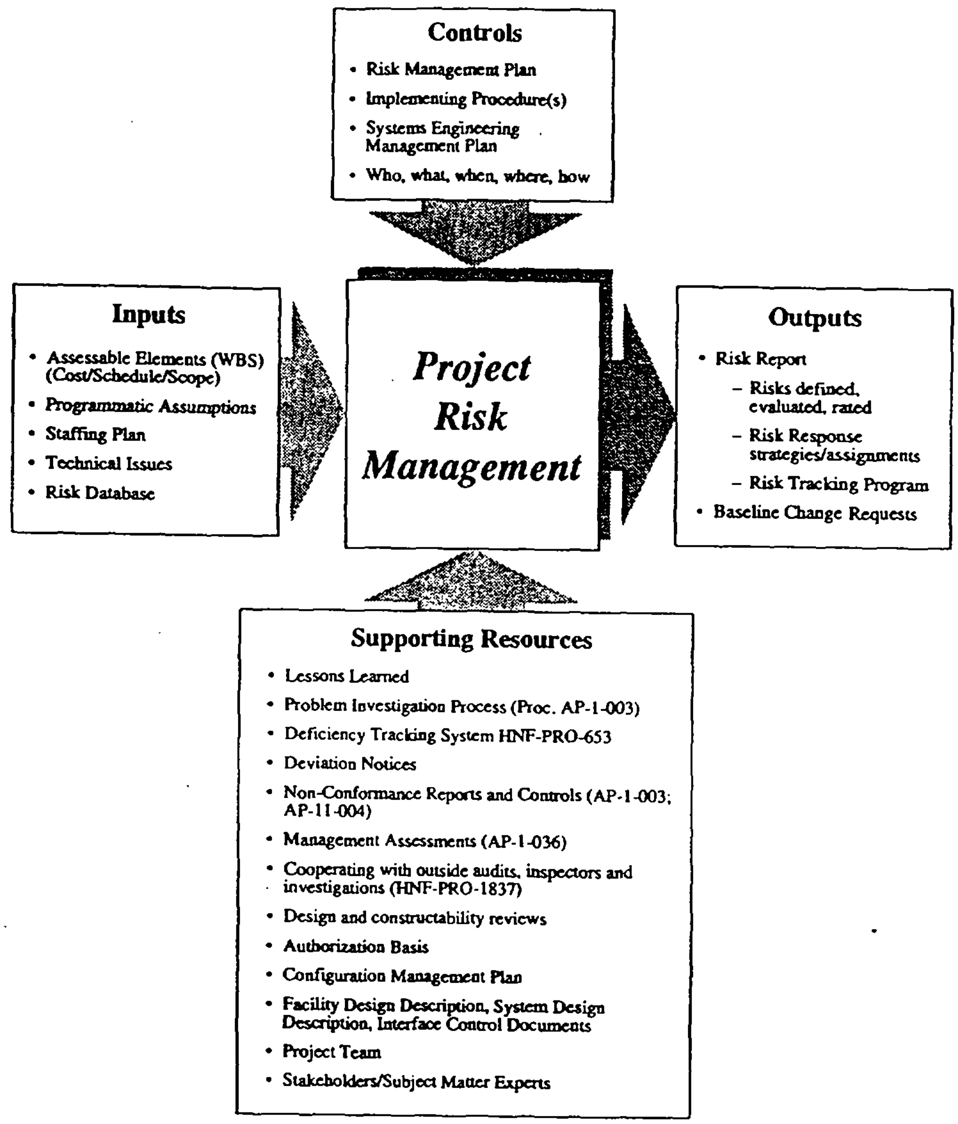


Figure 4-2. Proposed SNF Project Risk Management Business Model

5.0 Cost Estimate

5.1 Summary

The baseline for the SNF Project was changed in December 1998 to $1.586 billion. This change represented an increase of $497 million from the previous baseline, and was accomplished through approval of BCR 058. (This baseline was titled the High Probability Baseline, or HPB, by the project.) Subsequently, the deactivation and transitioning work scope was transferred into this project, bringing with it an additional $133 million and resulting in the current baseline for the project of $1.72 billion. This transfer of work scope was accomplished by a site-wide level BCR.

Of the $1.72 billion, approximately $1.2 billion remained to be expended beginning in FY 1999, and approximately $1.0 billion is planned from FY 2000 through project completion. The SNF Project is scheduled for completion in FY 2006, although some of the deactivation budget transferred to the project is planned for FY 2007. Table 5-1 depicts the funding profile for the project in accordance with the current baseline.

Table 5-1. SNF Project Baseline by Year

Fiscal Year	Baseline Total ($M)
Prior Years	533
FY 1999	192
FY 2000	191
FY 2001	191
FY 2002	195
FY 2003	153
FY 2004	106
FY 2005	86
FY 2006	47
FY 2007	26
Total	1,720

Although almost one-third of the total project baseline is for construction projects and equipment acquisitions, most of the remaining funding for the SNF Project is operational expense-type funding. There is approximately $83 million in capital equipment and just under $190 million in line item funding included in the remaining costs of the SNF Project.

The current SNF Project baseline is predicated on 17 key programmatic assumptions. These are presented in Appendix H.

Table 5-2 summarizes the project's estimated costs from FY 1999 through project completion by the major categories of the project's Code of Accounts (COA). A more detailed breakdown of the COA for the SNF Project is included in Appendix I.

Table 5-2. Project's Estimated Costs from FY 1999 Through Project Completion ($M)

Category	Estimated Cost	Percent of Total
Administration and Support	$371*	31.2%
Engineering	102	8.6%
Environmental, Safety & Health	85	7.2%
Construction	179	15.1%
Operations	219	18.4%
Maintenance	98	8.2%
Deactivation	133	11.2%
Total SNF Project	$1,187	

* Includes contingency - without contingency is $267 million, or 25 percent of total.

The project is currently broken into 26 sub-projects as shown in Table 5-3. One of these sub-projects, the Hot Conditioning System, has been deleted. A more detailed breakdown showing sub-projects by year can be found in Appendix J.

The Findings, Assessment and Recommendations discussed in the following sections are the result of collaborations between sub-project-specific sub-teams and the cross-cutting sub-team that evaluated the SNF Project cost baseline. Additional specific comments related to costs can be found in Section 3.0.

5.2 Findings

The current SNF Project baseline represents a newly developed, bottom-up baseline. It was not the result of incremental refinements and changes to the prior baseline, but rather a new estimate of project costs. The baseline was developed in this manner to address significant problems and shortcomings noted in the prior baseline by the newly installed Project Team in the first half of FY 1998. The baseline was finalized and approved at the end of FY 1998.

A principal objective of the new baseline development effort in FY 1998 was to quantify and approve a "high confidence baseline." In fact, the baseline that was approved is characterized as having a 90 percent probability of success, or confidence level, associated with the cost baseline. This was accomplished by building estimates and schedules that incorporated some degree of inherent conservatism, identifying known risks and incorporating mitigation costs in the baseline when appropriate, and assessing the risks and uncertainties that still remained in the cost estimate. A probabilistic contingency analysis was performed to support the inclusion of an appropriate contingency allowance in the baseline.

A Critical Analysis performed by Professional Analysis, Inc. (PAI) in 1998 reviewed the prior project baseline. That review found many deficiencies, errors, and inconsistencies in the prior baseline. As that effort was underway, the decision was made to develop a completely new baseline. Subsequently, PAI issued a Phase 2 Critical Analysis Report (see Appendix C, Documents

Reviewed). That report said "...PAI can state that the total project cost will not exceed the High Probability Baseline (HPB), less contingency, by more than 10 percent. However, PAI believes that there is potential for greater than 10 percent reduction of the HPB."

Table 5-3. SNF Project Baseline by Sub-project ($k)

WBS	Description	Total Cost	Pct. of Total	Remaining Cost[1]	Pct. of Total
1.03.01.01.10.10	Project Management and Integration	317,154	18.44	220,907	18.62
1.03.01.01.10.60	Site Wide SNF Projects (327 Fuel Transfer)	2,032	0.12	2,032	0.17
1.03.01.01.20.10	Project Mgmt. and Integration (Project Fee)	45,540	2.65	45,540	3.84
1.03.01.02.10.20	K Basins Maint. and Oper. (Through F.M.)	301,577	17.54	164,891	13.90
1.03.01.02.10.60	Site Wide SNF Projects (N Basin Fuel Mvmnt.)	148	0.01	44	0.00
1.03.01.02.15.20	K Basins Maint. and Oper. (Assoc. w/ Transition)	22,333	1.30	22,333	1.88
1.03.01.02.20.13	K Basins Facility Projects (Des/ Mod/ Const)	52,740	3.07	19,620	1.65
1.03.01.02.20.14	Fuel Retrieval Project (Des/ Mod/ Const)	54,005	3.14	23,003	1.94
1.03.01.02.20.15	Water Treatment (Des/ Mod/ Const)	38,640	2.25	22,849	1.93
1.03.01.02.20.16	Debris Removal Project (Des/ Mod/ Const)	16,832	0.98	12,142	1.02
1.03.01.02.20.17	MCO Acquisition (Des/ Mod/ Const)	85,266	4.96	71,336	6.01
1.03.01.02.20.18	Cask Transportation System (Des/ Mod/ Const)	17,602	1.02	368	0.03
1.03.01.02.20.41	K Basin Cold Vacuum Facility (Des/ Mod/ Const)	63,199	3.68	29,463	2.48
1.03.01.02.25.16	Debris Removal Project (During F.M.)	13,667	0.79	12,109	1.02
1.03.01.02.25.19	SNF Relocation (Common Operations)	198,583	11.55	184,833	15.58
1.03.01.02.25.41	K Basin CVD Facility (Operations)	44,726	2.60	44,726	3.77
1.03.01.02.30.50	Sludge Removal Project (Des/ Mod/ Const)	19,696	1.15	13,033	1.10
1.03.01.02.30.51	Sludge Treatment Project (Des/ Mod/ Const)	47,170	2.74	44,192	3.72
1.03.01.02.35.50	Sludge Retrieval/Removal Operations	9,686	0.56	9,686	0.82
1.03.01.03.10.30	Canister Storage Bldg. Facility (Des/ Mod/ Const)	152,624	8.88	38,890	3.28
1.03.01.03.10.40	Hot Conditioning System	8,771	0.51	0	0.00
1.03.01.03.20.30	Canister Storage Building Operations	51,403	2.99	51,403	4.33
1.03.01.04.10.60	Site Wide SNF (200 ISA Des/ Const)	1,024	0.06	560	0.05
1.03.01.04.20.60	Site Wide SNF (Des/ Move Fuel to 200 ISA)	20,395	1.19	17,851	1.50
1.03.01.04.30.60	Site Wide SNF (Oper/ Maint 200 ISA)	1,359	0.08	1,359	0.11
	Sum of WM01	1,586,172	92.24	1,053,170	88.75
1.03.01.02.50	Deactivation 100K Area Facilities	133,372	7.76	133,372	11.24
1.03.01.02.50.10	Deactivation Transition	144	0.01	144	0.01
Grand Total		**1,719,688**		**1,186,686**	

[1] Costs remaining after FY 98

During discussions with the Project Controls Manager it was stated that the PAI Critical Analysis effort was accomplished in parallel with the development of the HPB. In effect, the PAI role became

The baseline achieves full cost/schedule integration by tying all costs to schedule activities. In order to enable the costs to be segregated by fiscal year for funding and budgeting purposes, no schedule activity was allowed to cross fiscal year boundaries. In the case of activities that would span fiscal years, the activities were subdivided into annual activity segments. The integration was accomplished at the third level of the schedule.

The project WBS is dictated by site-wide requirements through Level 5. The 6th level is the sub-project. Sub-projects are broken down by "sub-project definition" (of which there are 124), and then the "Cost Account Project Number" (CAPN). There are slightly less than 500 CAPNs, of which 374 are currently active. The CAPN is the control point for the project, with an assigned manager, cost analyst, and scheduler.

The baseline costs are further broken down by schedule activity, then COA. There are over 700 distinct CAPN/COA combinations. Costs are further segregated or identified by resource codes (labor categories, materials, subcontractors, other direct costs, etc.) and Common Occupational Classification System codes. At its lowest level, the baseline estimate has approximately 8,000 detailed entries.

The baseline is supported by BOE documentation produced with the help of the database processes. There are 32 volumes of BOE documentation organized by sub-project. In addition to a presentation of the cost data at all of the various levels of detail, the BOE includes a full set of assumptions pertinent to the particular area of the project. The BOE also identifies the source of all cost or pricing data. References may be made to engineering estimates, bids, fair cost estimates, or contract awards. Copies of these documents are also maintained and comprise the estimate backup information. If the documents are not actually included in the backup section of the BOE, there is generally a reference to the documents in the BOE and the location and/or person responsible is noted in the BOE.

The project conducted a contingency analysis (with the help of PNNL personnel) to assess the required level of contingency to support the targeted 90 percent level of confidence. This analysis addressed risks or uncertainties in four categories:

- Standard cost uncertainties associated with the estimate process and the quality of estimate or supporting scope definition;
- Uncertainties associated with identified risks that had not been incorporated into the baseline;
- Cost uncertainties associated with the start and completion of fuel movement from the K Basins; and
- Uncertainties associated with risks that were not yet known or identified.

The contingency analysis identified the need for approximately a 10 percent contingency on the Total Project Cost (TPC) to achieve a 90 percent level of confidence. This was acknowledged as appearing low, given the technical difficulties and challenges confronting the SNF Project. However, the Project Team rationalized that "the HPB incorporates strategies for mitigating many potential risks directly into the baseline. For example, the time required for fuel removal operations was derived from the WITNESS model simulations of fuel and MCO handling operations. Therefore, the contingency needs of the project are lower than might be expected."

At the time of this review, the Project Team has stated that they remain confident that the cost objectives of the project can be achieved. Even though there have been changes identified that will result in cost increases, the overall level of contingency remains adequate in the opinion of the Project Director and Project Controls Manager. In addition, opportunities for cost savings have been identified. Both the Project Director and the Project Controls Manager, in particular, are very comfortable with the current TPC level. There are some concerns, however, with the level of funding available on an annual basis, particularly in the current fiscal year. However, the latest forecast of estimated costs indicates a small projected underrun in total project costs for FY 1999.

The project has experienced, or is forecasting, cost increases in a number of areas and some other potential cost increases surfaced during discussion between the Review Team and project personnel. Some of these are listed below.

- Approximately $1.5 million was recently spent on drain valve modifications in the basins.
- The continuing difficulties with SARs have resulted in an increase in TPC of approximately $5 million. This increase only represents the increased costs of the SAR work and does not include the cost impacts on the various sub-projects that result from delays in SAR approval.
- An additional $1 million will be required to address Cask Loadout changes. K Basin facility upgrades had higher than programmed costs because of the extra effort and the need to retain craft personnel on-site longer while the dropped cask mitigation effort is underway.
- Because FRS completion is proceeding on a two-shift, five days per week schedule to meet the TPA milestone, there are higher than planned fabrication and installation costs.
- There may be higher than planned costs incurred during the ramp-up from construction to operations for the CVD Facility.
- The use of contracted personnel, rather than the planned in-house employees, to perform operations activities has resulted in higher costs.
- The increased nuclear safety requirements are impacting operations plans and processes resulting in increased costs.

Offsetting these areas of cost increase is a number of identified or perceived opportunities for potential cost savings. Generally, these cost savings result from competitive procurement processes and the Review Team was not able to quantify their magnitude in some cases because of ongoing procurement actions (e.g., the MCO procurement). There are also areas that have not been able to add staff as quickly as planned, resulting in at least short-term cost savings.

5.3 Assessment

5.3.1 Cost Estimate Development Methodology

The SNF Project team is to be commended for the quality of the cost estimate baseline they have developed. The techniques and methodologies used to develop the baseline and the system within which the baseline is managed are sound and well conceived. In addition, they are among the best seen by this Review Team. In particular, this is an excellent example of cost/schedule integration—an objective that is not easily achieved in either the DOE or the commercial sector.

The level of detail in the baseline documentation, particularly the BOEs, and the use of the Intranet to communicate baseline data and facilitate updating and reporting of the baseline, are also noteworthy. One item that was missing when this review began was the overview and summary level documentation of the baseline. However, the Project Team had already identified this deficiency and a baseline summary document was made available for team review during the second week of the on-site visit.

The baseline estimate uses appropriate escalation rates and overhead rates consistently. This is facilitated by the database table structure and the baseline can be easily updated if rates change in the future.

The database allows the production of ad hoc reports that facilitate data analyses. For example, this team was able to review a report that broke baseline costs down by Resource Type (see Appendix K) and also COA (see Appendix I). A report was also provided to the team that showed the COA breakdown by sub-project and the sub-projects by COA to assist the analyses by the cross-cutting and sub-project-specific teams respectively.

The baseline database segregates costs by resource type. The only labor costs identified as labor are Project Hanford Management Contract costs. All other labor is shown as subcontract costs. Although the system is able to handle contract labor as hours, virtually all contracts are currently entered as lump sum costs. Therefore, it is not possible at this time to utilize the database to assess the total labor requirements for the SNF Project. This could hamper analyses of labor utilization and staff planning for the project.

Although the technique and methodology used to conduct the contingency analysis are in accordance with industry practices, the results of the analysis depict a project cost probability profile that shows much more cost certainty than would be expected for a project such as the SNF Project. This could be the result of the inherent conservatism of the underlying cost estimates, as the Project Team explains. However, it is also possible that it is the result of overstated confidence in the underlying cost estimates. For example, the modeling of schedule uncertainty assumed that the start of fuel movements could only range from a one-month improvement to a two-month schedule slippage. Similarly, the fuel movement finish date was assumed to vary by only a three-month improvement to only a one-month schedule slip. While the schedule does include some contingency, these ranges appear to be overly optimistic. Another example of an apparently high level of confidence in the base estimate was for SNF Relocations Common Operation (the sub-project that covers the operations activities associated with fuel transfer and loading of the MCOs). The contingency analysis for this sub-project resulted in the need for less than two percent contingency, even though there would appear to be a good bit of uncertainty with many of the operational assumptions (e.g., the effect of high dose rates in the K East Basin). If this degree of optimism pervades the contingency analysis details, the calculated contingency allowance may be inadequate to achieve the desired 90 percent level of certainty.

5.3.2 Cost Estimate Analysis

Several areas of the project's BOE were sampled and assessed by members of the Review Team. Some of the results of this effort have been discussed in earlier sections of this report, and additional results are presented in this section. In general, the BOEs were found to be well organized and included clear explanations of the cost estimate bases. As with any set of very detailed documentation, some inconsistencies, gaps and disconnects were observed. However, most of these were easily explained or clarified during discussions with project controls personnel.

Four of the SNF sub-projects comprise over 50 percent of the remaining costs of the project. These are:

- Project Management and Integration;
- K Basins Maintenance and Operations through Fuel Movement;
- MCO Acquisitions; and
- SNF Relocation Common Operations.

Each of these sub-projects was reviewed as a representative sample of the project cost baseline. The results of this assessment, and pertinent observations or issues, are discussed in the following sub-sections.

5.3.2.1 Project Management and Integration (PM&I)

PM&I is the largest single sub-project within the SNF Project. With approximately $221 million estimated to be required over the FY 1999 – FY 2006 period, this sub-project represents 19 percent of the remaining dollars for the project. The project's entire contingency is included in PM&I and this represents almost one half of the PM&I total. Without contingency, PM&I represents approximately ten percent of the remaining project costs. While this is a reasonable level for such a project, it should be noted that there is a large amount of administration and support activities in the other sub-projects as well. As shown in the COA Summary Table presented earlier, approximately 25 percent of the remaining project costs is administration or support in nature. This could be considered high; however the team did not have the opportunity for a detailed level review of these costs.

The single largest Cost Account Project Number (CAPN) within PM&I is for Project Controls ($34.8 million), and approximately $30 million is included for Project Direction, QA, Environment, Safety and Health, and Site Integration. Most of the costs in PM&I have been estimated as level-of-effort activities based on staffing plans.

While no specific problems were noted in the PM&I estimate, the team is concerned that the large, basic management cost areas (as listed above) remain fairly constant over the life of the project. It would be expected that Project Controls, Project Direction, etc. would show some degree of ramp-down as the project proceeded past the completion of fuel removal in FY 2003. A realistic assessment of the needs and requirements in the latter years of the project may offer some good opportunities for cost reduction or savings if significant ramp-down can be accomplished.

5.3.2.2 SNF Relocation Common Operations

The second largest sub-project is SNF Relocation Common Operation, with approximately $185 million projected to be required over the FY 1999 – FY 2006 period. It is this sub-project that addresses the operational activities needed to remove fuel elements, clean them, pack the MCOs, and load the casks. The breakdown of the sub-project into 25 CAPNs, and the categorization of activities into those CAPNs, is not inherently clear. The new Operations Manager plans to re-organize this work (together with the K Basins Maintenance and Operations and all of the other operations sub-projects). This appears to be necessary. There are instances of certain CAPNs within this sub-project also covering CSB or CVD operations when there are separate sub-projects for those items.

5.3.2.3 K Basins Maintenance and Operations (through Fuel Movement)

This sub-project, which is intended to include all activities necessary for minimum safe operations of the K Basins, is the third largest sub-project with approximately $131 million remaining to be spent. There are currently 45 CAPNs in this sub-project; however, as stated above, there are plans to re-visit the breakdown of costs within all of the operations sub-projects. A review of the details presented in this BOE found them to be generally well-documented. In many instances, the estimates are based on true activity-based costing techniques in which the work scope is quantified and the resources estimated to complete units of work scope have been identified, often through analysis of historical experience.

5.3.2.4 MCO Acquisitions

The MCO Acquisitions sub-project is estimated at $71 million for FY 1999 - FY 2006. Most of the costs are in two CAPNs – MCO Fabrication and Basket Fabrication. The BOE explains the rationale for the unit pricing upon which the estimate is based. Generally, this is the result of extrapolations and interpretation of the experience on the prototype MCOs and baskets previously fabricated by a vendor and the on-site shop, respectively. However, it was not clear how the estimated costs were spread by year, since the BOE does not include a fabrication and delivery schedule. Because the team was able to see such a schedule during discussions with the sub-account project manager, it is recommended that this schedule be included in the BOE in the future.

5.3.3 Cost Estimate Reasonableness and Achievability

The Review Team found no major omissions or errors in the cost estimate for the SNF Project. All areas sampled and reviewed seemed to be supported by reasonable assumptions and cost bases. The basic cost estimate, without contingency, appears to be reasonably developed and may in fact have sufficient conservatism built in to justify its being called a "high probability baseline."

Only $112 million in contingency was included in the baseline for a project estimated to cost approximately $1.1 billion (without contingency) over the next eight years. (Approximately $104 million in contingency remains as of the date of this review.) Based on the Review Team's initial perceptions, this did not appear to be adequate, nor did it appear to achieve the 90 percent level of confidence the project is communicating to its constituency. The Review Team believed the confidence of the Project Team might overstate reality, and be the result of focusing on the annual usage of contingency without fully and objectively assessing project uncertainties in the outyears of the project. Therefore, the Review Team attempted to perform its own risk analysis of the project. Although not done to the level of the project's own risk analysis (which addressed uncertainties by both year and funding types), this analysis does present an overall assessment of project risks and necessary contingency allowances.

The risk analysis model developed by the Review Team, the assumptions that formed the basis for the analysis, and the results of the analysis are described in Appendix L. While the SNF Project baseline remaining to be spent from FY 1999 through project completion is approximately $1.187 billion ($530 million has been expended through FY 1998), the Review Team's analysis projects the remaining costs at 90 percent level of confidence to be $1.19 billion. Therefore, within the current scope and plans of the project, it is likely that the current estimated baseline costs for the SNF Project should be sufficient to achieve project objectives. However, as discussed throughout this report, and as summarized in Section 4, there are many risks outside of this analysis that could not be quantified in terms of impacts. If these risks occur, they have the potential to significantly impact project costs.

5.4 Recommendations

1. As part of the semi-annual review of project costs and risks, reassess the adequacy of the project contingency allowance using the insights presented throughout this report and the analysis by the Review Team.

2. Assess the possibility of ramping down the PM&I activities as the project moves towards completion. Identify opportunities for staff, and therefore cost, reductions prior to the project end date.

3. Evaluate the adequacy of planned costs related to start-up and turnover from construction to operations. Look at staffing ramp-up required to support efficient operations and ensure that there is adequate funding to support timely staffing of the operations area.

4. Reassess the breakdown of costs required for operations and maintenance and the resources needed to achieve all operations objectives.

5. As the project proceeds and budgets and plans continue to evolve, attempt to reduce sub-project accounts in areas of conservative assumptions and hidden contingencies. Move all available funding to the separate contingency accounts and manage aggressively to minimize contingency allocation and usage.

6. Continue to refine and improve the BOE documentation. Consider the value of an independent review of the BOE at a suitable time in the future.

7. Consider using the capabilities of the project control baseline database to present the total labor hours for the project (and full-time equivalents) by forcing all contractor labor costs to be input as hours at an appropriate hourly rate.

6.0 Schedule and Funding

6.1 Summary

The Schedule Baseline (see Figure 6-1) has been approved and is resource-loaded with data from well-developed BOEs. A strong organization is rigorously managing the schedule, which is Primavera® based and capable of presenting all required looks to assess possible variances. The critical path is well-defined and understood and is being managed on a weekly basis. Virtually all schedule contingency prior to fuel movement has been used, and the project is managing 'work-arounds' to activities to handle schedule situations, and actively seeking additional schedule contingency.

The project has a plan to transfer schedule functions to an operations mode, and recognizes the problem areas to meet the November 2000 Fuel Removal Milestone and other follow-on milestones (see Table 6-1). FY 2000 and outyear funding is assumed and indeed is very much under the control of DOE-RL; however, it is assumed to occur on October 1 of each year and the project understands it must handle delays. Many activities both on and near the critical path are included with very short durations, and many others not included there are crucial to the project's success. The Project Controls Staff is managing the critical path well.

The Review Team 'sampled' several critical areas of the schedule (K Basin, CSB, CVD and SAR development) to assess the schedule risk and those results follow. The Review Team also consulted extensively with technical review teams, to assess schedule logic, reasonableness and durations, and those results are in the technical sections of this report.

The funding profile for the project was reviewed and found to be consistent with the estimate and schedule and the Congressional Budget Request. Funding for the project is a combination of capital funding for projects and operations funding for all fuel movement activities. However, the schedule is predicated on the prompt receipt of FY 2000 funding, and this could present a risk.

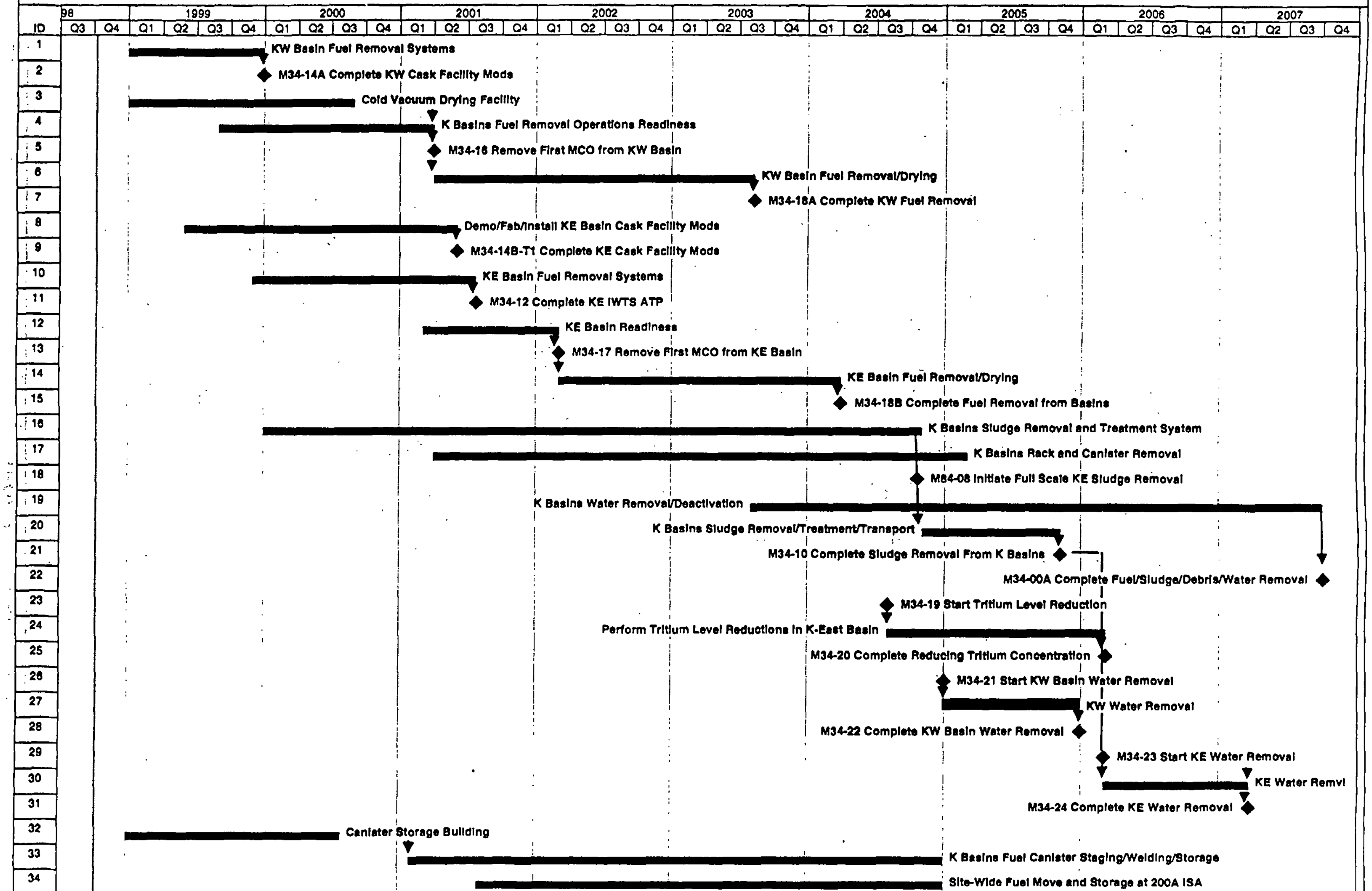
The Review Team generally concluded that, although a large number of activities must be accomplished to meet the November 2000 milestone, the major project schedule risk is not in the area of construction completion and hardware procurement at this stage, but in the areas of SAR documentation, ORRs, staffing, training, and startup. These latter activities include many sub-activities at the lower levels of the schedule, are under the control of the DOE and the contractors, are included with short durations, and can only succeed with full understanding and cooperation of the participants. The assessment of this risk schedule is included in paragraphs 6.3.5 and 6.3.6 of this section, Section 4 (Risk Management), Section 10 (Operational Readiness Reviews), and the Schedule Risk Analysis (Appendix L).

Table 6-1. Spent Nuclear Fuel Project Commitments

This table summarizes the enforceable milestones and target dates for the SNF Project. A "T" in the number indicates a target date.

Number	Description	Date
M-34-00A	Complete removal of spent nuclear fuel, sludge, debris, and water at DOE's K Basins(2)	07/31/07
M-34-03	Submit Proposed Plan and Focused Feasibility study for Remedial Action for the K Basins	11/30/98
M-34-04	Submit Remedial Design Report/Remedial Action Work Plan for the K Basins	03/31/00
Sludge and Debris Removal		
M-34-05-T01	Submit report on quantities, character, and management of K Basins debris	Annual
M-34-06-T01	Initiate K West Basin spent nuclear fuel canister cleaning operations	12/31/00
M-34-07-T01	Complete final safety basis for the transfer of K Basins sludge	12/31/03
M-34-08	Initiate full scale K East Basin Sludge Removal	07/31/04
M-34-09-T01	Complete K Basins rack and canister removal	12/31/04
M-34-10	Complete sludge removal from K Basins	08/31/05
Spent Nuclear Fuel Removal		
M-34-11-T01	Complete construction of K West Basin Integrated Water Treatment System	06/30/99
M-34-12	Complete construction of K East Basin Integrated Water Treatment System	02/28/01
M-34-13A-T01	Complete construction and installation of K West Basin Spent Nuclear Fuel Retrieval System	07/31/99
M-34-13B-T01	Complete construction and installation of K East Basin Spent Nuclear Fuel Retrieval System	11/30/00
M-34-14A	Complete K West Basin Cask Facility modifications	09/30/99
M-34-14B-T01	Complete K East Basin Cask Facility modifications	01/31/01
M-34-15A-T01	Complete two bays of the Cold Vacuum Drying Facility construction and installation	10/31/99
M-34-15B-T01	Complete remaining bay(s) of the Cold Vacuum Drying Facility construction and installation	06/30/00
M-34-16	Initiate Removal of K West Basin Spent Nuclear Fuel	11/30/00
M-34-17	Initiate Removal of K East Basin Spent Nuclear Fuel	11/30/01
M-34-18A	Complete Removal of all K West Basin Spent Nuclear Fuel	04/30/03
M-34-18B	Complete Removal of all K East Basin Spent Nuclear Fuel	12/31/03
Basin Water Remediation		
M-34-19	Initiate removal, replacement, and treatment of contaminated K Basins water	04/30/04
M-34-21	Initiate full scale K West Basin water removal	09/30/04
M-34-22	Complete K West Basin water removal	09/30/05
M-34-20	Complete removal, replacement, and treatment of contaminated K Basins water	10/31/05
M-34-23	Initiate full scale K East Basin water removal	10/31/05
M-34-24	Complete K East Basin water removal	10/31/06

Figure 6-1. Spent Nuclear Fuel Project Summary Schedule



Note: Years are in Fiscal Year

6.2 Findings

The project has elected to baseline the entire schedule (instead of just milestones as is normally the case). This presents the challenge of managing much more detail as part of the change control process. Although the baseline was formally approved in mid-December 1998, it was developed and put in service in April 1998 and has been in use as a control tool by the project since that time.

Schedule contingency was added in the form of extended durations for specific activities which were deemed most risky. Four months were added, and all but one week have been used for activities – most related to the initial SAR approval.

A strong schedule organization under the FDH Project Controls Office includes approximately 30 cost, schedule and estimating specialists who manage subcontractors who provide input for their contracts. This FDH office will continue to function through the entire project even through the shift to operations following the initiation of spent fuel movement.

The schedule baseline includes a number of Programmatic Assumptions (Appendix H) to meet Milestone M-34-16 "Initiate Removal of K West Basin Spent Nuclear Fuel." Each of the assumptions has schedule impacts beginning with the first assumption that "Safety Analysis activities within the SNF Project are the highest risk to meeting the TPA milestone." These assumptions define the risks under which the schedule was developed.

The project is using a Primavera® scheduling system that has the capability of focusing on specific areas of the WBS, and selecting to Level 4 and lower on request. The project is managing to Early Start/Early Finish of activities.

The critical path for the project is defined within the Primavera® schedule, and is made visible weekly to the project at meetings attended by representatives of each project area. Activities within 30 days of the Critical path are also tracked on a weekly basis. Meeting minutes are issued which highlight the issues surfaced, and action tracking is used to resolve them.

The schedule tracks systems activities to the turnover to operations and then through the fuel movement operations phase in detail to Level 4. A MOU between the SNF Startup Organization, Construction Projects, and Project Operations details transition responsibilities.

Funding is input in each fiscal year of the Primavera® schedule, and changes across fiscal year lines require manual revision. This feature provides a manual check on the change control process. Funding for the project is well-defined by fiscal year and WBS.

A major issue addressed by the Review Team was the ramp-up for FY 1999 - FY 2000 for SNF Removal Operations and the rampdown of operations from FY 2003 - FY 2005. The Operations funding represents a 100 percent increase ($19.9 - $39.9 million). The rampdown occurs consistent with the movement of fuel from K Basin, and represents an opportunity to cut cost if this can be accelerated.

6.2.1 SAR Activities

Review of the FSAR review/approval schedule, and discussions with the FDH SAR Manager, resulted in the identification of an issue with the preparation, review and approval process. DOE-RL review and approval of the project's FSARs (i.e., the MCO Topical Report, the CSB FSAR, the CVD Facility FSAR, and the K Basin SAR), via the issuance of a Safety Evaluation Report (SER), is a requirement due to the hazardous nature of the project's operations, i.e., Hazard Category 2. Currently, review and approval of these FSARs is scheduled between May and September 1999, to support fuel movement in November 2000. However, it is clear from discussions with the FDH SAR Manager that the level of effort to meet these approval dates cannot be sustained by the project SAR Group if the number of comments exceeds the ability of staff to resolve them. The SAR issue is further addressed in other sections of this report.

6.2.2 K Basin

The overall K Basin schedules of activities were sampled. The team reviewed the assumptions made in the generation of schedule activities between the 100 K East and 100 K West Basins in all facets of the fuel and debris removal and the logic appears similar. Several activity durations are comparative between K East and K West, yet K West activities are generally proceeding first toward the start of fuel movement by November 30, 2000. As noted in Section 3.2.1, K West is viewed as the better of the facilities from a radiological standpoint. The Review Team noted that the logic and durations for the K East Basin activities are similar to those for the K West Basin despite the fact that the K East Basin is more complex and an inefficiency may exist because of the higher facility contamination levels. See Section 3.1 for more detailed discussion.

During operations, significant maintenance and operations activities will continue in the 100 K Area from current operations through deactivation of the major systems until turnover of the facilities to the Environmental Restoration Program.

Milestone descriptions for K Basin have been developed and accepted as part of the *Spent Nuclear Fuel Multi-Year Work Plan for Work Breakdown Structure Element 1.3* (HNF-SP-1104). The milestone description provides the type, the level, the commitment relation to the DNFSB, and deliverables, as well as the definition of the activity and descriptions when such actions are considered complete.

6.2.3 Canister Storage Building

This WBS was estimated to be approximately 85-90 percent complete with the remaining activities to be completed in FY 1999 - FY 2000. Much of this work is a procurement action of tube plugs and impact absorbers. After receipt on site, the tube plugs must be filled with concrete. Present requirements include the need to have all plugs and bottom impact limiters in place prior to the start of fuel loading in the CSB. It is assumed that bids can be awarded this summer for design activities and release for fabrication October 1, 1999 with receipt of the FY 2000 funding.

SAR completion is a limiting condition for the fuel movement. Recent reviews of the SAR for this facility have resulted in approximately 1,000 comments. The only identified major issue is resolving the potential of an eccentric drop of the MCO and the recovery from this accident. The present path forward is to analyze and document the technical basis to resolve this issue without a hardware change. The responses received on the SAR of this project are being utilized as "lessons learned" on expectations by DOE of other facility SARs and is serving as a prototype to determine schedule issues for SARs.

Other than the SAR issues, it is assumed that turnover and start-up will be relatively simple as systems are being turned-over as they are completed. However, the full readiness review of this facility is still required and will be handled as a single readiness review for the entire process. See Section 3.5 for a more detailed discussion.

6.2.4 Cold Vacuum Drying Facility

The CVD Facility is nearing the completion of construction and all major procurements are in place and startup is proceeding on schedule. See Section 3.4 for a more detailed discussion.

6.3 Assessment

The Schedule Baseline, which includes the entire schedule instead of milestones presents a challenge of managing more detail as part of the change control process. It also forces much more discipline on schedule management because of the lack of flexibility in meeting milestones. The project appears up to this task because of the experience and dedication of the staff involved. All changes to date were found by the Review Team to be well documented. The interactions with the Project Controls staff and the sub-managers are extensive, and potential problems are given visibility before they occur.

The Review Team determined the schedule has considerable risk because of the short durations of critical activities, especially in the SNF Operations WBS. Major activities such as SAR approval, ORRs, transition, and startup are included with minimal durations and are success-oriented. The continual assessment of activities required to meet the milestones is critical to success. Even with the present high level of management attention, it is possible that situations may occur for which work-arounds will not exist.

The Project Controls Office will extend throughout the life of the project, but there will be a major transformation as the project moves into the full operations phase. The operations staff will replace the construction and procurement staffs (many with sub-contractors) now functioning so well. This shift in transition must continue to be well managed to prevent a situation where timely acceptance of equipment, or documents is not achieved.

The level of contingency in the project schedule requires the use of close management, work-arounds to accommodate slippages, and additional effort to gain float wherever possible. It also dictates the full understanding of what is required to complete the activities included in the durations provided. This places a large burden on the schedule staff to examine these activities in detail well ahead of time to understand what is required of whom. Turnover to operations and startup represent similar situations where the activities on the schedule represent a small fraction of the interactions necessary to complete the work. The project is managing this well.

The funding profile ramp-up of the SNF removal operations for FY 1999-2000 represents a major project challenge of getting new staff in place to meet the spending profile. This requires adequate planning and approvals in FY 1999 to meet the hiring requirements.

Sampled areas of risk by the schedule sub-team are as follows (additional schedule risk assessments are included in the technical sections of this report):

6.3.1 SAR Activities

While the reviews for these documents was originally scheduled earlier in the project, the review periods have been, and continue to be, delayed due to design and the number and complexity of comments received from DOE-RL. Very recently the SAR Manager indicated that, due to the number of comments received on previous SAR and the depth of analysis expected by DOE-RL, the CVD Facility FSAR issuance to DOE-RL will be delayed two weeks beyond the May 26, 1999 scheduled submission date. Unfortunately the review and approval of this FSAR is on, or near, the current Project Critical Path. To compound the risk it was discovered that many of the preliminary SARs and the MCO Topical Report have not been approved by DOE-RL, and thus a significant number of comments remain to be resolved that may resurface during the FSAR reviews.

Additionally, the durations to complete both the internal FDH reviews and DOE-RL reviews/approvals are considered inadequate, based on reviews to date (see CSB). While this baseline schedule assumes two months for an internal review and two months for the DOE-RL review/approval process, review periods to date indicate much longer periods are likely unless resolution of the expectations between the project and DOE-RL can be reached.

6.3.2 K Basin

In sampling the several portions of the schedule for the activities within the K Basin activities, some of the areas were developed in a bottoms up estimate defined in the BOE. Activities focused in the WBS elements for K Basins Operation and Maintenance, K Basin Facility Modification Projects, Fuel Retrieval System Project, the Integrated Water Treatment System Project, and the sludge treatment and removal activities appear to have sufficient detail for the development of the project schedule and funding. Level 3 schedules were provided for review, with Level 4 schedules and working details below (Level 5) provided upon request. The sub-project managers manage these schedules. Integrated Level 4 schedules are also generated for safety and operations activities. The integrated operations schedules provide the details for procedures and training, management self-assessments, and ORRs. Each of these activities are developed by facility within the SNF Project, including the K Basins.

Level 3 deactivation schedules were also reviewed. The schedule is not sufficiently developed to assess in detail the schedule and funding for this activity. These activities have been identified by FDH staff for analysis prior to the end of the 1999 calendar year. A BCR will be submitted to incorporate a seamless strategy for deactivating the basins following fuel, sludge, and debris removal.

There is also further consideration being given to the treatment and removal of the sludge. Current planning envisions the sludge to be removed and placed in the high level waste tanks. A notable concept is being evaluated for removing the sludge, and handling it with other transuranic waste at the site.

In review of the K West Basin facility schedule, there appears to be good integration of detailed project milestones. Although some of the duration's appear at risk due to the sheer volume of the work (see Section 3) and the limited resources (i.e., staffing), the general basis for developing a complete schedule are seen.

The K East Basin schedule is understandably not receiving the level of scrutiny of the K West Basin. Staffing integration planning is underway, but the operational differences associated with the higher contamination must be addressed below Level 3 to validate the durations included. Although the project has assumed that lessons learned from K West will offset the complexities in K East and keep the durations similar, the Review Team considers this a risky assumption.

6.3.3 Canister Storage Building

The ability to resolve the SAR issues without hardware changes may not be achievable. Hardware changes may not be able to be done in time to meet the need date without impacting the schedule.

The assumption of being able to proceed to full fabrication of Tube Plugs and Impact Limiters on October 1, 1999 may not be achievable as the funding and budget authority may not be available on the first day of the fiscal year.

6.3.4 Cold Vacuum Drying Facility

Only the In-Process Skid procurement activities have a potential for impacting the near-term schedule. There is a concern for meeting the long-term schedule in the area of transition to operations. Part of this is due to the need to have operators available to be ready for transition. Procedures and training to an approved SAR must also be in place prior to the start of fuel transfer. See Section 3.4 for additional detail.

6.3.5 "What If" Schedule Analysis of FSAR Approvals

Since the FSAR preparation, internal review, and DOE-RL review and approval process has become so critical to the project's success and its ability to meet the Fuel Movement Milestone of November 2000, the schedule sub-team conducted a qualitative "What If" analysis to assess the affect of an FSAR document delay to this milestone. While it is understood that the impacts to such a delay should be analyzed by using the project's Primavera® system logic, due to the limited time available the Review Team attempted to answer this question by using a qualitative approach that it believes yields results of the same order of magnitude and are consistent with this report.

For purposes of this analysis, the scenario assumed by the Review Team was that the last FSAR review and approval, the CVD Facility FSAR, currently scheduled for submission to DOE-RL on June 9, 1999 and DOE-RL approval on September 10, 1999, was delayed by an arbitrary period of six weeks (i.e., to October 22, 1999). The Review Team then assessed the schedule impacts of such a delay.

It is the Review Team's conclusion that the November 2000 milestone will slip by one week for every three weeks the FSAR approval is delayed unless appropriate work-arounds can be identified.

The Review Team's reasoning that only one week would be lost, in lieu of the full three weeks, is that the project has been very successful in developing work-arounds and prudently managing/using the schedule contingency that was in the original baseline schedule. For example, delays in FSAR approval by DOE-RL for the CSB have been absorbed, with no impact to the milestone, by not waiting for DOE-RL approval. Operations procedures are being prepared and operator training has started based on a contractor-approved FSAR. While it is recognized by the project that there is some risk in doing this, the Review Team agrees that this is an acceptable approach since the impact to a "greenfield facility," such as the CSB and the CVD, should not be significantly impacted by the DOE-RL SER. This is because SERs typically place more operational constraints on existing facilities that have a poorer defined design basis or have interface issues with facilities that have an operational basis that does not meet current standards. As another example, the recent cask loading system issue, which has been estimated to require approximately five months to resolve (design through checkout) was absorbed by the project by developing schedule work-arounds and by using the remaining seven weeks of schedule contingency. Further, the project is continually monitoring the SAR activities and their affect on the critical path.

Therefore, although the Review Team recognizes the project's efforts to date to absorb delays to key activities, a delay in the preparation, resolution of comments, and approval of the CVD FSAR is considered an event that can not be fully absorbed without work-arounds. Therefore, if the CVD FSAR approval date slips beyond the current float, this will result in a one day slip in the fuel movement date for every three days slip in FSAR approval, unless a significant work-around is identified.

This "What If" schedule analysis and its conclusion demonstrate the sensitivity and critical nature of the submittal of acceptable FSAR to DOE-RL, the review and approval of these FSARs, and the importance of resolving comments, in a timely manner.

6.3.6 "What If" Schedule Analysis of Operations Readiness Activities

As was done in Section 6.3.5, the schedule sub-team conducted a qualitative "What If" analysis to determine the effect of a delay in the MSA, Contractor ORR, or the DOE ORR to the Fuel Movement Milestone of November 2000. Since the sequencing of these activities are dependent on the Declaration of Readiness which depends on a number of activities including the DOE approval of the project's FSARs, it is logical to follow the FSAR "What If" analysis with this analysis. As with the previous analysis it is understood that the impacts should be analyzed by the use of the project's Primavera® system logic; however, due to time constraints, the Review Team attempted to answer this question by using a qualitative approach that is expected to yield results of the same order of magnitude.

The Review Team assumed that the MSA, Contractor ORR, or the DOE ORR will be delayed by any number of events, e.g., preceding events, delays in completing the reviews, or delays in completing the corrective actions from these reviews.

It is the Review Team's estimate that the November 2000 milestone would slip day-for-day with any slip in the completion of these readiness reviews (MSA, Contractor ORR, DOE ORR).

The Review Team's reasoning for this conclusion is that the project's current schedule has no contingency left and very little, if any, float in these activities. Further, the current schedule has only two weeks for conducting the ORRs and two weeks to resolve and take corrective actions from these ORRs. (These time durations are considered insufficient as is discussed in Section 10.0.)

6.4 Recommendations

1. Continue the ongoing efforts of the Project Controls Staff to highlight the critical areas under greatest risk. This is accomplished through coordination meetings resulting in detailed working schedules that outline responsibilities, inputs, deliverables, conditions for acceptance, and assumptions. Looking as far ahead as possible is recommended to identify work-arounds as soon as possible and ensure everyone understands what is required. Apply lessons learned continuously (e.g., CSB).

2. Ensure a smooth transition for transfer of project controls to the operations function to ensure adequate, experienced staffs are available and have time to become familiar with the situation.

3. Build Level 4 schedules for activities beyond November 2000 (including K East staffing and operations) as soon as practicable using lessons learned from K West.

4. Examine the risk of FY 2000 funding to identify impacts of delays beyond October 1999. Ensure the ramp-ups from FY 1999-2000 are understood and covered in FY 1999 by resolution of up-front issues.

5. Continue to manage the SAR activities and their effect on the schedule and its critical path to resolve any delays to meeting the November 2000 milestone.

6. Develop a deactivation schedule for each basin facility that would create a seamless transition from the end of fuel movement to the turn over to environmental restoration. At the completion of the fuel movements, the deactivation project activities should be incorporated. This seamless activity would assist in the closing of the K West facility earlier than anticipated and assist in reducing the outyear mortgage.

7. Aggressively continue to pursue resolution of SAR comment resolution for the CSB. (See Section 8.)

8. Evaluate the ability to proceed with fabrication of the tube plugs and impact absorbers for the CSB and available options should funding not be available on October 1, 1999.

7.0 Project Management and Integration

7.1 Summary

Project Management and Integration are large subject matters cross-cutting all aspects of the project. After careful evaluation, the Review Team concluded that not every element of project management needed to be reviewed in detail due to the stage of completion of the project. Instead, the team identified the elements deemed most critical at this time to the project's success, and these are addressed in some detail in the subsections below. Subsection 7.8, Other Project Management Areas, briefly addresses the other elements of project management as they relate to the SNF Project at this time.

The SNF Project has been executed under several management structures since its inception, starting with Westinghouse in 1995, then with DESH from late 1996 through early 1998, and currently under the direct management of FDH. Consequently, there have been considerable changes in management philosophies, individual managers and management systems throughout the life of the project.

The current management team is comprised of a number of hand picked individuals from various organizations from both on and off the Hanford site. The FDH SNF Project Director is a career Fluor Daniel employee who came to the Hanford site in 1996 as part of the Fluor Daniel transition team that assumed the M&I role when Westinghouse departed the site. The Director has been responsible for the SNF Project since then.

When FDH came on site, their structure incorporated several major subcontractors as part of their management team. These subcontractors each brought specialized capabilities and each assumed primary responsibility for individual major projects under the FDH M&I contract. The SNF Project was assigned to DESH, a subsidiary of Duke Power Corporation. DESH had the primary responsibility for the execution and completion of the SNF Project under the oversight of FDH.

DESH was unable to provide the project management that was necessary to successfully complete the project. In the spring of 1998, FDH took over management of the project directly. The FDH manager that had been assigned to oversee the DESH efforts became the SNF Project Director.

In the past year, the SNF Project Director has made substantial progress in mobilizing a talented management team, instituting appropriate sophisticated project management systems, and bringing discipline, focus and a sense of urgency to the entire project management process.

Virtually all of the top managers have been in their respective roles for one year or less. Most came from other positions at Hanford, and no consideration was given as to whether the individuals were FDH employees. The SNF Project Director wanted the best team available to execute this high visibility project, so the staff were chosen irrespective of their company pedigrees. Some managers are FDH employees, while others are employed by DESH, Numatec or Westinghouse. The result is a truly integrated "SNF Project Management Team."

Additionally, the SNF Project Director added key management positions that DESH did not have. For example, DESH chose not to have an Engineering Manager or Chief Engineer. FDH concluded it was an important position and filled it. Other important positions such as the Operations Manager and the Integration Projects Manager were also filled.

The SNF Project Director has implemented a PEP, and comprehensive systems to manage cost, schedule, configuration control, change and other management issues.

Significant staffing shortfalls are being addressed, and other potential impediments to the schedule have been identified and action plans put in place to manage them.

Numerous challenges remain before the project will be able to meet its objectives. These issues are addressed in other sections of this report in greater detail. From a project management perspective, it is obvious that substantial progress has been made in the past year to put the project on track toward its primary objective of moving spent fuel by November 2000.

7.2 SNF Management Organization

7.2.1 Findings

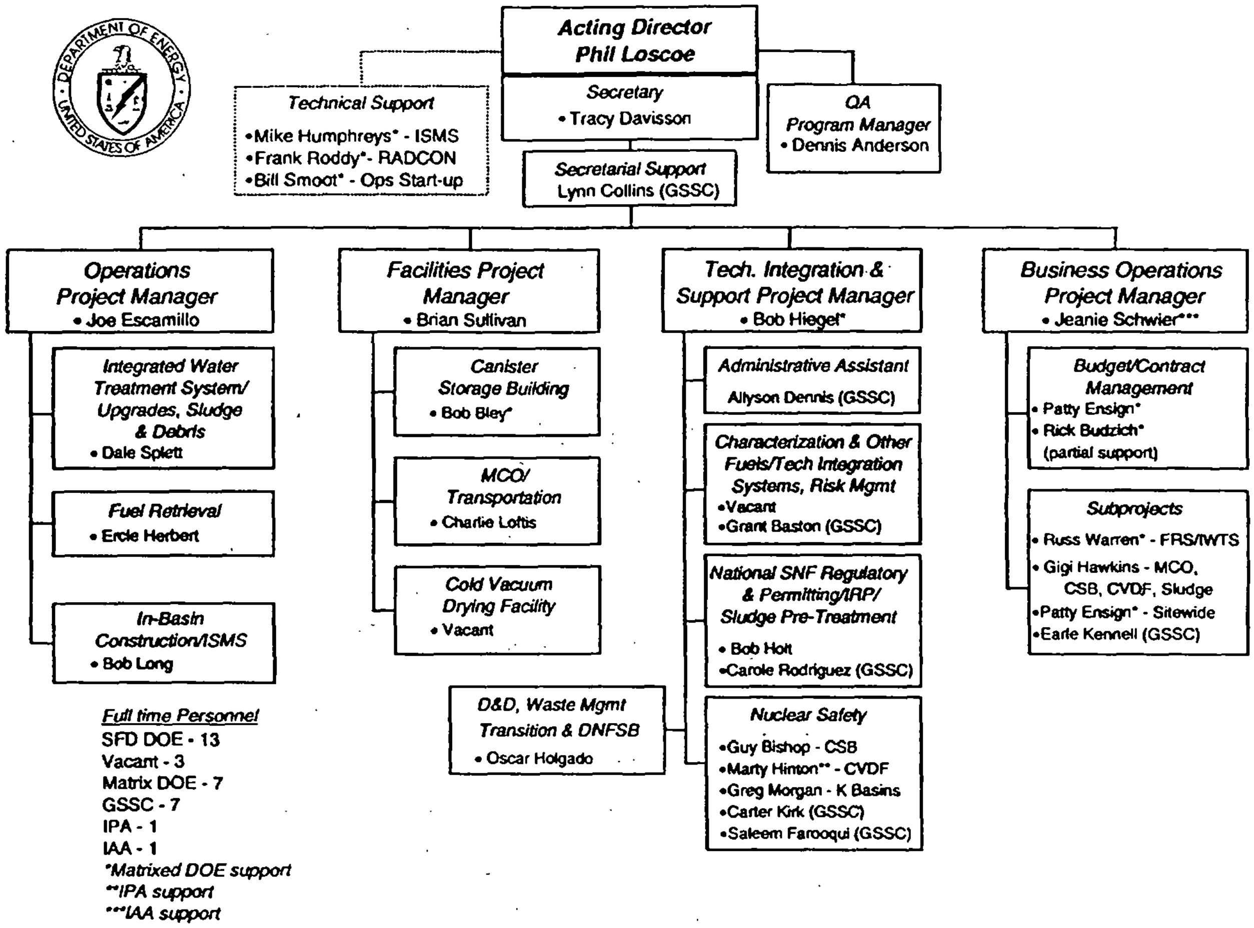
The SNF Project management team is organized along the traditional lines that one would expect for a complex, schedule driven EPC (engineer, procure, construct) project. However, the SNF Project is not just a stand-alone EPC project. It encompasses operations and integration with other site projects as well, so additional management positions exist in the structure. Both DOE's and the contractor's management organization charts are shown below (Figures 7-1 and 7-2 respectively).

The project management organization appears balanced and complete. The organization structure also addresses the unique aspects of the project. Critical management positions such as Engineering Manager and Operations Manager have only recently been filled (within the past three months), but the assigned individuals appear to be highly experienced and capable. The Project Controls Manager has been with the project since FDH took over direct management last year, and has put in place comprehensive, sophisticated systems needed to manage all aspects of project controls.

The FDH top management, to whom the SNF Project Director reports, has also undergone recent changes. The incumbents in the top two positions each have been in place less than one year. Both were hired from outside of FDH for these positions. The President and Chief Executive Officer of FDH is an ex-DOE employee, and the Executive Vice President and Chief Operating Officer, is a former contractor employee who has worked on various DOE projects for many years.

The FDH management team is keenly aware of the importance of the SNF Project, and have implemented a number of actions to ensure that the project is adequately supported, while at the same time is properly overviewed from a top management perspective. FDH's top management regularly interact with the SNF Project Director and the team in a variety of capacities. They have listened carefully to the unique support needs of the project (especially in terms of human resources and procurement needs), and they have taken positive steps to remove unnecessary obstacles from within the FDH organization that potentially impact the project. They also interface extensively with DOE-RL and other organizations outside FDH to provide needed support. Listening to the project's needs and *following up* have been strong suits of this upper management team.

Figure 7-1. Spent Nuclear Fuels Project Division

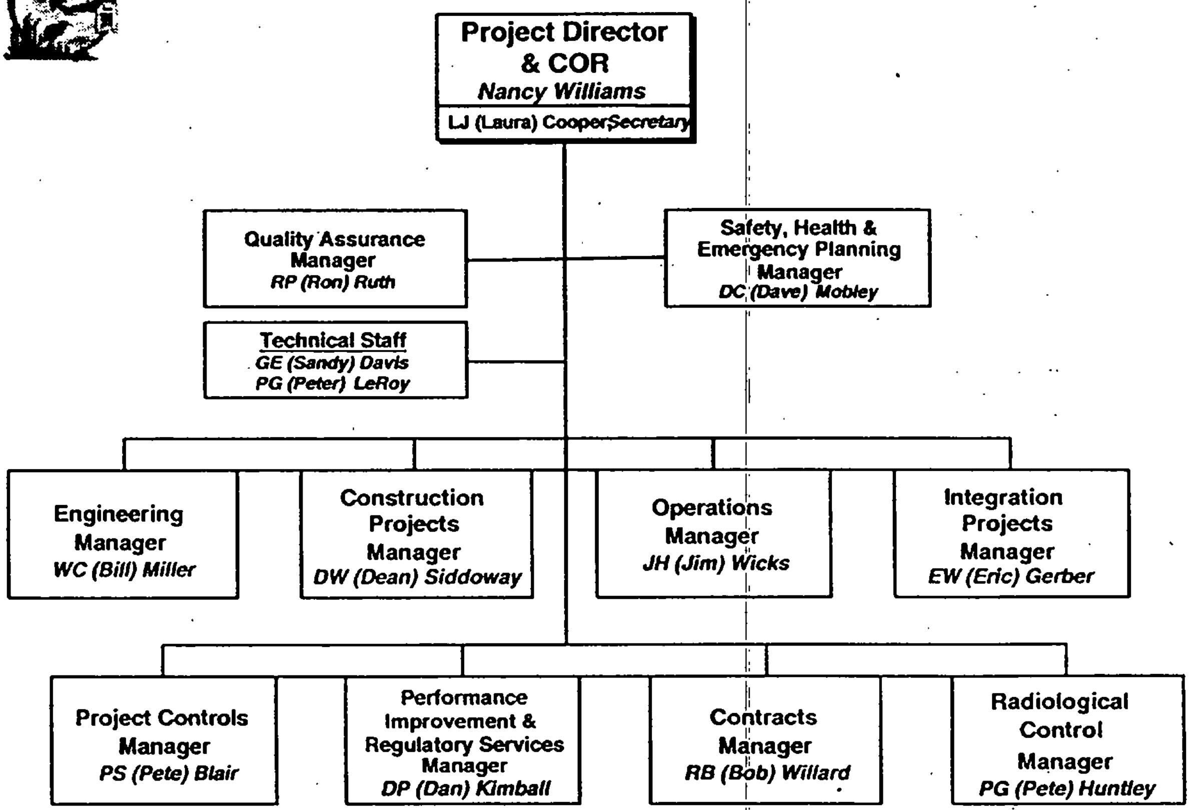


The DOE SNF Project Team has also undergone recent changes. Both the RL Assistant Manager for Spent Fuel and the Spent Fuel Division Director have recently changed due to the transfer of the incumbents. Additionally, and perhaps more significantly, the Manager of the Richland Operations Office is new to the site (less than one month). Further, the creation of the new Office of River Protection has relieved the DOE Manager of the Richland Operations Office of a significant area of responsibility, the TWRS Project, enabling him to devote a greater portion of his time to the SNF Project. Early indications are that he has given the SNF Project his highest attention. He has spent substantial quality time with the SNF Project Team (DOE and FDH) since his arrival, and he has indicated a determination to take necessary actions and make necessary decisions to ensure that the project is able to proceed as planned.

In June 1998, as committed to Congress the month prior, DOE recruited an experienced Business Manager from the Department of the Navy. Within the first two weeks of the Business Manager's arrival, it was determined that the baseline presented to the DOE in December was incomplete and that the $1.4 billion figure provided to Congress by the contractor was not going to be adequate to complete the project. It was agreed at that point to form a joint Review Team comprised of the DOE and FDH. The team consisted of the DOE and Contractor Project Directors, FDH Project Controls

Manager, DOE Business Operations Manager, and the FDH Project Execution Manager. Meetings were conducted daily with the sub-projects from July to October. In addition to those reviews, a second series of more detailed reviews, led by the RL Business Manager, were conducted at the project working level to ensure accuracy of the estimates being provided by the contractor to DOE. The DOE Business Manager and the Contractor Projects Controls Manager worked jointly to determine the level of detail required to formulate and manage the baseline.

Figure 7-2. Spent Nuclear Fuel Project Team (FDH)



Significant challenges still remain to the SNF Project Management organization. Notable amongst those are the review and approval process for the many SAR's needed to complete the project, and the preparedness of the organization to take over and operate the facilities when construction is complete and spent fuel is ready to be moved. These issues are discussed in detail elsewhere in this report.

The Review Team has identified one area of significant potential risk to the project from a management organizational perspective. FDH top management has decided to put in place a new Project Director to take over the project as it transitions from an EPC project to one involving significant operations. While possessing exceptional EPC project management skills, the current SNF Project Director does not have the requisite operations skills deemed by management to be important to successfully transition the project into operations, and subsequently managing the project when it is fully into operations. The implications of appointing a new Project Director at this stage of the project are potentially significant. This is discussed below in Assessment.

7.2.2 Assessment

The SNF Project Management organization is considered to be appropriate for the needs of the project. The individual managers in the organization are all qualified, experienced, and capable. Additionally, they have blended well as a team and seem to be highly motivated and dedicated to prevailing over the challenges of the project.

The Review Team is unanimous in its high opinion of the qualifications and caliber of the individual managers. From the Project Director down, each key manager is highly qualified, experienced and in possession of a "can do" attitude toward meeting the project's objectives. Each manager has a good knowledge of the entire project, not just his individual area of responsibility. Each also understands where his scope fits into the big picture of the project and has an appreciation of the importance of the various project elements. Most importantly, there appears to be a noticeable consistency of approach and attitude of the team toward solving the problems and successfully achieving the project's objectives.

The SNF Project Director deserves special recognition for the talent and efforts that were applied to turning the project around and organizing it for success. The Project Director personally put the management team in place, and led the efforts to develop and implement the numerous project management systems that were needed. The Project Director has been able to function effectively in an extremely complex environment that includes interfacing with numerous entities beyond the project organization, including a multi-faceted client organization, various regulatory bodies, and an active stakeholder organization concerned with the Hanford site. The Project Director has maintained a resolute focus throughout the process, and proactively works to anticipate and deal with anything that has the potential of impacting the project's ability to meet its objectives.

There are some staffing issues still to be dealt with, notably in the engineering and operations organizations. Both organizations are currently short-handed for their current and future workloads, and focused efforts are underway to place additional personnel in them. In the particular case of operations, there are qualifications and logistical issues that are making it difficult to staff up at the desired rate at this time. While the situation is not yet considered a crisis, it is a matter of great concern, and it is being given the appropriate level of management attention.

The FDH management team appears to be appropriately focused on the SNF Project and dedicated to ensuring its success. There is no desire on their part to repeat or continue the performance issues that plagued the project in the past and led to cost and schedule overruns and adverse publicity. FDH top management appears to be placing the right level of emphasis on supporting the project, removing unnecessary obstacles, and providing the appropriate level of management review and oversight to ensure the project's success.

However, there are key issues that require increased attention from both DOE and FDH top management at the site. Notable among these is the nuclear safety review process for SARs. Several critical safety related issues have remained unresolved over a long period of time, primarily due to differences of opinion or interpretation of project requirements. It is noted that FDH management, along with SNF Project management, has been proactive in working with DOE to bring these issues to resolution. The new DOE Manager of the Richland Operations Office has also expressed a conviction to work with the concerned parties to resolve the outstanding issues in a timely manner to support the project.

However, the inability of the project to bring to resolution the safety assessment issues suggests that there may have existed a technical leadership gap in the SNF Project organization. Recently, an Engineering Manager has been hired and he is introducing processes to address this gap. However, it is too early to determine if all technical issues are now under management control.

The Review Team had some concern about plans to replace the SNF Project Director at this time. The operations experience deficit of the incumbent is duly noted; however, the inspired leadership and project management skills that the Project Director has brought to the project over the last year have made a positive impact in positioning the project for success after several years of badly missed expectations. Of particular note is the key management team that has been put in place. This Review Team has been most impressed with every one of them, and there has been no hint in any quarter of disrespect for or disloyalty to the Project Director. To the contrary, there have been several unsolicited comments of praise for the job the Project Director has done. The Project Director is admired and respected for her intelligence, knowledge, management skills and toughness.

The concern over the potential impact to the project with the appointment of a new Project Director is twofold. First, the project has undergone several key management changes in its life. FDH must be careful not to exacerbate the potential impacts of this change. Secondly, potential team morale impact, if any, could depend on what happens to the current SNF Project Director in the process. It is imperative that the Project Team remain focused on the project.

7.2.3 Recommendations

This Review Team does not have any significant recommendations concerning the present project management organization. As previously discussed, the team that is in place is most impressive and appears capable of getting the job done. Specific management recommendations include:

1. Closely examine the potential technical leadership gap in resolving the SAR approval issues. This Review Team believes that the SNF Project organization should be proactive in this area in two aspects: 1) the SNF Project should prepare the technically best safety analyses of which they are capable, and then they should defend their positions as strongly as is reasonably possible; and 2) when professional disagreements are unable to be resolved at the working level, the SNF Project should take immediate steps to surface the issue(s) to the appropriate decision making level for adjudication.

2. Use heightened management attention, at all levels, to obtain the critical engineering and operations personnel that are needed to complete the facilities and operate them. In particular, the top management of FDH should take a high visibility, more proactive role in this process. While everyone is knowledgeable of the issue, it seems that the major burden for making it happen is falling on the individual managers, and they are occasionally having

to deal with unnecessary roadblocks from staff groups. We believe that FDH top management should take a leadership role in resolving the underlying issues that are impacting the ability of the SNF Management team to obtain the necessary resources.

3. Minimize the potential impacts of key management changes.

7.3 Project Controls

7.3.1 Findings

The SNF Project utilizes a resource-loaded Primavera® schedule and associated databases to document and manage its cost and schedule baseline. The technical and cost details associated with the project baseline are captured in an extensive multi-volume set of back-up information which can be generated from an on-line database which is accessible from the project Intranet. Routine and extensive ad hoc reports can be generated from the database.

The project has a Project Controls group currently comprising approximately 35 personnel. Most of these personnel are matrixed to the individual sub-projects to provide support in the cost and schedule areas.

The SNF Project has three primary levels of baseline change control boards. The highest level is the DOE-RL Board (chaired by the Manager of the Richland Operations Office or his designee in the Project Integration Division). This board meets as needed. The second level is designated as the "CCB Board" and is chaired by a senior FDH individual reporting to the Chief Operating Officer of FDH. This board meets weekly to consider site-wide issues pertaining to FDH. The third and most active level of baseline change control boards is designated the Baseline Review Board (BRB) and is co-chaired by the FDH project manager and the DOE project director. The BRB meets every two weeks. Baseline change is also controlled at the sub-project levels on a more informal basis.

The SNF Project maintains a BCR Log which reflects approximately $10 million in changes since the most recent baseline was established for use in September 1998. The BCRs are designated in the log as either "approved," "pending," or "void," which is synonymous with disapproval. BCRs may have positive or negative values which raise or lower the cost baseline respectively. Once BCRs are approved, they are incorporated into the baseline database on a monthly basis. Approved BCRs impacting cost may generate a drawdown or uplift to the contingency for the project.

The SNF Project also utilizes a system of Deviation Notices (DNs) which are the precursors to BCRs. The DNs are used to provide more timely notification of possible baseline changes. The disposition process for DNs is more informal, with only a sub-set of the DNs eventually transitioning to BCRs.

Schedule is managed aggressively for the SNF Project. Reports are generated for critical path and near-critical path activities and weekly review meetings are conducted.

The SNF Project has a work authorization/work planning system comprising approximately 375 active work packages which are called Cost Account Project Numbers (CAPNs), which reside nominally at WBS Level 8. A CAPN Responsibility Assignment Matrix does exist, but no formal approvals are required for opening a CAPN for expenditure. The project does not utilize a separate management reserve account, but instead relies exclusively on contingency. Accruals are made for items such as subcontracts, but may be based on physical progress.

Cost and schedule variance analysis is performed by the cost analysts who are matrixed to the sub-projects. In most cases, earned value percentages are determined by sub-project personnel and subcontractors and are verified by the cost analysts and Fluor Daniel Northwest sub-project personnel respectively. Cost and schedule variances are reviewed monthly by the DOE Project Director and the FDH Project Manager at nominally the WBS Levels 4/5. Currently, the project is experiencing negative cost and schedule variances of -4.0 percent and -8.4 percent respectively (fiscal year to date through April); however these variances are considered manageable over the remaining months of the fiscal year.

The Project Control organization takes a lead role in risk management for the SNF Project (see Section 4.0 for more discussion on risk management). The risk data resides in an automated database. The database contains a risk register, the name of the individual assigned responsibility for the risk, and quantitative data such as the probability and consequences of the risk event. The risk report is generated quarterly and is reviewed by the FDH Project Manager and DOE-RL.

7.3.2 Assessment

Based on previous comments by external reviewers, the SNF Project appears to have made substantial progress in the project controls area over the past year. This is a direct reflection of the project management skills and expertise possessed by project personnel and FDH as a corporation. Most of the systems discussed above had not been applied to the SNF Project a year ago. Progress in the project controls area has been dramatic, and project personnel should be commended for their efforts.

The baseline change control process utilized for the SNF Project appears to be functioning fairly well and is more than adequate. Documentation supporting the baseline management process is adequate and the design of the process and the activity level are appropriate.

The Review Team evaluated the processes used to change the baseline (through the BCR process) and manage the use of contingency for the SNF Project. The SNF Project is using the BCR process to incorporate all types of changes to the baseline. These include changes in scope or planned approaches, as well as better or more definitive cost estimates, actual contractor or vendor bids that differ from previously estimated costs, and other evolutions of cost quality from a conceptual or preliminary stage. The benefits of this process are the visibility and management attention that all changes receive. However, while it is recognized that such changes represent valid (and by definition) uses of contingency allowances, the Review Team is concerned that the many adjustments of the baseline will have the result of masking project cost and schedule performance issues or trends. It is more appropriate to use contingency to offset EAC or forecast changes (increases or decreases) but to keep the baseline, against which performance should be measured, unchanged for all but real changes in scope. Normally, there is a separate contingency account that is managed by an owner (i.e., DOE) that is used to adjust the baseline when true changes in scope or significantly different approaches are approved. It is also appropriate to exercise prudent management rigor in the approval of even the forecasted usage of contingency.

SNF Project personnel are obviously driven by the November 2000 TPA milestone for commencement of fuel removal from the K West Basin. Substantial management attention is given to the critical path activities leading up to this milestone. In the cost area, most management attention is focussed on contingency usage. When a BCR is approved, the adjustment to contingency is automatic. It is obvious that the FDH manager places extensive emphasis on contingency usage. However, more discipline in the contingency application and contingency analysis processes may be warranted as discussed above.

A form of schedule forecast is maintained for the project in the form of the current schedule. A separate cost forecast is also maintained by the cost analysts in the form of EACs, although the EACs appear to only address the current fiscal year. Trends that may affect outyear costs are not routinely captured as new EACs.

The work authorization process may need more discipline. It does not appear that any management approvals are required prior to opening up a work package (CAPN) to commence charging of work hours or expenditures. In addition to ensuring budget availability, additional control is probably warranted.

7.3.3 Recommendations

1. The SNF Project should consider more extensive and more formal utilization of cost and schedule forecasts (beyond the current fiscal year) into the periodic project reporting and management review processes.

2. Consider revision of the BCR and baseline management process to minimize changes to the performance measurement baseline for the project except for true or significant changes in scope or planned approaches. Evaluate the benefits of a separate contingency allowance, possibly under the control of the DOE, as the source of funding for approved BCRs. Use a forecast or EAC, rather than a revised baseline, to report on improved cost data such as better estimates or actual contractor or vendor awards. Reflect adjustments to the contractor-controlled contingency to offset changes to specific areas as a result of changing forecasts or EACs.

3. More emphasis should be placed on the analysis and use of cost and schedule variance reporting. In particular, the implications of current cost and schedule variances on the project EAC should be reviewed by management.

4. Specific management approval should be required prior to the opening of work packages (CAPNs).

7.4 Systems Engineering/ Value Engineering

7.4.1 Findings

The project has indicated the use of Systems Engineering, and there is evidence that many of the principles and requirements of this process have been incorporated. The Review Team determined this through queries directed at traditional systems engineering functions such as configuration management, change control, interface control, design reviews, baseline control, and Reliability, Availability, Maintainability studies. This function resides in the Chief Engineer's office, although portions of it are accomplished elsewhere (e.g., the Change Control Boards are managed under a Secretariat in the Project Controls Office). The Chief Engineer, on board for just three months, indicated his commitment to systems engineering functions and is taking steps to strengthen them. He indicated some are not as well developed as he would like. Indeed he has just assigned his Deputy to assess the Configuration Management process for effectiveness (see Section 7.5).

The project has also stated its commitment to Value Engineering, and again there is evidence that some of the requirements are being incorporated; however, the Review Team could not determine the project office under which this function has been specifically assigned. Optimization resulting in savings has occurred through systems engineering processes and the results are incorporated in the baseline.

7.4.2 Assessment

These functions are proceeding on the basis of good project management principles. The incorporation of Systems Engineering and Value Engineering into the project is 'ad hoc,' and the Review Team concluded that major opportunities and risk assessments are not being pursued on a formalized basis (see also Section 4). For example, Reliability, Availability, Maintainability analysis of the SNF process as a whole to determine points of failure, availability, spares, etc., is indicated as based on an early 'Witness Model.' The opportunities to 'buy time with money' and affect cost and schedule savings are being pursued in separate parts of the project and may not be integrated and all inclusive.

7.4.3 Recommendation

1. Assess the requirements of these two functions (i.e., Systems Engineering and Value Engineering). Incorporate formal functions to the level required to ensure the project will perform as a complete system, and to ensure cost and schedule savings are pursued on a rigorous, organized basis.

7.5 Project Integration

7.5.1 Findings

There are two important aspects of integration impacting on the SNF Project: the external interfaces with other site programs and projects, some of which are very closely linked with SNF objectives; and internal communications and interfaces within the SNF Project itself.

The SNF Project organization (FDH) has a position titled "Integration Projects Manager." This individual is responsible for the external interfaces of the SNF Project. In addition, this manager is charged with the oversight of certain sub-project areas that do not fit neatly into the other organizations within the project or that are in an early, conceptual planning stage of development. Examples of these sub-projects are the Site-Wide SNF, and the 200 Area ISA sub-projects.

The external interfaces managed by the Integration Projects Manager primarily involve the waste streams that will feed the Waste Management Project, and the transition of facilities to the Environmental Restoration Program. In addition, since the SNF Project is currently the owner of the CSB, and the CSB will also receive canisters containing the glass logs from TWRS, this interface is also managed by the Integration Projects Manager.

There is no one, single organizational vehicle or process for accomplishing internal integration within the SNF Project. Rather, an array of processes and procedures, together with good intra-project communications, is being used to achieve an integrated project.

Strong project direction and communication among the SNF Project Director and her direct reports achieve a great amount of project integration. During interviews by the Review Team, all key managers appeared to have a good grasp of the overall project and generally were cognizant of the activities and plans that will or could impact on their area of responsibility.

A very active and competent project controls organization also plays an important role in accomplishing integration within the SNF Project. This organization makes project data available to all parties in a very timely manner, and uses sound management techniques to assess potential changes or deviations for their impact throughout the project. Weekly critical path meetings involve all project parties so that each area of the project is aware of progress and key activities that may affect their particular sub-project.

The Chief Engineer, and his organization, are responsible for technical integration of the SNF Project and the interface controls necessary on the project. Within the engineering organization there is a Technical Integration Manager. This individual has responsibility for all Design Authorities on the project, and will continue to hold design authority responsibility during facility operations.

The project acknowledged during interviews that they have had problems in the area of Configuration Management, a key element in ensuring integration and consistency of the project from a technical perspective. The Chief Engineer has charged his Deputy with correcting this problem and improving the configuration management processes.

The plans for integration between engineering and operations are evolving. Cognizant engineers will have systems ownership and report to a Facility Manager within the Facilities Engineering organization that reports to the Chief Engineer. The Cognizant Engineers will, however, be matrixed to operations and the Operations Manager is very comfortable with the level of support and personnel commitment of these individuals to the operations organization. A shortage of staff in both the cognizant engineer function and the operations staff is impeding the development, refinement and application of these processes at this time. However, this deficiency is recognized by the Project Team and is being aggressively worked within the constraints of available budget.

There are processes and procedures in place for the interfaces between construction and operations, as are discussed in Section 7.7, Construction Completion and Turnover.

7.5.2 Assessment

External interfaces appear to be managed well under the leadership of the Integration Projects Manager. The project is aggressively looking at solutions to project problems and challenges from a site-wide perspective. An example is the treatment and disposal of sludge. An inter-project team is assessing alternative strategies that result in combining SNF sludge with other transuranic wastes at the site (see Section 3.8). On the surface, such an approach can be viewed as a shifting of work scope out of the SNF Project to solve a budget shortfall (current estimates for sludge treatment are significantly higher than those contained in the baseline). However, the SNF Project is demonstrating its creativity in looking for cost-effective solutions to project problems within the context of the entire site. This demonstrates the advantages of true site integration, and the SNF Project appears to be actively engaged in this process.

Internally, the SNF Project team appears to be functioning as a true, integrated team. All managers interviewed appeared to be "on the same page." Intra-project communications appeared to be very strong.

Because the engineering function is critical for achieving real technical integration on such a project, and the SNF engineering function appears to have received insufficient attention in the previous project organization, there is still much work that must be done to achieve technical integration objectives on the SNF Project. It appears the new Chief Engineer recognizes the challenges and has identified the key problem areas. Efforts are currently underway to solve these problems and are to be applauded.

Budget constraints, combined with other issues such as human resources policies and security clearance concerns, are severely hampering the necessary ramp-up in staffing in the operations area, including the cognizant engineers that will support operations.

An apparent philosophical disconnect associated with the construction to operations interface and integration was detected by the team. During an interview, the Operations Manager strongly communicated his philosophy that operations would not accept facilities from construction until they were adequately complete (see Section 7.7 for more discussion of the processes involved). However, in a later interview, the Project Controls Manager discussed the preliminary thinking and planning to remove construction forces from facilities as early as possible and involve operations staff in even the pre-operational acceptance testing (PATs). The Project Controls Manager sees opportunities for cost savings by reducing the overall number of staff on the project and using the operations staff which are cheaper for the project because they receive less layers of overhead burdens.

7.5.3 Recommendations

1. Aggressively pursue development or improvement of Configuration Management processes and procedures.

2. Support the needed staffing of the operations group and the cognizant engineering function through appropriate budget changes/increases and streamlined hiring processes.

3. Discuss the concerns and objectives of both the Operations and Project Controls Managers in terms of staffing and costs during construction completion and testing, and put transition plans in place that are acceptable to both parties but which will be focused on the primary objectives of the project - timely schedule completion and technical safety.

7.6 Construction Completion and Turnover

The transition between construction and operations is critical on every project. This section discusses the planned process for turn-over of construction to the operations staff, and the following section (7.7) discusses other issues related to the transition to operations.

7.6.1 Findings

In order to address this important phase of the project and to ensure a smooth transition with a clear delineation of responsibility, the Project Team has developed and implemented a guideline entitled *Memorandum of Understanding, Completion and Acceptance for the Spent Nuclear Fuel Project.*

The roles and responsibilities of the Construction Projects organization, the Project's Operations organization and the SNF Startup Team are clearly defined in the MOU. Figure 7-3 (which is part of the MOU) shows the clearly defined point when responsibility of the project transfers from the Projects organization to the Operations organization. This occurs at the time when PATs are complete. The role of the Startup Team throughout the whole process is also well defined.

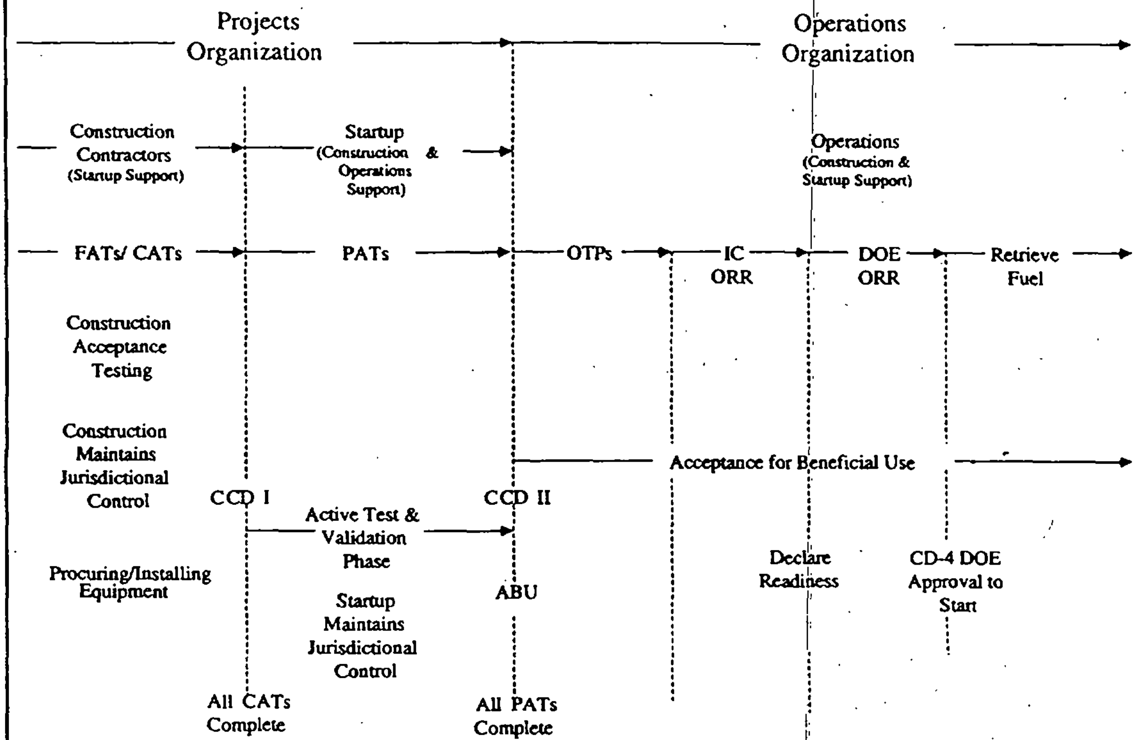
The Startup Team reports on a solid line basis to the Operations organization and on a dotted line basis to the Projects organization. Effectively, though, the Startup Team works to the needs of the Project organization until PATs are complete.

The functionality and efficacy of the construction completion and turnover process has not yet been tested. Only one small system (potable water) has been turned over to date. The transition was reported as smooth.

There is an understanding that the possibility exists for Operations to return a system or facility to the Projects Organization if the item in question proves to have latent design defects or construction workmanship problems.

Manufacturer's warranty issues after turnover are to be handled by Operations unless, as noted above, there is a major design defect (this could include systems or facilities engineering design or manufacturer's engineering design).

Figure 7-3. SNF Path Forward



ABU	Acceptance for Beneficial Use	FATs	Factory Acceptance Testing
CATs	Construction Acceptance Testing	IC	Integrating Contractor
CD	Critical Decision	OTPs	Operational Test Procedures
CCD	Contractor Critical Decision	PATs	Pre-operational Acceptance Testing

7.6.2 Assessment

The project was proactive in putting in place a well-defined plan for handling construction completion testing, pre-operational testing, turnover to Operations, and operational testing. Projects often suffer from a lack of organizational and responsibility clarity in this critical phase.

The construction completion and turnover process is essentially untested at this time and should be watched closely to identify any potential problem areas early.

In spite of this planning and early assignment of responsibilities, the efficiency of the process will undoubtedly be challenged when construction and pre-operational testing reaches a peak level of activity.

As identified elsewhere in this report, staffing of the Operations organization is a critical issue. Operations will play a very active role during pre-operational testing (even though they have no direct functional responsibility at that time), and the level of activity of systems and facilities testing will increase dramatically from now until November 2000. Further, once systems and facilities are accepted, the Operations organization will be occupied operating the systems they own and preparing for moving spent fuel in November 2000.

7.6.3 Recommendations

1. The Review Team reiterates its recommendations above (Section 6.2.3) that FDH top management take a leadership role in assisting the project in placing the needed personnel in the Operations organization as soon as possible.

2. Monitor the construction completion and turnover process closely in the early stages. Should problems occur with the process, quick corrective actions should be implemented to ensure that the system does not get backlogged and become unmanageable.

7.7 Transition to Operations

7.7.1 Findings

The SNF Project is undergoing a major transition from construction completion to turnover to operations. While an agreed upon process is in place for turnover, the Operations organization is not fully staffed and positioned to Accept for Beneficial Use (ABU) the systems that comprise the SNF Project.

Over 75 contract employees, rather than permanent operations staff, are currently performing turnover testing. The knowledge and expertise on the various systems will be lost to the SNF Operations organization once the contractors are finished.

The Operations organization has identified a need for 140 operators to meet the November 2000 start of fuel operations and to sustain operations once fuel movement is underway. The project today currently has 38 qualified operators with 10 additional operators in the "pipeline."

Cost overruns in construction sub-projects have translated in a reduction of funds available to hire operators this fiscal year. In addition, because of a shortage of operators in the Hanford area, the operations organization has resorted to the use of "headhunters" to fill the "pipeline" this fiscal year. In some cases it has taken six months from the time a requisition is prepared for an operator until the person is on board and minimally trained. This includes the delays associated with security clearances and administrative delays caused by FDH hiring practices.

The Operations Manager has a proven track record at Hanford. He successfully built a strong Operations organization at the Hanford Tank Farm.

Senior FDH management (President, Chief Operating Officer and Project Director) is keenly aware of the impending transition. They are taking steps to strengthen the operational aspects of the Project organization to meet this need. They have been actively involved in efforts to accelerate the hiring of operators.

7.7.2 Assessment

The Project has taken steps to put in place an Operations organization staffed with highly qualified and proven individuals. However, the lack of a fully staffed operations organization is currently hampering the turnover of systems from construction to operations. Additional resources in fiscal year 1999 could accelerate the acquisition and training of personnel. This would ensure that turnover is performed in a timely and cost-effective manner without the loss of expertise that comes from using contract employees. The ability to hire and retain cleared staff is limiting the pace at which the operations organization can be staffed.

7.7.3 Recommendations

DOE should support efforts to accelerate the staffing of the Operations organization in fiscal year 1999. DOE and FDH senior management should work closely to identify incentives to attract and retain qualified operators on a time scale needed to support turnover and ORR readiness.

7.8 Other Project Management Areas

7.8.1 Findings

Other project management areas deemed not critical to the achievement of the project's objectives at this time have not been discussed in detail. This is primarily due to the stage of the project's progress, and the fact that these areas are, for the most part, well underway or completed, and are unlikely to impact project outcome.

These areas include:

- Detailed Design and Design Coordination
- Procurement
- Subcontracting
- Materials Management and Warehousing
- Construction Management
- Project Safety

The detailed design and design coordination issues have been a problem for some time on the SNF Project. The problem areas have not been completely resolved. The placement of a new Engineering Manager in the management organization has resulted in the application of sound engineering management discipline, and the remaining outstanding issues relative to detailed design and design coordination are being addressed in a proactive manner.

The major procurement activities have been completed with the exception of the MCOs and fuel baskets. While these procurements are critical to the project, the procurement process itself is not considered an issue. There are technical issues requiring resolution before these purchases can be completed, but the procurement process is in place to obtain the equipment when they are resolved.

Most major construction subcontracting has been accomplished on the project. Considerable subcontracting efforts remain, particularly in the area of staff augmentation, but there are no perceived project risks in the remaining subcontracting activities.

Materials management and warehousing issues are under control and do not represent a threat to the project.

The appropriate staff is in place to manage the remaining construction on site. Schedules are well defined, work scopes are known, and construction crews and subcontractors are in place to complete remaining construction.

Project Safety is never a completed issue until the last person leaves the project. However, the FDH culture is highly safety oriented, and a good safety program is in place. There are no known aspects of Project Safety that are considered threatening to the project.

7.8.2 Assessment

It is considered that the other project management areas discussed above are being satisfactorily managed.

7.8.3 Recommendations

There are no specific recommendations in these areas.

8.0 Safety

8.1 Summary

The significance of problems associated with the development and approval of SARs and Technical Safety Requirements (TSRs) is currently well recognized at all levels within DOE-RL and FDH, and with the DNFSB. Many of these problems remained unresolved for months or years and only recently have corrective management actions (e.g., increased staffing levels, a more rigorous internal review process) been taken. The effectiveness of these corrective management actions has yet to be demonstrated.

SAR-related issues have threatened the validity of baseline costs and schedules in three ways. First, the effort to develop and review SARs and to resolve the thousands of review comments generated have been much greater than estimated in the baseline schedules. Secondly, in lieu of a formal design review process in the initial stages of the project, the SAR review served to first raise design issues between the DOE-RL and FDH. The adequacy of the MCO and canister storage tubes to withstand oblique MCO drops in the CSB, the selection of design codes for the helium piping in the CVD Facility, and the adequacy of the K Basin to withstand cask drops during fuel loading are among long-standing design issues uncovered in the SAR review process that, by themselves, could threaten baseline costs and schedules. Lastly, because the FSARs, TSRs and SERs must serve as the authorization bases from which operating procedures and subsequent training will ensue, delays in their completion now threaten the schedule of other project products needed for ORRs and fuel movement. Thus, the issuance of FSARs, TSRs and SERs could become critical path items for fuel movement.

8.2 Findings

The project's environmental impact statement is completed and approved. Accident analyses in the SARs have not uncovered any scenarios that would invalidate the bounding consequences presented in the environmental impact statement. Changes to assumptions in the environmental impact statement, such as for sludge disposition, will be handled through the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process. Thus, there is no foreseeable need to update the project environmental impact statement.

DOE-RL approved the SARP on February 12, 1999. Accident analyses in the facility SARs have not uncovered any scenarios that would invalidate the risks presented in the SARP. However changes in the MCO design will warrant minor updates to the SARP. This should not have a significant impact on the baseline cost and schedules.

The major ongoing SAR/TSR development and approval effort concerns SARs for the new CVD and CSB facilities, revisions to the existing (1996) SAR for the K Basin, and the development of an MCO Topical Report which will provide MCO design information needed to supplement information in the facility SARs. For purposes of approval for procurement, installation, and cold (non-radiological) operations, FDH chose to develop "phased SARs" reflecting major construction phases for the buildings and equipment of the CVD and CSB, and three Safety Analysis Documents (SADs) for new systems added to the K Basin. There are separate SADs for the Cask Loading

System, the FRS, and the IWTS. These have supported Unreviewed Safety Question (USQ) evaluations for new equipment installation in the K Basin. These preliminary SAR documents and the MCO Topical Report were reviewed by DOE-RL, which issued SERs permitting procurement and construction. However, the SERs identified several still-open issues, and there remain hundreds of comments on the preliminary SARs that have yet to be resolved.

Current SAR development and review activities are focused on FSAR/TSRs for the three facilities. Approval and implementation of the FSAR/TSRs are needed for hot (radiological) testing and operations. FDH currently plans to issue a single FSAR document comprised of a generic "project FSAR" and three "annexes" for the three facilities. DOE-RL reviewed the project FSAR and the CSB FSAR/TSRs (Annex A) and issued over a thousand comments on these. FDH's issuance of the CVD and K Basin FSARs, which are currently behind schedule, will be delayed even further to incorporate lessons learned from the CSB review.

In addition to the SARs discussed above, the project must also issue SARs, TSRs and SERs for activities involved with K Basin sludge removal, and the removal and treatment of the relatively smaller amounts of fuel in the K Basin that came from reactors other than the N Reactor. The SARs, TSRs, and SERS associated with these activities have yet to be developed and reviewed; however, it seems reasonable to assume that they will have little impact on the current schedule for N Reactor fuel removal. The COA tables show total estimated costs for preliminary SAR and FSAR efforts peaking respectively in FY 2001 and FY 2002, due to the significant costs for developing sludge removal SADs and FSARs.

In summary:

- The time periods associated with SARs and TSRs, particularly for comment resolution, are underestimated in the baseline and current schedules.
- A significant fraction of the DOE-RL's comments on the preliminary SARs and MCO Topical Report remain unresolved.
- FDH has issued only one of three major FSAR/TSR submittals and this has resulted in extensive comments made by DOE-RL.
- FDH has taken steps to improve the SAR development and review process, but the effectiveness of these steps has yet to be demonstrated.
- To meet the fuel-loading schedule, FDH currently plans to develop operating procedures and training with "contractor-submitted" instead of DOE-approved FSARs and TSRs.

8.3 Assessment

The SAR review and approval process for the SNF Project has a long history of problems, including:

- Design issues first raised in the SAR review process, rather than in a formal design review process;

- Differing interpretations between FDH and DOE-RL as to what satisfies the requirements of DOE 5480.23, STD-3009, and "Nuclear Regulatory Commission equivalency," particularly regarding the level of information and justification of positions to be presented in the SARs;

- Inability to resolve outstanding technical issues raised in the SAR review, and the initial failure to raise these issues to a high-enough management level;

- Unrealistic schedules and manpower costs for SAR development and review; and

- The development and review of many separate SAR documents in parallel, challenging manpower resources, consistency, and configuration management, and not permitting a lessons learned process that might have lessened the problems noted above.

Management briefings made during the on-site review indicated that SAR development was originally estimated to cost approximately $5 million, but the current estimate is approximately $10 million.

The current "Spent Nuclear Fuel Project Level 3 Schedule" shows that all baseline and current schedule dates for SAR/TSR development and approval activities have slipped. This schedule plus discussion with the FDH manager responsible for SARs indicate that FDH typically allows two months for internal review and another two months for DOE-RL review. However, past experiences indicate that these periods are actually much longer, and unresolved comments remain on all the preliminary SARs. The time to resolve comments was significantly underestimated. For example, FDH submitted the IWTS SAD to DOE-RL on June 11, 1998. An FDH letter requesting approval to install a particulate settler dated March 18, 1999 – nine months later and following new criticality and safety analyses – indicated that two of eight special Conditions of Approval for an August 31, 1998 SER remained uncompleted.

A significant portion of the DOE-RL's comments on the preliminary SARs and the MCO Topical Report remain unresolved. At the time of the Review Team visit, the DOE-RL staff indicated that 117 of the 870 comments on the CVD phased SARs remain open; 128 of the 881 comments on the CSB phased SARs remain open; 17 of approximately 200 comments on the K Basin SADs remain open; and 290 of the 497 comments on the MCO Topical Report remain open.

Many of these comments concerned design issues that would have been avoided if designs and design reviews had been completed before the preliminary SAR was drafted. Configuration management of design changes being made as SARs were updated was another area of concern.

FDH has issued only one of three major FSAR/TSR submittals, one comprising the generic project FSAR and the CSB FSAR/TSR (Annex A). DOE-RL issued 1,014 new comments on these. Many of these comments addressed inconsistencies or information voids between the documents, and presumably many reflected issues unresolved from the phased SARs. The CVD FSAR/TSR (Annex B) and the K Basin FSAR/TSR (Annex C) are behind schedule and have yet to be submitted to DOE-RL.

The failure to reach closure on SAR submittals means that the amount of parallel SAR development and review efforts keeps increasing, further challenging resources for both DOE-RL and FDH. Budget and schedule authorities for SAR activities still reside with FDH's major projects. The managers for these major projects are probably not as aware or appreciative of manpower conflicts as those who do the SAR work, that is, SNF Project Nuclear Safety. To set more realistic cost and schedule estimates, SNF Project Nuclear Safety's knowledge of workloads, manpower restraints, and lessons learned from previous reviews must play a key role in making the estimates.

From the management briefings given to the baseline Review Team, and from items mentioned in DOE-RL Manager's May 20, 1999 all-hands meeting, it is clear that both DOE-RL and FDH management are now aware of the significance of past SAR-related problems and are taking steps to improve the SAR development and review process. FDH managers said that FDH has recently increased and reorganized its engineering and nuclear safety staff. The engineering and nuclear safety managers are now empowered to raise SAR technical issues to upper FDH management and to hold back SARs that do not meet internal quality and consistency checks. The SNF Project Nuclear Safety Manager indicated that process changes are being made to increase the quality of SARs sent to DOE-RL by strengthening internal review, better ensuring consistency and configuration management, incorporating lessons learned from past SAR reviews, and attempting to align expectations between FDH and DOE-RL. However, the effectiveness of these changes can only be demonstrated by an increased quality of the future CVD and K Basin FSAR/TSRs, and by a quicker resolution of currently unresolved comments.

The CVD FSAR/TSRs should benefit most from the lessons learned from the CSB FSAR review, since like the CSB, it is for a new facility and has undergone a similar preliminary SAR development and review process. The K Basin FSAR/TSRs (Annex C) appears to present a greater challenge for review and approval. FDH has chosen to write this as a new, fully integrated document that will replace the existing 1996 authorization basis. In the new FSAR/TSRs approach, developers and reviewers must be able to distinguish between SAR elements of the 1996 authorization basis that reflect an existing old facility built to lesser but already approved design requirements, elements for new systems built to higher current design requirements, and elements that reflect the impact the new systems have on the older systems and structures.

Although some skepticism was expressed on both sides during interviews as to whether DOE-RL and FDH could align their expectations on such a large, complex, and completely new authorization basis document for the K Basin, there seemed to be a general agreement that such an approach was viable. However, DOE-RL expressed concern that the new FSAR/TSR might drop existing requirements in a way not obvious to the reviewers. So both sides have agreed to a "crosswalk of requirements" between the existing and new authorization bases. This crosswalk should aid FDH internal reviews as well as DOE-RL.

In parallel with the development and review of the K Basin FSAR, modifications to the facility will be made following the USQ and Engineering Change Notices (ECN) processes. The USQ and ECN processes essentially extend the Safety Analysis Document (SAD) process, keeping the 1996 SAR as a separate part of documents comprising the gradually changing facility authorization basis. These documents will aid developers and reviewers of the K Basin FSAR in distinguishing between what parts of the 1996 SAR remain unchanged, and what parts are updated.

To meet the fuel-loading schedule, FDH is currently considering developing operating procedures and training with contractor-submitted instead of DOE-approved FSARs and TSRs. This strategy would delay the need for fully-DOE-approved SERs from the fall of 1999 until the summer of 2000, just before the ORRs are to be performed. DOE-RL indicated it is in agreement with this approach (it provides DOE-RL with more time to resolve comments and issue an approval SER), and will issue a "letter" or "interim SER" that will serve to identify which comments are resolved and which are not. FDH will prioritize the development of procedures and training based, at least partly, on areas where comments are resolved. Both sides realize that this approach places the project schedule at risk in that the final SER could result in changes to the facility systems, TSRs, procedures and training that might not be accommodated in the current ORR and fuel loading schedules. However, given the delays in developing the FSAR/TSRs, the large number of outstanding unresolved comments and technical issues, and challenges posed in the upcoming review and approval process, the baseline Review Team agrees with FDH that DOE-RL approval of the FSAR/TSRs by the fall of 1999 is highly unlikely.

8.4 Recommendations

1. Continue to implement new SNF Project processes aimed at improving the quality of engineering and design, configuration management, SARs, SERs, and TSRs.

2. Find and implement a more effective way to resolve comments and technical issues raised in SAR/TSR reviews to meet the current fuel-loading schedule.

3. Establish new estimates of costs and schedules for SAR development and review with input from FDH Nuclear Safety, and reflect lessons learned from previous reviews and manpower restraints due to the large number of parallel SAR-related activities. Work-arounds to maintain the present baselines must be pursued.

4. Incorporate lessons learned from the CSB FSAR/TSR review into the development of the CVD and K Basin FSAR/TSRs and attempt to better understand and address the differences in interpretations of DOE 5480.23, STD-3009, and "Nuclear Regulatory Commission equivalency" requirements.

5. Ensure all project participants, including both DOE-RL and FDH upper management understand the schedule risk associated with developing procedures and training based on contractor-submitted rather than DOE-approved FSAR/TSRs.

9.0 Quality Assurance - 10 CFR 830.120 and DOE/RW/0333P

9.1 Summary

10 CFR 830.120 Quality Requirements

FDH is the M&I contractor responsible for implementing the Project Hanford Management Contract. FDH has a site-wide Quality Assurance Program (QAP) to meet DOE Order 5700.6C, NQA-1 and the OCRWM DOE/RW/0333P quality requirements. Each project maintains a set of standard operating procedures to meet specific project requirements. During 1996-98 FDH experienced numerous problems implementing quality assurance regulatory requirements, 10 CFR 830.120, at the K Basins and SNF Project activities.

In April 1998, DOE's Office of Enforcement and Investigation (EH-10) conducted an on-site investigation. The investigation covered five quality deficiencies reported in the Noncompliance Tracking System (NTS), five additional quality deficiencies reported into the Occurrence Reporting and Processing System (ORPS), and two additional concerns, related to noncompliance with procurement specifications, reported to EH-10 by DOE-RL. The five NTS quality deficiencies and the five ORPS quality deficiencies were pertaining to the SNF Project.

The EH-10 investigation grouped the deficiencies into three categories:

- Deficiencies in the Qualification and Oversight of Subcontractors;
- Deficiencies in Work Process (SAR/TSR) and Procedure noncompliance; and
- Deficiencies in the Quality Improvement activities for identifying, correcting and preventing recurrence of quality problems.

The investigation concluded that deficiencies in the implementation of quality requirements and adverse quality trends existed in the SNF Project. Although no adverse safety consequences were determined to result directly from these deficiencies, the number of incidences and the recurring nature of some of the deficiencies raised concerns about the adequate implementation of the QAP requirements. EH-10 was also concerned because DOE-RL had notified FDH of these quality concerns and that FDH corrective actions had not been fully effective to prevent the continued occurrence of some of these deficiencies.

On October 22, 1998, EH-10 held an Enforcement Conference with FDH to discuss these violations and the progress of an FDH correction action plan. One significant finding identified was that FDH management was not sufficiently engaged in the quality process. In response to this finding, FDH made changes in key management positions and responsibilities. Additionally, FDH committed to DOE, that, as part of the Quality Improvement Process (QIP), corrective actions would be implemented across all Hanford projects to fully correct the QAP problems. Due to these changes, EH-10 elected to defer final decision regarding the necessity of enforcement action for four months until the effectiveness of FDH QIP could be evaluated. In taking this action, EH-10 provided FDH the opportunity to demonstrate their commitment to correct QAP problems and to prevent recurrence of similar violations.

In April 1999, EH-10 conducted a review of FDH progress in resolving these quality problems as discussed at the Enforcement Conference and in accordance with FDH QIP. The preliminary results of the review concluded that inadequate progress was made in implementing the commitments made to DOE in correcting the identified quality problems. The EH-10 report was not issued at the time of this review.

DOE/RW/0333P Quality Requirements

A review was conducted of the SNF Project implementation of the quality requirements of the 0333P. The review concluded that the SNF Project is making progress implementing the 0333P quality requirements. However, a review of Audit Report IPA 99-03, dated May 18, 1999, identified key areas where additional action is required.

The audit was conducted by the Facility Evaluation Board (FEB) and resulted in the writing of three Corrective Action Requests (CARs). Two of the CARs were issued to the SNF Project, and one to FDH. CAR #3 covers the ineffective implementation of the corrective action management system used by FDH. This was also a concern expressed by EH-10 during their investigation.

Additionally, 26 Deficiencies Reports (DRs) were written identifying quality program implementation deficiencies. Also, several DRs identified similar quality deficiencies expressed by EH-10 during their investigation. The FEB evaluated the effectiveness of the SNF Project implementation of the 0333P and determined that implementation of the QARD by the SNF Project was ineffective.

It was also noted that the SNF Project experienced numerous problems fabricating 30 MCO fuel/scrap baskets during the trial run period to identify problems with the manufacturing process and quality program. This was a first time fabrication for DynCorp, which is an on-site fabricator. DynCorp's QAP Plan was immature (first time fabricating to 0333P or NQA-1 quality requirements) and the staff demonstrated that it did not possess a clear knowledge and understanding of what it would take to implement the quality requirements. SNF Project/DESH made a management decision prior to fabrication to assign QA personnel to monitor the fabrication process. Although DESH assigned onsite QA personnel to monitor fabrication, several of the quality related issues were identified by Government Acceptance Inspectors on DOE-RL oversight QA reviews. As a result of DynCorp fabricating the thirty baskets, about 60 Nonconformance Reports (NCRs) and two Stop Work Orders (SWO) were issued. Due to the numerous problems encountered by DynCorp, fabrication was two months behind schedule and the cost doubled.

To correct the problems in future basket fabrication, the SNF Project has formed a team with its major subcontractors. The team consists of FDH, SNF Project and DynCorp personnel [the Storage Sub-Project (MCO/Cask and Transportation) Manager, QA Manager, and the MCO Basket Fabrication Project Manager]. The team will share the development of the specification, fabrication, inspection and other quality requirements to ensure the quality of the MCOs and baskets.

Another issue which could impact the SNF Project is the determination of what quality requirements will govern basket fabrication, 10 CFR 830.120 or 0333P. The MCO baskets are not listed on the OCRWM Q-list and therefore are not considered by OCRWM to be safety related relative to long-term storage in the repository. DOE-RL is currently working with the NSNFP to determine the content of the quality program to be applied to the project.

Several SNF Project management personnel also expressed concern as to whether the fabrication of the basket can be accomplished at the rate needed to meet and maintain the fuel movement schedule –five baskets per day. While the SNF Project has planned a new management approach for the next phase of production, it is a very valid concern considering the immaturity of the quality assurance program and the numerous quality problems encountered during the manufacturing of the first thirty baskets.

9.2 Findings

10 CFR 830.120 Quality Requirements

The SNF Project implementation of quality requirements continues to exhibit numerous problems, which demonstrates ineffective implementation of quality requirements. The problems or deficiencies continue to be across the project. This is an indication that some actions taken to correct and prevent recurrence are ineffective and that additional actions are being taken by the SNF Project. A review of various quality documents indicated that FDH and the SNF Project had an adequate written program to meet 10 CFR 830.120 and DOE/RW/0333P quality requirements, but implementation of the program requirements is lacking, as evidenced by the numerous quality deficiencies identified.

FDH is revising the QIP to address concerns expressed by EH-10 and DOE-RL to enhance the overall quality improvement process. This is considered a positive step for FDH and would be beneficial to the SNF Project in implementing quality requirements. Changes in key SNF Project management positions and the display of teamwork were also considered positive steps for the project. Overall, project management demonstrated a very highly skilled and motivated working team to meet schedule obligations. However based on the continuing deficiencies, it appears that on some sub-projects schedule obligations affect the quality of the product.

DOE/RW/0333P Quality Requirements

The SNF Project has formed a team with its major subcontractors to fabricate the MCO baskets. The team will share the responsibilities for the total fabrication of over 2,000 baskets. If the project is to meet its schedule and cost projections, the team concept is the best and possibly the only approach that will work using the on-site fabricator.

Even though several deficiencies were identified relative to the implementation of 0333P requirements, these deficiencies also indicated deficient implementation of 10 CFR 830.120 and NQA-1 requirements. As such, fabricating the baskets is possible, but not without concern. As a side issue, if 0333P quality requirements are applied to the project there will be additional cost. The

SNF Project conducted a study to determine the cost and schedule impact of fabricating the baskets to 0333P quality requirements. The results of the report were not available at the time of this review.

9.3 Assessment

10 CFR 830.120 Quality Requirements

The findings were evaluated for impact to cost and schedule of the SNF Project. It is difficult to determine the impact to cost and schedule as a result of the SNF Project's ineffective implementation of quality requirements at this time, because most problems appear to be programmatic and can be corrected prior to actual fuel movement. The fines and penalties proposed by EH-10 are imposed on FDH and can not be passed on to the SNF Project. However, in the future there is the potential that the ineffective implementation of quality requirements and actions taken to correct problems/deficiencies, i.e., rework or repair, could impact the schedule and cost.

DOE/RW/0333P Quality Requirements

Based on past experience, the SNF Project implementation of 0333P quality requirements for the fabrication of the MCO baskets will be a challenge to the project. It should also be noted that fabricating the baskets to 10 CFR 830.120, though possible, will also be a challenge for the project. However, using the team concept with additional SNF Project QA support is the most reasonable approach to take to support meeting the fuel movement schedule.

9.4 Recommendations

10 CFR 830.120 Quality Requirements

1. Revise and improve the FDH QIP as soon as possible. The SNF Project management needs to take a more pro-active approach to identifying and reporting quality problems and preventing recurrence. Commitments made to EH-10 to address site-wide issues need to be addressed and maintained.

DOE/RW/0333P Quality Requirements

2. Identify the quality requirements for fabrication of the MCO baskets prior to fabrication. The cost and schedule impact study for fabricating the MCO baskets to meet 0333P quality requirements need to be shared with the OCRWM, DOE-RL, the NSNFP and DOE-EM headquarters organizations. The SNF Project should seek assistance from DOE-RL, NSNFP and DOE-EM headquarters to obtain relief from 0333P quality requirements and to use 10 CFR 830.120 quality requirements for basket fabrication.

3. Establish an effective communication system to enhance the sharing of information, in particular the lessons learned for fabrication for the first thirty baskets and implementation of quality requirements. The MCO basket fabrication team must receive strong support from senior management to ensure that quality requirements are not compromised for schedule obligations.

10.0 Operations Readiness Reviews

The operations readiness activities within WBS 1.03.01.02.25.19, SNF Relocation Common Operations, were reviewed. These included contractor MSA activities and the contractor ORR activities. While the scheduling for a DOE ORR was reviewed, the cost of this review is not included in the project baseline.

10.1 Summary

The review of the ORR activities found that the technical, cost and schedule baselines are sound, but at some risk, as explained below. These activities are on the project's critical path, occur late in the project's life, and are highly dependent on the successful completion of preceding activities. Therefore, timely completion of these activities is risk laden.

10.2 Findings

A review of the Basis of the Cost Estimate was conducted and concludes that the basis is reasonable and sound and is based on the requirements of DOE Order O 425.1A, *Startup and Restart of Nuclear Facilities,* and DOE-STD-3006-95, *Planning and Conduct of Operational Readiness Reviews (ORR).* The detailed backup sheets for the ORR revealed that the basic elements of an ORR were planned and estimated. These include a review of the safety basis; a review of other assessments that can be utilized; preparation of the Plan of Action, ORR Plan, and Criteria and Review Approaches Documents; the ORR Team preparatory work; ORR performance; and the closing out of the findings. A review of the assumptions for the ORR found them to be reasonable and based on project personnel experiences at other Hanford projects and other DOE sites. The total estimated cost for the major elements are as follows:

Contractor ORR	$4.997 million
ORR Operations Support	$0.454 million
MSA Staff Support	$1.919 million
MSA Tech Support	$1.386 million

A review of the schedule for the operations readiness activities found that a number of them are on the critical path for fuel movement. The review concluded that the appropriate milestones and activities are being monitored in the Level 3 Baseline Schedules. However, it was revealed that the milestones and logic in the Baseline Schedule are for fuel movement of the K West Basin only. The readiness review activities for the K East Basin are not included in the current logic and will be developed at a later time.

Discussions with the ORR Manager, who reports to the Operations Manager, also found that a DOE O 425.1A-required Contractor Plan of Action (POA) had been submitted to DOE-RL for approval approximately three weeks before this review. This document has to be approved by the appropriate startup authority (in the case of the SNF Project the startup authority is the DOE-RL Manager since the operation is classified as a Hazard Category 2), and provided to DOE's Office of the Deputy Assistant Secretary for Oversight (EH-2) for review and comment. The POA addresses the prerequisites for starting a Contractor ORR, and specifics on how each of the Minimum Core

Requirements will be addressed by the ORR. In anticipation of organizing the contractor ORR effort early in FY 2000, the contractor ORR Team Lead has been named in the POA.

Also reviewed was the current version of the SNF Project's *Management Self Assessment* (HNF-2039), Revision 1, dated May 1999. This document defines the process that SNF line management will use to ensure facilities, management systems, people, parts, paper, and processes are ready to allow fuel relocation operations to commence safely. Review of the MSA Plan and a sampling of two MSA Appraisal Forms, Function Area 2H300, Radiological Control and 2H100, Facility Operations, found the approach and depth of the MSA process to be comprehensive and complete. It was also learned during discussions with the ORR Manager that the MSA Plan underwent a formal Self Review from November 1998 through March 1999 by the appropriate line managers to determine if the criteria were correct, if there were any omissions, and for use as a training tool. The MSA Plan has been finalized, corrections have been made, and the document has been issued as a configuration-controlled document.

An interview with the FDH ORR Manager found him to be very knowledgeable and experienced with the planning and execution of readiness review activities. He has participated in a number of readiness review activities both at Hanford and the DOE Waste Isolation Pilot Plant. He currently has two ORR-experienced engineers working for him and feels this level of support is adequate for this calendar year. His cognizance of the requirements within DOE O 425.1 and DOE Standard 3006-95 should ensure success of these activities. However, when asked what his concerns were, he explained that approval and implementation of facility/operations safety documentation is the one area that poses the most risk to the success of the readiness activities. In particular, he mentioned the implementation of the commitments in the SARs will, in all likelihood, impact the activities he is responsible for.

Also discussed was a study to assess the benefits of proceeding with the readiness activities for two systems, the FRS and the IWTS in the K West Basin. By accelerating the readiness activities for these two systems, without the MCO loading and cask loading, the "process validation" process could proceed earlier allowing confirmation of the state of the fuel and the acceptance of the washing step within the FRS. This study is in response to a request by DOE-RL and is to assess three options: 1) use of a contractor authorized Beneficial Use; 2) use of the Readiness Assessment process; or 3) use of the ORR process. The study is still in progress and indicates the concerns the DOE-RL Project Team has concerning process validation activities.

10.3 Assessment

The review confirms that the project is well aware of the role, importance, and resources required by the readiness review activities. Much attention has been paid to these activities to date and the ORR Manager is fully aware of how dependent these activities are on the implementation of the safety documentation and the Authorization Basis. In addition, there is a concern about the durations for a number of the activities. These activities include the durations for corrective actions following the MSA, contractor ORR, and the DOE ORR. These durations are one week, two weeks, and two weeks, respectively. Discussions with the ORR Manager revealed that these corrective action time durations had recently been reduced to support resolution of the cask loadout issue.

Also of concern is that the current schedule logic requires the completion of all project preparations/actions by June 30, 2000, in support of the start of the MSA, which is scheduled to begin July 5, 2000. As discussed in Section 6.0 of this report, in light of other activities within the project that are slipping, the achievement of operational readiness by June 30, 2000, to support the MSA by the scheduled date is highly risk laden.

A review of the draft Contractor POA, dated April 1999 (draft since DOE-RL has not yet reviewed and approved it) found the document complies with the requirements of DOE O 425.1A and the elements recommended by DOE Standard 3006-95. (Note: DOE has not yet initiated the development of their POA but it is expected that this plan will be similar in content and format to the Contractor POA.) Of particular interest is the methodology section of the plan that explains that it is intended to provide guidance for performing the contractor MSA as well as providing the core objectives for both the contractor ORR and the DOE ORR. These core requirements are important to support both teams in the development of their respective ORR implementation plans.

Of concern is the lack of specifics concerning the scope boundaries of the MSA and ORR in existing facilities such as the K Basins. Although boundary activities are described in general terms, the lack of specificity in this area is expected to create misunderstandings and differences in expectations. Experience at similar radiologically-contaminated, older facilities that have been partially upgraded is that independent Review Teams often expect the entire existing facility or systems to meet the latest standards. Of particular concern are existing systems that support not only ongoing operations but also the new systems or operations, e.g., fire protection or radiological monitoring systems. Experience at other DOE sites is that the Review Team will expect the entire systems to meet current requirements unless the FSAR/Authorization Basis or the ORR Plans define the boundaries of where the systems have been upgraded and the justification for not upgrading the existing portion of the systems.

10.4 Recommendations

1. Restore a minimum of 30 days to take corrective actions following each of the three reviews: the MSA, the Contractor ORR, and the DOE ORR. Experience at other DOE site startups suggest 30 days is the minimal amount of time needed to take the necessary corrective actions to resolve findings from these reviews.

2. Resist actions by other project activities to delay or impinge on the July 5, 2000, date to start the MSA. While other project activities are not within the control of the ORR Manager, it is recommended that he resist actions by other activities to impinge on the time intervals needed to conduct the readiness review activities. Delay in the start of the MSA will probably delay the Contractor and DOE ORRs and impact the milestone of November 30, 2000 for the start of fuel movement.

3. Improve the definition of the boundaries of the MSA and ORR in the MSA Plan and ORR POA. This is particularly important in the K Basin portion of these assessments where existing systems are not required for fuel movement or they have not been upgraded to meet current requirements.

11.0 Conclusions

This Review Team has concluded:

- A strong and effective management team is in place, for both the DOE and the contractor organizations charged with accomplishing the SNF Project. Many components of this team are relatively new; however, in the opinion of this Review Team, the Project Team is highly capable and properly focused on meeting the project objectives.

- Considerable progress is evident in the area of baseline management and project controls. Although an area that has received much criticism in the past, the current processes and tools being used are as good as any seen by the Review Team on other DOE projects. The newly installed DOE Business Manager and the FDH Manager of Project Controls appear to be working as an efficient team to ensure that the baseline is well-defined and documented, that progress against the baseline is measured and reported, and that changes to the baseline are properly managed.

- The current cost baseline of $1.72 billion represents an achievable target for the SNF Project. Although risks and uncertainties exist, the contingency allowances included in the baseline, together with the generally conservative assumptions used to estimate the project costs and the apparent opportunities for possible cost reductions, should enable the project to be completed within the framework of this baseline cost estimate, assuming there is no significant extension of the overall project schedule.

- There is considerable schedule risk inherent in the current baseline plan. The risks are especially apparent in the schedule of activities that leads to the November 30, 2000 milestone date for commencement of fuel retrieval operations. The concessions made regarding enforceable milestones in the TPA have significantly reduced the available schedule contingency and that contingency has been used.

Specific, notable risks that may affect the November 30, 2000 milestone, and the recommendations for addressing those risks, are summarized below.

Risk 1: Safety Analysis Reports

Delays in the development (by FDH) and approval (by both FDH and DOE) of the SARs required to complete the SNF Project will have significant impacts on the development of procedures, training of operations staff, and the start-up and eventual operations of the facilities and processes required to move the SNF out of the K Basins. This Review Team has not determined the root cause(s) for the problems noted in the SAR process. However, it is apparent to the Review Team that the current process is not working in an efficient or optimal fashion and, unless the process is improved, the current schedule is very much at risk.

Recommendation

Re-engineer the SAR development and approval process to increase its effectiveness. This recommendation is an ACTION ITEM identified by the Review Team and is assigned to DOE-RL Manager for immediate attention and action.

As the SAR process is evaluated and improved, the following should be considered:

- Root causes should be identified, including causes that reflect problems in design, reviews and verifications, safety analysis, configuration control, quality assurance, or adherence to DOE Orders and requirements.

- The risks that exist while the fuel remains in the K Basins needs to be balanced against the safety risks related to fuel removal operations;

- Except for storage at the CSB, the SNF systems and processes will only operate for a period of approximately three years as opposed to the normal operational life of nuclear facilities;

- A graded application of the DOE requirements may be appropriate for the development and approval of SARs. Such a graded application must address the differences in interpretations that FDH and DOE-RL have concerning the DOE safety order and "Nuclear Regulatory Commission equivalency" requirements.

Risk 2: Transition to Operations

The SNF Project is not prepared to commence operations. Although this is to be expected given the current status of the project, significant risks were apparent to the Review Team. The Review Team noted that:

- Project components have not yet been operated as a full system. Until such operation begins, it is impossible to fully envision all potential problems that may be encountered during start-up.

- The project has experienced difficulties in recruiting and hiring the operations staff needed for operations, and, in the near term, to support start-up and the ORRs.

- The boundaries for the ORRs are not adequately defined. This is potentially a significant issue given that new systems are being installed in an old facility and integrated with existing systems and components.

- The planned durations for the ORRs (and the MSA), and corrective actions resulting therefrom, appear too short when compared to the experience of comparable DOE projects.

Recommendations

- Develop a comprehensive plan for accomplishing the transition from construction to operations. This recommendation is an ACTION ITEM identified by the Review Team and is assigned to the FDH Project Director for immediate attention and action.

- Streamline the hiring process for operations personnel. This recommendation should be accomplished through the collaborative efforts of both DOE-RL and FDH management.

- Plan for early fuel movements in the basins in order to "burn-in" the systems that will be used for fuel movement operations. This recommendation should be accomplished through the collaborative efforts of both DOE's Spent Nuclear Fuels Project Division and the FDH SNF Project Team.

Risk 3: Organization Changes

Disruptions to organizational continuity could impact the ability of the project to meet the November 30, 2000 milestone. The project has experienced significant and repetitive changes to key management positions in recent years. At this time it appears that a suitable and qualified team is in place and stability in the project organization may be more important than changes to address perceived organizational weaknesses or deficiencies.

Recommendation

Focus on stabilizing the project organization and minimize the effects of organizational changes, especially for key positions. This should be an overriding objective of both DOE-RL and FDH management.

Risk 4: Quality Assurance Standards for Baskets and Multi-Canister Overpacks

Uncertainty related to the applicability of the RW-0333P QA standard for the fuel baskets and MCOs could impact procurements and subsequent deliveries of these critical components. This risk is especially important at this time since the procurement action for the MCOs is now underway and an award is imminent. If resolution of this issue is not accomplished until after the contract is awarded, and the direction then differs from the assumed basis for the contract award, there may be significant schedule and cost impacts.

Recommendation

Resolve the RW-0333P QA issue for the MCOs and fuel baskets prior to procurement. This will require EM Headquarters to make a decision, based on the best available information, and provide appropriate direction to the Project Team.

Risk 5: QA Corrective Actions

The effect of the QA problems identified by DOE, and the likelihood of a resulting Compliance Order, may have an adverse impact on the project schedule. It is possible that the required corrective actions may result in delays for various project activities. There is also a risk of delay due to welding quality issues.

Recommendation

Plan for accomplishing required corrective actions within the constraints of the current project schedule. FDH project management should identify work-arounds and contingent approaches as appropriate to maintain the current schedule to the maximum extent possible.

Post-2000 Risks

In addition to the above risks that may impact on the November 30, 2000 milestone, there are many risks and uncertainties that could affect the project's ability to complete all fuel movements by December 2003 as required by the TPA. These include the implementation of a first-of-a-kind system on a production basis, the radiological conditions in K East Basin, the unproven design for the water treatment system, and the Reliability, Availability, and Maintainability (RAM) of the overall system.

Recommendations

- Re-examine the overall system RAM and operational efficiency. The SNF Project Team should consider augmenting system capability where appropriate and possible if such a need is identified by the RAM analysis.
- Enhance the planning (and level of detail thereof) for those project activities required after the November 30, 2000 milestone including opportunities for both cost and schedule savings related to sludge removal and disposal operations. The FDH project management team should begin such planning in the very near term, so as to maximize the usefulness of these plans.

Finally, the Review Team wishes to thank all SNF Project personnel for their cooperation and openness that helped to make this review a success. It is believed that implementation of the recommendations resulting from this review should enhance the possibility for project success.

APPENDIX A

APPENDIX B

BIOGRAPHIES OF REVIEW TEAM MEMBERS

GARY ABELL

Mr. Abell is currently a Manager in the Systems Engineering Department of the Projects, Engineering and Construction Division of the Westinghouse Savannah River Company. Mr. Abell holds a B.S. and M.S. in Metallurgical Engineering. In addition to the seven years involved in applying the systems engineering process to Savannah River Site (SRS) projects, he has 22 years experience in the commercial nuclear field. Mr. Abell has held several managerial positions in which he was responsible for engineering and technology development of equipment and processes to test their effectiveness. Mr. Abell has applied systems engineering in developing the Heavy Water Reactor option of the New Production Reactor program; served as Project Engineering Manager for the design of the Commercial Light Water Reactor Tritium Extraction Facility; and served on the HLW Salt Disposition Systems Engineering Team chartered to identify and evaluate alternative solutions to the In-tank Precipitation Process at SRS.

Mr. Abell has been the recipient of the George Westinghouse Signature Award for his knowledge of, and team leadership in, implementing the systems engineering process on a large and complex project. He is a member of the International Council On Systems Engineering and holds two patents.

JAMES E. BARRY, P.E.

Mr. Barry has over 32 years of experience in the management of construction, engineering, maintenance and technical services organizations and projects worldwide. His diverse experience base includes the fields of power, industrial, manufacturing, infrastructure, hydrocarbons, mining and metals, pharmaceuticals, and bridges and prestressed concrete. For over a decade, Mr. Barry has resided outside the continental U.S. in six different international locations and has had organizational and project responsibilities in 20 countries. Mr. Barry has a B.S. in Civil Engineering and is a registered Professional Engineer in California.

Most recently, Mr. Barry served as President and CEO of Fru-Con Construction Corporation, a $420 million per year, full-service engineering, procurement, construction and technical services company. Previously, as Vice President and General Manager of the Power Services Business Unit of Fluor Daniel, Inc., Mr. Barry had total operating and profit and loss responsibility for a $350 million per year unit that provided engineering, construction and maintenance services on nuclear and fossil power plants for the electric utility industry throughout the U.S. In addition, Mr. Barry specializes in project management, construction management, construction engineering, contract administration and project controls. He has also managed organizations that provide construction, maintenance, and outage support for nuclear and fossil-fired power plants. Mr. Barry served as an officer in the U. S. Navy Civil Engineer Corps in Vietnam and Europe.

WILLIS W. BIXBY, JR., PH.D.

Dr. Bixby has 24 years of experience in the Department of Energy (DOE) and Nuclear Regulatory Commission (NRC) nuclear programs. Dr. Bixby has a Ph.D. and M.S. in Nuclear Engineering and a B.S. in Chemical Engineering. He has served as the Deputy Assistant Secretary of Energy for Site Operations and for Facility Transition and Management; as Deputy Manager for the DOE Richland Operations Office; and as Director of the DOE West Valley Demonstration Project. He has also served as Manager of the DOE Office at Three Mile Island and as Branch Chief of the DOE Idaho Operations Office.

Dr. Bixby has demonstrated skills in analyzing and resolving technical problems with experience in all phases of large nuclear and environmental cleanup projects. He has established the program responsible for the safe shutdown of key DOE weapons production facilities; managed the removal, packaging, and transportation of Special Nuclear Material remaining after production operations; and managed the program responsible for shipping the damaged fuel from Three Mile Island Unit 2 to the INEEL. Dr. Bixby also managed the development and implementation of the safety approach for the pretreatment and vitrification of liquid high level waste at the DOE's West Valley Demonstration Project.

JAMES G. BURRITT, P.E.

Mr. Burritt has 37 years of management and technical experience in the nuclear and maritime industries. He has an M.S. in Management and a B.S. in Metallurgical Engineering. As General Manager of Newport News Industrial Corporation, Mr. Burritt had total authority and responsibility for the operation of an $18 million company involved in manufacturing and field operations that provided equipment, technical services, and industrial services to the commercial electric power, petrochemical, and process industries. As Manager of Test Engineering for Newport News Shipbuilding, he directed a staff of 250 engineers and technicians in conducting the new construction test program for submarines and aircraft carriers. While serving in the Navy, he commanded the Naval Ship Systems Engineering Station that performed test, evaluation; and in-service engineering. The station had 1700 scientists, engineers, and technicians, and an annual budget of $160 million.

Mr. Burritt has an extensive background in performance evaluations, inspections, and program development. He developed the program architecture for the external independent review of the TWRS Privatization Program Phase 1B1, the design and financing phase. He has led or participated in four readiness reviews to proceed with the design and demonstration phase of the plutonium reprocessing tank waste retrieval system (TWRS) phase 1A. In addition, Mr. Burritt has conducted an independent evaluation of the effectiveness of the International Nuclear Safety Program in the countries of Bulgaria, Lithuania, Czech Republic, Slovak Republic, and Hungary for DOE and the U. S. Agency for International Development (USAID). He has also served as a member of the U.S. Management and Technical Team which evaluated the Russian design changes involved with converting three plutonium production reactors to energy producers only.

THOMAS R. CLOUD

Mr. Cloud has 25 years of experience in project management, construction management, project engineering, and construction evaluation. Mr. Cloud has a B.S. in Construction Engineering. As Project Manager/Business Development Manager for J.A. Jones Construction Services, he has managed the mobilization and implementation of the long-term incremental decommissioning project at the Rancho Seco Nuclear Generating Station near Sacramento, CA; served as a technical consultant in preparing and packaging subcontractor scopes of work for various demolition projects at Rocky Flats Environmental Technology Site; and served as Project Manager, responsible for overall construction management and coordination during design and construction of eight high level nuclear waste storage tanks at the DOE Hanford Site.

As Vice President/Construction Manager for the Rocky Flats Project, Mr. Cloud was responsible for overall site management of construction activities at the Rocky Flats Environmental Technology Site (RFETS). Since the curtailment of plant production activities in 1989, responsibilities shifted to increased overall management of deactivation, decontamination, decommissioning, and demolition of nuclear material processing equipment and facilities throughout the former plutonium production buildings at RFETS.

LEWIS B. (BEN) GANNON, P. E.

Mr. Gannon is an experienced Professional Engineer with over 25 years of experience in nuclear facility design, construction, operations and project management that includes nuclear power generating plants, nuclear fuel reprocessing facilities, nuclear waste management operations, and defense nuclear materials productions operations. His experience ranges from structural design of nuclear generating facilities to project management of a number of multi-million dollar defense materials production/processing and high-level waste management facilities. Mr. Gannon has a M.S. in Environmental Management and a B.S. in Civil Engineering.

Mr. Gannon has over 13 years experience with the Department of Energy where he was responsible for a number of large and diverse programs within the Offices of Nuclear Materials Production and Defense Waste and Transportation Management. These duties included preparation and review of numerous environmental, safety and health programs and documents as well as directing a staff in the management of the nuclear waste management programs being conducted at various DOE Operations Offices.

Mr. Gannon's more recent experience includes managing Science Applications International Corporation (SAIC) professionals in providing waste management technical support to the DOE Office of Waste Management as well as providing direct technical support to numerous DOE Field Offices in the waste management and nuclear fields. This experience includes participation in numerous Operational Readiness Reviews and Technical Safety Appraisals for DOE facilities at DOE sites such as LLNL, WIPP, DWPF, WVDP and Hanford.

CHRISTOPHER O. GRUBER

Mr. Gruber has approximately 25 years of experience in all facets of cost engineering, cost management, and project management and control for engineering and consulting organizations. He has an M.B.A. in Finance, a B.A. in Business Economics, and is a certified cost engineer. Mr. Gruber's vast experience includes environmental restoration, hazardous and radioactive waste management facilities and operations, utility engineering and construction, nuclear facility modifications, synthetic fuels development, petroleum refinery construction, and reviews of DOE engineering, construction, operations, and high technology projects and programs.

Mr. Gruber has participated on independent reviews or cost assessments of many DOE programs, including an assessment of the Environmental Restoration Program; Defense Programs Rapid Reactivation Project; and Project EM - an independent assessment of DOE's Environmental Management Program and all DOE sites and field offices. Mr. Gruber has also developed Standard Operating Practices and Procedures and Performance Indicators for DOE's Waste Management Program. In addition, he has developed a cost estimating manual and associated guidance documentation for the Yucca Mountain Project and developed program-level policy and guidance documents covering cost and schedule estimating throughout the Civilian Radioactive Waste Management Program.

ANAND P. GUPTA

Mr. Gupta has 36 years of experience in Project/Program Management, Construction Management, Cost Analysis and Cost Estimating. He is a Professional Engineer. He has two Masters' degrees, one in Environmental Engineering, and the other in Soil Mechanics and Foundation Engineering; and two Bachelors' degrees, one in Civil Engineering and the other in Science with majors in Physics, Mathematics and Statistics.

As an Engineer with the Department of Energy, Mr. Gupta is in program management and has conducted Independent Cost Estimates (ICEs), reviewed baselines, and developed program/project management policies. As an engineer with the Voice of America (VOA), he analyzed construction and development budgets for the VOA modernization, maintenance and repairs programs. He also developed rough order of magnitude estimates for budget purposes and review construction estimates from Architects and Engineers for modernization, and maintenance and repairs activities.

DAN GUZY, P.E.

Mr. Guzy has 27 years of government and private sector experience as a manager and supervisor in his areas of expertise: safety analysis, seismic design, and mechanical/structural engineering. He holds three degrees in mechanical engineering, obtained from the University of Maryland and M.I.T. He is a member of the American Society of Mechanical Engineers and is registered as a Professional Engineer in the State of Maryland.

Currently, Mr. Guzy is a safety engineer in DOE/EH's Office of Facility Safety Analysis (EH-3). He has participated in the Office of Environment, Safety & Health's (EH's) and DOE field office reviews of BNL's HFBR, INEL's Pit 9 Facility, SRS's F-Canyon, and proposed privatized waste treatment facilities for Hanford's high level waste tanks. He was a member of SAR and BIO review teams for BNL's HFBR, ORNL's Vault Building, Hanford's WESF facility, Sandia's Hot Cell Facility, and the Mound site, and has participated in numerous accident analysis reviews of EIS's and EA's.

Mr. Guzy was a key participant in DOE's Spent Fuel, Plutonium, and Highly Enriched Uranium Vulnerability Assessments. He has been a member of DOE committees to establish natural phenomena hazard evaluation criteria and is currently participating on the ANS Committee 2.26, Classification of Nuclear Materials Facilities for Natural Phenomena Hazards. While in the Office of Nuclear Safety (ONS) he participated in ONS's safety assessments of nuclear facilities. Mr. Guzy led the ONS restart assessment of the High Flux Beam Reactor and the Spent Fuel Working Group's vulnerability assessments of West Valley and Brookhaven.

TEH HSIEH

Mr. Hsieh has ten years of experience in ensuring nuclear safety at various DOE facilities which included reviewing numerous safety analysis reports (SARs), sometimes together with technical safety requirement (TSR) for facilities handling nuclear material (including fissile material), explosive, nuclear waste, and hazardous chemicals. Duties included participation in the review, development, implementation, and appraisal of programs related to SAR, TSR, USQ, seismic resistant design, seismic safety assessment, surveillance, and recommendation of corrective actions for deficiencies and safety issue resolutions.

At the Savannah River Site, Mr. Hsieh led the Safety Evaluation Report (SER) team to review the Chapter 15 Accident Analysis of the Updated SAR for the K-Reactor. The review team consisted of national nuclear safety experts independent of the management and operating contractor, Westinghouse Savannah River Company, namely senior engineers from DOE including the Office of Nuclear Safety, supporting contractors, and national laboratories (LANL and INEEL).

Mr. Hsieh also supported other DOE sites as a subject matter expert in nuclear safety. For example, he participated in the nuclear weapon safety program appraisal at Sandia National Laboratory, the nuclear criticality review of the Spent Fuel Program at SRS, and the EM vulnerability assessment of low level nuclear waste hazards at Fernald.

PETER J. KLEMKOWSKY

Mr. Klemkowsky is currently with the U. S. Department of Energy (DOE) at the Federal Energy Technology Center (FETC), Energy and Environmental Services Division, supporting product services for the Center for Acquisition and Business Excellence. In the past 14 years, he has been involved with technical management related to capital infrastructure projects in both public and private sector organizations. Over the last seven years, he has been active in departmental reviews and management initiatives for External Independent Assessments, facility deactivation, materials in inventory, nuclear materials disposition, business management and project management processes. Prior to DOE activities, Mr. Klemkowsky was a program/project manager for capital improvement projects ($250 million) on both state and local levels with the State of Maryland. As a participant on project teams, Mr. Klemkowsky has been responsible for project development and planning, baseline development, design, construction, inspection services, and project management controls. He has a B.S. degree from Western Michigan University.

THAD T. KONOPNICKI, P.E. (COMMITTEE CHAIR)

Mr. Konopnicki has over 21 years of experience in government and private industry in the areas of program/project management, strategic planning, and cost and schedule control. He has an M.S. in Electrical Engineering, an M.B.A. in Finance, and a B.S. in Mechanical Engineering. In addition, Mr. Konopnicki is a Registered Professional Engineer and has certification in the areas of strategic planning and cost engineering.

For 11 years, while working in private industry, Mr. Konopnicki performed cost analysis, cost research, and cost modeling for the Army, Navy, Air Force, and the Department of Defense. While with Bechtel Power Corporation, Mr. Konopnicki managed the Management Information Group responsible for estimating, monitoring, and controlling costs associated with the design, procurement, and construction of fossil and nuclear power generating stations.

At the Department of Energy, Mr. Konopnicki is leading the establishment of a new Project Office to perform Independent Project Reviews on behalf of the Assistant Secretary for Environmental Management. Previously, he led EM's Privatization Program, a $1B+ program which emphasizes fixed-price contracting and innovative financing as a major part of the Department's Contract Reform and Performance-Based Contracting effort.

RAM B. LAHOTI, P.E.

Mr. Lahoti has over 33 years of experience in government and private industry in project management, quality assurance, and design and construction management of environmental waste management projects. He also has over 24 years of management and supervisory experience. Additional areas of experience include: high level nuclear waste repository, nuclear power plant design, heavy structural metal and non-metal, and transportation projects. Mr. Lahoti has a Masters Degree in Civil Engineering and is a registered Professional Engineer in Structures and Civil Engineering in the State of Pennsylvania.

Mr. Lahoti has over 19 years with the Department of Energy as projects Team Leader managing the capital projects for the Office of Waste Management. He is currently detailed to the proposed Office of Project Management. He has held positions as Director of Solid and Liquid Waste, Director of the Construction Management Division, Director of Quality Assurance for OCRWM-HQ, branch chief for Underground Facilities for Yucca Mountain Project, Director of Analysis and Evaluation Division for the Salt Repository Project, and Branch Chief for Design, Construction, and In Situ Testing for the Salt Repository Project. Mr. Lahoti has managed multi million dollar efforts in the areas of geosciences; exploratory shaft and repository designs; research, development, design and prototype testing of waste packages and equipment; and development of codes and models.

David J. Pepson

Mr. Pepson has 25 years of chemical engineering experience in government and private industry in the areas of process engineering, project engineering, and hazardous and radioactive waste treatment. He has a B.S. in Chemical Engineering. Mr. Pepson's experience includes serving as project manager for the design and start-up of a plant wastewater treatment system, as project manager to develop a fully automated system to burn by-product hydrogen, and as Process/Project Engineer and Area Production Supervisor in chlorine/caustic manufacturing. His responsibilities included conducting "what-if" safety analysis and developed risk contingency start-up plans for major production outages.

As a government employee at the Environmental Protection Agency, Mr. Pepson led numerous site operational reviews of wastewater and hazardous waste treatment systems for the purpose of establishing Best Available Technology industry regulations. He also directed treatment evaluation studies at electroplating facilities, semiconductor manufacturers, and copper forming.

At the Department of Energy, Mr. Pepson has served as Program Manager for the Tank Waste Remediation System (TWRS) and the Idaho High Level Waste Program. He has co-led a major Systems Engineering Review of the TWRS project. In addition, Mr. Pepson has worked with the National Academy of Sciences on an International Vitrification Workshop.

Clifford F. Poor, Ph.D., P.E.

Dr. Poor has 39 years of technical and management experience in the investor-owned and government nuclear and environmental sectors. He has a Ph.D. in Chemical Engineering and is a Certified Professional Engineer in Nuclear Engineering. Dr. Poor has managed complex projects and programs requiring the coordination of interacting companies, organizations and multi-disciplinary groups to accomplish design, development, construction, testing, operation, decontamination and decommissioning, and environmental restoration of nuclear facilities and sites.

Dr. Poor has extensive experience in working within the Department of Energy (DOE) environment, knowledge of DOE regulations and orders and a proven ability to develop, understand and adapt to new technologies. He has worked at Hanford, Idaho National Engineering and Environmental Laboratory, Grand Junction Project Office, Lawrence Livermore National Laboratory, and DOE Headquarters. He has in-depth experience on government-owned and commercial nuclear power plants including technical support services, program/project management of major plant modifications, plant start-up and operational readiness, plant systems simulation studies, process development, computer applications to plant control systems and outage management, and environmental restoration and waste management.

GUY JOHN SCANGO, P.E.

Mr. Scango has 35 years of program/project management experience in both private industry and government with a comprehensive "hands-on" background in planning, design, construction, and operation of large programs and complex projects. He has a B.S. in Mechanical Engineering and is a registered Professional Engineer. Mr. Scango has a comprehensive knowledge of the DOE baselining process, including establishing/assessing tiered technical, cost and schedule baselines, and establishing thresholds for approval at the next higher level. He is experienced in conducting independent cost estimates, development/assessment of resource loaded schedules, development/assessment of Basis of Estimates, assessment of overhead costs, and determination of cost range and contingency through risk analysis of R&D/new technology.

As a DOE employee, he has served in the Office of Civilian Radioactive Waste, Office of Field Management, and in the Superconducting Super Collider program. Mr. Scango has participated in an independent review of the Tank Waste Remediation System at the Hanford Site; managed Independent Cost Estimates on over 40 Programs, including the Nuclear Waste Stockpile Program and the $5.3 billion Environmental Cleanup Program. At the DOE Secretary's direction, Mr. Scango organized and led a team of 75 individuals in a baseline validation of the $8.4 billion Superconducting Super Collider Program.

As an independent consultant, Mr. Scango has completed tasks including the Strategic Petroleum Reserve Readiness Review, Rocky Flats Ten-Year Plan Review, Accelerator Production of Tritium risk analysis, Brookhaven Graphite Reactor deactivation, and a Spallation Neutron Source Independent Review.

LARRY VAUGHAN

Mr. Vaughan has over 19 years of experience in the Quality Assurance/Management arena as a Nuclear Quality Assurance Engineer/Manager/Advisor. He is a Quality Assurance Specialist with a strong technical background in nuclear waste management, team leadership, consensus building, and quality management. Mr. Vaughan has a B.A. in Mathematics and is a member of the American Society of Quality Control.

Mr. Vaughan has 10 years of experience with the Department of Energy. He is currently serving as a Quality Assurance Advisor to the Assistant Secretary for the Office of Environmental Management. He is responsible for providing quality assurance/management support to EM organizations, advising, evaluating, and reporting on the effectiveness and efficiency of EM QA management activities. He represents the Office of the Assistant Secretary on the Working Capital Fund Board, the DOE-wide Quality Assurance Working Group, and the DOE Rule Implementation Steering Group.

Mr. Vaughan has served as team leader on two successful efforts for DOE and EM. He was team leader for the DOE Nuclear Safety Management Rule, 10 CFR 830.120 "Quality Assurance Requirements," which was the first cross-cutting team to address development, review and approval of rule implementation plans and programs. He also led the development of the first EM Quality

Award Application for the DOE Energy Quality Award Program. As a result, EM was awarded the "Commendation Quality Award" for outstanding startup efforts in the area of Total Quality Management. Mr. Vaughan has also served as the EM Price Anderson Amendment point-of-contact, providing guidance on PAAA policies to EM senior management, staff and Field elements. In addition, he has reviewed and analyzed field reports and contractors' documents containing information regarding suspect/counterfeit items to address issued raised by the Office of Inspector General.

W. LEE WILLIAMS, P.E.

Mr. Williams has over 25 years of experience with the Department of Energy. He has over 14 years of experience as a Project Manager with a strong background in cost estimating and value engineering. Mr. Williams has a B.S. in Construction Management and is a Certified Professional Engineer. Mr. Williams has extensive experience in Independent Project Validations and Peer Reviews across the Department. In addition, he has participated on many Departmental Committees on project management, cost reduction, pollution prevention, high level waste, and other program related activities.

At the DOE Idaho Operations Office, Mr. Williams has served as program lead for construction management processes; the Architect Engineering Program, the Cost Estimating Program, Value Engineering Program, and the Project Validation process. In addition, he has served as Senior Project Manager and mentor for Idaho Project Managers, Matrix Group Manager for Project Managers, and managed numerous projects including Major System and Major System Acquisition level projects.

APPENDIX C

DOCUMENTS REVIEWED

Technical

- SNFP Summary Process Flow Diagrams, May 1999
- *Functional Design Criteria (FDC) for the K West Basin IWTS*, SD-SNF_FDC-003
- *Functional Design Criteria (FDC) for the K East Basin IWTS*, SD-SNF_FDC-002
- *Fiscal Year Production vs. Funding Profile (MCOs and Baskets)*, draft, February 17, 1999.
- *Spent Nuclear Fuel Multi-Canister Overpack Fuel Scrap Basket Shop Floor Fabrication Lessons Learned Session*, August 12-13, 1998, Ares Corporation, September 9, 1998.
- *Spent Nuclear Fuel Multi-Canister Overpack Scrap Basket Fabrication/Quality Assurance Program Lessons Learned Session*, August 12-13, 1998, Ares Corporation, September 9, 1998.
- WHC-SD-SNF-FRD-011, Revision 0, *Spent Nuclear Fuel Cask and Transportation System Functions and Requirements*, July 1996.
- WHC-SD-SNF-FRD-016, Revision 0, *Spent Nuclear Fuel Multi-Canister Overpack Technical Functions and Requirements*, May 1996.
- *K West Basin IWTS Safety Assessment Document*, HNF-SD-SNF-SAD-002
- *Assessment Report: Quality Assurance Review of Office of Civilian Radioactive Waste Management Requirements Implementation*, May 20, 1998.
- Memo, C.A. Hansen, Assistant Manager for Waste Management, DOE-RL, to D.G. Huizenga, Associate Deputy Assistant Secretary, EM-60, DOE-HQs, *Potential Issues Associated with the Disposal of N Reactor and Single Pass Reactor (SPR) Spent Nuclear Fuel (SNF) in a U.S. Department of Energy (DOE) Deep Repository*, November 10, 1998.
- Memo, C.A. Hansen, Assistant Manager for Waste Management, DOE-RL, to R.D. Hanson, Fluor Daniel Hanford, Inc., Contract No. DE-AC06-96RL13200—Modification of Spent Nuclear Fuel (SNF) Project Standards/Requirements Identification Documents (S/RIDS) Relative to Office of Civilian Radioactive Waste Management (OCRWM) RW-0333P, Quality Assurance (QA) Requirements Description (QARD), November 16, 1998.
- Memo, R.D. Davis, NSNF Quality Assurance Program Manager, to R.W. Clark, Office of Quality Assurance, *Hanford Procurement of Multi-canister Overpacks (MCOs) (OPE-SFP-99-089)*, April 2, 1999.

- DOE O 425.1A, *Startup and Restart of Nuclear Facilities*, U.S. Department of Energy, Washington, DC, approved December 28, 1998.

Cost

- *Baseline, Subproject Basis of Estimate Book*, Fluor-Daniel Hanford, Inc., January, 1999 (32 Volumes).
- Contingency Requirements for SNF Project, BCR SNF-98-058, November 9, 1998
- SNF Contingency Analysis, FDH-9950387, Letter Williams to Hansen, January 19, 1999
- Cost Drivers Analysis for SNFP, BCR SNF-98-058, December 10, 1998
- *Critical Analysis of the SNF Project's Activity-Based Cost Estimating, Final Phase 2 Report*, by Professional Analysis, Inc. Sept. 30, 1998
- *(O1) COA Summary* – printed 5/19/99

Schedule

- Schedule Management Procedures
- Level II Schedule (Current vs. Baseline)
- Level III Schedule (Current vs. Baseline)
- Subtask Schedules
- Critical Path Activities (Rev. 5B)
- Near Critical Path Activities (<30 day float)
- Critical Path Status Summary Memorandum
- Completion Date/Not Complete Activities
- CSB Startup Detail Schedule (Level IV)
- CVD Detail-Testing Schedule (Level IV)
- Spent Nuclear Fuel Project Multi Year Plan, SNF-SP-104, November 98

Management

- Memorandum of Understanding, Completion and Acceptance for the Spent Nuclear Fuel Project, May 3, 1999 Revision
- HNF-3552, *Spent Nuclear Fuel Project Execution Plan*, Revision 0.A, dated March 17, 1999.
- Project Management Plan 200 Area
- MOU Completion and Acceptance for SNF
- SNF Project Organization Charter, HNF-3552, Rev. 0.8, April 12, 1999
- Spent Nuclear Project Operational Staffing Plan, December 1998
- Programmatic Assumptions, Volume I, Section 5
- WBS Dictionary
- Baseline Change Proposal, BCR SNF-1999-059
- DOE RLID 425.1, *Startup and Restart of Facilities Operational Readiness Reviews and Readiness Assessments*, U.S. Department of Energy, Richland Operations Office, Richland, WA.
- *Spent Nuclear Fuel Project Final Safety Analysis Report*, HNF-3553, Rev. 0, February 11, 1999, Vol. 1 – SNF Project FSAR—Annex A (Vol. 2) – Canister Storage Building FSAR & TSR.
- February 12, 1999 letter from H.E. Bilson (DOE-RL) to R. D. Hanson (Fluor Daniel Hanford, Inc.) approving the Safety Analysis Report for Packaging (SAR), HNF-SD-TP-SARP-017, Rev. 1.
- HNF-2039, Revision 1, *Management Self Assessment*, Draft, May 1999.
- HNF-SD-SNF-POA-001, *Plan of Action for the Spent Nuclear Fuel Project Fuel Handling and Process Operations Operational Readiness Review*, Draft, April 1999.
- NSNF QA Staff Memo, D. Truman, NSNSF, to R. Davis, *Observation of the Project Hanford Management Contract (PHMC) Independent Program Assessment Audit*, IPA-98-05, March 6, 1998.
- Risk Comparison R2c report (original and quarterly updated) (by status), May 19, 1999
- Systems Engineering Management Plan, HNF-DS-SNF-SEMP-001, Draft Rev. 2
- SNFP Midyear Project Review, May 19, 1999

PERSONNEL INTERVIEWED

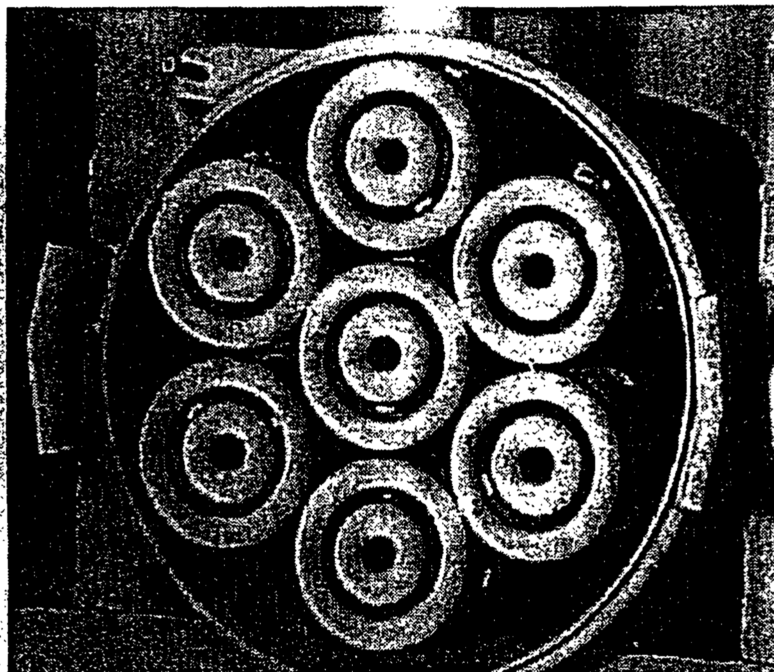
Ken Bergsman	Design Authority for IWTS, FDH SNF Project
Pete Blair	Project Controls Manager, FDH SNF Project
Jack Cloud	Project Manager for the MCO/Basket Procurements and Cask Transportation, FDH SNF Project
Michael Cowen	Westinghouse Safety Management Solutions, senior consultant to Nancy Williams
Jeff Daniels	Operations Control Team Leader, FDH SNF Project
Sid Daughtridge	Project Manager, CSD, FDH SNF Project
Joe Escamillo	Operations Project Manager, SNF Project Division, DOE-RL
Eric Gerber	Integration Projects Manager, FDH SNF Project
Ron Hanson	President and CEO, FDH SNF Project
Bob Hiegel	DOE/RL/SNFP, SNFP Technical Integration and Support Manager, lead for SER reviews for K-Basin SADs, and for acceptance review of CSB & CVD phased SARs, CSB FSAR/TSR, and MCO Topical Report
Pete Hinojosa	Consultant, Operations Office, FDH SNF Project
Marty Hinton	DOE/RL/SNFP – reviewer for CSB & CVD phased SARs and CSB FSAR
Linda Inions	Cost Analyst, FDH SNF Project
Jeff Johnson	Cost Analyst, FDH SNF Project
Jim Klos	Manager of Operational Readiness Reviews and MSA, FDH SNF Project
Phil Loscoe	Acting Director, SNF Project Division, DOE-RL
Jim Mathews	K-West Operations Manager, FDH SNF Project
Roger McCormack	Project Manager 200 Area ISA, FDH SNF Project
Bill Miller	Engineering Manager (Chief Engineer), FDH SNF Project
Greg Morgan	DOE/RL/SNFP – reviewer for K-Basin SADs, FDH SNF Project
Robert Morgan	(DESI), Manager of Nuclear Safety for FDH SNF Project
Carroll Phillips	Consultant, Schedule/Construction , FDH SNF Project
Jeff Rampon	Cost & Scheduling Reporting Manger, FDH SNF Project
Gwen Risenhoover	Baseline Management Manager, FDH SNF Project
Jean Schwier	Business Operations Project Manager, SNF Project Division, DOE-RL
Walter Scott	DOE/RL/ES&H, leader for DOE-RL SER reviews of CSB & CVD phased SARs, CSB FSAR/TSR, and MCO Topical Report
Dean Siddoway	Construction Projects Manager, FDH SNF Project
Bill Smoot	Quality Assurance Manager, DOE-RL
John Truax	Deputy Operations Manager, FDH SNF Project
R. W. Rasmussen	Project Manager for IWTS, FDH SNF Project
Dave Van Leuven	Executive Vice President and COO, FDH SNF Project
Judy Wells	Integrated Management Systems & Reports, FDH SNF Project
Jim Wickes	Operations Manager, FDH SNF Project

Bob Wilkinson	Schedule Manager, FDH SNF Project
Robert Willard	Manager of Contracts, FDH SNF Project
Nancy Williams	Project Director, FDH SNF Project

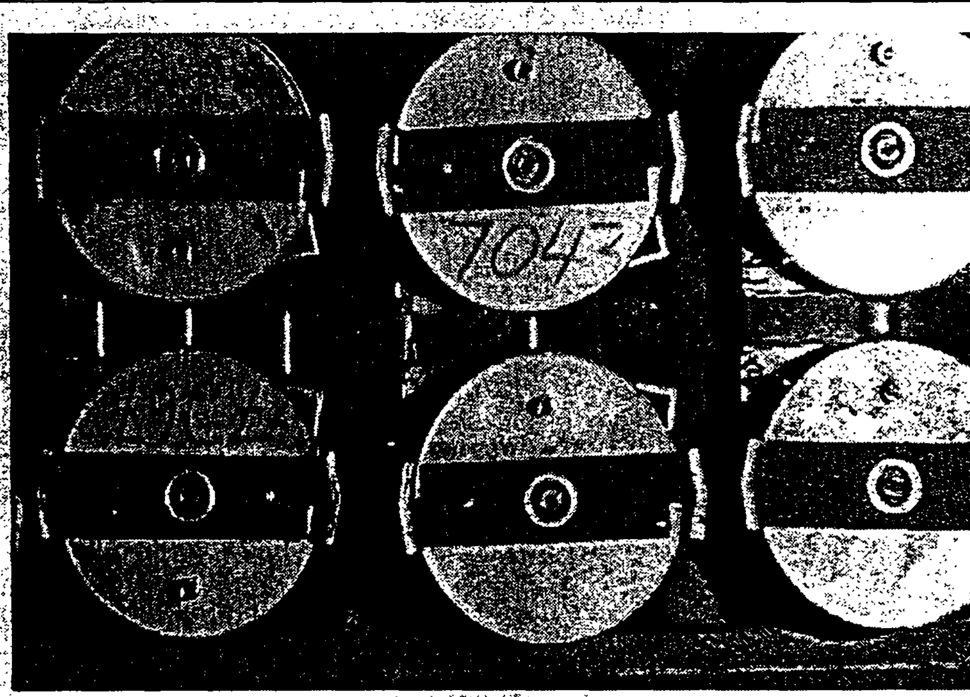
APPENDIX E

APPENDIX E

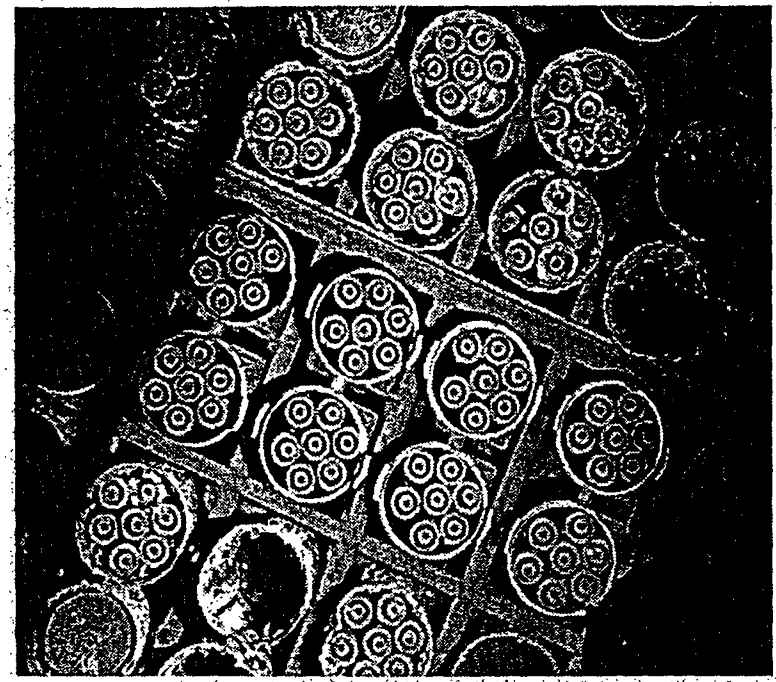
Photographs and Illustrations



Intact Fuel in the Basin

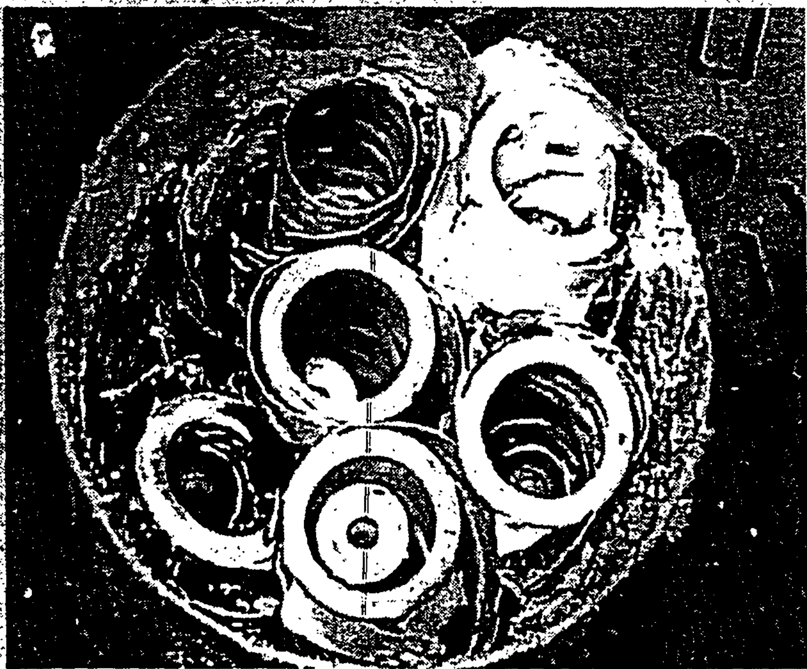


Fuel in K West Basin Encapsulated (lids on)

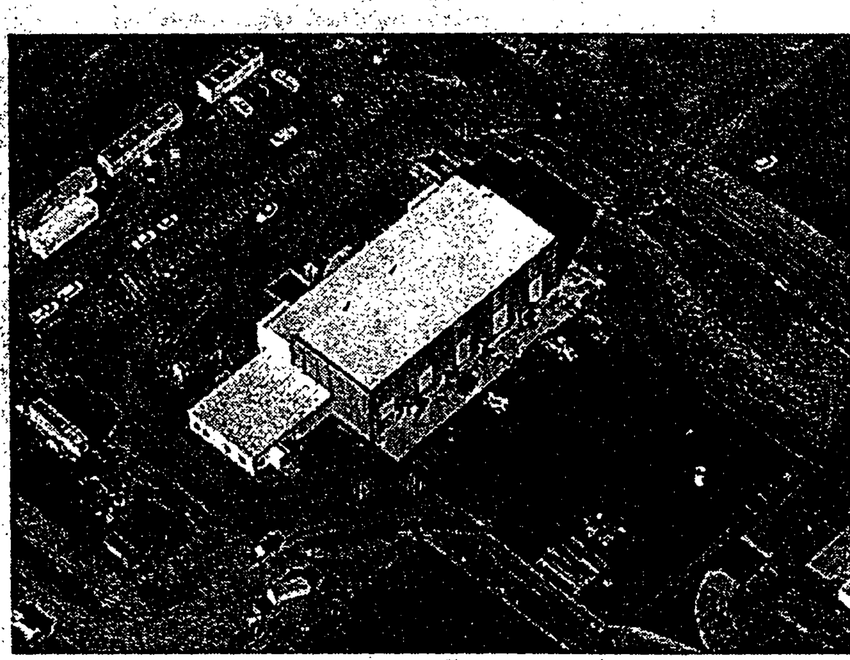


Multiple Fuel Canisters in K East

Bad Fuel in the K Basins

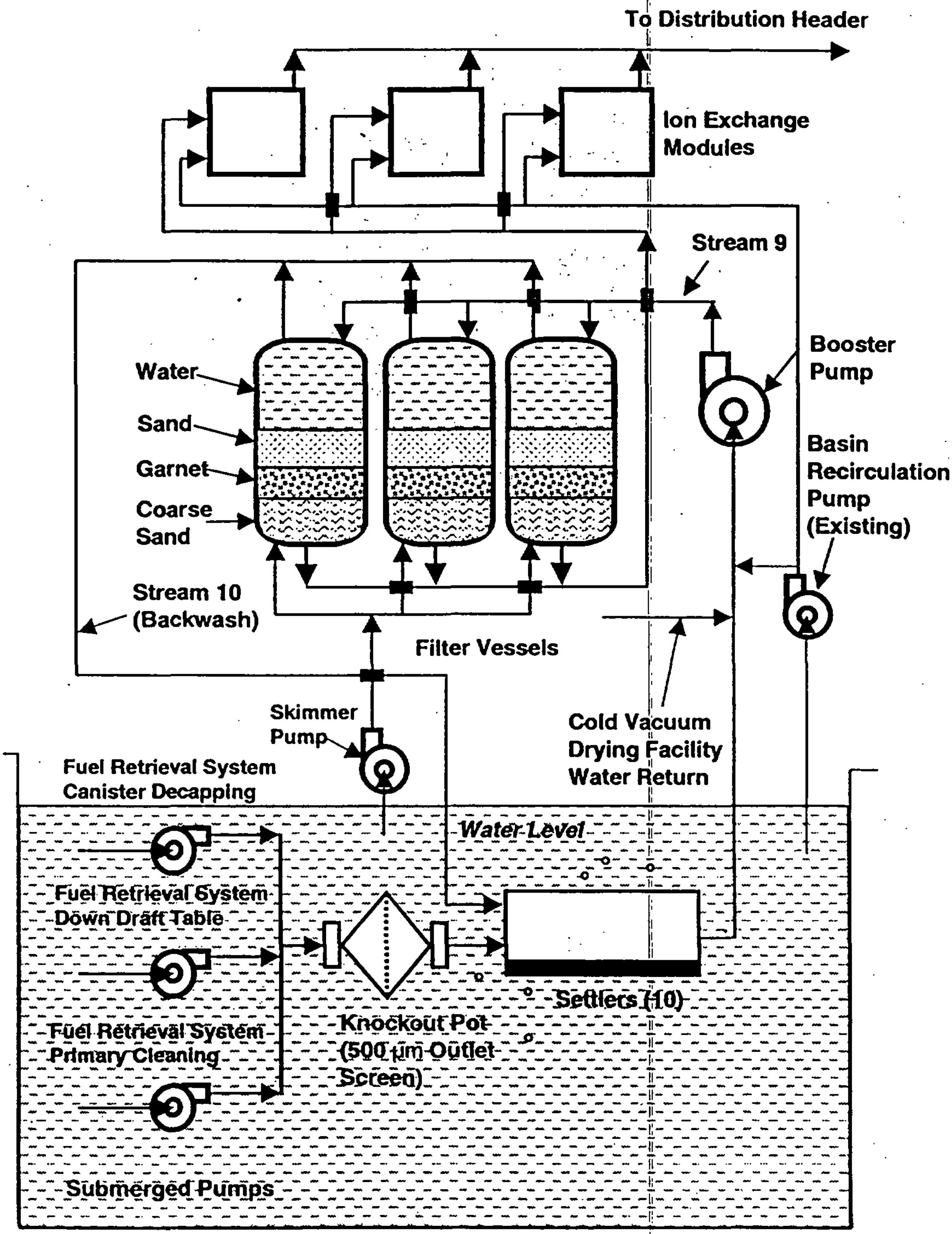


Fuel Basket on the Left and Scrap Basket on the Right

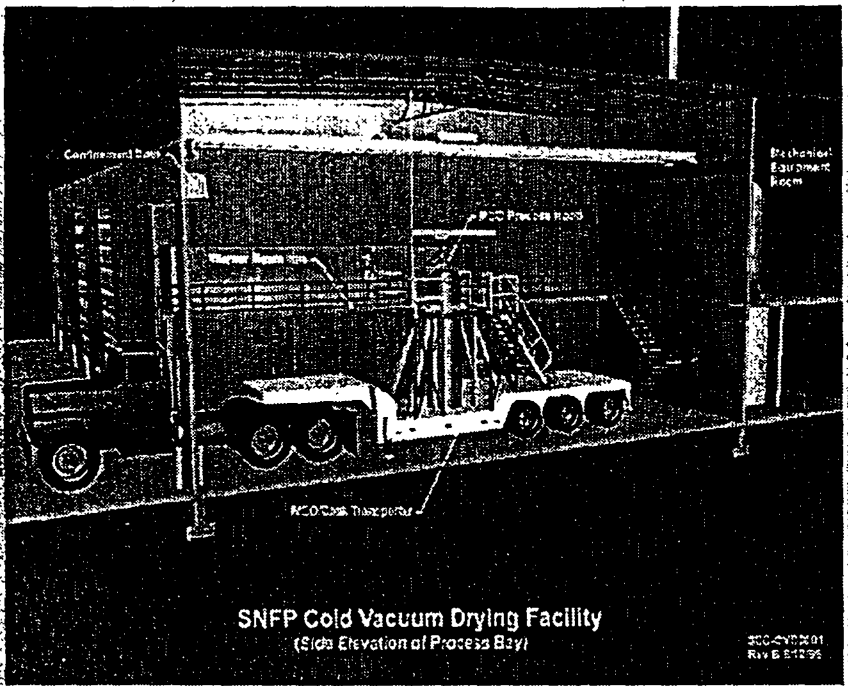


Aerial Shot of the CVD Facility in 100K

Integrated Water Treatment System Schematic Flow Diagram

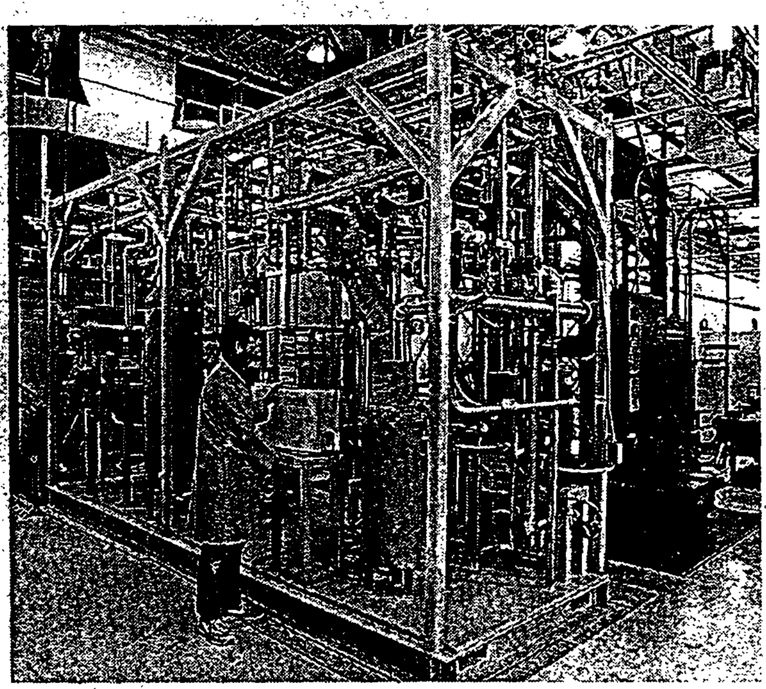


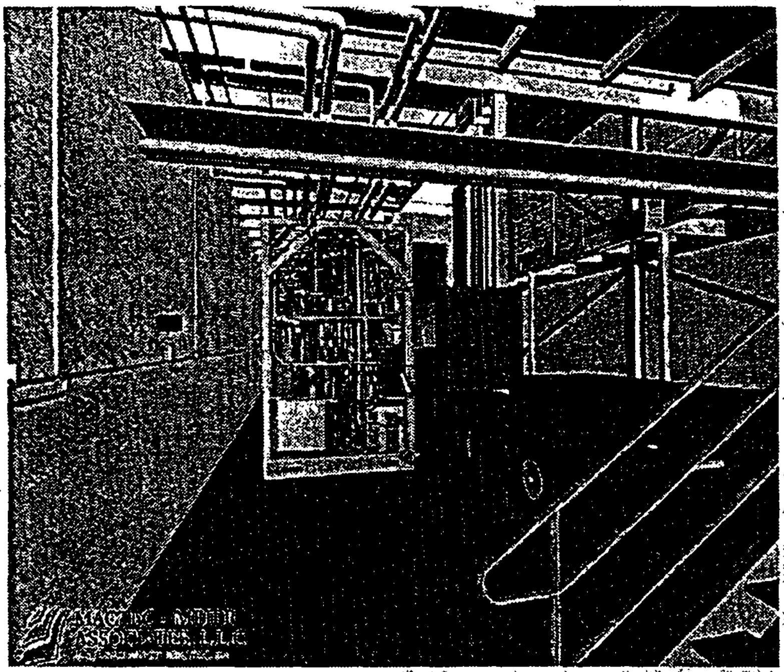
RG98040053
IWTS



Side Elevation of CVD Facility with MCO/Cask Transporter

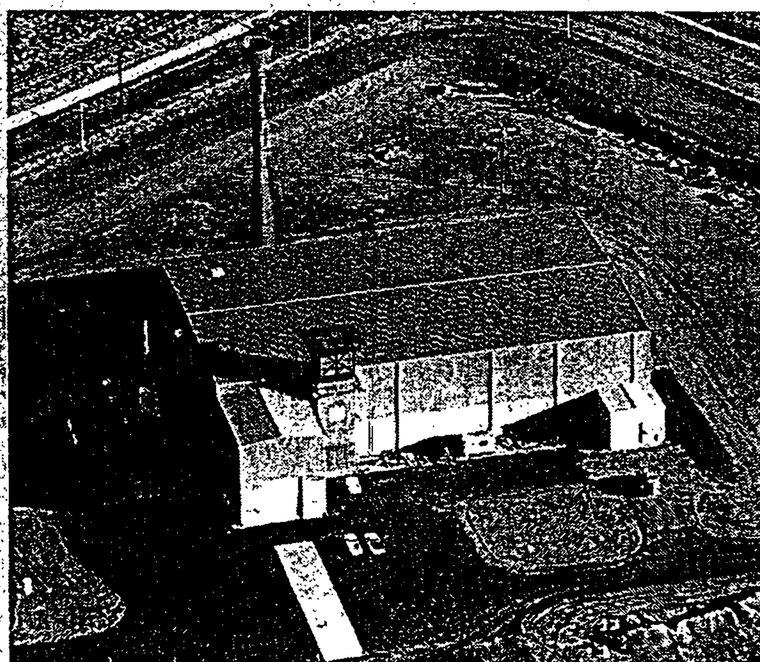
Skid Mounted CVD Processing Equipment in the 300 Area (full-scale prototype)



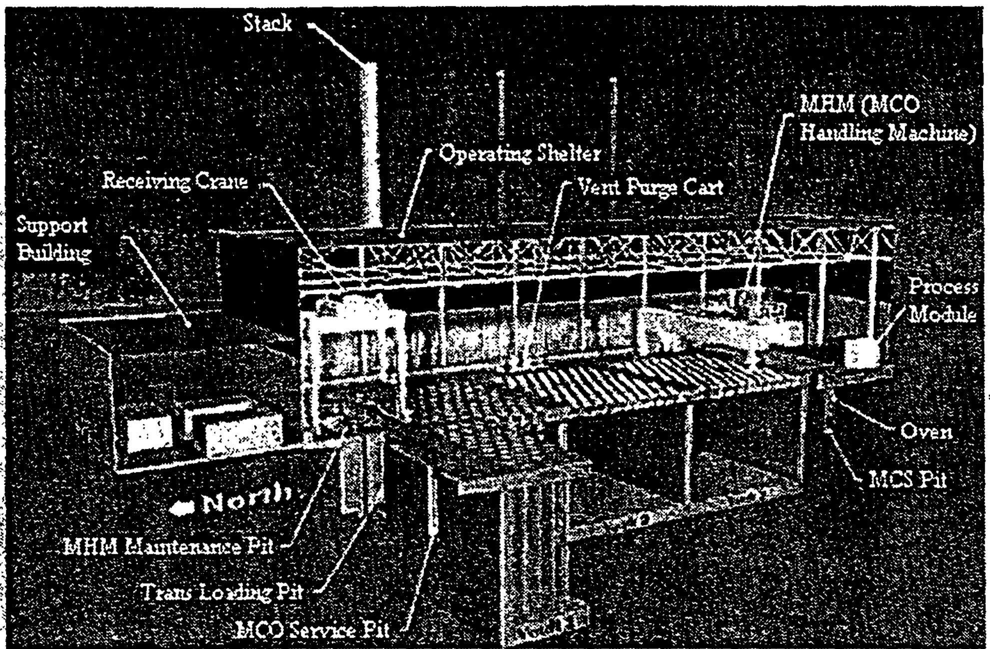


Conceptual Drawing for the Inside of CVD with Skid Mounted Processing Equipment

Aerial shot of the Canister Storage Building in the 200E Area



Conceptual Design Drawing of a Cutaway of the Canister Storage Building



APPENDIX F

Table F-1. K West Water Treatment Parameters

	WORKING (NOMINAL) VALUE	ESTIMATED MAXIMUM VALUE
Cs-137 in canister liquids	10,000 Ci Total	10,000 Ci Total
Cs-137 per canister	2.1 Ci	25 Ci
TRU (soluble)	2 Ci Total	2 Ci Total
Sludge volume per canister	0.8L	
Sludge volume	3 m^3	6.2 m^3
Cs-137 in sludge	50,000 Ci Total	120,000 Ci Total
TRU (particulate)	2700 Ci Total	6,700 Ci Total
Sludge activity (all radionuclides)	150,000 Ci Total	400,000 Ci Total
Plutonium in sludge	15,000 Ci Total	40,000 Ci Total
Uranium in sludge	7 metric tons	16.2 metric tons
Radiolytic decay heat of sludge	600 watts	1400 watts
Sludge contents	Equivalent to 400 fuel assemblies	Equivalent to 1,000 fuel assemblies
Particle density	1g/cc to 19 g/cc	
Particle size	Submicron to ¼ inch screen size	

This information was obtained from the following sources:

a. 137 Cs per canister: HNF-SD-SNF-ANAL-014, *Cesium-137 in K West Basin Canister Water*, Revision 0.
b. Sludge volume: EDT from A.L. Pitner (no document number), *K West Sludge Volume Estimates*, dated February 6, 1997.
c. Sludge mass: calculation using data in EDT from A.L. Pitner (no document number), *K West Sludge Volume Estimates*, dated February 6, 1997; EDT from A.L. Pitner (no document number), *K West Sludge Volume Estimates*, dated February 6, 1997; and DSI from D.J. Trimble to D.S. Takasumi, *K West Basin Canister Sludge Inventory*, dated January 26, 1997.
d. Density: *Handbook of Chemistry and Physics*.
e. Particle size range: WHC-SP-1182, *Analysis of Sludge from Hanford K East Floor and Weasel Pit*, released May 4, 1996.
f. Radionuclide properties of particulate: HNF-SD-SNF-TI-015, *Spent Nuclear Fuel Technical Databook*, Revision 1.
g. Decay heat: HNF-SD-SNF-TI-015, *Spent Nuclear Fuel Technical Databook*, Revision 1.

Table F-2. K West Quantities by Isotope

ISOTOPE	ACTIVITY IN CANISTER SLUDGE (Ci)	MASS OF CANISTER SLUDGE (Kg)	ISOTOPE	ACTIVITY IN CANISTER SLUDGE (Ci)	MASS OF CANISTER SLUDGE (Kg)
H-3	3.25E+02	3.28E-05	Sn-126	1.28E+00	4.49E-02
C-14	5.63E+00	1.26E-03	Sb-125	3.15E+02	3.04E-04
Fe-55	1.66E+01	6.65E-06	Sb-126m	1.28E+00	1.62E-11
Co-60	3.77E+01	3.33E-05	Te-125m	7.65E+01	4.25E-06
Ni-63	3.72E+01	6.04E-04	I-129	5.29E-02	2.99E-01
Kr-85	5.36E+03	1.37E-02	Cs-134	1.75E+02	1.35E-04
Sr-90	8.87E+04	6.51E-01	Cs-137	1.14E+054	1.31E+00
Y-90	8.87E+04	1.63E-04	Ba-137m	1.08E+05	2.01E-07
Zr-93	3.42E+00	1.36E+00	Ce-144	3.88E+00	1.22E-06
Nb-93m	2.04E+00	7.23E-06	Pm-147	4.11E+03	4.44E-03
Tc-99	2.43E+01	1.43E+00	Sm-151	1.48E+03	5.61E-02
Ru-106	9.79E+00	2.92E-06	Eu-152	8.28E+00	4.796E-05
Rh-106	9.79E+00	2.75E-12	Eu-154	9.55E+02	3.54E-03
Cd-113m	3.03E+01	1.40E-04	Eu-155	1.96E+02	4.20E-04
ACTINIDES					
U-234	6.94E+00	1.1101	Pu-241	5.13E+04	4.98E-01
U-235	2.72E-01	125.8	Am-241	2.84E+03	8.28E-01
U-236	1.04E+00	16.048	Am-242	1.39E+00	1.72E-09
U-238	5.37E+00	15980	Am-242m	1.39E+00	1.43E-04
Pu-238	8.70E+02	0.05083	Cm-242	1.15E+00	3.49E-07
Pu-239	1.69E+03	27.2	Cm-244	9.88E+00	1.22E-04
Pu-240	9.38E+02	4.114			

This table was developed using data provided in HF-SD-SNF-TI-015, *Spent Nuclear Fuel Technical Databook*, Revision 1, Table 5-2, and assuming that 6.2 m^3 of sludge is equivalent to 16.2 metric tons of uranium.

APPENDIX H

SNF PROJECT PROGRAMMATIC ASSUMPTIONS

001 Safety Analysis activities within the SNF Project are the highest risk to meeting the Tri-Party Agreement milestones. All parties must adhere to the baseline schedule as submitted.

002 Reasonable recruiting efforts, within the Project Hanford Management Contract control, will provide adequate candidates for operator and Health Physics Technician training. Once trained, SNF staffing will not have major impacts due to other DOE program cutbacks.

003 Confirmatory characterization and process data will not be found to be outside of the current "bounding" assumptions.

004 Process validation during the initial fuel relocation is successful. Operational uncertainties have been incorporated into Witness model simulations as part of baseline. Since full mockup testing with production personnel has not been possible (to save time and cost), the contractor will maintain the process flow model on a continuing basis such that any required changes in schedule can be reflected as soon as possible in the project baseline.

005 FDH will provide written notification to DOE-RL within sixty (60) calendar days of any local needs that require reprogramming within the SNF Project.

006 K East will begin operations with a Readiness Assessment.

007 CERCLA Regulation

- The scope of the K Basins CERCLA interim remedial action consists of the following, upon issuance of the Record of Decision:
  - Removing the SNF, sludge, debris, and water from the basins
  - Transferring the SNF to the SNF conditioning facility
  - Treating the sludge to meet waste acceptance criteria of the receiving facility(ies)
  - Transferring the sludge to the receiving facility(ies)
  - Pretreating the water and transferring it to the Effluent Treatment Facility
  - Transferring the debris to appropriate facilities
  - Deactivating the basins
- Does not impact system design
- Administrative process does not impact start of fuel movement.

008 OCRWM (RW-0333P rev.7)

- Evolving requirements will not significantly impact system design, procedures, and fuel movement. Any future changes will be handled by change control on the project.

009 Tank Waste Remediation System (TWRS) Interface

- No impacts at CSB to SNF baselines (dates, budgets, technical)
- Sludge will be transferred to TWRS and stored in double shell tanks (DST).

010 Annual funding will be consistent with baseline requirements.

011 TWRS authorization basis will not change in such a way that sludge pretreatment is adversely impacted.

012 Transfer/receipt of waste streams will not be a limiting factor in attaining readiness for transition to ER.

013 K Basins transition to ER is based on removal of all fuel, sludge, water, and designated debris from the basins.

014 A portion of FRS, IWTS, load out systems and CVD must remain operational for potential processing of residual basin fuel elements or pieces discovered during the Sludge removal process.

015 CSB Operations is turned over to WM-02 at the beginning of FY 2005 based on completion of welding in FY 2004.

016 Baseline assumes no changes in DOE requirements for nuclear material accountability and no DOE changes in security requirements for the project facilities.

017 Baseline assumes that limited number of MCOs will be monitored for pressure during the first portion of the fuel retrieval task and that all others will be welded without further monitoring. It is assumed as part of the SNF Contingency Analysis that the project will investigate a cost effective way to non-intrusively monitor all capped and welded MCOs while in storage to prove that high pressures do not exist in the MCOs.

APPENDIX I

SNF PROJECT- CODE OF ACCOUNTS SUMMARY

Code	Account	Totals	Code	Account	Totals	Code	Account	Totals
A000	General Administration and Support	114,632,976	B000	General Engineering	31,820,862	DB00	Sitework/Civil	367,593
AA20	Project Direction	21,765,758	BA10	Engineering Studies	1,066,342	DE00	Buildings	423,947
AA30	Program Management	33,114,201	BA20	Pre-Conceptual/Conceptual	4,990,674	DF00	Equipment	111,608,211
AA40	Fee	44,214,880	BA30	Definitive Design	8,877,005	DH00	Electrical	2,554
AD10	Internal/External Communications	651,690	BA40	Process Development	13,877,608	DM00	Testing (ATP/OTP)	3,636,571
AF10	Contract Management	10,074,124	BA50	Project Closeout	1,195,971	DN00	Inspection	525,843
AF20	Acquisitions	17,296,963	BB10	Preliminary Safety Analysis Report	2,639,650	EA00	General Process/Plant Operations	76,065,910
AF30	Warehouse Material Management	234,083	BB20	Final Safety Analysis Report	4,974,879	EB00	Surveillance	14,512,976
AF40	Transportation	732,772	BB30	Criticality	434,161	ED00	Startup (Test/Operations Readiness Review)	8,585,782
AG10	Protective Forces	15,173,984	BC10	Operational Procedures	15,058,137	EE00	Audit/Assessment/Corrective Action	19,636,041
AG20	Physical Security	823,082	BC20	Emergency Repair Design Support	783,713	EF00	Waste Transfer	16,088,698
AG40	Information Security	283,454	BC40	As-Builts	3,922,103	EH00	Sampling/Laboratory Analysis	12,057,052
AG60	Material Control and Accountability	3,700,493	BC60	Systems Documentation	4,811,597	EI00	Waste Characterization	31,682
AH10	Training Program Administration	21,292,491	BD00	Field Supervision/PIC Activities	7,077,760	EJ00	General Operations Support	72,258,930
AH20	Training Development	11,631,966	BE00	Engineering Standards and Procedures	843,437	EK00	Pollution Prevention/Waste Minimization	162,203
AH30	Training Implementation (Delivery)	654,166	CA10	Planning	239,966	F100	Maintenance Procedures	122,332
AH40	Training Evaluation	249,670	CA20	Permitting	2,081,137	FA10	Facility - Preventive/Predictive	14,168,788
AH50	Training Attendance	5,969,315	CA30	Regulatory Compliance Integration	8,473,006	FA20	Facility - Corrective	38,165,603
AJ10	System Development	153,196	CA40	Environmental Reporting and Monitoring	327,630	FA30	Facility - Work Control	35,832,505
AJ20	System Maintenance	875,390	CB10	Radiation Protection	53,720,572	FB00	Custodial	3,156,578
AJ50	Computer/Network Infrastructure	526,734	CB20	Industrial Hygiene	5,101	FC10	Vehicle/Equip. - Preventive/Predictive	261,135
AJ60	Document Control	282,174	CB30	Fire Protection	118,349	FC20	Vehicle/Equip. - Corrective	22,641
AJ70	Records Management	1,727,813	CB50	Transportation Safety	626,940	FD10	Roads/Parking - Preventive/Predictive	371,721
AK10	Internal	101,551	CB60	Emergency Preparedness	1,936,021	FE00	Grounds Maintenance	1,447,171
AL10	QA/QC Support	19,821,960	CB70	Safety Oversight	5,026,384	FF10	Electric - Preventive/Predictive	2,776,871
AL20	Independent Review and Oversite	1,256,416	CB80	Nuclear Safety	12,282,199	FF20	Electric - Corrective	1,530,146
AL30	Regulatory Technical Support	6,134,487	CB90	Industrial Safety	4,952	FG10	Water - Preventive/Predictive	256,042
AQ00	Project Control	35,784,003	D000	General Construction	49,558,116	FG20	Water - Corrective	221,908
AR00	Systems Engineering	2,339,764	DA00	Support and Oversight	13,180,287	GB00	Deactivate Facility Systems	133,371,933
							Grand Total	1,189,123,483

Note: The above includes only the "to-go" costs in the current baseline (FY 1999 through project completion).

(5A1) PROJECT BY PBS BY SUBPROJECT

		Prior Yr	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	Total
WM01													
1.03.01.01.10.10	Project Management and Integration	67,534	28,713	33,154	35,331	34,073	28,075	26,676	25,669	27,764	10,164	0	317,154
1.03.01.01.10.60	Site Wide SNF Projects (327 Fuel Transfer)	0	0	2,032	0	0	0	0	0	0	0	0	2,032
1.03.01.01.20.10	Project Mgmt and Integration (Project Fee)	0	0	8,330	8,210	8,340	8,410	6,380	3,490	1,840	540	0	45,540
1.03.01.02.10.20	K Basins Maint & Oper (Through FM)	104,312	32,374	33,841	33,951	34,735	35,394	26,970	0	0	0	0	301,577
1.03.01.02.10.60	Site Wide SNF Projects (N Basin Fuel Mvmnt)	24	80	44	0	0	0	0	0	0	0	0	148
1.03.01.02.15.20	K Basins Maint & Oper (Assoc. w/Transition)	0	0	0	0	0	0	0	15,317	7,016	0	0	22,333
1.03.01.02.20.13	K Basins Facility Projects (Des/Mod/Const)	27,829	5,292	10,720	8,088	810	0	0	0	0	0	0	52,740
1.03.01.02.20.14	Fuel Retrieval Project (Des/Mod/Const)	18,142	12,860	12,223	8,705	2,075	0	0	0	0	0	0	54,005
1.03.01.02.20.15	Water Treatment (Des/Mod/Const)	10,223	5,568	9,377	10,928	2,544	0	0	0	0	0	0	38,640
1.03.01.02.20.16	Debris Removal Project (Des/Mod/Const)	4,567	123	346	2,028	1,398	6,432	1,735	204	0	0	0	16,832
1.03.01.02.20.17	MCO Acquisition (Des/Mod/Const)	7,942	5,988	6,244	10,011	25,610	28,607	865	0	0	0	0	85,266
1.03.01.02.20.18	Cask Transportation System (Des/Mod/Const)	11,809	5,425	299	69	0	0	0	0	0	0	0	17,602
1.03.01.02.20.41	K Basin Cold Vacuum Facility (Des/Mod/Const)	13,325	20,411	23,864	5,599	0	0	0	0	0	0	0	63,199
1.03.01.02.25.16	Debris Removal Project (During FM)	1,558	0	0	33	5,733	1,308	2,445	2,073	516	0	0	13,667
1.03.01.02.25.19	SNF Relocation Common Operations	6,363	7,387	19,663	31,218	39,355	42,198	40,660	10,944	795	0	0	198,583
1.03.01.02.25.41	K Basin CVD Facility (Operations)	0	0	330	8,642	9,837	10,699	9,876	3,681	1,661	0	0	44,726
1.03.01.02.30.50	Sludge Removal Project (Des/Mod/Const)	5,482	1,181	475	1,037	2,036	3,013	5,019	1,237	218	0	0	19,696
1.03.01.02.30.51	Sludge Treatment Project (Des/Mod/Const)	0	2,978	3,064	2,250	5,797	12,522	14,309	6,250	0	0	0	47,170
1.03.01.02.35.50	Sludge Retrieval/Removal Operations	0	0	0	0	0	589	961	1,164	6,972	0	0	9,686
1.03.01.03.10.30	Canister Storage Bldg Facility (Des/Mod/Const)	82,275	31,459	25,472	13,418	0	0	0	0	0	0	0	152,624
1.03.01.03.10.40	Hot Conditioning System	8,557	214	0	0	0	0	0	0	0	0	0	8,771
1.03.01.03.20.30	Canister Storage Building Operations	0	0	381	8,338	13,059	13,145	12,032	4,448	0	0	0	51,403
1.03.01.04.10.60	Site Wide SNF (200 ISA Des/Const)	0	464	349	211	0	0	0	0	0	0	0	1,024
1.03.01.04.20.60	Site Wide SNF (Des/Move Fuel to 200 ISA)	2,195	349	1,704	2,887	5,694	3,802	784	2,981	0	0	0	20,395
1.03.01.04.30.60	Site Wide SNF (Oper/Maint 200 ISA)	0	0	0	0	241	350	374	394	0	0	0	1,359
	Sum of WM01	**372,137**	**160,866**	**191,910**	**190,955**	**191,337**	**194,545**	**149,086**	**77,850**	**46,783**	**10,704**	**0**	**1,586,172**
WM01A													
1.03.01.02.50	Deactivation 100K Area Facilities	0	0	0	0	0	629	3,595	27,729	39,231	36,253	25,935	133,372
1.03.01.02.50.10	Deactivation Transition	0	0	144	0	0	0	0	0	0	0	0	144
	Sum of WM01A	**0**	**0**	**144**	**0**	**0**	**629**	**3,595**	**27,729**	**39,231**	**36,253**	**25,935**	**133,516**
Grand Total		**372,137**	**160,866**	**192,055**	**190,955**	**191,337**	**195,174**	**152,681**	**105,579**	**86,014**	**46,957**	**25,935**	**1,719,688**

APPENDIX K

RESOURCE SUMMARY REPORT (BASELINE COSTS BY RESOURCE TYPE)

		FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	Totals
0	Payroll cost plus fringe										
00	Nonexempt Labor	1,928,219	2,120,057	1,972,174	1,984,673	1,742,007	1,112,955	840,485	404,138		12,084,708
01	Exempt Labor	43,217,167	51,906,432	52,724,872	50,615,468	44,273,620	22,434,385	12,009,020	6,555,519		283,736,483
06	BU Labor	11,605,232	21,674,087	38,140,768	42,790,926	37,076,539	12,693,330	6,873,972	0		170,854,854
07	Bargaining Unit Overtime	102,887	111,082	113,475	115,978	88,942	67,788	33,832	0		633,984
Summary for 0		56,853,505	75,811,658	92,951,289	95,487,045	83,181,108	36,308,458	19,757,309	6,959,657	0	487,310,029
1	Materials										
10	Material and Equipment	4,686,313	7,810,819	9,729,911	8,184,009	6,013,675	1,740,719	1,419,965	4,775		39,590,186
13	Tools & Safety Equipment	43,165	43,446	44,381	45,359	34,786	35,534	9,984	0		256,655
14	Office Supplies	380,432	357,836	478,861	255,676	210,786	144,340	75,768	14,931		1,918,430
15	Shop and Lab Supplies	21,805	21,945	22,418	22,913	17,572	15,569	12,837	0		135,059
19	Computer Hardware & Software	526,767	119,338	104,729	100,005	70,333	27,465	13,956	6,245		968,838
Summary for 1		5,658,482	8,353,384	10,380,100	8,607,962	6,347,152	1,963,627	1,532,510	25,951	0	42,869,168
2	Subcontractors										
21	PO Contracts	49,767,682	35,655,339	45,111,764	55,771,540	24,881,185	39,748,901	44,938,557	38,134,959	25,935,000	359,925,127
23	Misc. Purchased Services	40,753	44,637	44,708	45,693	35,042	23,037	8,558	0		242,428
26	Misc. Membership and Fees	5,347	5,759	5,883	6,012	4,611	1,396	1,426	0		30,434
2L	TRAINING - ONSITE	11,164	7,038	7,190	7,348	5,636	4,189	713	0		43,278
2M	TRAINING - OFFSITE	143,411	154,446	153,955	157,349	120,669	42,661	9,498	0		781,989
3D	Other Hanford Contractors	2,367,188	715,639	231,854	236,987	214,979	174,336	163,829	141,918		4,246,710
91	B&W PROTEC, INC.	1,517,844	730,464	746,224	762,680	564,888	169,941	86,801	0		4,598,862
92	DE&S NORTHWEST, INC.	285,016	431,752	375,797	331,706	78,779	0	0	0		1,503,050
93	Waste Management NW	1,107,983	704,935	678,479	828,835	406,294	273,609	49,643	31,227		3,681,005
94	FLUOR DANIEL NORTHWEST	34,306,553	29,805,794	6,092,993	2,870,863	9,606,222	5,099,988	462,385	169,385		88,414,183
94G	FDNW (Mowat/Grant)/ no GFS/ 7.7%G&A FY98	13,970,578	6,179,543	0	0	0	0	0	0		20,150,121
97	LOCKHEED MARTIN SVCS, INC.	1,234,251	709,910	436,919	439,594	391,568	520,570	1,029,971	160,979		4,923,762
98	COGEMA	656,749	606,502	0	0	0	0	0	0		1,263,251
Summary for 2		105,414,719	75,551,778	53,885,766	61,258,587	36,509,873	46,058,628	46,751,381	38,638,468	25,935,000	490,004,200
3	Other Direct Costs										
41	TRAINING SERVICES	421,367	712,853	771,701	146,584	609,008	166,973	22,355	14,122		2,864,963
42	FIRE SYS MAINT	118,349	0	0	0	0	0	0	0		118,349
44	CRANE & RIGGING	183,582	160,707	163,405	167,009	128,077	87,264	21,395	0		911,439
45	Engineering testing	774,411	31,992	32,661	33,402	25,615	17,453	17,829	0		933,383
4A	Consolidated Transportation	69,485	66,974	68,416	69,926	54,423	45,645	155,597	3,406		533,872
4D	STANDARDS LAB	63,155	68,015	69,480	71,013	54,458	63,039	24,248	0		413,408
4E	ELEC MAINTENANCE	383,207	0	0	0	0	0	0	0		383,207
4G	DRY WASTE DISPOSAL	16,743	0	0	0	0	0	0	0		16,743
4J	TRANSIT OPERATIONS	11,909	0	0	0	0	0	0	0		11,909
4N	LOCKSMITH	28,616	0	0	0	0	0	0	0		28,618
4T	200 AREA SITE SVCS	148,678	130,008	25,458	0	0	0	0	0		304,344
4V	FLEET LEASE COSTS	320,275	548,710	428,344	437,790	403,243	155,341	15,051	0		2,308,754
4W	OT LUNCHES	8,564	3,467	2,632	1,671	1,434	977	998	0		17,943
4x	WATER SYSTEMS - SANITARY	123,330	28,152	28,760	29,394	22,542	30,718	31,378	0		294,274
51	SAMPLE ANALYSIS	914,108	542,958	554,658	588,888	434,740	222,569	79,952	0		3,315,873
52	WSCF Lab - Sample analysis	1,916	1,616	1,307	1,338	1,025	698	713	0		8,611
54	SOLID WASTE DISPOSAL	112,999	119,700	122,280	124,976	95,842	91,314	635	0		667,746
5B	OFFSITE DISPOSAL	118,848	127,993	130,751	133,634	102,482	93,101	11,886	0		718,697
5E	BPA ELEC ALLOCATION	392,718	422,938	432,050	441,577	338,639	461,461	39,264	0		2,528,865
5J	JOB CONTROL SYSTEM (JCS)	47,530	0	0	0	0	0	0	0		47,530
5P	PATROL POOL	2,773,329	2,986,730	3,051,066	3,118,368	2,217,504	679,763	347,204	0		15,173,984
5V	FLEET MAINTENANCE	16,309	18,885	16,924	17,297	13,265	9,456	7,119	0		99,055
6A	IRM Services BUSINESS COMPUTING	27,908	28,216	26,145	26,721	20,492	27,925	0	0		155,407
6H	DESKTOP SUPPORT	10,300	12,712	9,804	10,020	7,685	0	0	0		50,521
6P	MULTIMEDIA SVCS	703,635	149,395	168,946	154,848	133,142	68,774	39,048	29,240		1,447,028
Summary for 3		7,789,473	6,159,819	6,104,828	5,652,654	4,663,616	2,222,471	814,694	46,768	0	33,354,323
4	Other Originated Costs										
1P	PROCUREMENT CARD PURCHASE	281,498	281,830	282,430	288,658	221,367	152,259	44,216	0		1,552,258
25	HANFORD SITE TELEPHONE	16,660	17,944	18,330	18,734	19,155	19,576	16,000	16,351		142,750
2R	Relocation & Educational Reimbursement	14,853	15,996	16,340	16,701	12,808	1,396	1,426	0		79,520
2T	Travel Expense	249,358	430,151	490,497	493,899	115,293	48,077	31,096	29,806		1,888,177
57	PGM RESERVE BUDGET	7,446,326	16,122,211	18,867,079	15,039,531	16,230,150	15,314,281	17,663,481	700,000		106,383,058
Summary for 4		8,008,694	16,868,132	19,674,676	15,857,523	16,598,773	15,535,589	17,756,219	746,157	0	110,045,763
7	G&A Exemptions										
71M	INCENTIVE FEE	8,330,000	8,210,000	8,340,000	8,410,000	6,360,000	3,490,000	1,840,000	540,000		45,540,000
Summary for 7		8,330,000	8,210,000	8,340,000	8,410,000	6,360,000	3,490,000	1,840,000	540,000	0	45,540,000
Grand Total		192,054,873	190,954,771	191,336,659	195,173,771	152,680,522	105,578,773	88,452,113	46,957,001	25,935,000	1,189,123,483

Note: The above includes only the "to-go" costs in the the current baseline (FY 1999 through project completion).

APPENDIX L

L.1 Analysis of Cost Risks for the SNF Project

L.1.1 Introduction

The EM-5 Review Team, in its assessment of the SNF Project, was concerned about the adequacy of the project's contingency allowance and the presentation of the cost baseline as a 90 percent probability or confidence level baseline. For this reason, the Review Team attempted to model the risks observed during the review in a manner similar to that used by the Project Team, that is, by using a Monte Carlo simulation or risk analysis model. Such a model can quantify the risks inherent in the project and determine the level of contingency necessary to achieve a 90 percent level of confidence. This document discusses the assumptions of the Review Team and presents the risk analysis results.

L.1.2 Risk Assumptions

The risk analysis model only addressed remaining project costs (that is, those costs in the baseline for FY 1999 and beyond). Table L-1 summarizes the risk analysis inputs used for the analysis. Some of the major risk areas are also discussed below. For further insight and information regarding these risks, the reader is referred to the technical and risk management sections of this report (Sections 3.0 and 4.0).

- General: The effects of SAR delays are not considered in this analysis. However, it should be recognized that there are minimal *cost* risks associated with slippage in the November 2000 start of fuel movement milestone. Project "hotel costs" only begin to accrue significantly if the overall project schedule is extended. However, if the duration required to successfully move all fuel out of the K Basins is much longer than the three years in the current baseline plan, the schedule stretch that would result would have a fairly significant impact on project costs by extending those hotel costs and adding costs in the operations area. Because it is not possible to probabilistically assess the risks of a longer operations schedule, this possible impact is excluded from this analysis.

- SNF Operations
  - Staffing Ramp-up may require additional resources
  - Lower productivity than estimated may occur
  - This will be first of a kind operation
  - K East Basin inefficiencies will likely be more than estimated

- MCOs
  - Analysis assumes no MCO design modifications
  - MCO fabrication will proceed with minimal production problems
  - Basket fabrication may encounter shop production problems which could require another shift
  - The impact of quality requirements may result in higher basket costs

- Integrated Water Treatment System
  - System operation within specifications is assumed
  - No major changes in design before operation will be required

- Cold Vacuum Drying Facility:
  - Additional staff could be required (engineers, maintenance)
  - Full-scale mockup will facilitate training and operation

- Canister Storage Building
  - Assumes no further construction modifications
  - Additional operations staffing could be required (engineers, maintenance)

- K Basin Facility Projects, Fuel Retrieval Project
  - Construction of the K East Basin will be less efficient than estimated
  - 'Lessons learned' efficiencies are not reflected in the K East Basin design
  - Possibility that nuclear safety discussions could effect operations savings

- Sludge Treatment
  - Assumed 20 percent probability that full treatment will be required at 2-3 times the current estimate, and 80 percent probability that some minimal level of treatment will be necessary before sludge is transferred to TWRS

- Deactivation
  - Assumed that deactivation could be accomplished in one year less than currently estimated

Beyond the above risks and uncertainties, normal estimate accuracy ranges were also considered, based on the perceptions of the team members and reviews of the BOE documents.

L.1.3 Risk Analysis Results

As can be seen in Table L-2 and Figure L-1, this risk analysis generally confirms the SNF Project's assessment of the confidence level of the remaining baseline for the project. The SNF baseline remaining to be spent from FY 1999 through project completion is approximately $1.187 billion ($530 million has been expended through FY 1998.). The Review Team's risk analysis results would show the remaining costs required at 90 percent level of confidence to be $1.19 billion.

L.1.4 Conclusions and Qualifications

Within the current scope and plans of the project, it is likely that the current estimated baseline costs for the SNF Project should be sufficient to achieve project objectives. In fact, because of the very real possibility of avoiding the high potential impact of sludge treatment, and the possibility to shorten the deactivation schedule, there may be the opportunity for significant cost reduction for this project.

However, there are many risks outside of this analysis that could not be quantified in terms of impacts but that, if they occur, would *significantly* affect project costs. Some of these are:

- The IWTS may not operate in accordance with the technical requirements of the project. If operational problems are encountered, there may be very significant cost and schedule impacts on the project.

- The SNF removal process and related operations are scheduled and estimated based on assumed production durations and capabilities. Examples include MCO loading capacities (number of baskets, number of debris baskets), CVD in-process time, etc. Any perturbations in these assumptions could have a significant impact on project costs and schedules.

- Significant levels of design modifications and facility retrofits resulting from SAR approvals or needed to correct operational deficiencies are not assumed or included in the current baseline.

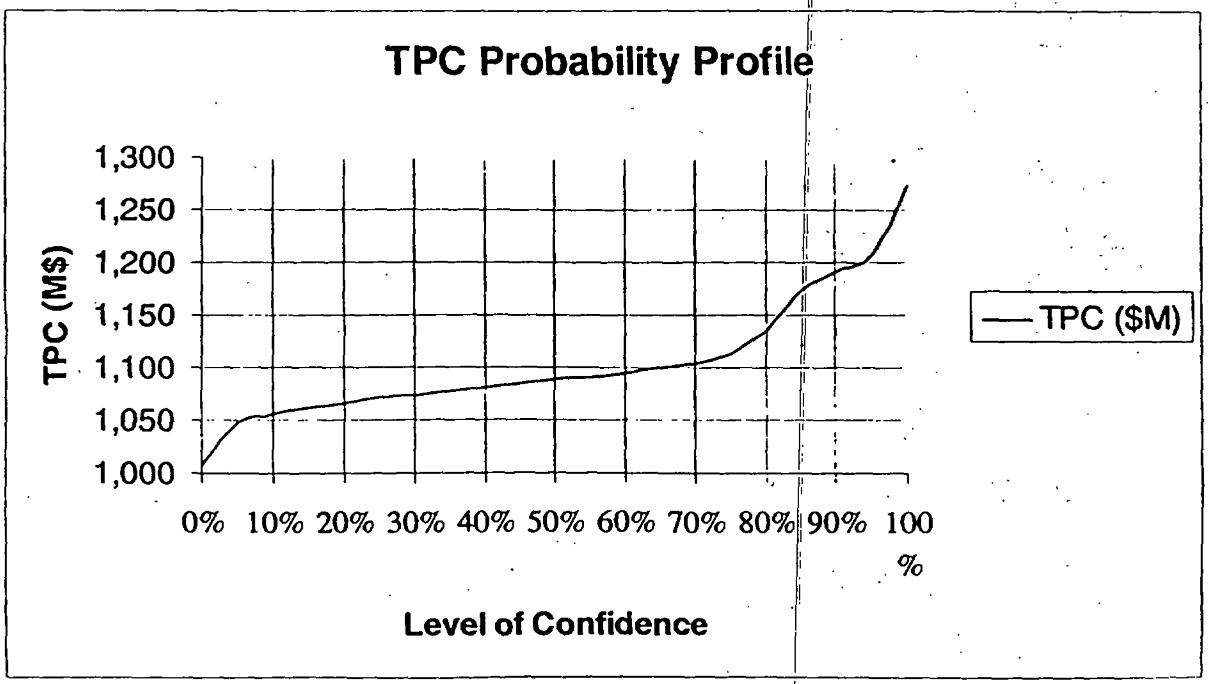
Table L-1. Cost Risk Analysis Assumptions

WBS	Sub-Project	Remaining Total	Lowest	Highest	Notes
WM01					
1.03.01.01.10.10	Project Management and Integration	116,673	111,000	134,000	Excludes contingency. Range based on -5% to +15%
1.03.01.01.10.60	Site Wide SNF Projects (327 Fuel Transfer)	2,032	2,000	2,200	CPI = .89 at 70% complete
1.03.01.01.20.10	Project Mgmt. and Integration (Project Fee)	45,540	40,000	45,540	Assumes no more fee is possible
1.03.01.02.10.20	K Basins Maint. and Oper. (Through F.M.)	164,891	140,000	180,000	Range based on -15% to +10%
1.03.01.02.10.60	Site Wide SNF Projects (N Basin Fuel Mvmnt.)	44	20	20	Complete
1.03.01.02.15.20	K Basins Maint. and Oper. (Assoc. w/ Transition)	22,333	19,000	25,000	Range based on -15% to +10%
1.03.01.02.20.13	K Basins Facility Projects (Des/ Mod/ Const)	19,620	17,500	26,000	Assumes KE work -10% to +50%, other -10,+20%
1.03.01.02.20.14	Fuel Retrieval Project (Des/ Mod/ Const)	23,003	21,000	30,000	Assumes KE work -10% to +50%, other -10,+20%
1.03.01.02.20.15	Water Treatment (Des/ Mod/ Const)	22,849	22,000	25,000	Range based on -5% to +10%
1.03.01.02.20.16	Debris Removal Project (Des/ Mod/ Const)	12,142	11,000	15,000	Assumes KE work -10% to +50%, other -10,+20%
1.03.01.02.20.17	MCO Acquisition (Des/ Mod/ Const)	71,336	65,500	82,000	Based on basket risks, with general estimate uncertain
1.03.01.02.20.18	Cask Transportation System (Des/ Mod/ Const)	368	250	400	Insignificant costs remaining
1.03.01.02.20.41	K Basin Cold Vacuum Facility (Des/ Mod/ Const)	29,463	29,000	35,000	CPI = .8 and some work remaining
1.03.01.02.25.16	Debris Removal Project (During F.M.)	12,109	11,000	15,000	Range based on -10% to +25% (KE effect)
1.03.01.02.25.19	SNF Relocation Common Operations)	184,833	157,000	222,000	Range based on - 15%,+20%
1.03.01.02.25.41	K Basin CVD Facility (Operations)	44,726	42,000	53,000	Increased staff and + or - 5% estimate
1.03.01.02.30.50	Sludge Removal Project (Des/ Mod/ Const)	13,033	10,000	16,000	Range based on + or - 20%
1.03.01.02.30.51	Sludge Treatment Project (Des/ Mod/ Const)	44,192	10,000	150,000	Low only pretreatment, high full treatment
1.03.01.02.35.50	Sludge Retrieval/ Removal Operations	9,686	8,000	12,000	Range based on + or - 20%
1.03.01.03.10.30	Canister Storage Bldg. Facility (Des/ Mod/ Const)	38,890	37,000	41,000	Range based on + or - 5%
1.03.01.03.10.40	Hot Conditioning System	-			
1.03.01.03.20.30	Canister Storage Building Operations	51,403	46,000	56,500	Range based on + or - 10%
1.03.01.04.10.60	Site Wide SNF (200 ISA Des/ Const)	560	500	600	Insignificant costs remaining
1.03.01.04.20.60	Site Wide SNF (Des/ Move Fuel to 200 ISA)	17,851	16,000	19,000	Range based on -10% to +5%
1.03.01.04.30.60	Site Wide SNF (Oper/ Maint 200 ISA)	1,359	1,200	1,500	Range based on + or - 10%
	Sum of WM01	948,936	816,970	1,186,760	
WM01A					
1.03.01.02.50	Deactivation 100K Area Facilities	133,372	100,000	155,000	Range based on -25% to +15%
1.03.01.02.50.10	Deactivation Transition	144	115	175	Range based on + or - 20%
	Sum of WM01A	133,516	100,115	155,175	
Grand Total		1,082,452			

Table L-2

Risk Analysis Results	
Confidence Level	**TPC ($M)**
0%	1,008
5%	1,048
10%	1,057
15%	1,062
20%	1,066
25%	1,070
30%	1,074
35%	1,077
40%	1,081
45%	1,084
50%	1,088
55%	1,091
60%	1,095
65%	1,099
70%	1,105
75%	1,113
80%	1,135
85%	1,173
90%	1,190
95%	1,208
100%	1,273
Note: Above does not include $533 M spent through FY 1998.	

Figure L-1



L.2 Analysis of Schedule Risks for the SNF Project

L.2.1 Introduction

The Review Team assessed the risk in the project's schedule to determine the probability of meeting the November 2000 milestone for fuel movement. Activities beyond November 2000 were not assessed at this time because the risks involved with the operation of the specific systems have a direct bearing on that part of the schedule and these are not known at this time. Because of the short duration of this review each sub-team utilized a qualitative judgmental assessment to arrive at it's assessment of the probability of meeting the November 2000 milestone based on the results of their assessment of the technical systems evaluated during the review. The results are considered to be of the same 'order of magnitude' as a detailed Primavera® risk assessment.

The risk analysis was conducted for two different cases;

Case 1: The probability that the systems are ready to operate to meet the November 2000 milestone, and no SAR requirements are considered (this allowed the Team to focus only on the readiness of the systems to operate).

Case 2: The probability that the systems are ready to operate with SAR requirements incorporated within the float provided and either:

2A. Documentation changes only to the SAR are required or

2B. Retrofits to facilities or major operational changes are required.

The effect of ORR risks on the schedule was assessed separately because it is scheduled after the SAR approvals and is on the Critical Path and was handled separately within this Review. ORR are discussed in Section 6.5.6 and 10 if this report.

L.2.2 Risk Analysis Assumptions

Based on the review, the Review Team's conclusions as to the progress and management of the project, the following assumptions were deemed appropriate:

- The risk analysis assumed that the systems could be completed through startup and testing with the present baseline designs intact, and procurements of MCOs, baskets and casks have no major changes.
- The analysis assumes that the Project Management Team would continue to function well in the present manner to meet the short schedule durations.
- The analysis assumes that project management work-arounds and adequate cost contingency will be available to manage problems within the present schedule to hold to the critical path.

- The SAR preparation, resolution of comments and approval of SARs is within the Project's control and resolution is given highest priority.

- The analysis assumes that staffing and other operations functions included in the Basis of Estimate are executed as described.

- The analysis assumes that the startup and testing of the individual systems proceeds according to baseline design, and the combined system startup program proceeds as described and scheduled.

L.2.3 Conclusions

The results of the analysis are shown in the Table L-3 "Schedule Probability of Meeting November 2000 Milestone" (and further described in Report Section 6.3.5, "'What If' Schedule Analysis of FSAR Approvals" and Section 6.3.6 "'What If' Schedule Analysis of ORR Approval").

The results shown in Table L-3 reflect the expert opinion of each of the respective Sub-Teams as to the probability of achieving the schedule milestones for their respective facility or system needed to support the overall project milestone of November 2000.

The Table shows that the Review Team had:

- A high confidence (90+ percent probability) that the required systems can be completed on time to meet the November 2000 milestone without SAR consideration and under the assumptions made (Case 1).

- A lower confidence (75-80 percent probability) that the November 2000 milestone will be met when the SAR process is considered. This reflects the impacts on current process problems but assumes that improvements will be pursued on a priority basis. It further assumes that SARs can be approved with *only documentation changes* required (Case 2A).

Although not shown in Table L-3, the Review Team had a very low confidence (approximately 20 percent probability) that the November 2000 milestone will be met when the SAR process is considered, and SARs are approved *which require system retrofits or major operational changes* (Case 2B).

Report Section 6.3.5 describes a case which could lead to a <u>one week slip in the November, 2000 Milestone for each 3 week slip in the last SAR approval.</u>

Report Section 6.5.6 presents an analysis which describes a <u>day for day slip in the November, 2000 Milestone</u> if the ORR is delayed beyond the date in the Schedule.

It further indicates the Review Team's conclusion that the duration in the schedule for the ORR is too short given the experience of the Review Team on other ORR's. Report Section 10 "Operational Readiness Review" further expands on this issue.

The probability of moving all fuel by FY 2003 was not assessed by the sub-teams because this is dependent on the reliability of the systems, and this will only be determined through sustained operations.

Table L-3. Schedule Probability Meeting November 2000 Milestone

Sub-Team	% Probability without SAR (Case 1)	% Probability with SAR (Case 2A)	Comments
CVD	95%	80%	Project virtually complete. SAR schedule issues resolved.
IWTS	95%	80%	Construction virtually complete
CSB	95%	80% w/Document changes	Without SAR; Remaining procurements and acceptance tests will support 11/2000.
SNF Common Operations	90%	N/A	Staffing/training could impact the 11/2000 milestone and the K East Basin Operations
Fuel Removal & Basin MODs	95%	75% w/document changes	K Basin issues are complex and involve both K West and K East Basins
MCO's	95%	90%*	* Topical Report Assumes document changes only. No redesign or retrofit