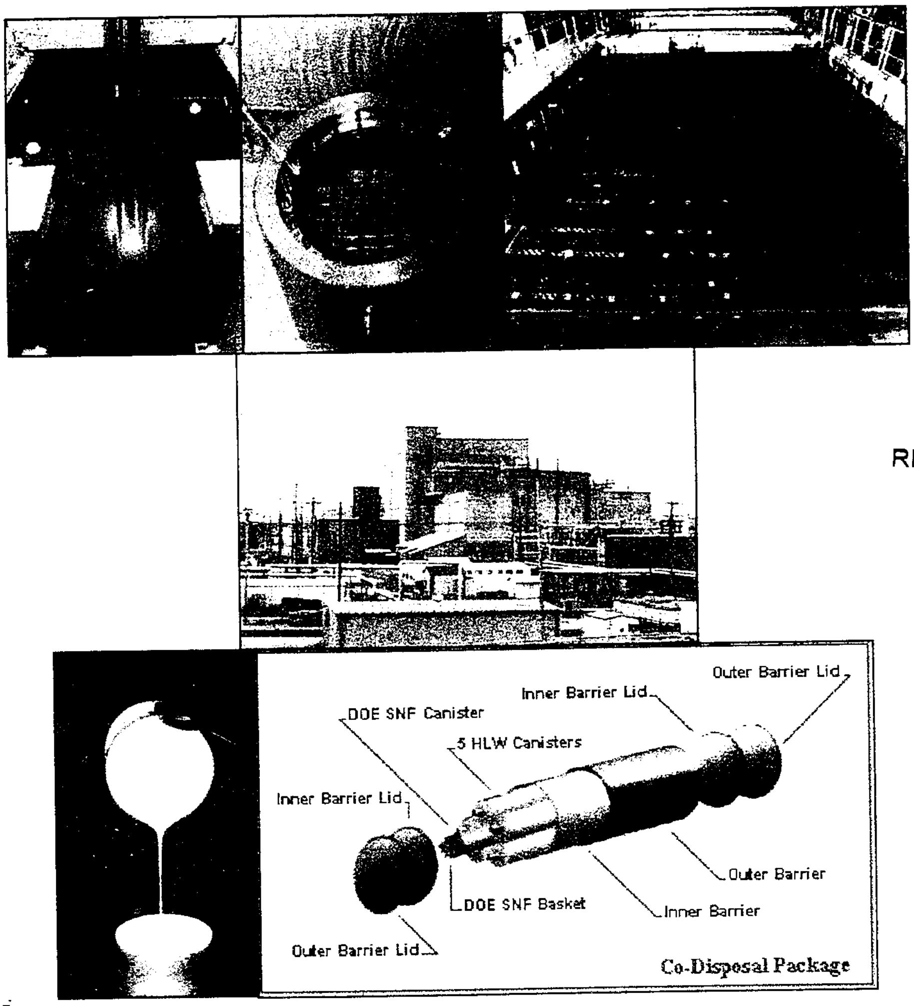
WSRC-RP-98-00713

SAVANNAH RIVER SITE
FY 1999 SPENT NUCLEAR FUEL INTERIM MANAGEMENT PLAN

NOVEMBER 1998



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Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

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FY 1999 SPENT NUCLEAR FUEL INTERIM MANAGEMENT PLAN

APPROVED BY:

E.R. CONATSER, PROGRAM INTEGRATION MANAGER
SPENT FUEL STORAGE DIVISION
WESTINGHOUSE SAVANNAH RIVER COMPANY

NOVEMBER 1998

Westinghouse Savannah River Company
Savannah River Site
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CONTRIBUTORS TO WSRC-RP-98-00713

Lead Editor

M. E. Dupont

Contributors (alphabetical order)

A. L. Adams
C. M. Brizes
S. D. Burke
L. R. Canas
W. D. Clark, Jr.
E. R. Conatser
J. E. Dickenson
M. E. Dupont
N. C. Iyer
J. F. Krupa
L. T. Lamm
D. W. Lentz
J. R. McEntire
S. W. O'Rear, Jr.
J. Rideaux
A. J. Stapf
S. J. Strohmeier
J. E. Thomas
W. T. Wertz

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EXECUTIVE SUMMARY

Introduction:

This document has been prepared to present in one place the near and long-term plans for safe management of SRS SNF inventories until final disposition has been identified and implemented. This management includes:

- Transfer for processing SNF identified as "at risk" in the Interim Management of Nuclear Materials EIS Records of Decision (ROD),
- Receipt of research reactor spent nuclear fuels (SNF) from foreign and domestic sources,
- Complete process development of the melt and dilute treatment technology for the preparation for repository emplacement of SNF which will not be reprocessed, contingent on decisions to be made in the SRS SNF Management EIS,
- Procurement of a treatment and dry storage capability to provide any facilities necessary to place unreprocessed SNF into a "road ready" form for transportation to a national geologic repository.

The activities described are consistent with FY 1999 Annual Operational Plan. Summarized below are highlights, key decision dates, and baseline assumptions of this plan.

Highlights:

The SNF management program will focus on the following activities during the next few years:

- Completion of shipments of remaining Mk 16, Mk 22, and miscellaneous spent nuclear fuels to the SRS Canyons for processing in FY 2002, and shipments of tritium targets to the Tritium Facilities for recovery of tritium in FY 2000.
- Timely and efficient receipt and management of foreign and domestic SNF, primarily in L-Basin.
- Possible deinventory of RBOF by the end of FY 2006.
- Design of a proposed Treatment and Storage Facility to be used for deinventory of existing SRS wet storage basins and preparation of the unprocessed SRS inventory into a road-ready form for eventual shipment to a geologic repository.
- Support for the completion of the SRS Spent Nuclear Fuel Management EIS, which will determine the disposition of the current SRS inventory and expected receipts which have not been previously designated for processing. This support includes:
  - Assessment of alternative treatment technologies which may provide a viable disposition path for unprocessed aluminum-based spent nuclear fuels when chemical processing options are no longer available.
  - Evaluation of the environmental impacts of a new Treatment and Storage Facility (TSF), estimated to be available in 2005.

Key Decision Dates

The following key decisions will determine future program direction:

- DOE decisions on additional materials requiring canyon processing. Supporting documents include:
  - Nuclear Materials Processing Needs Assessment 1QFY1999
  - Study of the Nonproliferation Implications of Proposed Management Alternatives for Aluminum-based Research Reactor Spent Nuclear Fuel 1QFY1999

- SRS SNF Management EIS Record of Decision: FY1999

Figure 1 illustrates the projected SNF inventory management plan based on current off-site receipt schedules, wet basin deinventory rates, and Treatment and Storage Facility and repository availability.

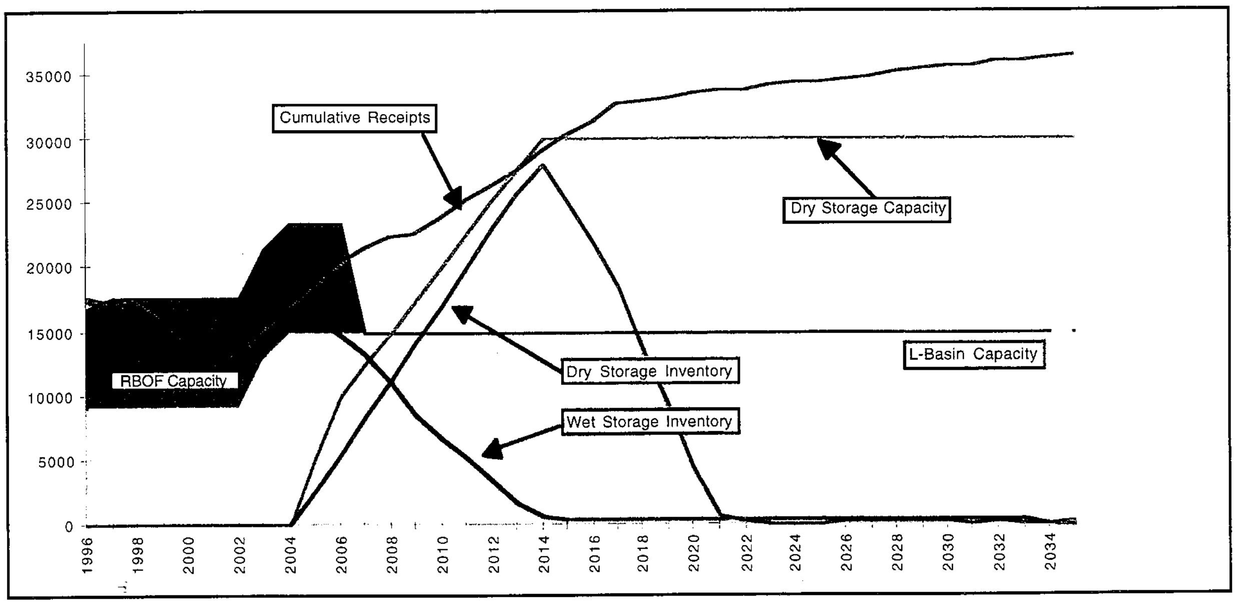


Figure 1 SNF Inventory Management Plan

Figure 2 illustrates the components of the projected cask handling capacity which will be required to accommodate all anticipated SNF movements. Shipments to the repository are assumed to begin in 2015 with 30 kg U-235 per canister. (The actual quantity of U-235 allowed in each canister will be determined by the repository waste acceptance criteria). Repository shipments rates are assigned at 18 casks per year containing 9 canisters each, which is the current allocated rate for emplacement of all DOE SNF. At this rate, which assumes SRS SNF receives first priority for emplacement, which is unlikely, SRS deinventory would occur about 2021, with further cask movements at a rate equivalent to fuel receipts. Actual rates will be determined at a future date by factors such as: emplacement priority, treatment required to meet the repository waste acceptance criteria, etc.

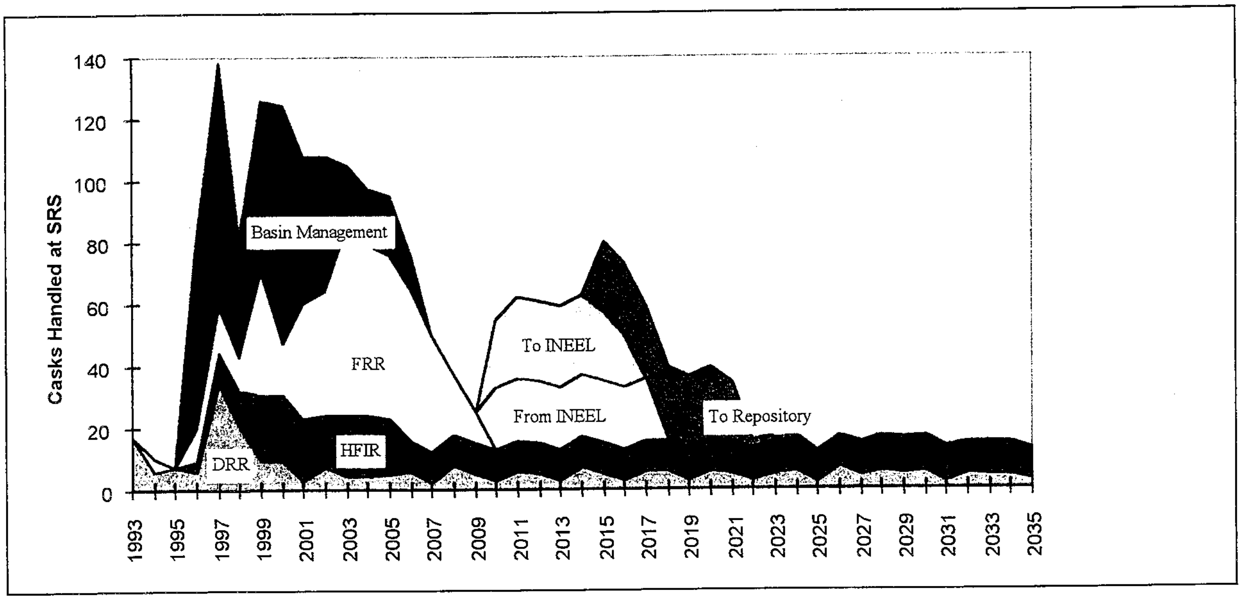


Figure 2 SNF Transfer Activity

Key Assumptions

Baseline Plan:

- Transfer "at risk" SNF to Canyons for processing per the Records of Decision for the IMNM EIS. A decision will be made in the SRS SNF Management EIS ROD whether to process SNF identified as problematic in the Research Reactor Task Team Report (Table 5.2-1). Unprocessed basin inventories will be managed in existing wet storage basins until they can be treated and placed into new dry storage, contingent upon disposition decisions to be made in the SRS SNF Management EIS ROD in 1999.

- Combined foreign and domestic research reactor spent nuclear fuel receipts sustained at no more than 7 casks per month between 1996 and 2009. Domestic SNF receipts will continue until at least 2035.

- On-site transfers from RBOF to L-basin and from RBOF, K, and L basins to the canyons and the Tritium Facilities are planned.

- Deinventory and retirement of RBOF in FY 2006 is assumed. (A study is underway to determine whether and when the deinventory of RBOF would be appropriate.)

- The TSF will be constructed in 105-L and will be operational in FY 2005. Delay could require additional storage racks in L-basin or extending operations in RBOF at approximately $20 million per year. Cask receipts for TSF will be handled through L-basin.

- Exchange of SRS SS/Zr-clad SNF for INEEL aluminum-based SNF begins in FY 2010.

- The schedules in this Plan are sensitive to assumptions about off-site (DRR and FRR) receipt rates, on-site transfers from RBOF to L-basin and from wet storage to dry storage, shipment of Mk 16/22 elements to canyon facilities per approved schedules, exchange of SS/Zr fuels at SRS for aluminum-based fuels at INEEL, and availability of the Treatment and Storage Facility and the repository.

Required Funding:

Fiscal Years	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**
Dollars ($M):										
K Area/Basin	29	30	31	22	23	24	24	25	25	25
L Area/Basin	36	37	40	39	42	41	45	44	45	46
RBOF/Basin	19	20	21	21	22	22	23	23	6	1
Subtotals	84	87	92	82	87	87	92	92	76	72
Est. Manpower (FTEs)	641	621	649	602	602	602	602	602	493	463
TSF Facility:										
Line-item TPC	3	15	3	3	66	67	67			
Alt. Tech. / TSF Ops	9	5	2	2	2	2	21	20	20	21
Subtotals	12	20	5	5	68	69	88	20	20	21
K-Area Materials Stg.										
KAMS TPC	25	19								
KAMS Ops		2	2	2	2	2	2	2	3	3
Subtotals	25	21	2	2	2	2	2	2	3	3
Detritiation Facility										
TPC/Ops	2	5	4	3	3	3	3	3	3	
TOTALS ($M)	123	133	103	92	160	161	185	117	102	96
(FTEs) *	943	846	728	681	1061	1061	1180	771	657	607
Other Expenses ($M)										
Security (WSI)	14	20	20	21	29	30	30	31	30	31
DOE Prog Mgmt	5	5	5	5	5	5	5	5	5	5

* Estimated manpower for FY03 – 05 include estimates of subcontracted construction personnel.

Table 1 Forecast Funding and Manpower

Assumptions:

1. The estimated costs provided above are used for planning purposes and were derived using the Savannah River Site FY 1999 Annual Operational Plan as the beginning basis. Out-year budget requirements were estimated by factoring detailed out-year program planning assumptions and schedules (Section 3.1) against this AOP baseline. Actual budget estimates will be developed and approved by WSRC and DOE during the appropriate AOP budget cycle.

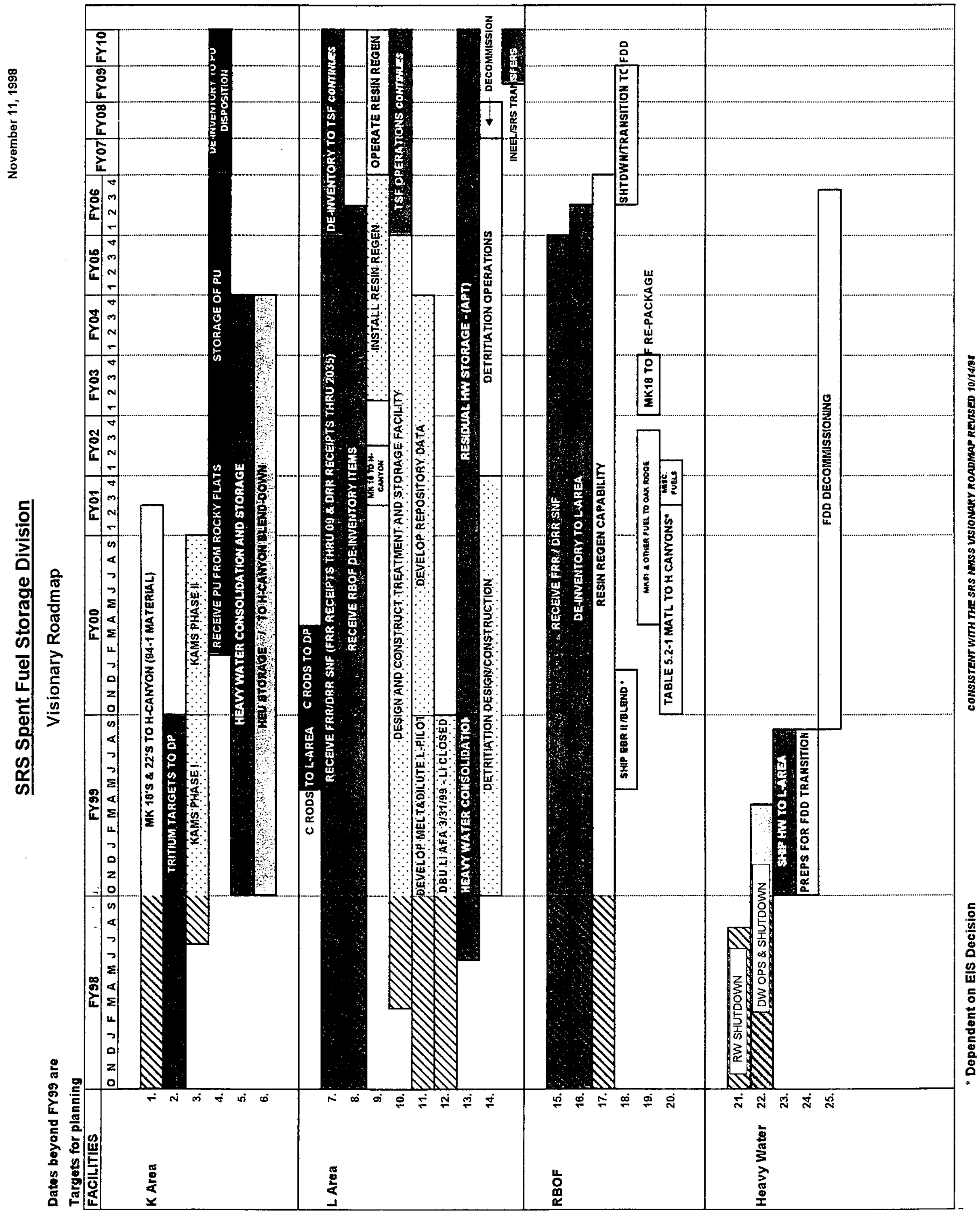
2. These estimates reflect "Budget Outlay" (BO) only.

3. The escalation factor applied to SRS Spent Fuel Storage Division estimates is 2.7% and is consistent with Accelerating Cleanup Plan update guidance.

4. TSF Operating expenses were escalated to FY 2005 from FY 1998 base-year dollar estimates used in the May 1998 Cost Study.

5. The manpower estimates for FY 2003 - 2005 include estimates of subcontracted construction personnel.

Spent Fuel Storage Division - Visionary Roadmap



Spent Nuclear Fuel Management Strategy:

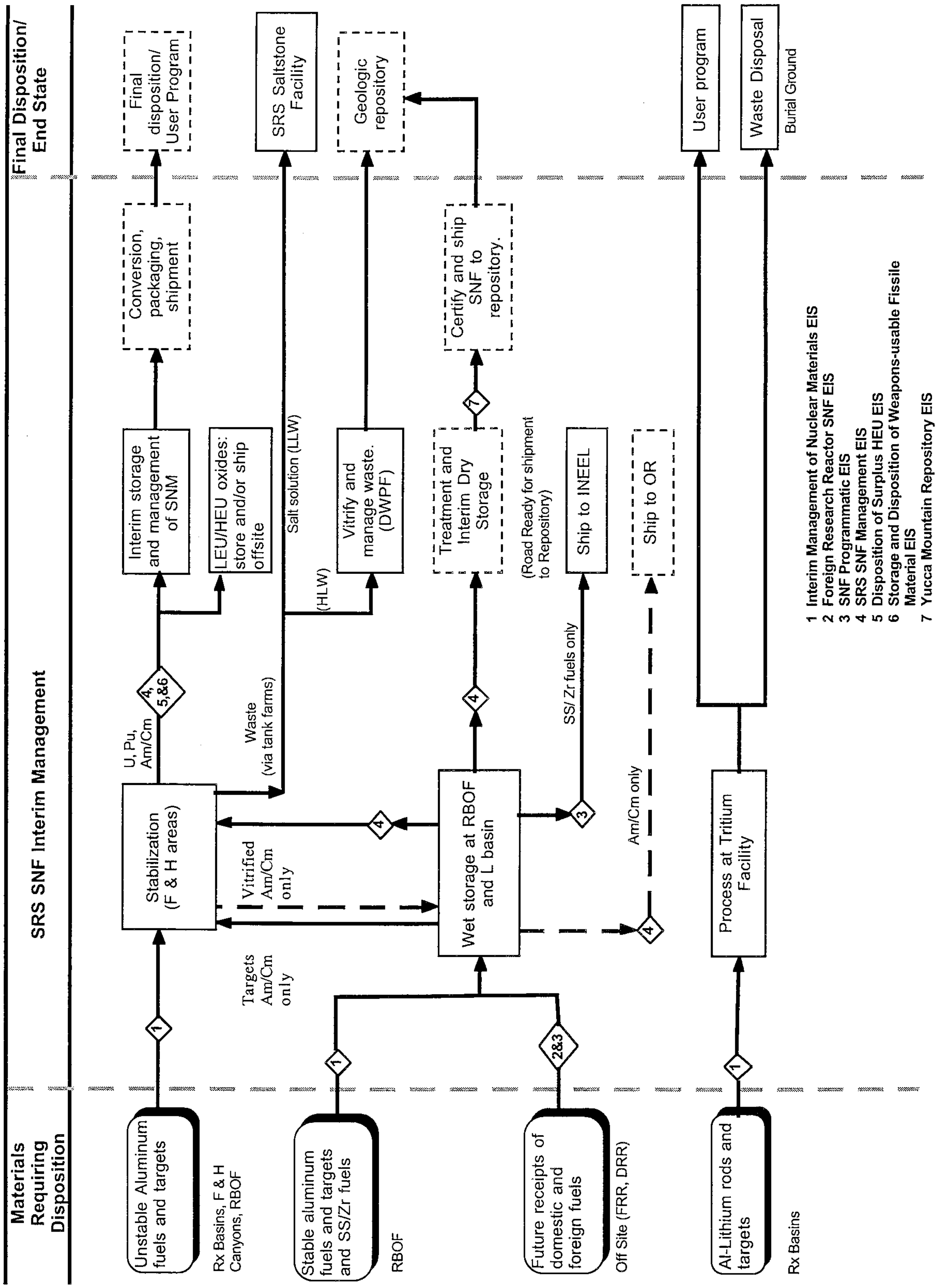


Figure 4 Spent Nuclear Fuel Management Strategy

SRS Materials-flow Concepts

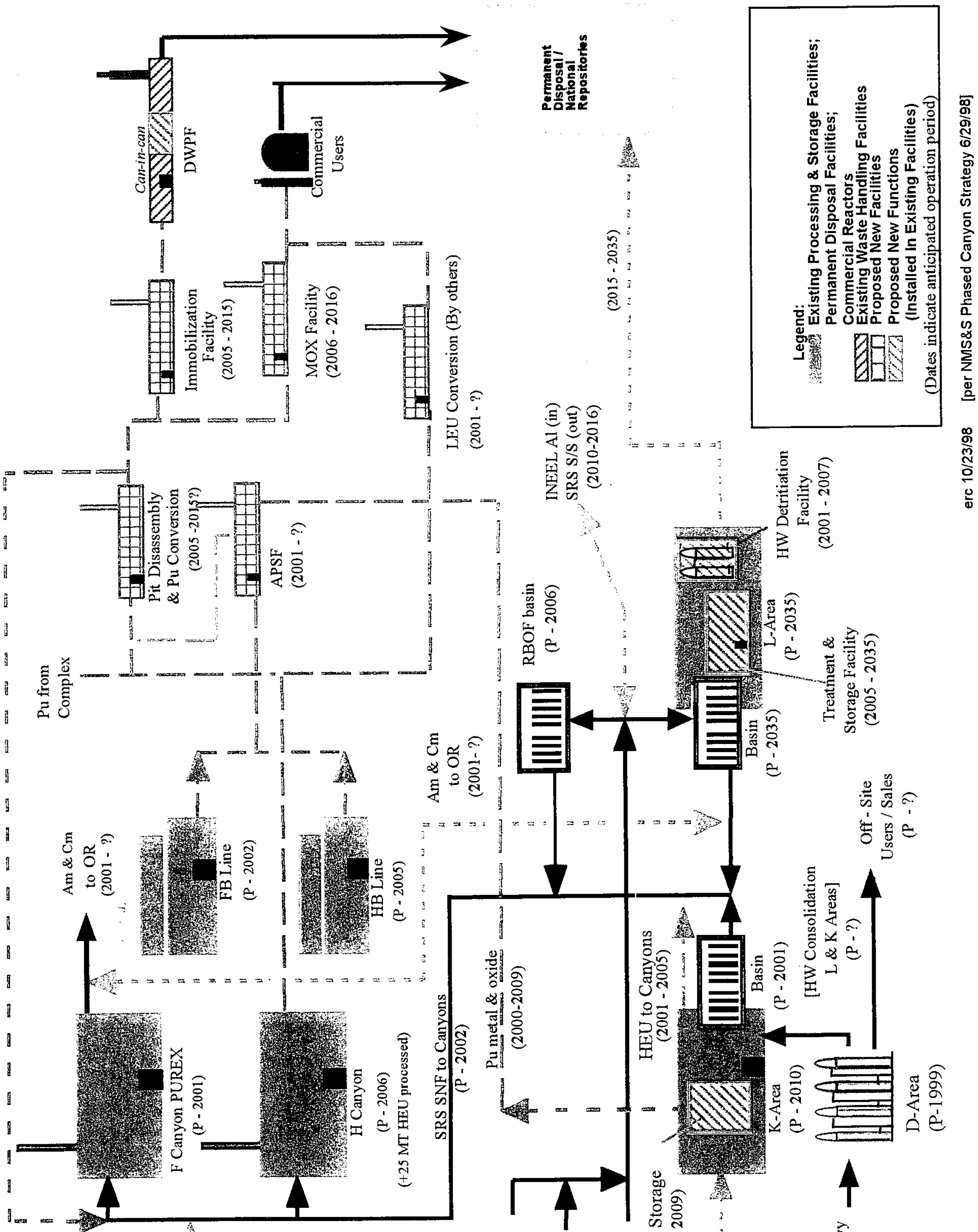


Figure 5

1.0 BACKGROUND AND INTRODUCTION

This document is intended to present in one place the near and long-term plans for management of SRS SNF inventories. These plans are based on current DOE direction and on assumptions of future program funding and progress; they are obviously subject to change. Accordingly, this document will be updated periodically. The Baseline activities and costs for spent fuel management which are given in this Interim Management Plan are consistent with the FY 1999 Annual Operational Plan.

The core of this plan is a description of the implementation strategy for managing SRS spent fuel, based on a few key assumptions. It assumes limited processing through the end of the 94-1 window as per the IMNM EIS Record of Decision (ROD), with limited additional processing to occur as a result of the SRS SNF Management EIS ROD. It further assumes spent fuel which is not processed will be prepared for dry storage in the proposed Treatment and Storage Facility, pending shipment off-site for disposal in a geologic repository. The plan provides reactor basin inventory projections by year, a Level I schedule of SNF spent fuel management activities, a discussion of unresolved issues, and brief discussions of contingency plans.

1.1 Changes from FY 1998 Interim Management Plan

The following are significant changes in this Plan from the SRS FY 1998 Spent Nuclear Fuel Interim Management Plan, published January 1998:

- A recommendation was made to DOE that melt and dilute technology be used to treat for disposal the aluminum-based SNF which is not stabilized using conventional chemical processing. An FY 2000 project has been validated, for design only, to implement the melt and dilute process inside the 105-L building. Road-ready storage of the treated SNF would be provided outside the facility in dry modular storage. The project would become the Treatment and Storage Facility (TSF).

- Current plans assume the deinventory of RBOF by 2006 and continuing operation of L-basin in conjunction with the TSF. (Future basin operation strategy is the subject of a study, currently in progress).

- The quantity of Foreign Research Reactor SNF expected for receipt is currently approximately 12900 assemblies, down from the original 17800 assembly estimate, based on the stated plans of some countries not to participate in the program. This quantity is subject to further change during the 13 year return window (1996 - 2009).

- Processing of Mk 22 SNF through H Canyon continues. However, as a result of further development of the 94-1 processing schedule, the completion of the dissolution of the remainder of the 94-1 SNF (Mk 16, Mk 22, and miscellaneous SNF) is now projected to be delayed approximately 1 year, until early FY 2002.

2.0 SNF MANAGEMENT STRATEGY AND DRIVERS

SNF Program Strategy

The purpose of this plan is to outline near-term actions (over the next ten years) and long-term goals for management of SRS spent nuclear fuel. The SRS Spent Nuclear Fuel Program strategic objectives are as follows:

- Complete the stabilization of the remaining SNF identified as "at-risk" in the IMNM EIS Records of Decision, and the planned deinventory of all SNF in storage in the K and RBOF storage basins.

- Receive and manage foreign and domestic research reactor aluminum-based fuel in the L-reactor storage basin, and for a limited time in RBOF, safely and without incident.

- Complete the development of the melt and dilute treatment technology, in order to prepare spent fuel which is not processed in the SRS canyons for ultimate disposal in a geologic repository.

- Proceed with design of a Treatment and Storage Facility to receive, treat, package, and safely dry store the spent fuel in a "road-ready" form awaiting availability of a geologic repository. This will permit the deinventory and eventual decommissioning of the RBOF storage basin. (Note: Decisions regarding the environmental consequences of the alternative technolog(ies) and the proposed Treatment and Storage Facility will be made in the SRS SNF Management EIS ROD.)

2.1 SNF Program Drivers - NEPA

2.1.1 INEL PEIS/ROD

The Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory (now INEEL) Environmental Restoration and Waste Management Programs Final EIS Record of Decision was issued on May 30, 1995. The key SRS impacts from this decision are as follows:

- Consolidation of aluminum-based SNF at SRS
  - Shipment of-aluminum-based fuel elements from U.S. universities, other DOE and other U.S. Government sites to SRS, most by 2014.
  - Shipment of aluminum-based Foreign Research Reactor (FRR) spent fuel elements to SRS, if receipts of FRR SNF were resumed by the FRR SNF EIS

- Consolidation of non-aluminum-based SNF at INEEL
  - Shipment of non-aluminum-based SNF inventory at SRS to INEEL.

2.1.2 IMNM EIS/ROD

The relevant Interim Management of Nuclear Materials EIS Records of Decision were issued on 12/12/95, 2/8/96, and 4/2/97. Key SRS impacts from these decisions are as follows:

- Process Mk31 targets and existing canyon solutions
- Process MK 16/22 SNF, TRR SNF, one EBR-II canister which was leaking, and miscellaneous "at risk" SNF and targets.

2.1.3 FRR SNF EIS/ROD

The Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel EIS Record of Decision was issued on May 13, 1996. Key SRS impacts from this decision are as follows:

- Return up to approximately 17800 FRR SNF elements to SRS between 1996 and 2009. (Note: Current projections call for receipt of approximately 12900 elements, based on the stated plans of some countries not to participate in the program.)
- Receive high and low-enriched target materials currently in liquid form containing 0.6 MTHM. The original target materials would be similar to the source of Sterling Forest Oxide, currently stored in RBOF.
- Initiate accelerated development of alternative treatment and/or packaging technologies intended to prepare aluminum-based SNF for repository emplacement. Implement this new technology, if possible, by 2000.
- Process any FRR SNF which presents a health and safety concern while canyon stabilization of at-risk materials is in progress, in accordance with the Records of Decision for the IMNM EIS.
- Initiate a study examining the proliferation risks, costs, and timing associated with a decision to chemically separate some of the FRR SNF. (The cost study was issued July 1997, revised December 1997, and supplemented May 1998. A draft of the proliferation study is currently in review and is expected to be available in early FY 1999.)

2.1.4 SRS SNF Management EIS

The Notice of Intent for the SRS Spent Nuclear Fuel Management EIS was signed on December 23, 1996 and released to the public in the Federal Register on December 31, 1996. The draft EIS is expected to be released for public comment in FY 1999. Key decisions from this document will be as follows:

- Determines the environmental consequences of a proposed SNF Treatment and Storage Facility, recommended by the June 1996 Research Reactor Task Team report.

- Determines the disposition of all of the SRS aluminum-based SNF inventories (including new domestic and foreign receipts) which were not designated for processing by the IMNM EIS Records of Decision or which were designated as programmatic materials with no disposition identified.
  - Identifies additional spent nuclear fuels which should be reprocessed while the canyons are operating to stabilize at-risk materials identified in the IMNM EIS RODs.
  - Supports a decision on implementation of alternative disposition technolog(ies) for preparing SRS aluminum-based spent nuclear fuel for geologic disposal.

2.2 Other Program Considerations

2.2.1 Research Reactor Task Team Report

The Record of Decision for the Foreign Research Reactor SNF EIS states that the DOE will aggressively seek alternatives to conventional chemical processing for disposition of aluminum-based fuel with a final selection of a technology and implementation, if possible, by the year 2000. In alignment with this expectation, DOE sponsored a Task Team in the Spring of 1996 to evaluate eleven potential alternative technologies for aluminum-based fuel disposition under four criteria: 1) confidence in success, 2) cost, 3) technical suitability, and 4) timeliness. The Task Team recommended[1] the simpler technologies be evaluated as potential alternatives to conventional chemical processing. Proposed alternative disposition technologies were: Mass limited direct disposal or co-disposal with HLW glass logs in repository waste packages, or co-disposal of isotopically diluted (either mechanically or by melting) fuel.

The Task Team recommended some specific SNF (Tables 5.2-1 and 5.2-2, see Appendix B) be considered as candidates for conventional processing because they would be problematic for repository disposal, would require costly additional treatment or characterization, and/or because the potential release of fission products from them to the wet basins is a "potentially significant health and safety concern". The disposition of these fuels has been evaluated as part of the SRS SNF Management EIS.

2.2.2 National Research Council Study

The National Research Council recently completed a study of the treatment options under investigation by the DOE for the disposal of research reactor aluminum spent nuclear fuels[2] . The study consisted primarily of the reexamination of the findings of the Research Task Team Report mentioned above, and the assessment of the adequacy of the technology development activities underway at SRS. The Council identified three primary tasks to be performed in the study:

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[1] DOE, *Technical Strategy for the Treatment, Packaging, and Disposal of Aluminum-Based Spent Nuclear Fuel - A Report of the Research Reactor Spent Nuclear Fuel Task Team,* June 1996.

[2] National Research Council, *Research Reactor Aluminum Spent Fuel - Treatment Options for Disposal*, National Academy Press, Washington, D.C., 1998.

- Examination of the set of technologies chosen by DOE and identification of other alternatives that DOE might consider;
- Examination of the waste-package performance criteria developed by DOE to meet anticipated waste acceptance criteria for disposal of aluminum spent fuel and identification of other factors that DOE might consider; and
- To the extent possible given the schedule for (the) project, an assessment of the cost and timing aspects associated with implementation of each spent nuclear fuel treatment technology.

After completing the study, the Council concluded the following:

- The DOE identified a reasonably complete list of disposition alternatives for study.
- The methodology used to screen and rank the treatment alternatives was appropriate for the degree of technical maturity and the amount and quality of available data.
- The primary (melt and dilute) and backup (direct co-disposal) treatment options are likely to work as described and produce acceptable waste forms.
- The DOE should give more careful consideration to the use of the conventional reprocessing option as there appear to be several technical advantages to this option over the others considered.
- All important waste-package performance criteria have been identified, although many of the waste acceptance criteria are preliminary and could change significantly as waste package and repository designs are refined.
- The work underway at SRS appears properly focused and appropriate to demonstrate conformance with the waste acceptance criteria, despite the fact the waste acceptance criteria are poorly defined and may be subject to significant change.
- The cost and schedule estimates are suitable for comparison of the options and selection of one or more preferred alternatives.
- The cost and schedule estimates are not, however, suitable for budget planning purposes because the schedule estimates are ambitious, are limited by the lack of conceptual designs for some of the treatment facilities and because some of the process steps have not yet been demonstrated to work for aluminum spent fuel, and because the cost estimates do not consider the impacts of program delays on costs and schedules.

2.2.3 Nuclear Regulatory Commission Review

The Nuclear Regulatory Commission performed a review[3] of the technical program underway at SRS to examine the interim storage and disposal of aluminum-based spent nuclear fuel. In general, the NRC report of the review was favorable, concluding that "based on current information, the staff believes that both the direct co-disposal and melt-dilute options would be acceptable concepts for the disposal of aluminum-based research reactor SNF in the repository." The review did, however, recommend additional testing and analyses which the NRC felt would be required to fully address issues related to the performance of the direct co-disposal and melt-dilute waste forms in the repository preclosure (including interim dry storage) and postclosure environments. DOE/WSRC subsequently met with the NRC to develop an action plan to

[3] Nuclear Regulatory Commission, *"Review of the Technical Issues Related to Interim Storage and Disposal of Aluminum Based Spent Nuclear Fuel"*, NRC-02-97-009, June 5, 1998.

respond to and implement their recommendations. These actions are being followed as part of the continuing involvement of the NRC in the SRS technology development program.

2.2.4 Alternative Cost Study

In December 1997, WSRC completed a cost study[4] which evaluated the costs of ten alternative technologies (co-disposal, melt and dilute, press and dilute, electrometallurgy, dissolve and vitrify, glass material oxidation and dissolution system (GMODS), plasma arc melting, conventional (canyon) processing followed by co-disposal, conventional processing followed by melt and dilute, and conventional processing followed by processing in a new smaller facility) based on assuming "privatized facilities."

In this study, of the ten alternatives, processing followed by co-disposal of the minimal receipts scheduled post-2010 produced the lowest total life-cycle cost, approximately $2 billion. Processing followed by Melt and Dilute was $100 million higher. Grouped about $200 - 300 million higher were (in order): melt and dilute, direct co-disposal, and total processing. Press and dilute was about $500 million higher. Electrometallurgical processing and the three vitrification technologies (Plasma Arc, GMODS, and Dissolve and Vitrify) were $1.2 - 1.7 billion higher than the processing/co-disposal alternative.

In the Spring of 1998, WSRC proposed that the L-Reactor building be modified for a melt and dilute process as opposed to building a "greenfield" facility. A preconceptual cost estimate[5] was developed to support this proposal.

As a result of this proposal, and a DOE-HQ-conducted independent review of the December study, WSRC was requested to evaluate additional cases[6][7][8] based on a standard Line-Item project, assuming currently expected receipts, a 25% percent reduction in receipts, delays of 2 1/2 and 4 years for HEU blend-down, and revisiting the estimate of value of recovered uranium. Life-cycle costs were evaluated on a discounted (7% and 3.8%) as well as a constant dollar basis. Processing followed by Co-Disposal at INEEL of remaining receipts was found to have the lowest cost on a constant dollar basis ($1.2B vs $1.9 - $3.3B) and also on a discounted basis. However, this alternative is not consistent with the Department's recent programmatic decisions and agreements regarding SNF management and therefore will not be evaluated in the SRS SNF Management EIS. Treatment of the SNF inventory by Melt and Dilute in a facility installed in 105-L, which is the current disposition planning basis, was estimated to cost approximately $1.95 B.

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[4] WSRC, *Savannah River site Aluminum-Clad Spent Nuclear Fuel Alternative Cost Study Rev 1 (U),* WSRC-RP-299 REV 1., December 1997.

[5] WSRC, *Preconceptual Design Package Spent Nuclear Fuel Transfer and Storage Services Savannah River Site – Building 105-L,* G-CDR-L-001 Revision B, March 1998.

[6] DOE, Memorandum, C.E. Anderson to W. G. Poulson, "Request for Additional Cost Studies on the Alternative Technologies and 105L Alternative", April 28, 1998.

[7] WSRC, *Revision of Savannah River Site (SRS) Aluminum-clad Spent Nuclear Fuel (SNF) Alternative Cost Study (U),* SPM-SPI-98-0066, October 29, 1998.

[8] WSRC, *Savannah River Site Aluminum-clad Spent Nuclear Fuel Alternative Cost Study – Addendum (U),* WSRC-RP-97-299 REV. 1 ADD.1, May 1998.

2.2.5 Accelerating Cleanup-Paths to Closure

Assistant Secretary for Environmental Management A. L. Alm directed the development of a ten-year plan detailing SRS plans for stabilization of nuclear material inventories and remediation of site facilities. This plan, which is now known as the Accelerating Cleanup-Paths to Closure (ACPC), is intended to supersede the pre-existing 5-year planning activity with the vision of maximizing cost-effective program accomplishments (stabilization/remediation) within a ten-year planning window. The Baseline activities and costs for spent fuel management which are given in this Interim Management Plan are consistent with the FY 1999 Annual Operational Plan and, where applicable, with the January 1998 SRS ACPC update. Changes to the facility assumptions which have occurred since January 1998 will be included in the next ACPC update, scheduled for January - April 1999.

2.2.6 Interaction With Other SRS Missions

The SNF receipt, storage, and disposal mission shares common facilities with several other on-going SRS initiatives, creating the potential for an indirect impact on the SNF program. The major programs discussed below are or will be located within the reactor buildings.

- The DNFSB 94-1 materials consist of irradiated materials stored in the fuel storage basins. Unirradiated Highly Enriched Uranium (HEU) is also stored in the K Reactor building. Additional minor quantities of HEU may be received at SRS for storage with the existing SRS inventories. Disposition of the irradiated materials is discussed in Section 3.4. Several options for the use and/or disposal of the HEU are currently being evaluated and were identified in the Record of Decision for the Disposition of Surplus Highly Enriched Uranium Final EIS (Ref. 4).

- A portion of the 105-K Reactor building will be used for temporary storage of plutonium from Rocky Flats, pending availability of the new Actinide Packaging and Storage Facility (APSF) now under construction in F Area. Use of temporary storage facilities in 105-K will permit early deinventory of fissile materials from Rocky Flats, resulting in substantial savings for the DOE.

- Negotiations with a commercial organization are underway which may result in the installation of a new heavy water processing system in the assembly area of 105-L. This system would be used to purify and detritiate 900 metric tons of the SRS inventory of heavy water for subsequent sale for use as reactor moderator/coolant. At the completion of the six-year mission, the facility would be decommissioned and returned.

2.2.7 Interaction With DOE National SNF Program

The SRS SNF Program maintains a close working relationship with other DOE Sites which manage DOE SNF, and in particular with the DOE National SNF Program office at the Idaho National Engineering and Environmental Laboratory (INEEL). Coordination of effort through National SNF Program working groups assures cost-effective utilization of limited DOE resources and eliminates duplication of effort at the Sites. An example would be the development of implementation plans for the RW-0333P Quality Assurance Program, which regulates the acceptance criteria for the proposed geologic repository.

There are top-level documents prepared by the National SNF Program which broadly define the goals and objectives of the DOE SNF Program. These include DOE/RW-0333P, "Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program", the DOE-Owned Spent Nuclear Fuel Technology Integration Plan, the DOE-Owned Spent Nuclear Fuel Strategic Plan, the Spent Nuclear Fuel Program Requirements Document, and others. SRS SNF Program documents, including this Plan, are consistent with those documents, unless they have been superseded by new guidance.

In support of the National SNF Program, the SRS SNF Program has responsibility for aluminum-based SNF from foreign and domestic research reactors. Current plans call for all DOE aluminum-based SNF to be shipped to SRS for management and eventual disposition. The SRS SNF Program is responsible for the development of technolog(ies) for the safe management of aluminum-based SNF while in wet or dry storage, and for the development of the appropriate disposition for these SNF.

2.2.7.1 Complex-wide Environmental Management Integration

A national integration activity is underway, aimed at coordinating the material disposal plans under development at the various DOE complex sites. This Complex-wide Environmental Management Integration activity produced alternative disposition plans in an effort to reduce costs and accelerate the clean-up of the wastes generated during the Cold War. Included in these plans were proposals to coordinate the development of technologies for preparation of SNF for eventual emplacement in a geologic repository, and to avoid, where appropriate, the duplication of facilities for the treatment and storage of SNF. The SRS SNF disposition map generated as part of this effort is provided in Appendix B.

3.0 BASELINE PLAN

3.1 Baseline Plan Assumptions

Program budgets for FY 2000 and beyond are not yet firm. The following are detailed planning assumptions, based on proposed facility operations and funding requirements.

General Assumptions:

1. Assume processing of "at risk" SNF per the Records of Decision for the Interim Management of Nuclear Materials Environmental Impact Statement (EIS). In addition to the "at risk" fuels, fuels noted as problematic in the Research Reactor Task Team Report (RRTT Report, Table 5.2-1; See Appendix B) will be considered for processing in F and H Canyons. Additional powdered fuel to be received as a result of the FRR EIS (RRTT Report, Table 5.2-2; See Appendix B) and other current and future SNF inventories will be considered separately. Actual disposition decisions will be made in the Record of Decision for the SRS SNF Management EIS. The independent DOE sponsored study on the non-proliferation implications of processing will not preclude processing during the 94-1 window.

2. Assume the receipt of approximately 12900 aluminum based SNF and target assemblies at SRS from foreign countries as specified in the FRR SNF EIS Record of Decision, (except deleting SNF from France, Belgium, Iran, Pakistan, South Africa, and HFR Petten - Netherlands), beginning in FY 1996 and continuing for 13 years.

3. Assume the receipt of aluminum-based SNF from domestic research reactors continues through 2035.

4. Assume the receipt of aluminum based SNF from the Idaho National Engineering and Environmental Laboratory (INEEL) starts in FY 2010 and the shipment of zirconium/stainless steel clad SNF from SRS to INEEL starts in FY 2010.

5. Most incoming fuel will be stored in L-Reactor Basin. RBOF will be used for the receipt of casks which are not compatible with L-basin (e.g., TN 7/2 casks), are better suited to unloading in RBOF, and/or to support unscheduled outages in L-basin. Negotiations are underway to phase-out the receipt of casks which cannot be accommodated in L-basin. Transfers from RBOF to L-basin will be completed as the work-load permits. Projected receipts and transfers are for planning purposes only and may change due to numerous conditions beyond the control of DOE or WSRC.

6. Processing plans are consistent with the current Phased Canyon Strategy -Visionary Roadmap (see Appendix B). This strategy assumes operation of both F and H Canyons for the processing of SNF.

7. Resources, costs and available headcount reflect the FY 1999 Annual Operating Plan and the SRS January 1998 Accelerating Cleanup - Paths to Closure update.

8. The SRS Spent Nuclear Fuel Management EIS for management of spent fuel not currently covered by an EIS will be completed in FY 1999. The Record of Decision for this EIS will not preclude some level of processing in the 94-1 window.

9. Research and development are establishing parameters for direct disposal and melt/dilute options. Melt and dilute is the current planning basis. NRC "review comments" on the alternative treatment technology development will be solicited.

10. A new Treatment and Storage Facility will be available in the 105-L building by the end of FY 2005.

K-Area:

11. Four-shift operations will continue in K Area until deinventory of irradiated nuclear materials is completed. Around-the-clock operation of the K Control Room, supporting building surveillance and maintenance activities for K and L reactor facilities, will continue until deinventory of all SNF, Pu, HEU, and Heavy Water is complete.

12. Deinventory of Mk 16 and Mk 22 SNF (94-1 materials) will be completed during 1QFY 2001 with all other nuclear materials removed shortly thereafter.

13. Shipments of tritium targets to the Tritium Facilities will be completed by 2QFY 2000.

L-Area:

14. Operations are assumed to continue indefinitely in L-basin. With the assumption the Treatment and Storage Facility (TSF) would be located in the 105-L building, L-basin would be used for the receipt and temporary storage of all incoming SNF, pending transfer into the TSF.

15. L-basin will receive foreign and domestic research reactor SNF at a rate of up to 7 casks per month. Transfers to deinventory RBOF will be completed during periods when off-site SNF is unavailable. Additional storage racks may be required in L-basin to accommodate all receipts.

16. Four-shift operations will continue in L-basin throughout FY 1999. Basin personnel support both K and L basin activities.

17. Deinventory of Mk 16 SNF (94-1 materials) will be completed by December 2001. Transfer of the remaining inventory into the TSF will begin in 2005. However, as L-basin will be used for future receipts into TSF, some wet storage inventory will likely be maintained.

RBOF:

18. The RBOF inventory will be transferred to L-basin, except pending NEPA decisions, a portion of the inventory may be transferred off-site or to the canyons for processing. RBOF deinventory is currently assumed to be completed by 2QFY 2006, pending the outcome of a basin utilization study currently in progress. By that time, all off-site SNF receipts must be in casks which can be accommodated in L-basin.

19. Two-shift operations will continue in RBOF through FY 1999.

20. The capability to regenerate resins for portable deionizers will be maintained at least until 2QFY 2006.

Treatment and Storage Facility:

21. Critical Decision 1 (CD-1) has been approved for the FY 2000 Treatment and Storage Facility design-only Line Item Project to be located in 105-L building. The design contract will be awarded in FY 2000, construction will begin in FY 2003, and the facility will be ready to receive SNF by 3QFY 2005.

22. The Treatment and Storage Facility will include new dry storage.

3.2 Storage Operations

Spent nuclear fuel is currently stored in three water-filled storage basins: K and L-reactor storage basins, and RBOF. (P-basin was previously deinventoried to K and L-basins, minor quantities of non-fuel components are stored in C-basin). The vulnerabilities associated with the wet storage basins have been mitigated, including improvements in water chemistry control to provide a good storage environment for aluminum-based SNF, upgraded level detection systems, and upgraded RBOF seismic qualification category (PC2 to PC3). All storage basin safety documentation has been updated, as well.

Some of the facilities used for the management of SNF will also be used for other missions (105-K and L), creating the potential for logistics conflicts among missions (e.g., construction activities, increased facility populations, enhanced security requirements, etc.) Diligence will be required to insure these potential conflicts are minimized.

Figure 3-1 illustrates the deinventory plan for the wet storage basins. (Note: Inventories in Figure 3-1 do not include tritium targets or miscellaneous non-fuel components.)

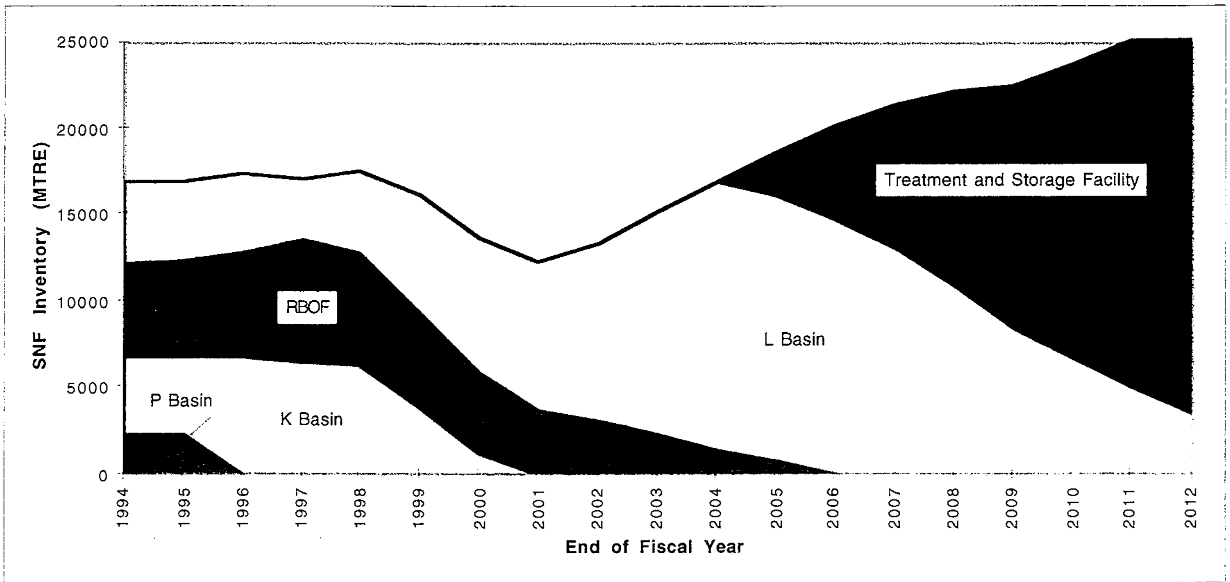

Figure 3-1 Wet Basin Deinventory Plan

The following describes plans for the operation of the facilities used in the management of spent nuclear fuels.

3.2.1 105-K Building

The K-basin is being used for storage of production reactor SNF and miscellaneous SNF and targets pending shipment to H-Canyon for processing, and tritium targets pending shipment to the Tritium Facilities. Cobalt slugs stored in K-basin, which are included in the miscellaneous SNF scheduled for processing, will be transferred to L-basin for consolidation with the larger quantity of similar material already in storage. Current plans will result in K-basin deinventory in FY 2001.

Unirradiated HEU is currently stored in the 105-K Building. Additional storage capacity may be added to accommodate HEU currently stored at other DOE Sites. Disposition of this material was covered in the Record of Decision for the Disposition of Surplus Highly Enriched Uranium Final EIS dated July 29, 1996 (Ref. 4). A small quantity of slightly irradiated research reactor SNF from Uruguay has also been placed into dry storage in 105-K. Disposition of this material will be covered by the Record of Decision for the SRS SNF Management EIS.

Heavy Water is currently stored in drums and tanks in 105-K and in drums in 105-13K. In addition, the HW currently stored in tanks in 105-C and P will be relocated to K and L areas.

K-Area Material Storage (KAMS):

Increased plutonium (Pu) storage capacity is needed at SRS to support the early movement of Pu metal and oxide material from Rocky Flats to SRS prior to APSF operation. Building 105-K will be modified to provide interim storage (approximately 10 years) of Pu until an alternate disposition is identified. The upgrades to Building 105-K will provide interim capability to store

Pu in type 6M, type 9975, and type 9517 shipping containers. Approximately 2100 additional type 9975 or 9517 shipping containers will be procured as part of the program. Facility modifications will include the security upgrades required for storage of Category 1 Special Nuclear Material; the physical security requirements for assembly storage operations and some facility surveillance and maintenance activities will also increase.

Container receipt and storage operations are scheduled to begin 2QFY 2000 with completion in early FY 2002. Starting in early FY 2002, containers of non-3013 packaged material will be transferred to APSF for repackaging; a portion of these containers will be returned to K-Area. In FY 2008, material will be shipped to a Material Disposition Facility where the Pu will be either converted to mixed oxide fuel (MOX) for use in commercial nuclear reactors, or vitrified with high level waste glass for disposal. All inventory in K-area will be removed by the end of FY 2010.

A high-level schedule of K Area activities and an associated manpower summary chart are provided in Appendix A.

3.2.2 105-L Building

Current plans call for 105-L to be the primary SNF receipt and storage facility. Recent projects in L-basin have installed racks which will permit storage of up to approximately 9200 MTR-type and 60 HFIR SNF elements. (Additional storage capacity is available for SNF from SRS reactors). Additional storage racks will likely be required. A dedicated cask decontamination facility and an LWT cask unloading capability are now operational. These upgrades permit L-basin to be used for most domestic and foreign SNF receipts. RBOF will be used temporarily for receipt of casks which cannot be accommodated in L-basin, but by 2006, all off-site SNF will be required to be received in casks compatible with L-basin. L-basin will provide the cask receipt capability for the proposed TSF and will be used for limited storage of SNF, pending transfer into the TSF.

Treatment and Storage Facility:

In April 1998, DOE gave approval for an FY 2000 design-only line-item project to provide an alternative treatment process and storage facility for aluminum-based SNF at SRS. The approval directs WSRC to continue conceptual development of the melt and dilute treatment technology, utilizing the 105-L reactor building to house this new process rather than constructing a new facility.

As currently envisioned, casks containing SNF would be received through the existing cask receipt area of L-basin, unloaded underwater, and the SNF placed into underwater storage racks. The SNF would later be transferred into the melt and dilute treatment facility, which would be installed in the 105-L process room (where the L-reactor vessel is located). The SNF would then be melted together with depleted or natural uranium in an induction furnace, resulting in an ingot with an enrichment of less than 20% U-235. These ingots would be placed into stainless steel canisters for "road ready" storage either inside or adjacent to the 105-L building. These canisters would eventually be shipped to a geologic repository for emplacement with DWPF high level waste glass canisters.

Heavy Water Detritiation:

Heavy Water is currently stored in drums and tanks in 105-L. Additional heavy water, currently stored in tanks in 105-C and P, will be relocated to K and L areas.

Current plans call for the installation of a heavy water detritiation facility in the assembly area of 105-L. This facility will be designed, fabricated, and tested, then shipped to SRS for installation and operation by WSRC personnel. Approximately 900 metric tons of heavy water will be processed and sold for use as reactor moderator/coolant. At the completion of the 6-year processing mission, the facility will be shut-down, and removed. The facility is expected to begin operation in FY 2002.

A high-level schedule of L Area activities and an associated manpower summary chart are provided in Appendix A.

3.2.3 RBOF

Current plans call for phase-out of operations and deinventory of the RBOF facility by the end of 2006, based on the current schedule for development of a Treatment and Storage Facility. A basin utilization strategy evaluating this alternative is under development (see below). Under this plan, the RBOF inventory would be transferred either to L-basin for storage, off-site for programmatic reuse, or to the canyons for processing. Limited receipts which could not be accommodated in L-basin would be expected to continue in RBOF for a few years.

A basin utilization strategy evaluating the advantages of the deinventory of RBOF must consider the following:

- Bundled aluminum fuel transfers from RBOF will require integration with the resources available for completing any Authorization Basis changes and with L-basin operating schedules.
- HFIR and RHF transfers require design and procurement of additional storage racks for L-basin (see section 3.10), and the review and/or development of the Authorization Basis for the associated cask transfers.
- Timing and logistics for disposal of the PM-3a Europium control rods must be defined.
- The transfer of the stainless steel/zirconium-clad SNF will require design and procurement of racks, specification of cask transport criteria, and appropriate Authorization Basis documentation for the wide range of fuel configurations.
- Optimization of transfer operations will require obtaining additional cask inserts, developing appropriate basin resource loading and operation schedules, and integration with project activities, scrap disposal and canyon processing schedules, etc.

A high-level schedule of RBOF activities and an associated manpower summary chart are provided in Appendix A.

3.4 Limited Processing

Fuels identified in the IMNM EIS Records of Decision as "at risk" are being transferred from existing wet storage and processed in F and/or H Canyon. These consist of Mark 31 targets, Mark 16 and Mark 22 spent fuel, Taiwan Research Reactor Fuel, miscellaneous spent fuel and targets currently stored in reactor basins, and one canister of EBR II target material which was leaking. The following is the status of the fuel processing:

- The Mk 31 targets were completed in January 1997.
- The EBR II SNF was completed in March 1997.
- The TRR SNF was completed in April 1998.
- Dissolution of the Mk 16 and 22 SNF began in July 1997 and is currently approximately 3% complete. The schedule for the remaining processing will be finalized following development of an interagency agreement between the DOE and the Tennessee Valley Authority regarding the acceptance criteria for the diluted uranium which will be recovered from the SNF and used in fabrication of new commercial reactor fuel. This agreement is scheduled to be completed in late 1998. The tentative target for completion of dissolving the Mk 16 and 22 SNF is early FY 2002.
- The miscellaneous fuel and targets will be processed concurrent with the M16/22 SNF.

These “at risk” fuels represent approximately 175 MT of the approximately 215 MT spent fuel inventory at SRS in 1996. In addition to these "at risk" fuels, fuels noted as problematic in the Research Reactor Task Team Report (RRTT Report, Table 5.2-1; See Appendix B) will also be considered for processing in F and/or H Canyon; the schedule above assumes these fuels will be processed beginning in FY 2000. The disposition of these problematic SNF, other existing SRS SNF inventories, and projected receipts are the subject of the SRS SNF Management EIS.

Current plans do not include processing of any FRR SNF received as a result of the recent policy renewal, except where required to resolve health and safety risks. Less than 1% of the FRR/DRR SNF to be received is assumed in the FRR SNF EIS to be degraded to the point of being a “health and safety risk” (i.e., 1% of FRR/DRR receipts may be candidates for processing). It may be advantageous to accelerate the return of any SNF which would create a health and safety risk in wet or dry storage to permit near-term processing in the SRS canyons. Decisions made regarding the repository waste acceptance criteria for aluminum-based HEU SNF and the applicability of potential alternative treatment technologies may identify additional aluminum-based SNF for which conventional chemical processing is appropriate.

In the Record of Decision for the FRR SNF EIS, DOE committed to complete a study on the proliferation implications of separative processing. A draft of this study is currently scheduled to be completed in the first quarter of FY 1999. Depending on the results of the proliferation study and on the SNF Management EIS ROD, limited additional processing may occur.

The SRS spent nuclear fuel processing plans are consistent with the recommendations of a Secretarial Action Memorandum (Ref. 11), dated July 17, 1997, which outlined a strategy for utilization of the SRS canyons for the near-term stabilization of nuclear materials. The September 1998 SRS Nuclear Materials Stabilization Visionary Roadmap included in this document (Appendix B) was further derived from the SRS Chemical Separation Facilities Multi-

Year Plan, dated September 1997, with appropriate approved revisions. Operation of both F and H Canyons for the processing of SNF is planned.

3.5 Off-Site Spent Nuclear Fuel Receipt Program

Spent nuclear fuel will continue to be received from foreign research reactors until 2009 and from off-site domestic and government sources until at least 2035[9]. Approximately 1300 casks are expected from off-site reactors, with foreign spent fuel accounting for approximately 450 of the total. Current plans, which take into account a reduction in the number of countries electing to participate in the FRR SNF return policy and completion of shipments from 3 countries (Colombia, Spain, and Switzerland), call for receipt at SRS of aluminum-based FRR spent nuclear fuel from 27 countries, including 13 countries with "other-than-high-income economies." In addition, SRS will serve as a temporary way-point for some shipments of stainless steel clad SNF which are enroute to INEEL, but which arrive in the U.S. through East Coast ports. Spent nuclear fuel remains to be received from 16 university and U.S. government research reactors in 13 states between 1998 and 2035. All shipments from 4 research reactors in 3 states, and all shipments from 2 states (New Mexico and Georgia) have been completed. Schedules for receipt of SNF from both foreign and domestic research reactors are being validated with facility operators to ensure cost effective management of the receipt program. This plan further assumes the receipt of aluminum-based SNF from the Idaho National Engineering and Environmental Laboratory (INEEL) beginning in FY 2010 and the shipment of zirconium/stainless steel clad SNF from SRS to INEEL beginning the same year. Current receipt schedules for off-site SNF are included in Appendix A.

The nominal SRS basin receipt capacity will be 7 casks per month, or up to 84 casks per year with an optimum delivery schedule, however, sprint capacity could exceed 7 casks in some months. The receipt rate for FRR and domestic/government spent nuclear fuel between 1999 and 2009 is expected to average about 60 casks per year (Figure 2). However, basin operations during several years will be at or near capacity, consistent with the availability of the SNF. The FRR returns will range from 16 - 61 casks per year until receipts are completed with 10 casks in 2009. Domestic/government receipts will range from 12 - 37 casks per year until 2017 and are expected to be about 15 casks per year between 2018 and 2035.

Figure 3-3 is based on the current receipt schedule (99-0) for casks from foreign and domestic reactors. It is intended to illustrate the typical month-to-month variability in casks receipts. (Although the maximum sustained cask handling capacity of 7 casks per month is occasionally exceeded, the excess is processed in subsequent months.) This schedule is subject to frequent revision according to such factors as the availability of spent nuclear fuel and casks, overland and overseas transportation schedules, and numerous other factors.

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[9] The future operating schedules of the domestic research reactors is unknown and subject to change over time. While these reactors provide a variety of valuable services, including personnel training, materials research, and the production of medical radioisotopes, their long-term operation is subject to budgetary and political factors beyond the control of the DOE. For the purposes of this Plan, continued operation of the existing reactors, or replacements for them, is assumed.

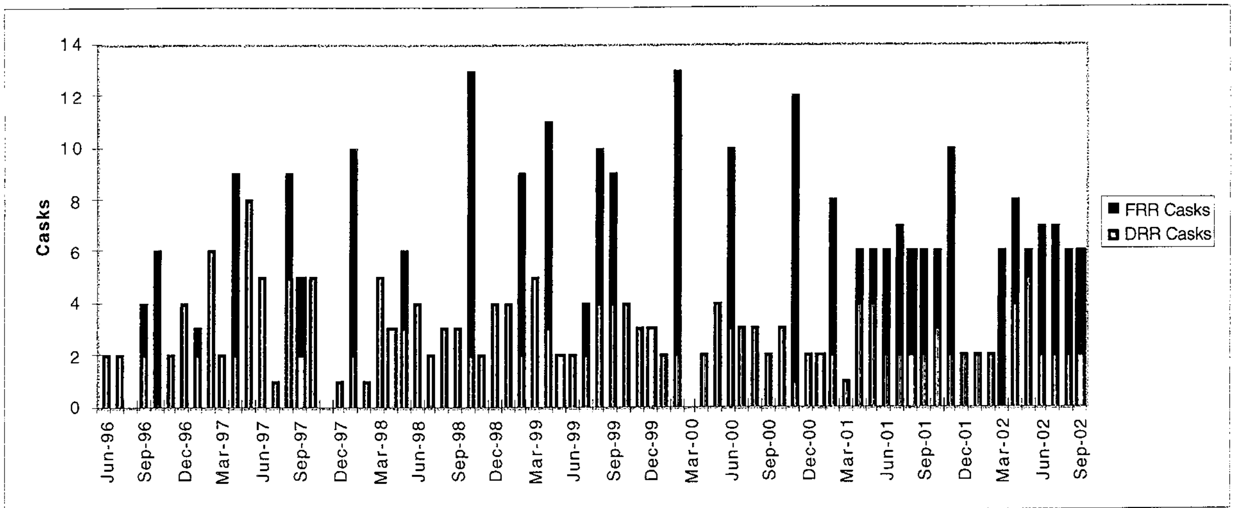

Figure 3-3 Cask Receipt Schedule

Figure 3-4 shows the projected distribution of FRR SNF receipts by uranium enrichment.

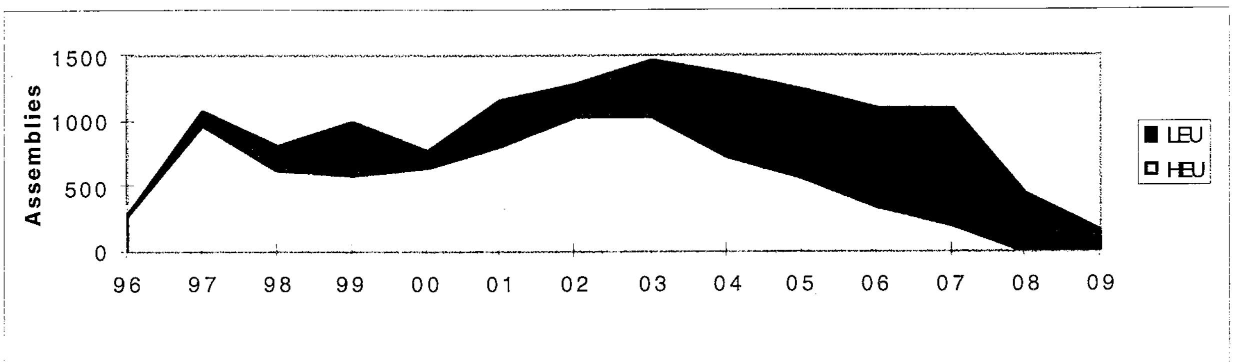

Figure 3-4 FRR SNF Receipts by Enrichment

3.5.1 Inspections at Off-site Research Reactor Facilities

Many off-site reactor facilities which are currently planning to ship SNF to SRS have not shipped SNF in a long time, if ever. Facility inspections have proven to be very helpful in assessing the condition of the SNF, as well as in gathering adequate fuel description data required for shipment. Facility visits have also provided SRS personnel the opportunity to observe fuel and cask handling operations first-hand, which is especially valuable for those fuel-types and/or casks which have never been received at SRS. SRS personnel have used digital cameras and the internet to transmit photographs for "real-time" evaluation at SRS. Video equipment is also used during the fuel inspection and cask loading operations for historical and procedural purposes. SRS personnel have performed on-site inspections of foreign and domestic research reactor spent nuclear fuel at 29 reactor facilities, to date; inspections of 5 facilities are currently scheduled for FY 1999.

3.5.2 Off-Site Receipt Computer Models

A computer model is used to optimize the planning, scheduling, and analysis of SNF shipments from off-site facilities, both foreign and domestic. The simulation model, called OFFSHIP, greatly reduces the time and effort required to analyze the complex global transportation systems, involving dozens of source reactors, multiple cask and fuel types, and time-dependent SNF inventories.

3.6 Cask Management

Facility operations are currently constrained by cask handling capacity. The limited on-site cask transfers which are required, must be managed in such a way that interference with off-site cask receipts is minimized. In addition, there are limited casks available for shipment of SNF from off-site locations, so optimum utilization of casks is crucial. Consequently, cask management is critical to the efficient and cost-effective movement of SNF.

As part of a continuing effort to optimize on-site cask utilization, a study was recently completed which will result in an increase in the number of bundles of SRS SNF which can be loaded into an on-site cask for movement to the canyons. The increase from 3 to 6 bundles per cask cuts in half the number of shipments required to move the SRS SNF.

Table 3-1 shows the number of casks projected to be handled during FY 1999 (from schedule 99-0).

	OFFSITE TO:		RBOF TO:		K BASIN TO:		
MONTH	RBOF	L BASIN	L BASIN	CANYON	CANYON*	TRITIUM	TOTALS
Oct-98	2	8	1				11
Nov-98		5			1	1	7
Dec-98		4	6		1		11
Jan-99		3	5		2	2	12
Feb-99	1	5	2		2		10
Mar-99	1	7	1		2	2	13
Apr-99		5	4	1	2	1	13
May-99		8		1	2	1	12
Jun-99	2	1			2	1	6
Jul-99		3	1	2	2	2	10
Aug-99	2	8		5	2		17
Sep-99		5	2	3	2		12
Totals	8	62	22	12	20	10	134

* Assumes 6 bundles per cask

Table 3-1 Casks To Be Processed in FY 1999

3.7 Current Project Activities

3.7.1 SNF Treatment and Storage Facility Project

In response to direction from DOE-SR, a Business Plan[10] was prepared in FY 1998 to provide the basis for a decision by DOE on the privatization of an SNF Treatment and Storage Facility that may be required for future handling of aluminum-based DOE spent fuel at SRS. The Business Plan included project and life-cycle cost estimates for the SNF treatment technologies recommended in the Research Reactor Task Team Report (co-disposal and melt/dilute) based on pre-conceptual designs. Based on the preliminary results of the Alternate Technology Program, both of these favored technologies were judged to be capable of providing a disposal form that could be placed in "road ready" interim storage at SRS, pending the availability of a permanent national repository. The fundamental conclusions of the Business Plan were that: 1) within the level of accuracy of the project and life-cycle cost estimates, which were based on pre-conceptual designs, it could not be demonstrated that privatization would result in a significant cost savings when compared to a traditional line item project, and 2) several areas of potentially significant risk to the project required further mitigation. These areas of potential risk include:

- NRC licensing strategy,
- Repository waste acceptance criteria,
- SNF treatment technology uncertainty,
- SNF characteristics and receipt rates, and
- DOE project funding availability.

In April 1998, Critical Decision 1, Approval of Mission Need was received from DOE for an FY 2000 design-only line item to support handling of aluminum-based DOE SNF at SRS. The CD-1 approval directs WSRC to continue conceptual development of the melt and dilute treatment technology, utilizing the 105-L building to house this new process. In response to the Approval of Mission Need, a project team was formed to focus on advancing the conceptual design to support project validation in the Spring of 1999. A Conceptual Design Report (CDR) for the design-only project will be developed to provide better technical, cost, and schedule baselines for the design project in comparison to the pre-conceptual design used to acquire CD-1 approval. The CDR development will be closely integrated with the Alternate Technology Program to reduce the areas of risk identified above.

3.7.2 RBOF Lighting Upgrades (TPC - $0.3M)

Additional storage and processing requirements indicated a need for improved lighting systems to safely and efficiently manage the spent fuel projected to be received. Project S-6085 provides for additional and upgraded lighting in RBOF to facilitate ongoing and new spent fuel handling missions. This project is presently in the construction stage.

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[10] WSRC, *Business Plan for Determination of the Optimal Implementation of Dry Spent Fuel Storage at SRS (U)*, WSRC-RP-97-00773, September 1997.

3.7.3 L-Basin Lighting Upgrades (TPC - $1.0 M)

Lighting upgrades are required to support the increase in the storage and processing capability of L-basin. This project includes installation of new and rework or removal of existing electrical components.

3.7.4 L Area 85 Ton Transfer Bay Crane Modernization (TPC - $1.2 M)

The transfer bay crane is used to move fuel casks into the disassembly basin to start the unloading process for domestic and foreign SNF receipts. This crane is used extensively and is approximately 40 years old. This project will upgrade the control and power systems to present-day industry-standard variable frequency controls with an encoder positioning system. Additionally, all motors will be replaced for maximum reliability and optimum performance. The project is currently in the design phase.

3.8 Potential Project Activities

The following projects are under consideration:

3.8.1 L Area 120 Ton Stack Area Crane Modernization

The stack area crane is used to perform initial receipt of the fuel casks and final assembly of the cask for shipment to the next destination. This project would perform the same general modifications as the L Area 85 Ton Transfer Bay Crane Modernization project. The project is in the conceptual design phase.

3.8.2 Replacement Resin Regeneration Facility

Current plans call for the deinventory and closure of RBOF in 2006. However, the facility used to regenerate the deionizer resin beds, which are used to maintain wet storage basin water chemistry, is located in RBOF. A suitable replacement for this facility will be required before the RBOF facility can be closed.

3.9 Supporting Technology Development

No additional technology is required to support limited processing in the SRS Canyons. However, technology development is required to support the transition to a potential alternative fuel disposition capability. The focus of the program is to:

- Validate the requirements that have been developed for interim dry storage,
- Validate the process developed for the Melt and Dilute treatment option,
- Demonstrate the aluminum SNF form meets the repository characterization and stabilization requirements,
- Establish the protocols to qualify metallic waste forms for the repository, and
- Ensure viability of technical approaches through independent reviews by the Nuclear Regulatory Commission (continuing) and the National Academy of Sciences (complete).

The schedule for the technology development activities is designed to support the Treatment and Storage Facility project and the repository license application. The facility technical functional requirements were developed in 1998. Inputs for supporting the development of the Total System Performance Assessment for the repository license application began in 1998 and will continue up to (and, if needed, following) the submittal of the application to the NRC approximately March 2002.

Technology development activities that have been completed to date, or which will be completed in the near future include the following:

- Development of corrosion models and storage criteria for dry interim storage.
- Design and fabrication of a test canister for initiating dry storage testing with irradiated spent nuclear fuel.
- Completion of criticality analysis by the DOE-RW M&O for repository disposal of high enriched uranium.
- Development of laboratory-scale equipment to support the melt and dilute option.
- Reviews of regulatory requirements for the disposal of aluminum-based spent nuclear fuel.
- Review by the National Academy of Sciences of the research activities and the DOE-HQ task team recommendations associated with the disposition technology development program.
- Review by the Nuclear Regulatory Commission, consistent with the Memorandum of Understanding for communicating between the NRC and DOE-EM.
- Completion of a comprehensive status report on the alternate technology development programs and issuance of the functional performance requirements, including the technical bases for the functional performance requirements.
- Submission of an ASTM Test Protocol, for ballot, for qualification of the aluminum metallic waste form by 2QFY 1999.
- Initiation of testing of melt-dilute forms for interim storage by 2QFY 1999.
- Completion of the process development of the melt and dilute technology using unirradiated mock-up fuel elements and initiate validation of the melt-dilute process by 4QFY 1999.

3.9.1 Recommended Disposition Technology - Melt and Dilute

The most significant technical issue for direct disposal of SNF is the difficulty in predicting the adequacy of engineered criticality controls over geologic time. The melt and dilute disposition technology can mitigate this concern by reducing the effective enrichment to more easily controlled limits. Dilution could also resolve potential proliferation concerns by reducing the uranium enrichment so that use in a weapon would no longer be feasible. A recommendation was made to DOE that melt and dilute technology be used to treat for disposal the aluminum-based SNF which is not stabilized using conventional chemical processing.

The melt and dilute technology would reduce the isotopic enrichment of the SNF by melting the fuel and adding uranium-238, either from depleted or natural uranium. A target enrichment has not been selected, but would be less than 20% uranium-235. The technology development program is addressing a number of SNF-form issues including: homogeneity requirements, degradation rates, optimum operating parameters (e.g., temperature, volume of melts, and criticality concerns during melting), production scale-up considerations, and packaging designs.

3.9.2 Alternative Disposition Technology - Direct/Codisposal

The objective of the alternate technology development program is to provide technical methodologies and analyses to support qualification of DOE-owned aluminum-based SNF for interim dry storage and ultimate repository disposal. The primary path envisioned for ultimate disposition involves transfer and processing of wet-stored SNF into an aluminum-SNF waste form by melting and diluting into a sealed canister. The canisters would be placed into interim dry storage for up to 40 years, awaiting repository disposal. They would then be transported to the repository and placed into waste packages for emplacement.

Changes in the expected repository acceptance criteria may make it feasible, or economically attractive to dispose of intact SNF. The aluminum-SNF waste form would need to meet requirements for both interim dry storage and geologic disposal systems. Exposure of aluminum-SNF waste forms to various environments will cause changes from initial conditions. Degradation could result in the release of radionuclides from the aluminum-SNF matrix and reconfiguration of fissile species, which could effect the performance of the proposed repository. Therefore, analytical and experimental activities are being conducted to characterize the response of the aluminum-SNF forms to potential repository environments. Characterization of the response of these materials to interim storage environments has already been completed, except for validation testing.

3.10 Spent Nuclear Fuel Management Challenges and Uncertainties

This section characterizes issues which have been identified in previous studies and outlines the approach to their resolution. Organizations responsible for resolution are indicated in parentheses.

1. Funding Availability (SRS Management): With the end of the Cold War, budget allocations to support materials stabilization efforts at the Savannah River Site are being reduced. The approach taken to secure adequate funding for the SRS SNF Program is to:

    a) Quantify each Scope of Work with specific cost, and

    b) Clearly identify the impacts of any proposed funding reduction in such a way that essential SNF Program activities can be defended as competitive with other essential activities at the SRS and within the DOE Complex.

2. Rebundling Materials in RBOF (SFSD Operations): A baseline plan assumption is that Table 5.2-1 materials will be selected for near-term processing by the Record of Decision for the SRS SNF Management EIS, including the Sterling Forest Oxide (SFO) material. In addition, the unirradiated Mk42 targets have been proposed for processing. To conserve storage space in RBOF, the cans of SFO material were consolidated into 8 cans per storage bundle in 1996 and the Mk42 tubes were stored as nested tubes. Criticality limits would require rebundling the SFO materials into bundles containing no more than 3 SFO cans prior to processing in the canyon dissolvers. Similarly, the 16 bundles of nested Mk42 target tubes would require rebundling into approximately 32 individual components prior to processing.

3. Late Identification of Cask Licensing Requirements (SFSD Engineering): Experience to-date with the spent fuel returns program substantiates that shipping plans and schedules are often influenced by the availability of casks which have been properly licensed and certified to transport specific fuel types. On several occasions, the NRC and the DOT have been requested to compress cask certification reviews/approvals in order to meet DOE receipt schedule commitments.

   To minimize or eliminate this issue, a technical description of the SNF remaining to be shipped under the current returns program must be determined. Once the fuel details are known, a fuel/cask comparison database can be created. The database will allow timely comparison of a specific fuel to the authorized contents requirements of a particular cask type and will highlight any potential shipping problems.

4. 70-Ton Shipping Cask Recertification (SFSD Engineering): The five 70-ton shipping casks, which are used for on-site movement of various nuclear fuels and fuel components, have been in service for more than 30 years and were not designed or fabricated to Department of Transportation (DOT) Standards. However, the WSRC Transportation Safety Manual (19Q) requires these casks to be certified in accordance with DOT Standards. Current DOT Standards permit the certification of on-site shipping casks to be "grandfathered", but require formal certification per an established program and development of a Safety Analysis Report for continued use beyond October 1, 2000. To this end, a 70-Ton Cask Program was established in November 1995 to certify the casks for continued on-site use. Certification completion is scheduled for March 1999.

   The 70-ton shipping casks are fabricated with one of three different internal configurations, depending upon the type of fuel to be moved in the cask. Failure to recertify any one of the five casks would impact timely and efficient movement of SNF on-site and could require internal modification of the remaining casks. Failure to recertify all of the casks would severely restrict or eliminate all on-site SNF transfers - impacting transfer of at-risk SNF to the canyons for processing, basin deinventory, etc. To date, the identified modifications include cask trunnion reinforcement and a modified bolting arrangement to permit through-bolt attachment of the cask lid.

5. End of Life Nucleonics (SFSD Engineering): Storage of spent fuel is currently based on beginning of life fissile material values and does not take credit for burn-up. This increases storage space requirements in wet basins, dry storage, and in the repository. An experimental project is underway to attempt to reduce the materials uncertainty for SRS casks, which may increase allowable cask loading, and to develop a methodology for crediting burn-up in criticality calculations, further increasing shipping and storage capacities.

   Initial spent fuel reactivity measurements were completed in July 1998. Additional measurements are scheduled for November 1998, pending review and acceptability of the July data. Proof-of-concept is projected for February 1999.

6. Availability of Adequate SNF Storage Capacity (SFSD Fuel Integration): Additional storage racks for MTR-type SNF, stainless steel and zirconium clad (SS/Zr) SNF, and HFIR SNF will be needed at some point in the future as L-basin becomes the primary storage facility. A study will be conducted during FY 1999 to determine the range of times when additional racks would be required, as a function of differing assumptions such as receipt rates, RBOF deinventory plans, and TSF availability. Preliminary analysis indicates sufficient floor space exists in L-basin to install any required racks. A discussion of the potential storage requirements for each major fuel type is provided below.

MTR-type SNF:

Storage capacity for approximately 9200 MTR-type SNF assemblies has been installed in L-basin. At the beginning of FY 1999, storage space for approximately 6900 assemblies will remain in the existing storage racks. Based on the current forecast for off-site receipt and on-site transfers consistent with de-inventory of RBOF in FY 2006, this capacity could be exceeded as early as FY 2003. See Figure 3-5.

SS/Zr-clad SNF:

Storage to accommodate transfers of some of the stainless steel or zirconium-clad SNF from RBOF will require a different rack design than used for the aluminum bundled fuel. Initial transfers of SS/Zr SNF from RBOF are anticipated beginning as early as FY 2000, in order to support RBOF deinventory completion in FY 2006. More detailed plans will need to be developed to determine exactly when new design racks will be required.

HFIR SNF:

SRS currently has 10 HFIR cores in storage in L-basin with capacity for 60; 14 cores are in storage in RBOF, with capacity for 20. By the beginning of FY 1999, the Oak Ridge HFIR facility will have 63 spent HFIR cores in backlog storage. Ten (10) additional spent HFIR cores will be produced per year, except for FY 2000, in which a 5-month HFIR reactor outage is planned. Oak Ridge has proposed shipment of approximately 20 HFIR cores per year in a dedicated cask until the backlog is depleted in about 2005. According to this proposal, the existing L-basin storage capacity would be exceeded during FY 2001 (see Figure 3.6). A reduced shipment rate that depletes the Oak Ridge HFIR backlog during FY 2009 is also shown for comparison.

By the time the TSF would begin accepting HFIR cores for treatment, 120 or more additional storage locations in L-basin may be needed. Preliminary review indicates 60 additional positions could be added to rows currently containing scrap in vertical tube storage, using the original rack design. Minor design modifications would be required to mount racks in other basin locations.

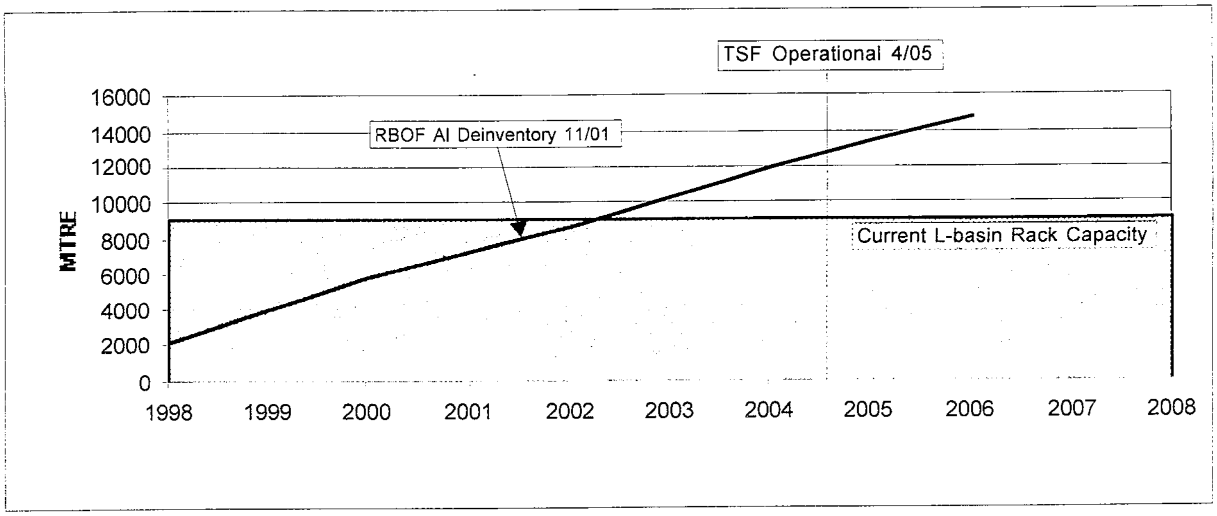


Figure 3-5 MTR-type Storage Capacity Requirements

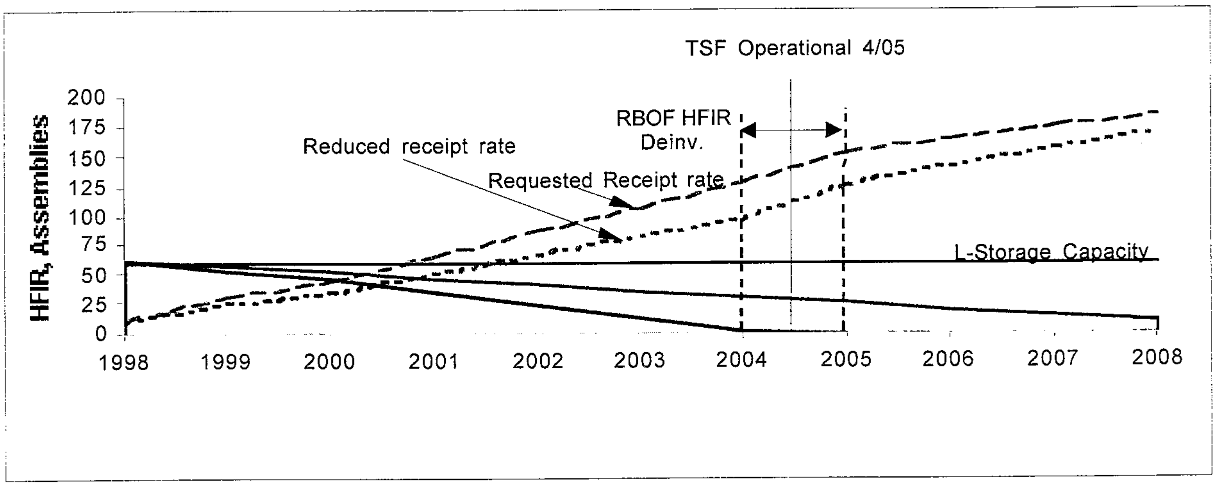


Figure 3-6 HFIR Storage Capacity Requirements

7. SNF Storage Basin and Canyon Interactions (SFSD Engineering, NMSS Operations): Current plans call for processing a portion of the existing SNF inventory in the SRS Canyons. This will permit the rapid deinventory and closure of the K-basin and, to a lesser degree, the RBOF basin. However, the SRS Canyons are also under consideration for use in deinventory and stabilization of other nuclear materials stored in the DOE Complex. Careful consideration will be required to ensure the cost savings to be gained from potential Canyon processing scenarios offset the costs which would be incurred from any delays in closure of SRS basins.

8. Replacement Resin Regeneration Facility (SFSD Engineering): Current plans call for the deinventory and closure of RBOF in 2006. However, the facility used for the regeneration of deionization resins, which are used to maintain the water chemistry in the wet storage basins, is located in RBOF. Closure of RBOF will require establishment of an alternate resin regeneration facility to serve the needs of L-basin.

9. Repository Availability (TSF Project): While the repository availability date is currently estimated at 2010, the earliest availability for SRS SNF and high-level waste is projected to be approximately 2015. Both of these dates are uncertain. Therefore, interim storage must be suitable for an extended and as yet indeterminate period of time.

   The design life of dry storage will be a minimum of 40 years.

10. Repository Acceptance Criteria (TSF Project): The requirements for repository emplacement of DOE-owned aluminum-based high-enriched uranium fuel are not established and are subject to change in the years prior to repository availability. Functional requirements which will satisfy preliminary acceptance criteria have been developed as the basis for designing the Treatment and Storage Facility. (See Figure 3-7) Significant changes in these criteria could negatively impact the design, construction, or operation of the TSF.

11. Potential Sale of Cobalt (SFSD Fuel Integration, SFSD Engineering): The SRS cobalt inventory is part of the miscellaneous SNF targets identified for processing by the Record of Decision for the Interim Management of Nuclear Materials EIS. Current plans call for consolidation of the cobalt inventory in L-basin as part of the K-basin deinventory, followed by dissolution in the canyons and discharge to the high-level waste tanks. A study will be completed during FY 1999 to determine if there would be sufficient economic value to justify seeking commercial sale of some or all of the inventory.

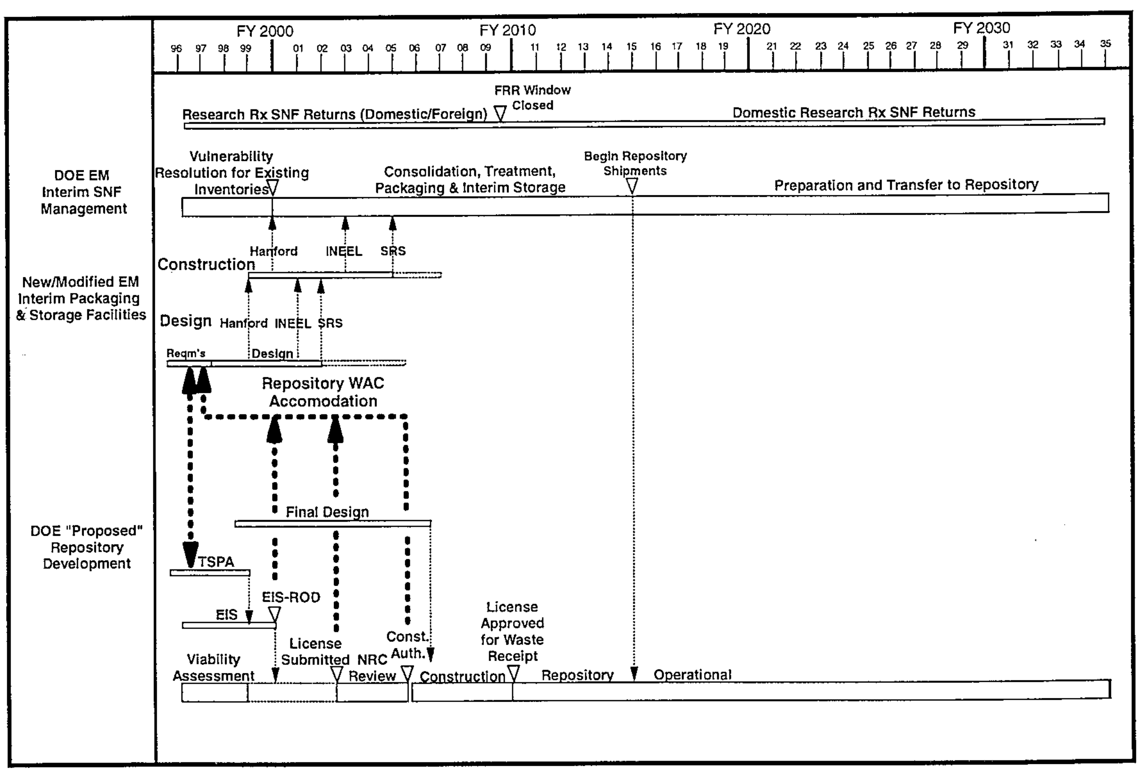


Figure 3-7 Repository Timeline

4.0 CONTINGENCY ANALYSIS

4.1 Sensitivity to Baseline Assumptions

4.1.1 Foreign Fuel Receipt Program Participation

There are two high-inventory countries which are still undecided about participation in the Foreign Research Reactor Receipt Program. (This is in addition to the countries which have indicated they will not participate in the program: Belgium, France, Iran, Pakistan, and South Africa). At this time, Canada has indicated tentative plans to start shipments in 2001, and HFR Petten (Netherlands) may start as early as 1999. However, should Canada and HFR Petten chose not to participate, the anticipated FRR SNF receipts would be reduced by approximately 50% in total casks and 40% in total assemblies.

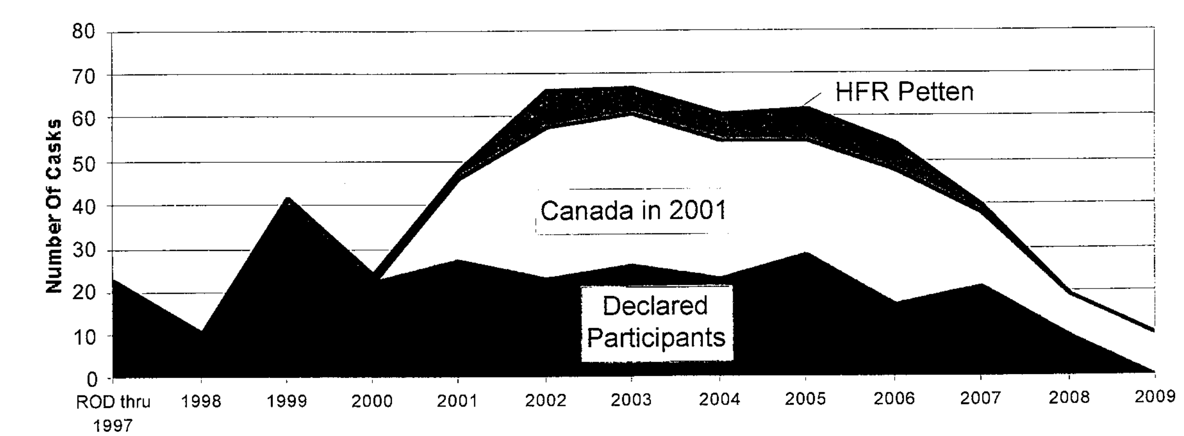


Figure 4-1 FRR Cask Receipt Schedule

4.1.2 Domestic Fuel Receipt Program Participation

The projections used in this document for receipt of domestic research reactor SNF through 2035 are based on the current plans for operation of the DOE and university reactors which use aluminum-based SNF. These plans are, of course, subject to change. Figures 4-2 and 4-3 illustrate the key contributors to the domestic receipt program, in terms of expected numbers of assemblies and casks, respectively. Clearly, changes in the operating strategies of the HFIR or Brookhaven reactors, or a change in the decision to exchange SNF with INEEL (see Section 4.2), would have a significant impact on future receipts at SRS.

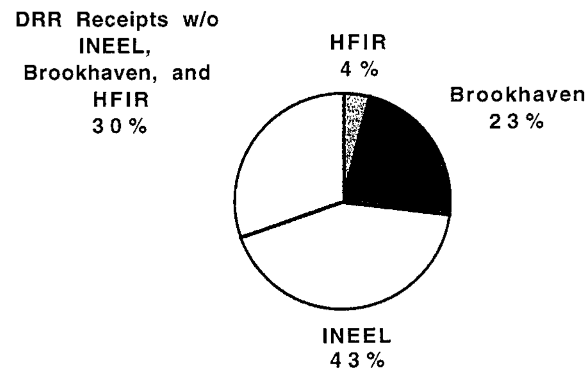


Figure 4-2 DRR Receipts by Assembly

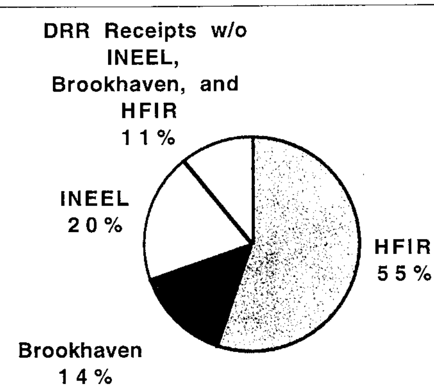


Figure 4-3 DRR Receipts by Cask

4.1.3 Improved Efficiency in Foreign Cask Shipments

The Foreign Fuel Receipt Program is intended to address potential weapons proliferation concerns by returning foreign research reactor SNF of U.S. origin between 1996 and 2009. Accomplishing this task will require the shipment of hundreds of casks of SNF from as many as 41 countries, over land and across the seas. To date, several foreign reactors operators have delayed their SNF returns for various technical, political policy, or economic reasons. Some others have indicated they will not participate in the Program, but may reconsider before 2009. This has raised concerns that insufficient receipt capacity could exist during the last few years of the program. While DOE and WSRC continue to emphasize to the reactor operators the importance of early returns of SNF to avoid shipping conflicts at the end of the program, special attention may be required to address specific circumstances. Options need to be developed to address the potential shipping bottle-neck and to improve the efficiency of foreign cask shipments.

4.2 Activities with Potential Longer-Term Significance

The following items with potential longer-term significance to the SRS SNF Management Program have been identified:

- Approximately 2000 MTRE of stainless steel/zircoloy clad (SS/Zr) SNF are currently stored at SRS and approximately 10500 MTRE of aluminum-based SNF are expected to be received from INEEL. A baseline assumption is that these inventories will be exchanged beginning in 2010, in accordance with the SNF Programmatic EIS ROD. If it is later determined that these SNF are suitable for direct disposal in the repository, without treatment, consolidation by fuel type may not be necessary, thus saving transportation and facility operations/handling costs. This alternative is among those being considered as part of a DOE-EM Integration effort currently underway (Ref. 19). (Implementation of this alternative would require, as a minimum, a supplemental ROD for the SNF Programmatic EIS). If these inventories are not exchanged, the SNF inventory to be managed at SRS will be about 8000 MTRE less than assumed as the baseline case.

- Americium/curium bearing materials were identified as materials with potential programmatic value in the IMNM EIS RODs. The SRS SNF Management EIS may decide to use the RBOF or L-basin to temporarily store these materials or to ship them to other sites for use. Close coordination will be required to minimize interference with planned off-site SNF receipts and shipments.

APPENDIX A

INVENTORY

DATA

SFSD Basin SNF Inventory - As Of 10/1/98

(excludes any fuel movements in progress)

	RBOF			L basin			K basin			C basin		
Fuel Type	**Assys**	**Bundles**	**Kg HM**	**Assys.**	**Bundles**	**Kg. HM**	**Assys.**	**Bundles**	**Kg. HM**	**Assys.**	**Bundles**	**Kg. HM**
-- SNF, TARGETS, and MATERIALS -- "DISPOSITIONED IN SRS IMNM EIS RODs" --												
- ALUMINUM BASED SNF -												
SRS Fuels & Targets												
Mk 16 (3 ea: O,M,I)	5	5	6.0	538	189	2706	31	15	140			
Mk 16 middle, inner							1		2			
Mk16B inner target				1								
Mk22 (2 ea: O,I)	1	3	3.0				1220	314 in HTS	4074			
Mk22 targets (outer)							208	in VTS	n/a			
Mk22 targets (inner)							208	in VTS	n/a			
Mk60B							82		n/a			
Cf Sources				4		0	12		0	2		0
Mk 18	65		1.0									
Mk51 (Amer. slug)							60	in 1 bucket	0.4			
Other	114		0.4									
Li-Al reactor materials:												
- Control Rods GR				7		n/a	61	not irrad.	n/a	3		n/a
- Control Rods GM				3		n/a	61	not irrad.	n/a	9		n/a
- Control Rods FA				9		n/a	122	not irrad.	n/a	61		n/a
- Control Rods FM				3		n/a	61	not irrad.	n/a	59		n/a
- Sparger Inserts (15 ea)				3		n/a	3	not irrad.	n/a			
- Sparger Inserts (10 ea)							3	not irrad.	n/a			
Subtotal SRS SNF and Targets	**185**		**10.4**	**568**		**2706**	**2133**		**4216.8**	**134**		**0**
"Other misc." SNF												
Mk50 slugs				1		3	16	(2 assm.)	52			
Pu Monitor Pin				18		0						
Cobalt (kg not HM)				603		"58"	170		"19"			
Mk 42 target assem.	2		1.4									
Thulium Slugs				5		n/a						
PuBe				1			6					
-SNF MATERIALS -- "DISPOSITION IDENTIFIED IN INEL SNF MANAGEMENT PEIS"-												
SS or Zr CLAD SNF												
ANL-MXOX	8		0.6									
B&W	1		0.1									
CVTR	34	3	67.5									
Dresden Nucl Power *	35		2452.9									
EBWR	298		9982.0									
Elk River *	189	38	5028.6									
EPRI	1		0.0									
GCRE	72		61.3									
H B Robinson	1		0.5									
Hanford Eng Dev Lab	63		2.8									
HTRE	13		4.0									
Light Water Reactors	16		12.7									
ML-1	68		58.6									
N.S. Savannah	1		3.0									
ORNL BW-1	13		0.5									
ORNL SIW-1	3		0.2									
Saxton	102	11	420.3									
Shippingport	2	2	16.1									
SPERT	3		42.2									
SRS-HWCTR	409		2105.1									
Vallecitos BWR	7		19.1									
Subtotal SS/Zr (DRR)	**1339**		**20278.0**									
CANDU	4		49.5									
Subtotal SS/Zr (FRR)	**4**		**49.5**									
Total SS/Zr	**1343**		**20327.4**									
Total w/ Disposition Identified	**1530**		**20339.2**	**1196**		**2709.0**	**2325**		**4268.8**	**134**		**0**

SFSD Basin SNF Inventory - As Of 10/1/98
(excludes any fuel movements in progress)

	RBOF			L basin			K basin			C basin		
Fuel Type	**Assys**	**Bundles**	**Kg HM**	**Assys.**	**Bundles**	**Kg. HM**	**Assys.**	**Bundles**	**Kg. HM**	**Assys.**	**Bundles**	**Kg. HM**
-SNF, TARGETS, and MATERIALS -- "DISPOSITION TO BE IDENTIFIED IN SRS SNF MANAGEMENT EIS"-												
Domestic Research Reactor												
ANL- Janus	19	4	2.8									
ATSR	20	4	3.2									
Bulk Shielding Reactor				40	10	6.8						
Ga Tech RR	25	5	4.5									
HFBR	140	28	38.0	911	182	244.5						
HFIR	54	0	213.2	14		40.9						
Iowa State	11	3	1.8	11	3	1.7						
LANL Omega West	87	15	15.0									
Missouri U RR (Columbia)				216	92	147.9						
MIT	56	19	19.4	64	8	21.8						
NIST	16	4	1.2	110	28	8.6						
Ohio St U	24	4	3.4									
ORR HEU + ORR LEU	162	30	124.3	32	7	52.2						
RINC	66	12	8.0									
Sterling Forest Fuel	200	34	28.4									
U of Michigan	48	8	34.0									
U of Missouri RR (Rolla)	28	5	n/a									
U of Virginia	44	8	6.9									
Subtotal DRR Aluminum	**1000**	**183**	**504.1**	**1398**	**330**	**524.4**						
Foreign Research Reactor												
ASTRA (Austria)	26	5	3.7									
DR-3 (Denmark)	30	5	2.9	61	13	8.3						
ENEA (Italy)				133	30	36.8						
FMRB (Germany)	92	16	11.7									
FRG-1 (Germany)	33	6	4.5	107	31	39.4						
GRR-1 (Greece)	65	11	9.2	41	11	5.2						
HIFAR (Australia)				215	48	30.1						
HMI (Germany)				132	15	14.6						
HOR (Netherlands)	33	9	4.0									
IAN-R1 (Colombia)	21	6	2.4									
JEN-1 (Spain)	2		0.4	39	10	15.8						
JMTR (Japan)				171	43	69.9						
McMaster (Canada)	41	7	5.5									
Nereide (France)	46	8	35.4									
R-2 (Sweden)	232	43	31.9	136	28	18.1						
RECH-1 (Chile)	28	5	3.9									
RHF (France)	4	0	25.6									
SAPHIR (Switzerland)	167	29	110.4									
Subtotal FRR Aluminum	**820**	**150**	**251.4**	**1035**	**229**	**238.2**						
OTHER SNF												
Fuels & Specimens /Table 5.2-1												
Sterling Forest Oxide (powder)	676	87	98.1									
SRE * (declad)	37	37	2130.6									
EBR-II (declad)	353	59	16773.6									
Other misc. SRS fuel & targets												
Mk 42 target assm. (unirradiated)	16		38.7									
Mk 14	1	1	0.2									
Subtotal "Other"	**1083**	**184**	**19041.2**									
Total Aluminum w/o Disposition	**2903**	**517**	**19796.7**	**2433**		**762.6**						
Total w/ Disposition Identified	**1530**		**20339.2**	**1196**		**2709.0**	**2325**		**4268.8**	**134**		**0**
Total SRS Inventory	**4433**		**40135.9**	**3629**		**3471.6**	**2325**		**4268.8**	**134**		**0**

* Thorium based fuel

SNF Receipts (MTRE, except for HFIR)*

End of FY	FRR Assy	FRR Target Mat'l	DRR Assy	INEEL MTRE	HFIR Cores	Cum. MTRE✈
1996	379		69		3	448
1997	542		1169		10	2159
1998	549		304		11	3012
1999	1264		205		22	4481
2000	645		95		22	5221
2001	859		122		20	6202
2002	902	274	174		17	7278
2003	1302	270	126		20	8706
2004	1224	270	105		20	10035
2005	1147	216	189		18	11371
2006	898	324	168		10	12437
2007	1025	184	63		10	13525
2008	445		246		10	14216
2009	160		147		10	14523
2010			84	1317	10	15924
2011			210	1317	10	17451
2012			147	1317	10	18915
2013			84	1317	10	20317
2014			231	1317	10	21865
2015			147	1317	10	23329
2016			84	1317	10	24730
2017			210	1310	10	26250
2018			182		10	26432
2019			84		10	26516
2020			210		10	26726
2021			147		10	26873
2022			84		10	26957
2023			189		10	27146
2024			168		10	27314
2025			63		10	27377
2026			231		10	27608
2027			126		10	27734
2028			161		10	27895
2029			189		10	28084
2030			168		10	28252
2031			63		10	28315
2032			147		10	28462
2033			126		10	28588
2034			105		10	28693
2035			105		10	28798
Totals	11341	1538	6927	10530	463	

* Projections are for year to be received.

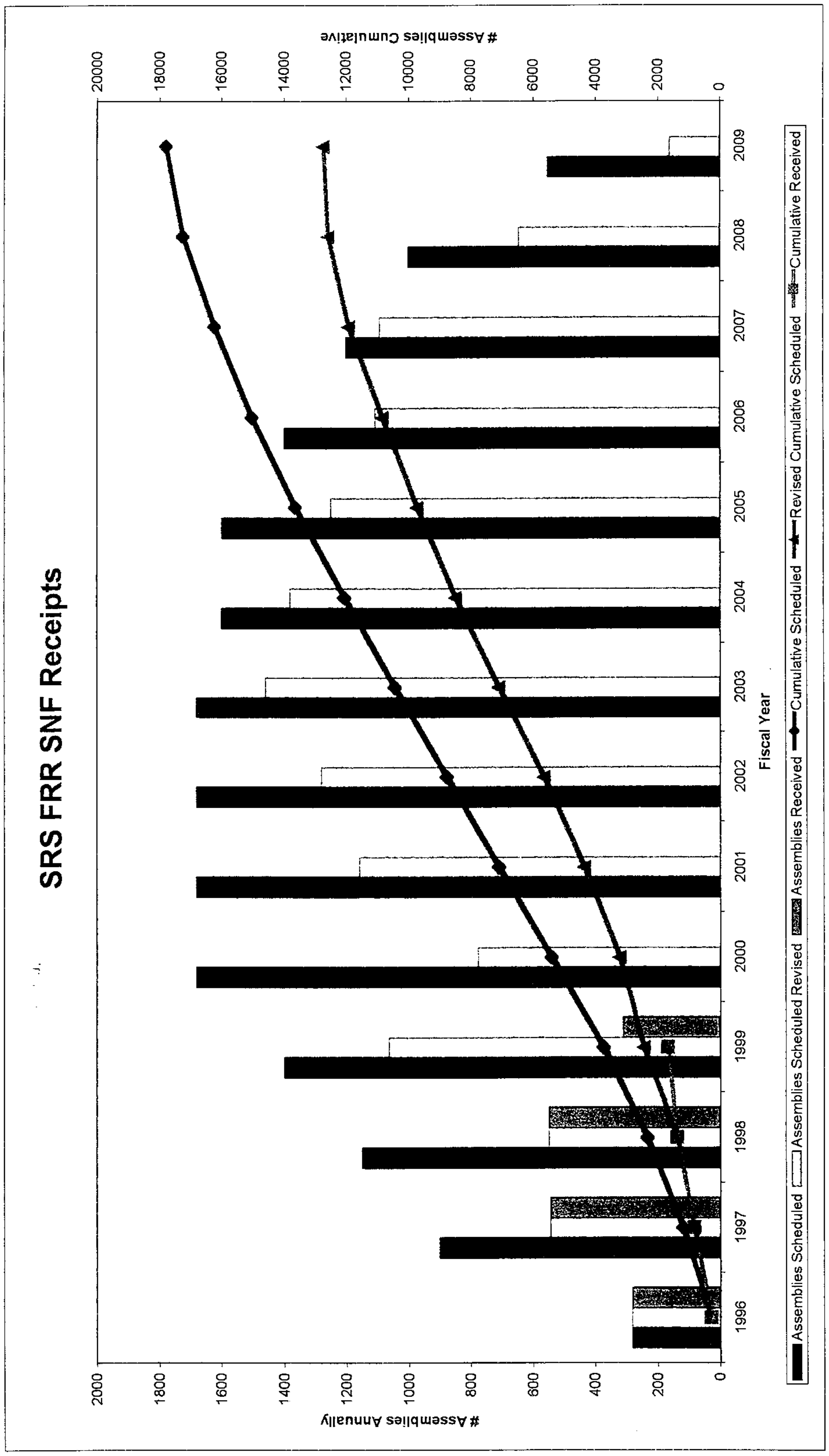
✈ Does not include HFIR

Cask Receipts/Shipments*

End of FY	FRR	DRR/ DOE	INEEL	HFIR	Receipt Totals	Shipments to INEEL (SS/Zr)	Shipments to the Repository
1996	11	6		3	20		
1997	15	34		10	59		
1998	11	21		11	43		
1999	40	9		22	71		
2000	16	9		22	47		
2001	37	3		20	60		
2002	40	7		17	64		
2003	61	4		20	85		
2004	55	4		20	79		
2005	53	5		18	76		
2006	48	6		10	64		
2007	38	2		10	50		
2008	19	8		10	37		
2009	10	5		10	25		
2010		3	20	10	33	22	
2011		6	20	10	36	26	
2012		5	20	10	35	26	
2013		3	20	10	33	26	
2014		7	20	10	37	26	
2015		5	20	10	35	22	18
2016		3	20	10	33	17	18
2017		6	20	10	36		18
2018		6		10	16		18
2019		3		10	13		18
2020		6		10	16		18
2021		5		10	15		18
2022		3		10	13		18
2023		5		10	15		18
2024		6		10	16		18
2025		2		10	12		18
2026		7		10	17		18
2027		4		10	14		18
2028		6		10	16		18
2029		5		10	15		18
2030		6		10	16		18
2031		2		10	12		18
2032		5		10	15		18
2033		4		10	14		18
2034		4		10	14		18
2035		3		10	13		3
Totals	454	243	160	463	1320	165	363

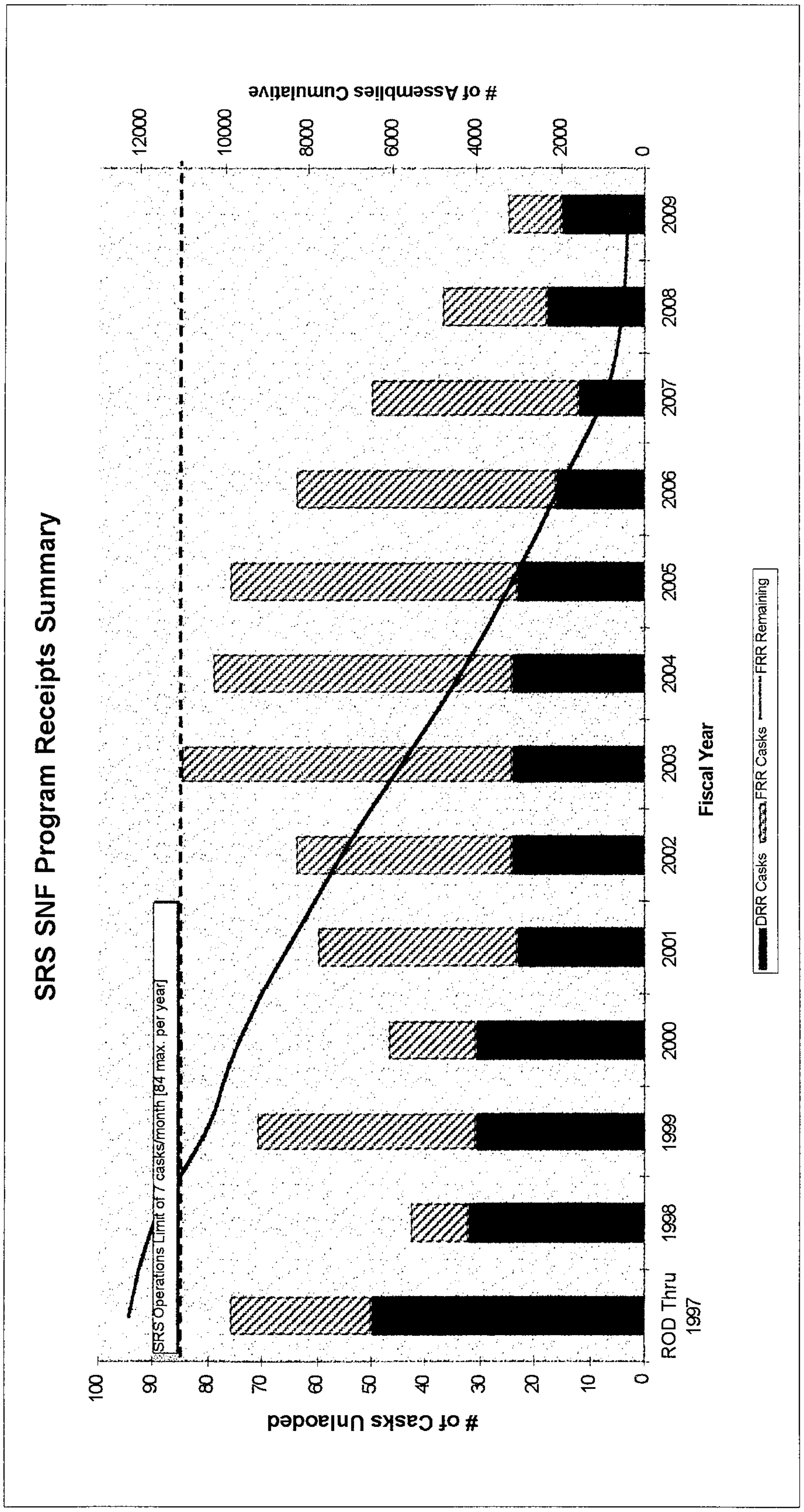
* Projections are for year to be received.

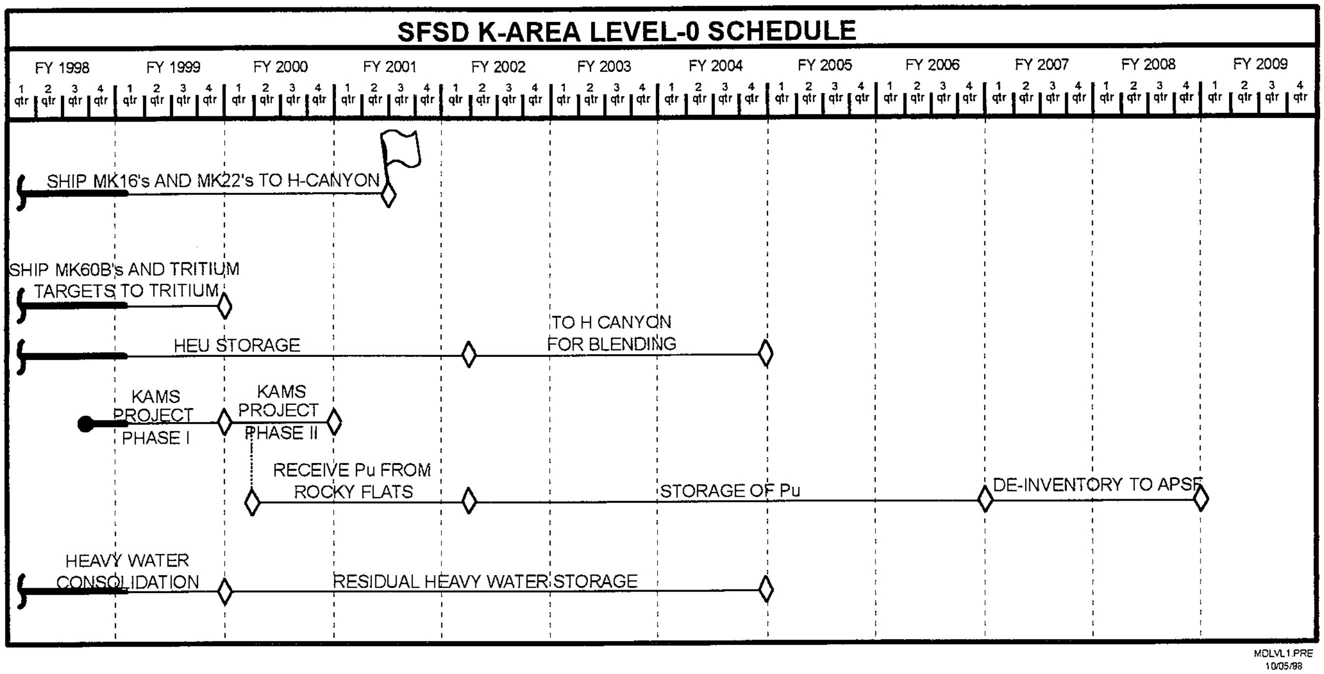
srsfrrd.xls

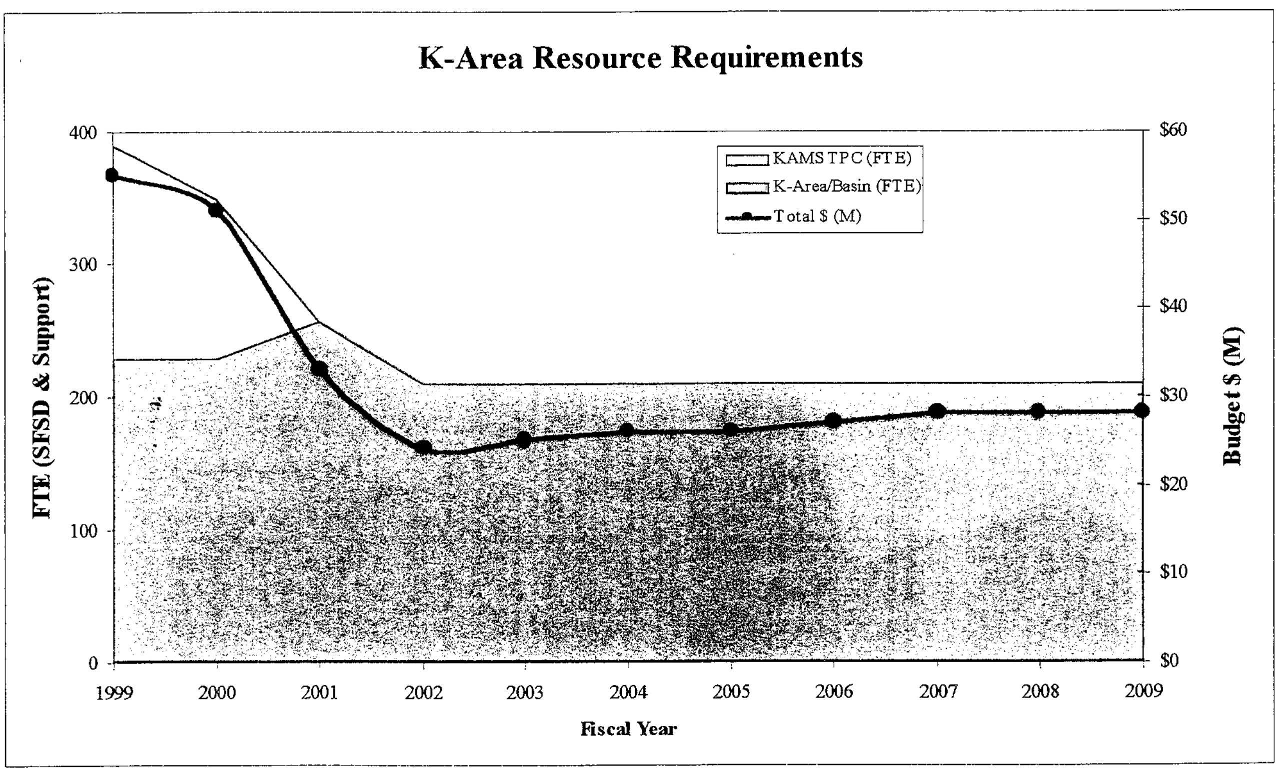


11/11/98

Assumes Base Case Scenario: France, Belgium, HFR Petten, Pakistan, Iran, and South Africa not participating in FRR Program. Canada shipments resume in CY2001.


SRS SNF Program Receipts Summary
SRS Operations Limit of 7 casks/month [84 max. per year]
# of Casks Unloaded
# of Assemblies Cumulative
Fiscal Year
ROD Thru 1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
DRR Casks
FRR Casks
FRR Remaining


SFSD K-AREA LEVEL-0 SCHEDULE
FY 1998
FY 1999
FY 2000
FY 2001
FY 2002
FY 2003
FY 2004
FY 2005
FY 2006
FY 2007
FY 2008
FY 2009
SHIP MK16's AND MK22's TO H-CANYON
SHIP MK60B's AND TRITIUM TARGETS TO TRITIUM
HEU STORAGE
TO H CANYON FOR BLENDING
KAMS PROJECT PHASE I
KAMS PROJECT PHASE II
RECEIVE Pu FROM ROCKY FLATS
STORAGE OF Pu
DE-INVENTORY TO APSF
HEAVY WATER CONSOLIDATION
RESIDUAL HEAVY WATER STORAGE
MDLVL1.PRE
10/05/98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K-Area/Basin (FTE)
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FTE (SFSD & Support)
Budget $ (M)
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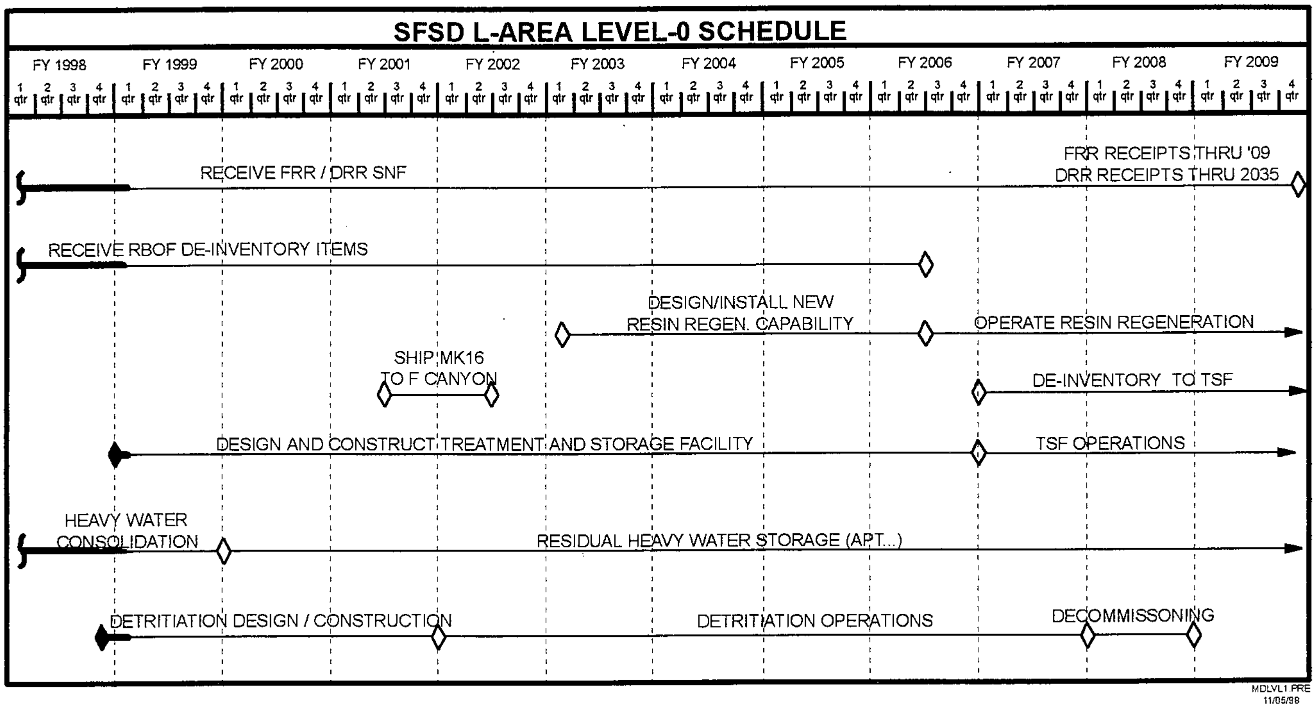
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FY 2009
RECEIVE FRR / DRR SNF
FRR RECEIPTS THRU '09
DRR RECEIPTS THRU 2035
RECEIVE RBOF DE-INVENTORY ITEMS
DESIGN/INSTALL NEW RESIN REGEN. CAPABILITY
OPERATE RESIN REGENERATION
SHIP MK16 TO F CANYON
DE-INVENTORY TO TSF
DESIGN AND CONSTRUCT TREATMENT AND STORAGE FACILITY
TSF OPERATIONS
HEAVY WATER CONSOLIDATION
RESIDUAL HEAVY WATER STORAGE (APT...)
DETRITIATION DESIGN / CONSTRUCTION
DETRITIATION OPERATIONS
DECOMMISSONING
MDLVL1.PRE
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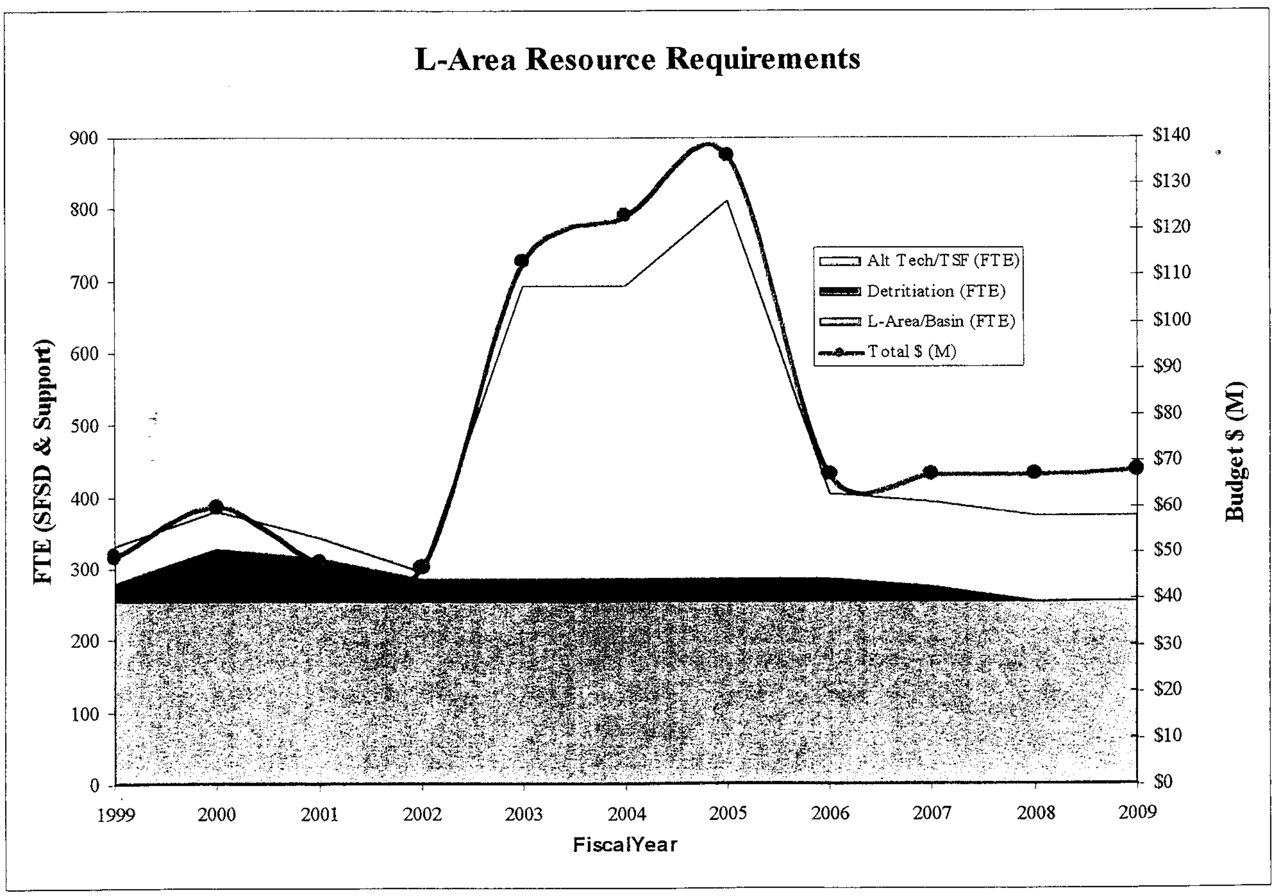
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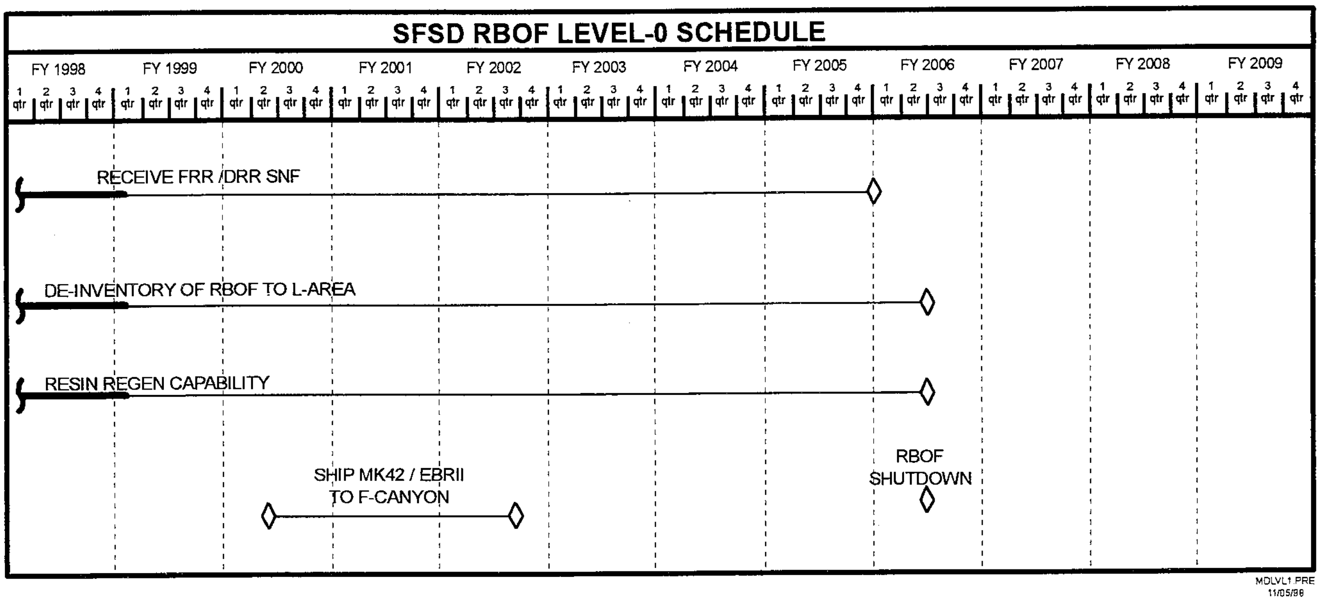
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FY 1998
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FY 2008
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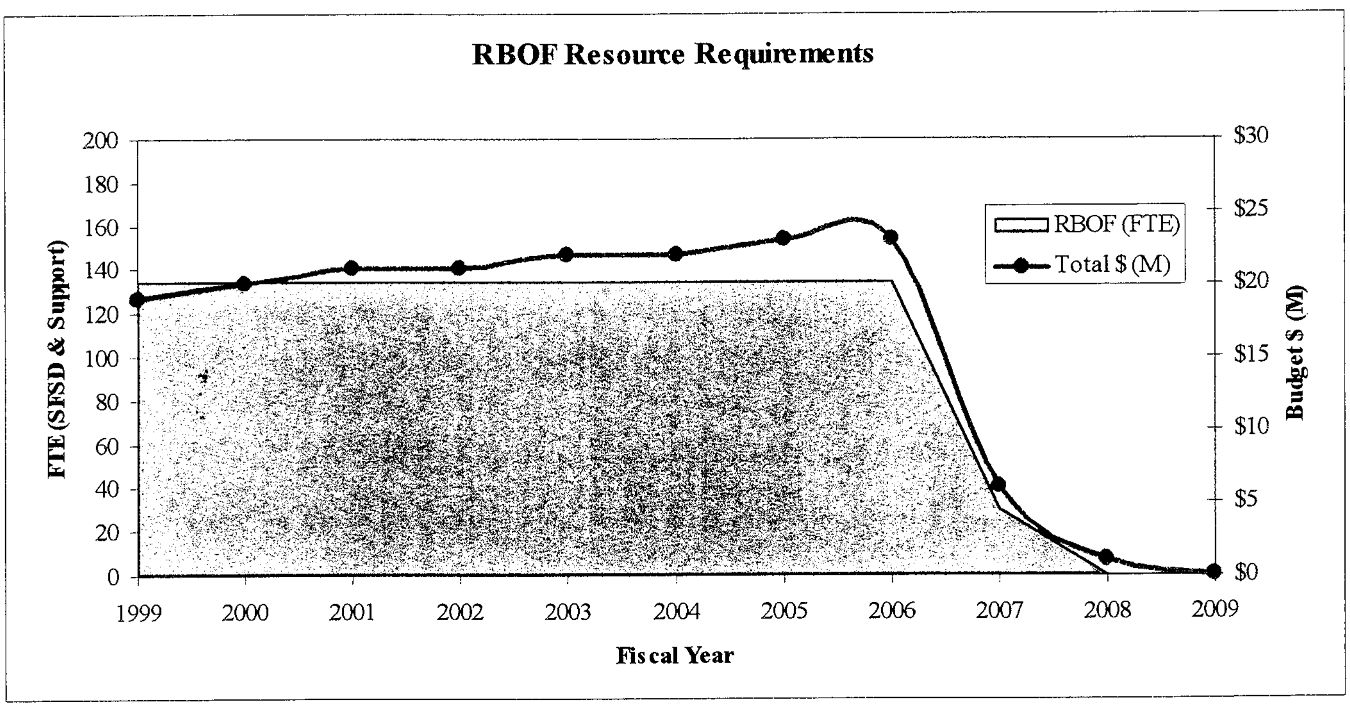
RECEIVE FRR /DRR SNF
DE-INVENTORY OF RBOF TO L-AREA
RESIN REGEN CAPABILITY
SHIP MK42 / EBRII
TO F-CANYON
RBOF
SHUTDOWN
MDLVL1.PRE
11/05/98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Total $ (M)
Fiscal Year
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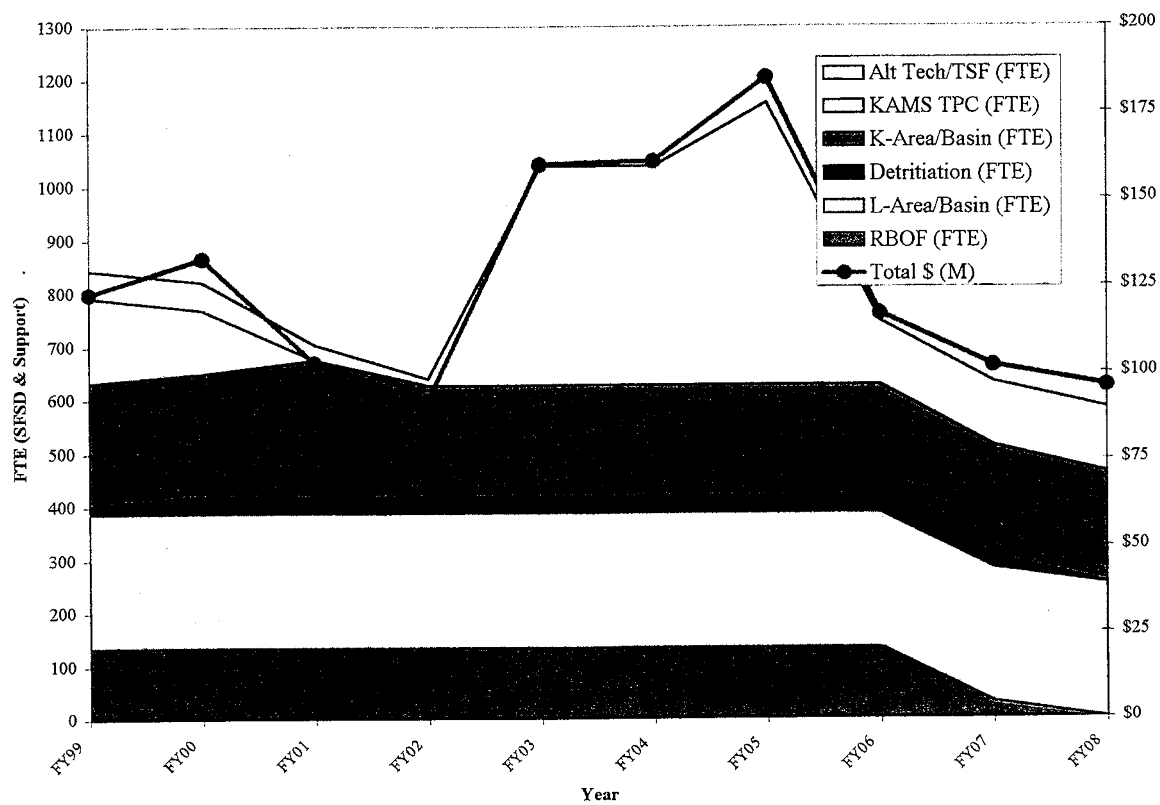
SFSD Resource Requirements



APPENDIX B
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Fuel Recommended for Processing by the Research Reactor Task Team

The tables below summarize fuels recommended for processing by the Research Reactor Task Team Report, the driver for processing, and estimated processing time. These fuels were considered processed for the purposes of this plan.

Table 5.2-1 Aluminum-Clad SNF Processing Candidates[1]

Fuel Type	Reason for Processing	Alternatives	Number of Items	Mass (MTHM)	Volume (m^3)	Dissolving Time[2] (Years)
Metallic Uranium Fuels:						
Taiwan Research Reactor	Poor cladding condition and historical failures. Uranium metal will react quickly with basin water if canister leakage occurs, with release of fission products to the basin and the potential for gross canister failure. Not suitable for direct disposal without treatment.	Ship to Hanford for hot vacuum dry treatment. Store in Canister Storage Building being constructed at Hanford.	62 cans	16.11	1.47	0.4 X-H
Experimental Breeder Reactor-II	Fuel is declad. Uranium metal will react quickly with basin water if canister leakage occurs, with release of fission products to the basin and the potential for gross canister failure. Uranium metal fuels may not be suitable for repository emplacement because uranium metal is not chemically stable (forms oxides or hydrides). Not suitable for direct disposal without treatment.		59 cans	16.58	3.00	0.8 X-H
Sodium Reactor Experiment	Fuel is declad. The uranium-thorium metal will react quickly with basin water if canister leakage occurs, with release of fission products to basin. Not suitable for direct disposal without treatment.		36 cans	2.127	0.02	0.2
Oxide Target Materials (particulate residues from medical isotope production):						
Sterling Forest Oxide	Particulate materials would readily disperse in basin water if canister leakage occurs, with release of fission products to the basin . Repository emplacement of particulate material is not allowed.	Ship to INEL for stabilization using the Electrometallurgical Treatment option.	878 cans	0.102	3.7	0.6
Failed and Sectioned Fuels:						
Oak Ridge Reactor (canned silicide, oxide, aluminide pieces)	Placing cans of failed and sectioned fuels into existing storage basins presents potential environmental, safety, and health concerns. Future canning and characterization would result in additional personnel exposure and expense.	Store at SRS in a suitable facility for dry storage pending resolution of disposition path.	9 cans	0.0195	0.1	0.3
High Flux Isotope Reactor (canned oxide fuel pieces)	The quantities of sectioned fuels are very small.		1 can	0.0000126	0.011	
Tower Shielding Reactor (canned aluminide fuel)			2 cans	0.00025	0.022	
Tower Shielding Reactor (aluminide fuel)	Element is a one-of-a-kind full-core. Special canning of this unique element, with attendant personnel exposure and expense, would not be cost-effective.		1 element	0.0092	0.1	

Notes:
1. The total volume of 8.42 m^3 listed in this table represents 3.3 percent of the 255 m^3 of DOE-owned aluminum-based SNF expected to be in inventory by 2035. The total mass of 34.9 MTHM represents 56.3 percent of the 62 MTHM expected to be in inventory by 2035.
2. The SNF materials can be processed in either the F or H canyon unless an "X-H" is present, indicating that the SNF materials can not be processed in H-canyon because it is not configured to process depleted or natural uranium fuel at any practical throughput.

Table 5.2-2 FRR SNF Requiring Additional Consideration

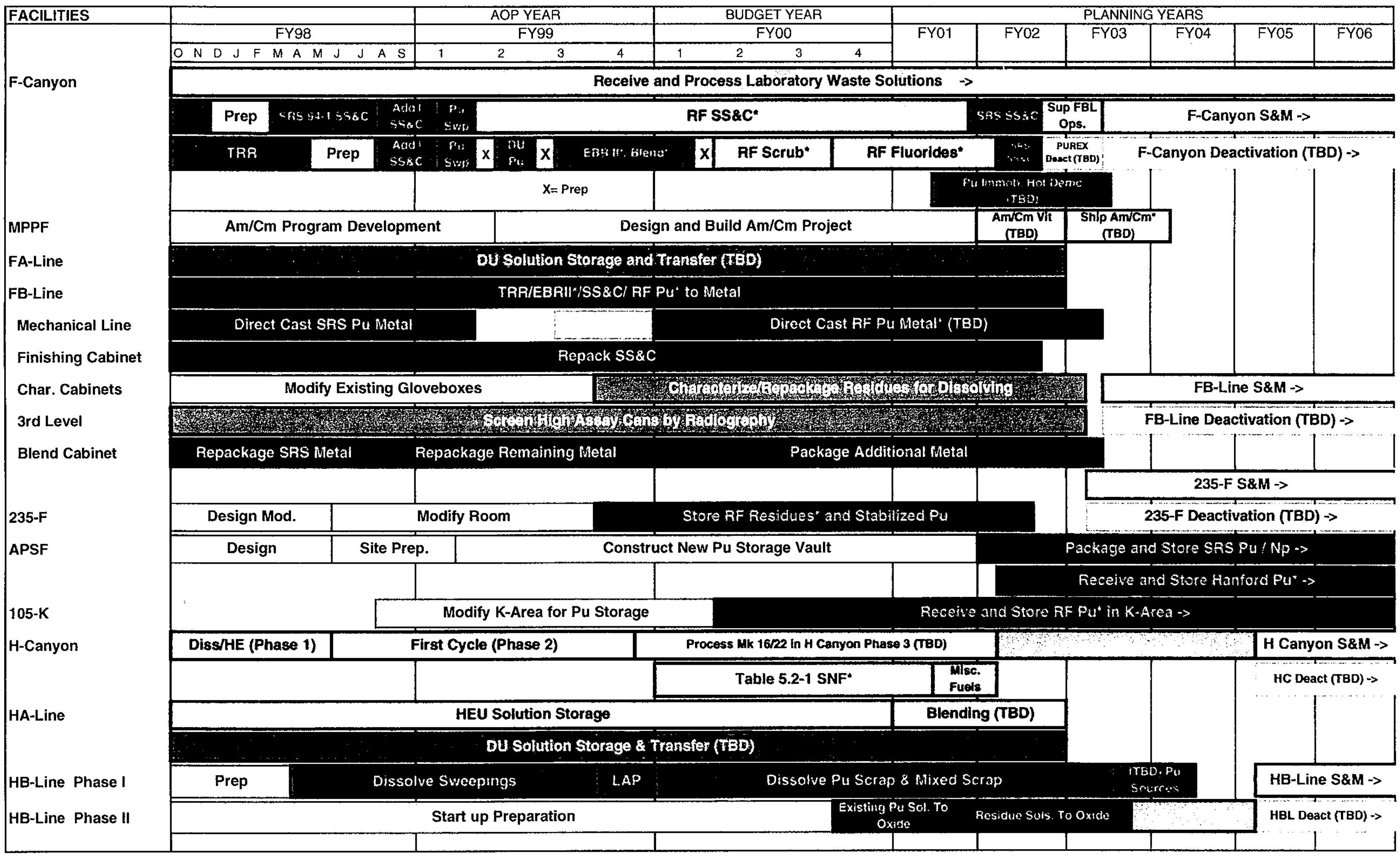
Fuel Type	Reason for Processing	Alternatives	Mass (MTHM)	Volume (m^3)	Dissolving Time[2] (Years)
Target materials in powdered form to be received under FRR EIS (Canada, Belgium, Argentina, and Indonesia)	Similar materials have previously been received in particulate form.[1] Particulate materials would readily disperse in basin water if canister leakage occurs, with release of fission products to the basin. Repository emplacement of particulate material is not allowed.	Explore receiving the material in a different form (that is suitable for direct disposal) from the reactor operators. Store in Canister Storage Building being constructed at Hanford.	0.56	6.5	3.5[2]

Notes:
1. It has been assumed that this material will be packaged, and in a form similar to that of the Sterling Forest Oxide SNF.
2. Much of this material is currently in a liquid form and has been shipped in the past in powdered form. It may be possible to dilute and solidify the fuel in a form suitable for disposal at the foreign reactor site prior to shipment to the U.S. This option will be evaluated during the R&D effort recommended to be conducted by SRS.

Dates Beyond FY99 are Targets for Success Planning

SRS Nuclear Materials Stabilization and Storage
Phased Canyon Strategy - Visionary Roadmap
September 1998

Dates Beyond FY99 are Targets for Success Planning



* Note: NEPA Decision Required

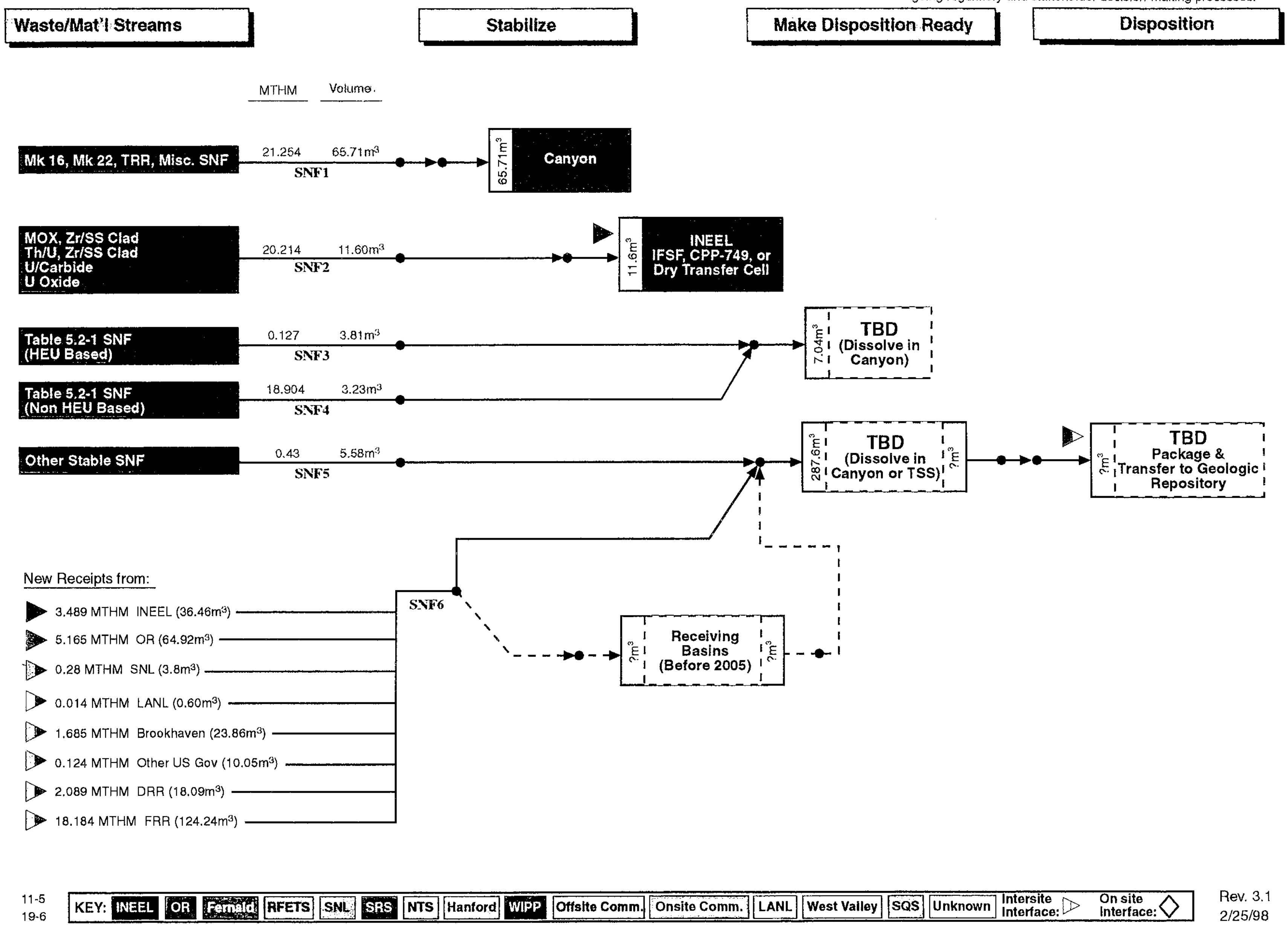
Revised per John Dickenson

Printed: 10/14/98
Revision Date: 10/14/98

SRS SNF Baseline Disposition Map

PREDECISIONAL DRAFT

This map is conceptual and in many cases does not represent cleanup or transfer decisions; this map does not preclude the on-going regulatory and stakeholder decision-making processes.



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Rev. 3.1
2/25/98

APPENDIX C

ACRONYMS

Acronyms

Al	Aluminum - cladding
Am	Americium
APSF	Actinide Packaging and Storage Facility
CDR	Conceptual Design Report
Cm	Curium
DNFSB	Defense Nuclear Facilities Safety Board
DRR	Domestic Research Reactor
DWPF	Defense Waste Processing Facility
EIS	Environmental Impact Statement
EMI	Environmental Management Integration
FRR	Foreign Research Reactor
FY	Fiscal Year
GMODS	Glass Material Oxidation and Dissolution System
HEU	Highly Enriched Uranium (>20% U-235)
HFIR	High Flux Isotope Reactor
IMNM	Interim Management of Nuclear Materials (EIS)
INEEL	Idaho National Environmental and Engineering Laboratory
INEL	Idaho National Engineering Laboratory (now INEEL)
KAMS	K Area Materials Storage
LWT	Legal Weight Truck
MTHM	Metric Ton Heavy Metal
MTRE	Materials Test Reactor - Equivalent (equivalent storage requirements)
NEPA	National Environmental Policy Act
NMSS	Nuclear Materials Stabilization and Storage (WSRC division)
NRC	Nuclear Regulatory Commission
OR	Oak Ridge (National Laboratory)
Pu	Plutonium
RBOF	Receiving Basin for Offsite Fuel
ROD	Record of Decision
SFSD	Spent Fuel Storage Division
SNF	Spent Nuclear Fuel
SNM	Special Nuclear Material
SS	Stainless Steel
TEC	Total Estimated Cost (of project)
TPC	Total Project Cost
TRR	Taiwan Research Reactor
TSF	Treatment and Storage Facility
U	Uranium
Zr	Zirconium - cladding

OSR 14-357# (Rev 12-11-96)
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DOE CONTACT: BILL CLARK

Westinghouse Savannah River Company
Document Approval Sheet

Document No. WSRC-RP-98-00713

Title: FY 1999 Spent Nuclear Fuel Interim Management Plan

Primary Author/Contact (Must be WSRC)	Location	Phone No.	Position	User ID
Mark Dupont- Contact	707-C	7-9529		05525

Organization Code	Organization (No Abbreviations)
T5000	Spent Fuel Storage Division

Other Authors: E. R. Conatser, J. R. McEntire, S. W. O'Rear, J. E. Thomas, D. W. Lentz,

Deadline Date for Approval: 12-30-98 (RCVD 12/7/98)

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Keywords: spent fuel, waste management, SRS

Westinghouse
Savannah River Company

P.O. Box 616
Aiken, SC 29802

December 2, 1998

WSRC-RP-98-00713
MSD-STI-97-3673

DOE Contact
Bill Clark

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Department:	Spent Fuel Storage Div.
Document Title:	FY 1999 Spent Nuclear Fuel Interim Management Plan

Presentation/Publication:
Meeting/Journal: N/A

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Location:
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K. DESCRIPTION/ABSTRACT

This document has been prepared to present in one place the near and long-term plans for safe management of SRS SNF inventories until final disposition has been identified and implemented.

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C. CONTACT AND RELEASING OFFICIAL

1.Contact (*if appropriate, the organization or site contact to include in published citations who would receive any external questions about the content of the STI Product or the research information contained therein*)
Name and/or Position K.J. Schmidt, Manager STI Program & Site Support
E-mail ______ Phone (803) 725-2321
Organization Westinghouse Savannah River Company

2. Releasing Official X I verify that all necessary reviews have been completed (e.g. Patent, Copyright, ECI, UCNI, etc.)
Released by (*name*) K. J. Schmidt Date (*mm/dd/yyyy*) ......
E-Mail ______ Phone ______

FY 1999 Spent Nuclear Fuel Interim Management Plan

by

M. Dupont

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

E. R. Conatser

J. R. McEntire

S. W. O'Rear

J. E. Thomas

D. W. Lentz

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