DOE/DP-0110P

TRITIUM CONSOLIDATION COMPARISON STUDY: COST ANALYSIS

December 1992

U.S. Department of Energy

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U.S. Department of Energy
Washington, DC 20585

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I. EXECUTIVE SUMMARY

In February 1991, the Department of Energy released the Nuclear Weapons Complex Reconfiguration Study. As a part of the planning for this effort, in March 1992, the Department released the Nonnuclear Consolidation Plan (NCP) to analyze alternatives on how best to achieve the preferred option of consolidating nonnuclear activities at a single site. This plan compared six plants - Kansas City, Mound, Pinellas, Rocky Flats, Y-12 and Pantex - as possible nonnuclear consolidation sites. Based upon the analysis in this plan the Department announced that an Environmental Assessment would be prepared on the preferred alternative of consolidating most of the activity at the Kansas City Plant with some work relocated to other sites. The tritium activity at the Mound Plant (MP) would be transferred to the Savannah River Site (SRS) where significant other tritium activity is conducted.

This "Tritium Consolidation Comparison Study: Cost Analysis" was prepared to ascertain the relative cost advantage of locating the tritium activity at either the MP or the SRS. This study compares the costs and schedules for tritium reservoir filling, emptying, surveillance, and processing activities to be performed at the MP and the SRS with the alternative of consolidating these activities at each of these two sites. For reference purposes this study also sets forth the projected costs of taking no action to reconfigure which would leave both plants operating. The scope of work estimated is for a steady-state weapons workload based on Planning and Production Directive 92-1A.

The study found that either site could perform the mission with additional resources. The MP could support an operational date for all requirements in late 1996 while the SRS date would be late 1997.

Based on differing current mission assignments, both sites would require modifications for consolidation. The MP would be required to make some modification for most of their operations. MP has full capacity and capability for commercial sales, life storage and recovery. The tritium activities at the MP would be in two facilities, the underground Technical Building and the Semi Works Research Complex.

SRS would be required to make fewer but more expensive modifications. SRS would need to add component evaluation operations and process development. The tritium activities at SRS would be in five facilities, 233-H processing building, 232-H storage and separation building, 234-H storage, loading, evaluation, and recovery building, 236-H recovery building and 238-H reclamation building. Building 233-H, also called the Replacement Tritium Facility (RTF), is an underground facility that is not yet operational. DOE Headquarters has raised concerns regarding the seismic adequacy of RTF. DOE SR Field Office and Westinghouse Savannah River Company are continuing geotechnical investigations of the soil conditions under the RTF to determine whether or not any modifications to the facility are required. A recent study indicates that given the worst outcome of the aforementioned investigations, the RTF still offers significant safety improvements to environmental risks and worker safety by moving the high hazard tritium operations from the current above ground facilities at the SRS into the RTF. Other buildings would be required at SRS for related activities.

Tables 1 and 1a illustrate the total life cycle costs (LCC) for each option in constant 1992 dollars and present value dollars using a 5.5 percent inflation factor and a 7 percent real discount rate. The cost estimates were projected for the period 1993-2050 based on the assumption that if the mission were moved to SRS the entire MP could be closed in 15 years, following required decontamination and decommissioning (D&D). The total cost, in constant 1992 dollars, for consolidating at MP is estimated to be $5.39 billion which includes the overhead costs of keeping MP operational, and for consolidating at SRS the estimate is $3.4 billion. The estimate for no action is $7.67 billion. In present value dollars the estimates are $1.17 billion for consolidating at MP, $1.08 billion for consolidating at SRS and $1.87 billion for no action.

Environmental restoration costs were not included since they represent a liability for the Department regardless of which option is selected. Costs for D&D are included only for those actions which create a new D&D obligation such as putting RTF into operation at SRS. This study is based on the assumption that MP would be closed after 15 years and the full overhead savings would be realized for the last 35 years of the study period.

TABLE 1

TRITIUM MISSION LIFE CYCLE COST COMPARISONS
IN BILLIONS OF 1992$ *

OPTION >	NO ACTION (KEEP BOTH PLANTS)			SUM OF PRE-SENT VALUES	CONSOLIDATE @ MP	SUM OF PRE-SENT VALUES	CONSOLIDATE @ SRS	SUM OF PRE-SENT VALUES
V LIFE CYCLE COST CATEGORY V	MP	SRS	BOTH					
**** OPERATING COSTS ****								
TRITIUM MISSION	2.12	2.87	4.99		2.56		3.07	
OTHER (NON-TRITIUM OVERHEAD BURDENS & NN ACTIVITY TRANSFER FRONT END COSTS)			2.68		2.68		0.15	
TOTAL OPERATING COST			7.67		5.24		3.22	
** INITIAL CONSOLIDATION COSTS **								
TOTAL INIT. CONS. COST			N/A		0.15		0.18	
*** TOTAL COST FOR OPTION ***			7.67	1.87	5.39	1.17	3.40	1.08

* SUMS OF PRESENT VALUES CALCULATED FOR BASE CASE USING 7.0% REAL DISCOUNT RATE.
SENSITIVITY STUDIES USING OTHER DISCOUNT RATES SHOWN BELOW.
(NOTE: PRESENT VALUE SUMS NOT CALCULATED AT CATEGORY DETAIL LEVEL)
CONSTANT DOLLAR OPTIONS BROKEN DOWN IN MORE DETAIL IN TABLE 1A

SENSITIVITY STUDIES: REAL DISCOUNT RATE

4.0%	2.99		1.97		1.55
10.0%	1.34		0.80		0.84

09-Dec-92

TABLE 1A
TRITIUM MISSION LIFE CYCLE COST COMPARISONS
IN MILLIONS OF 1992$

OPTION > / V COST CATEGORY V	NO ACTION (KEEP BOTH PLANTS) MP (A)	SRS (B)	BOTH (C=A+B)	CONSOLIDATE @ MP (D)	AVOIDED COST IF CONS @MP (C-D)	CONSOLIDATE @ SRS (E)	AVOIDED COST IF CONS @SRS (C-E)
**** OPERATING COSTS ****							
TRITIUM MISSION							
DIRECTS	829	1270	2099	1098	1001	1328	771
INDIRECTS + SITE OH	1043 (1)	1203	2246	1225	1021	1355	891
OTHER (4)	247	399	646	239	407	389	257
SUBTOTALS	2119	2872	4991	2562	2429	3072	1919
NON-TRITIUM MISSION (3)							
DIRECTS	x	x	0	-	0	-	0
INDIRECTS + SITE OH	2684	x	2684	2684	0	50 (2)	2634
OTHER	x	x	0	-	0	100 (5)	-100
SUBTOTALS	2684	0	2684	2684	0	150	2534
TOTAL OPERATING COST	4803	2872	7675	5246	2429	3222	4453
** INITIAL CONSOLIDATION COSTS **							
TPC	N/A	N/A	N/A	60	-60	109	-109
TRANSITION COST	N/A	N/A	N/A	85	-85	55	-55
D&D TO SAFE SHUTDOWN	N/A	N/A	N/A	3	-3	16	-16
TOTAL INIT. CONS. COST	0	0	0	148	-148	180	-180
*** TOTAL COST FOR OPTION ***			7675	5394	2281	3402	4273

(1) REPRESENTS THE PORTION OF MP OVERHEAD ATTRIBUTABLE TO TRITIUM RELATED OPERATIONS BASED ON THE CURRENT RATIO OF TRITIUM FTE'S TO TOTAL MP FTE'S.

09-Dec-92

(2) "x" VALUES REMAIN THE SAME REGARDLESS OF OPTION.

(3) REPRESENTS INCREMENTAL OVERHEAD COSTS AT KCP RESULTING FROM NON-TRITIUM ACTIVITY TRANSFERS AS INDICATED IN THE CURRENT NNC PLAN.

(4) "OTHER" INCLUDES DIRECT & INDIRECT OPS COSTS FOR THE NON-STEADY STATE YEARS 1993-1997 (ACCUMULATED). FOR "PRESENT T-MISSION" COLUMNS IT MAY ALSO INCLUDE SOME SMALL CAPITAL PROJECTS.

(5) REPRESENTS $100M OF FRONT END COSTS FOR TRANSFERRING NN ACTIVITIES TO LANL & KCP.

II. BACKGROUND, SCOPE, AND METHODOLOGY

A. BACKGROUND

In April 1991, the Department of Energy (DOE) began efforts to develop a Nonnuclear Consolidation Plan (NCP). The plan's purpose was to analyze alternatives and to make recommendations on how best to consolidate Defense Programs nonnuclear activities at a single site. The major conclusion of the NCP was that the Kansas City Plant is the most favorable site for consolidation. The DOE initiated efforts to develop Conceptual Design Reports (CDR) from the production sites involved. The main purpose of these efforts was to obtain budget-quality cost estimates. The CDRs were delivered in May 1992.

On April 27, 1992, the Office of the Deputy Assistant Secretary for Weapons Complex Reconfiguration (DP-40) began a comparative analysis for the SRS and the MP. This analysis would compare tritium reservoir filling, emptying, surveillance, and processing capabilities/capacities at these two sites. Costs and schedules to effect these consolidated activities for a base-case reconfigured processing facility would also be identified. MP was requested to prepare a Tritium Feasibility Study to support the analysis. SRS input was not requested since it had already prepared a CDR.

In June 1992, a revision was made to the preferred alternative on discussed in the NCP. This study is based on that revision. The major difference is that the Pinellas Plant neutron generator loading (NGL) activity is now planned for Los Alamos National Laboratory (LANL) rather than SRS or MP as assumed in the SRS CDR and the MP Feasibility Study. Differences are explained in later chapters. Sources of cost data are referenced in Appendix B.

B. SCOPE

The scope of the study was defined in a memorandum dated May 29, 1992 (Appendix F). The commissioned study was to provide a total cost estimate that is supportable for performing the consolidated tritium activities at either the MP or the SRS. The cost estimate for each site/plant would be developed on a common basis and would be used to compare differences in costs in performing the identified activities. Cost estimates are not considered to be budget quality.

Tritium production and extraction functions were precluded from the scope of this study.

C. METHODOLOGY

Defense Programs (DP-60) developed the study with a study group composed of representatives from Albuquerque Field Office, Dayton Area Office, DP-20, DP-40, DP-60, LANL, Lawrence Livermore National Laboratory (LLNL), Oak Ridge National Laboratory, Pinellas Area Office, and the Sandia National Laboratory, California. The study was chaired by DP-64.

The study group reviewed data, visited sites, assembled data, and prepared the report. The two main documents reviewed were the SRS CDR dated April 1992 and the MP Feasibility Study dated August 1992. The study group requested additional information and made adjustments for the purpose of capability/capacity comparability. Another adjustment was for the revision to the neutron generator loading activities and calorimetry which were changed from the original plan. Draft reports were sent to the affected sites for their review for accuracy and comments. Their comments were reviewed, evaluated, and incorporated as appropriate.

The study group divided the tritium operations into the following categories: inspection/reservoir storage, reservoir loading, chemical separation, isotope separation, gas mixing analytical system, loading and finishing, inert loading, reclamation, helium-3 recovery, component evaluation operations, commercial sales/inertial confinement fusion loading, life storage, recovery, and container management facility. Subprojects for these operations are shown in Appendix A by the following breakout: description, existing capabilities, required modification, cost of modification, schedule and a comparison.

The study group evaluated the estimated costs for completeness, consistency and comparability. Two architect/engineer (A/E) firms, Fluor-Daniel, Inc., and Dames and Moore, Inc., conducted independent cost evaluation (ICE). No major issues with the submitted costs were identified in the evaluation of the MP Feasibility Study. The costs shown in the SRS CDR were judged to be high and the Savannah River Operations Office, upon further review, reduced the estimated cost which is now in line with the ICE.

A revised CDR is being prepared by SRS to reflect the June 1992 revised preferred alternative. The magnitude of these changes is anticipated to be on the order of an increase of four million dollars to the April 1992 TPC (constant dollars), however the data has not been validated and therefore is not reflected in this study.

III. LIFE CYCLE COST CATEGORIES AND DEFINITIONS

This study considers all of the FY-1993 through FY-2050 costs and benefits for consolidation of the tritium work at either site, i.e., the total life cycle costs. Life cycle costs are subdivided into five major categories: A) TPC (total project cost); B) Transition Costs; C) Annual Operating Costs; D) Capital Upgrade and D&D costs; and E) Cost Adjustments for Other Effects of Nonnuclear Consolidation. These five categories may be defined as follows:

A. TPC

TPC includes TEC (Total Estimated Cost) and OPC (Operating Dollar Funded Project Cost). This represents the front end cost of consolidation at a receiver site.

1. TEC

The TEC represents the portion of the TPC funded by capital dollars. It includes Title I, II, and III Engineering, Design, and Inspection costs (E,D, & I) for new facilities and equipment or for modifications to facilities or equipment; equipment, materials, and labor (construction directs) for new items or modifications; indirect construction costs such as construction management, Quality Assurance, home-office costs, etc.; overall project management costs; and the capital-funded portion of the start-up costs. To the above costs a contingency is added to cover within-scope cost uncertainties or possible cost omissions. TEC is often referred to as simply "Capital Costs".

2. OPC

These operating funded items include conceptual design, National Environmental Policy Act (NEPA) and other Environment, Safety and Health (ES&H) documentation, research and development, training, manual preparation and operating funded services provided to the project and the operating-funded portions of the operational readiness review (ORR) and start-up costs.

B. TRANSITION COSTS (RELOCATION AND OTHER SPECIAL COSTS)

Included in the total cost to DOE are costs that do not fit in the TPC. Costs incurred by the non-selected site for close-out, technology transfer, safe shutdown and maintenance of the closed facilities at that site are examples of these costs.

C. ANNUAL OPERATING COSTS

This category includes the following: Operations direct staffing, indirect staffing, consumables and replacement materials including utilities and Government Furnished Materials, site overheads, waste management, and transportation. Operating costs do not include the cost of the tritium. Most of these costs are those incurred by the Management and Operation (M&O) Contractor at the site. When annual operating costs are summed over the operating lifetime of the facility they usually constitute the largest portion of the other life cycle costs.

D. CAPITAL UPGRADE AND DECONTAMINATION AND DECOMMISSIONING (D&D) COSTS

Capital upgrade costs constitute periodic expenditures for replacement of major capital items or major renovations. For this study, the anticipated upgrade costs were levelized on an annual basis during the steady-state operating years. D&D costs are those costs anticipated after facility shutdown for placing the facility in a safe shutdown condition. For this study, D&D costs are included only for those actions which create a new D&D obligation. Costs of D&D for conditions which existed prior to the decision are not included.

E. COST ADJUSTMENTS FOR OTHER EFFECTS OF NONNUCLEAR CONSOLIDATION

This category includes the cost avoidances (benefits) realized by shutting down operations at the donor site. Also included are front-end costs for transferring other nonnuclear (non-tritium) operations to new receiver sites (other than SRS or MP). These front end costs are applicable to MP shutdown (tritium consolidation at SRS) only.

IV. LIFE CYCLE COST ASSUMPTIONS AND CLARIFICATIONS

The major cost-related assumptions and guidelines which are the basis for the estimates are as follows:

A. GENERAL ASSUMPTIONS

1. The two tritium consolidation options are relocation of all post-extraction tritium operations to either the SRS or to the MP. The SRS option resides within the larger scope June 1992 nonnuclear consolidation scenario which also affects facilities other than SRS and MP. Appendix D shows the activity transfers for the NCP. The June 1992 plan assumes the NGL activity going to LANL rather than SRS. For the MP option, it is assumed all post-extraction tritium operations will go to MP with the exception of the NGL activity which is also assumed to go to LANL.

2. Another June 1992 plan effect is the relocation of calorimetry to LANL if other tritium activities are consolidated at SRS. If tritium consolidation takes place at MP, calorimetry will remain. Since this represents a deviation from the "apples to apples" criterion the front-end transfer cost for calorimetry to LANL is shown as additive to the SRS cost option.

3. Further adjustments to the tritium consolidation costs at each site are expected as SRS revises their CDR. Some of the changes shown in this report were made by the study group in lieu of contractor CDR data which was not available. The SRS CDR, from which the tritium subproject TEC and TPC figures were extracted, was based on the December 1991 NCP and its activity transfers. It is presumed that the removal of NGL and Calorimetry TEC/TPC from the SRS data therein reported does not affect the costs of other tritium subprojects. In mid-October, MP issued new cost data reflecting the removal of the NGL costs from their feasibility study. These data are reflected in the MP costs presented here.

4. The steady state workload for the years 1997 onward is based on Planning and Production Directive 92-1A.

5. SRS K-reactor operations costs are not included.

6. Year-by-year life cycle costs are reported in constant 1992 dollars. Detail TEC and TPC are generally reported in escalated dollars based on Departmental rates unless otherwise noted. The life cycle cost spreadsheets present cash flows from FY 1993 - FY 2050 in FY 1992 constant dollars.

7. Year-by-year life cycle costs are reported only for the categories described in III-A above and are not broken down by year for each

tritium consolidation subproject or Work Breakdown Structure (WBS).

8. For purposes of discounting a 7.0 percent annual real discount rate is used for the base case.

B. LIFE CYCLE COSTS

1. Direct and indirect operations costs were requested of the sites per the definitions used in the Albuquerque Budget Reform Task (ALBURT) system of cost accounting of the Albuquerque Field Office.

2. A one-shift operation is assumed for steady-state staffing. Any surge requirements will be covered by adding additional shifts.

3. Removal of inventory, safe shutdown and preparation of facilities for takeover by DOE/EM and its remediation contractor(s) are the incremental D&D cost in this study. DOE/EM environmental restoration costs are not included.

C. TRANSITION COSTS

1. Costs for consolidation at MP include the SRS cost for shipping inventory prebuild and packing and shipping existing tritium inventory. Costs for consolidation at SRS also include MP costs for packing and for shipping a smaller inventory.

2. If MP is selected for tritium consolidation the nearly-complete replacement tritium facility (RTF) at SRS will not "go hot". Some costs at SRS will be incurred for project termination.

D. COST ADJUSTMENTS FOR EFFECTS OF NONNUCLEAR (N-N) RECONFIGURATION

1. If tritium operations at MP are transferred to SRS, it is assumed that other DP-funded nonnuclear activities at MP, such as detonator production, will be transferred to other receiver sites as shown in Appendix D. This means that the front-end transfer costs for these activities must be included in the SRS total life cycle costs. A small overhead burden is also realized at the receiver site (KCP) for these activities. ($1 million per year is assumed.)

2. The 50-year cost avoidance for SRS tritium operations (if tritium consolidation takes place at MP) represents the annual costs of those tritium activities that SRS presently performs but at the lower projected workload from P&PD 92-1A for FY 1998-2047. Operating costs other than overhead are also included. Table 1A shows how avoided costs are calculated.

3. The 50-year cost avoidance for MP operations (if tritium consolidation takes place at SRS) has two parts. The first portion of the cost avoidance for MP is the direct portion of those operating costs for tritium operations now performed at MP. The second portion is the reduction/termination of all MP overhead costs due to relocating tritium and other nonnuclear DP-funded operations. The direct portion of the MP non-tritium, other non-nuclear activity operations, cost does not terminate, but is recognized at the receiver sites as similar annual direct cost for similar workload. The additional overhead cost at these new receiver sites associated with these nonnuclear activities is small ($1 million per year) because these activities only add a small amount of work to sites already performing many other DP-funded weapons activities. It should be noted that the MP overhead cost avoidance is time-phased, i.e., the most cost avoidance is realized in the last 35 of the 50 years when DOE has closed the MP completely. From 1998 to 2012 (15 years) EM will fund the MP reduced overhead. This scenario is based on the April 1992 Supplemental Cost Study for Nonnuclear Consolidation.

E. FACILITY ASSUMPTIONS

1. The useful life will be through 2050.

2. All work will be done in DOE owned or constructed facilities on existing site property.

F. PERFORMANCE MEASURES

1. Minimize the introduction of new hazardous chemicals, new hazardous operations and new regulated waste streams;

2. Minimize new parts to manufacture, new parts to procure, job transfers, new technologies to transfer and consider the availability of technical personnel;

3. Minimize both capital and operating cost: and

4. Minimize payback time (cost consolidation divided by annual net savings).

G. OTHER ASSUMPTIONS

1. Cost escalation and contingencies per the current DOE guidelines for CDRs.

2. If an alternative requires that radioactive materials be introduced into an uncontaminated facility, the costs for eventual D&D are treated as decision costs. Costs for D&D of previously contaminated facilities are considered to be sunk costs incurred at the time nuclear operations were started. Therefore, these D&D costs are not considered decision costs.

3. If the decision is made to consolidate tritium activities at the MP, the MP nonnuclear activities also would remain.

4. First funding for reconfiguration would begin the third quarter of FY 1993.

5. To determine floor space and equipment requirements, each technology base will usually be sized to support the total workload on the most difficult or space-consuming products in the enduring stockpile.

6. The study group approached consolidation considering the general requirements of the Department. Although the enduring stockpile will be fully supported every contingency and every weapon system has not been considered.

7. Cost for transportation included in the study assumed the current Department of Transportation (DOT) regulations.

8. The DOE recognizes that the availability of certified shipping containers for tritium is an issue. The study assumes that shipping containers will be obtained to support consolidation.

9. New tritium supply will be available no earlier than FY 2005. K Reactor and the associated infrastructure must be retained at SRS as a production contingency until that time.

V. LIFE CYCLE COST DATA

A. LIFE CYCLE COST SUMMARIES

Table 2 presents the constant dollar projected cash flows for all of the life cycle cost categories considered for consolidation of tritium facilities at the SRS. Table 3 presents the cost data in the same format for the MP. These spreadsheets are consistent with the June 1992 NCP revision and exclude any NGL activity assumed to be terminated at Pinellas Plant. These spreadsheets incorporate the assumptions listed in Section V.

B. FRONT END COSTS (TEC/OPC/TPC)

The upper portions of Tables 2 and 3 provide annual cash flow data in constant dollars for the "front end" TEC/OPC/TPC. The time phasing of the cash flows was provided by the sites. Constant dollar TEC/OPCs are shown in Tables 2 and 3 for comparative purposes and accordingly are smaller than the escalated values reported by the sites and included in Appendix B. Standard DOE escalation factors were used to de-escalate the cash flows for use in Tables 2 and 3 and for use in the discounted cash flow (present value) analysis.

C. RELOCATION, CLOSE-OUT, AND OTHER SPECIAL COSTS

Tables 2 and 3 also show the close-out and safe shutdown costs for the donor site. Tech transfer costs (donor site personnel relocated to the consolidation site) are in the OPC for the selected site. They are on the order of $0.5M for each site. MP has stated that they do not need any special equipment moved from SRS if they are chosen. Each site has $0.15M in costs to provide shipping containers to the donor site for transfer to the accepting site. SRS estimates a total cost of $70M to close out their site Post Extraction Tritium mission and put it in safe shutdown. For MP, $55M has been estimated for the same purpose. Neither estimate includes the costs to DOE/EM for environmental restoration of the donor site facilities. The cost of transferring inventory from one site to the other is included in the life cycle costs. The remaining completion costs for RTF at SRS are also included for each option. For consolidation at MP, the project close out costs are included. For consolidation at SRS, the project completion costs are included.

D. DECONTAMINATION AND DECOMMISSIONING (D&D)

D&D costs are shown for the end of life of the consolidation (selected) site's Tritium facilities. The scope of D&D is merely that of putting the facility in safe shutdown status. Again, no DOE/EM comprehensive (demolition or complete decontamination) remediation program is assumed.

The D&D costs are spread over two or three years depending on the site.

For cost estimating details reference Appendix B, "Detailed Cost Data including References and Sources."

TABLE 2

CONSTANT DOLLAR LIFE CYCLE COSTS FOR TRITIUM CONSOLIDATION AT SRS

Constant 1992$ Unescalated Costs	Total ($M)	1992	1993	1994	1995	1996	1997	50 yrs 1998–2047	2048	2049	2050	APP DOC KEY
NON-CAPITAL PART OF TEC (OPC)												
Consolidation Mission	20.74		0.67	4.19	5.99	9.88						a
Miscellaneous Projects	0.30		0.20	0.10								b
RTF Completion	27.40		26.80	0.60								c
Total OPC	48.44		27.67	4.89	5.99	9.88						
CAPITAL (CONSOLIDATION MISSION)												
Engineering Design & Inspection	12.16		7.05	3.38	1.73	0.00						d
Construction	22.17		0.56	15.74	5.87	0.00						e
Project Management	3.91		1.27	1.35	0.80	0.49						f
Contingency	9.72		3.80	3.85	1.94	0.12						g
TEC (SRS CONSOLIDATION MISSION)	47.96		12.69	24.31	10.34	0.62						
OTHER CAPITAL												
Miscellaneous Projects	1.10		0.60	0.50								h
RTF Completion	11.00		11.00	0.00								i
TEC (CONS. MISSION + OTHER)	60.06		24.29	24.81	10.34	0.62						
TPC (SRS)	108.49		51.96	29.71	16.33	10.50						
OTHER LIFE CYCLE COSTS												
Staffing (Direct)	1040.80		33.05	34.15	29.30	26.30	18.00	900.00				j
Staffing (Indirect)	1040.80		$33.05	34.15	29.30	26.30	18.00	900.00				j
Site Overheads	517.70		14.40	14.90	12.80	11.50	9.10	455.00				k
Materials & Replacements (Consumables)	136.00		6.10	8.40	3.50	3.25	2.25	112.50				l
Waste Management & Transportation	17.10		0.50	0.50	0.40	0.40	0.30	15.00				m
Capital Upgrades	319.55		1.55	4.00	4.00	4.00	6.00	300.00				n
MP Closeout, Safe Shutdown & Tech Transfer	65.15				11.15	11.00	11.00	22.00				o
Tritium Inv Trans from MP to SR	0.13				0.13							oo
D&D	16.00			4.00				3.00	3.00	3.00	3.00	p
Total Other Life Cycle Costs	3143.23		88.65	100.10	90.58	82.75	64.65	2707.50	3.00	3.00	3.00	
Total Life Cycle Costs before Adjustments	3251.72		140.61	129.81	106.91	93.25	64.65	2707.50	3.00	3.00	3.00	q

1. Annual cash flows for years 1998–2047 same as for 1997
2. Escalated TPC cash flows shown on Appendix Table B.1
3. DOC KEY refers to sources listed on Appendix Table B.3
4. Costs based on April 1992 CDR with NGL & Calor. removed. Costs do not refl 11/92 rev. SRS CDR.
5. Boldfaced type in boxed region in upper left reflects portion of lifecycle costs escalated in Table B.1 in Appendices.

TABLE 2 (CONTINUED)

Unescalated Costs (Constant 1992$)	Total ($M)	1992	1993	1994	1995	1996	1997	50 yrs 1998-2047	2048	2049	2050	APP DOC KEY
COST ADJUSTMENTS												
Front-end cost for Calorimetry trans. to LANL	6.90		1.87	3.50	1.48	0.05						q1
Overhead burden for transferred NN activities	50.00							$50.00				
Relocation of MP Non-T3, N-N activities												
7 N-N Activities to LANL	12.48		1.70	2.56	5.48	2.74						u
5 N-N Activities to KCP	9.56		5.04	4.01	0.19	0.32						v
Tech Trans from and safe shut of MP other N-N	71.25				14.25	14.25	14.25	28.50				w
Total Cost Adjustments	150.19		8.61	10.07	21.40	17.36	14.25	78.50	0.00	0.00	0.00	x
TOTAL LIFE CYCLE COSTS WITH ADJUSTMENTS	3401.91		149.22	139.88	128.31	110.61	78.90	2786.00	3.00	3.00	3.00	y

TABLE 3

CONSTANT DOLLAR LIFE CYCLE COSTS FOR TRITIUM CONSOLIDATION AT MOUND

Constant 1992$ Unescalated Costs	Total ($M)	1992	1993	1994	1995	1996	1997	50 yrs 1998-2047	2048	2049	2050	APP DOC KEY
NON-CAPITAL PART OF TPC (OPC)												
Other Project Costs (Pre-Authorization & Preops)	11.97		0.82	4.50	2.80	1.06	2.79					a
CAPITAL												
Engineering Design & Inspection	3.70		1.70	0.35	1.15	0.25	0.25					b
Construction	14.57		0.48	7.53	1.28	3.78	1.50					c
Project Management	0.60		0.12	0.12	0.12	0.12	0.12					d
Contingency	5.40		0.67	2.22	0.71	1.05	0.75					e
TEC (MP MISSION IN CH 5 + CEO)	24.27		2.97	10.22	3.26	5.20	2.62	0.00	0.00	0.00	0.00	f
OTHER RELATED PROJECTS	20.05		6.68	6.68	6.68							g
ADDITIONAL PINCH WELDERS	3.30		0.47	1.82	0.35	0.46	0.2					g1
TPC (Mound Plant)	59.59		10.94	23.22	13.09	6.72	5.61	0.00	0.00	0.00	0.00	
OTHER LIFE CYCLE COSTS												
Staffing (Direct)	694.70		8.15	9.70	11.25	12.80	12.80	640.00				h
Staffing (Indirect)	845.16		12.48	15.42	15.42	15.42	15.42	771.00				h
Site Overhead	500.50		9.10	9.10	9.10	9.10	9.10	455.00				h
Materials & Replacements (Consumables)	122.00		1.58	1.88	2.06	2.24	2.24	112.00				i
Waste Management & Transportation	52.16		0.56	0.78	0.90	0.96	0.96	48.00				j
Capital Upgrades at MP	348.17		3.21	10.33	10.44	8.92	17.27	298.00				k
SRS Closeout & Tech Transfer	70.35				0.15	45.00	8.40	16.80				i
SRS/RTF Fwd Costs if Shutdown 12/15/92	12.00		12.00									m
Tritium Inv Trans from SRS to MP Incl Pre-Build	2.60			0.12		2.48						m1
D&D	0.00											n
Total Other Life Cycle Costs	2647.64		47.08	47.33	49.32	96.92	66.19	2340.80	0.00	0.00	0.00	
Total Life Cycle Costs before Adjustments	2707.23		58.02	70.55	62.41	103.64	71.80	2340.80	0.00	0.00	0.00	o
COST ADJUSTMENTS												
50-yr of MP non-tritium overhead burden **	2676.50							2676.50				
TOTAL LIFE CYCLE COSTS WITH ADJUSTMENTS	5383.73		58.02	70.55	62.41	103.64	71.80	5017.30	0.00	0.00	0.00	q

1. Except for SRS Closeout & Upgrades Cash Flows for Years 1998-2047 are same as for 1997
2. Escalated TEC/OPC/TPC Cash Flows are on Table B.2 (boldfaced type in boxed region in upper left shows corresponding unescalated values.)
3. DOC KEY refers to sources listed in Appendix Table B.4

** $28.4M/yr for 15 yr, $64.3M for 35 yr. (non-tritium OH only, T3 burden is in cons. life cycle costs.)

VI. OTHER CONSIDERATIONS

A. ES&H

The DOE places health and safety as its highest priority. In keeping with this philosophy, compliance of MP and SRS proposals is discussed below.

MP's proposed T Building operations are planned to meet ES&H regulations. One upgrade is a $3,300,000 TEC project to bring T Building into compliance with the Life Safety Code. MP also plans to continue some low-level tritium operations in SW building. This facility is an older building that will need continual upgrades to be used throughout the duration of the consolidation mission assignment. The SRS CDR proposes fully compliant operations in the RTP. Continuing upgrades in the other buildings will be required to comply with Federal and State regulations, laws, and Orders.

B. TECHNICAL

Currently, there are differences in the types of technical expertise available at the MP and the SRS due to their current mission assignments. However, these differences do not preclude either site from accepting new roles and responsibilities resulting from consolidation. Both sites have technically well-qualified staff for direct and indirect support. Rather, the current staff skills help define the transfer of technical expertise required to achieve the goals of the tritium-related DP mission in a reconfigured complex.

The primary functions to be transferred from the SRS to the MP are WR production related-reservoir inventory storage, tritium storage, loading and unloading, reclamation and purification, finishing, shipping, receiving and disposal. WR production capability for a few components is presently available at the MP in its facilities; some expertise is already available in the production area. However, an increase in work force staffing levels with appropriate technical expertise would be needed for the MP to assume the added responsibilities of additional reservoir designs and to maintain sustained loading operations in support of projected production requirements.

MP's relatively limited experience in reservoir loading and unloading operations, especially at sustained production rates, presents some risk for the SRS-to-MP option, especially early in the transition. For the SRS, the use of TCAP in RTF tritium operations poses technical risk for the MP-to-SRS option as it has not been proven with tritium. While extensive cold testing (using protium and deuterium) has been conducted, this experience is an uncertain predictor of behavior with tritium, especially after several years of operation. Current capabilities exist in 232-H for this activity.

Another risk of ending operations at either site is the loss of technical expertise due to disruptions associated with consolidation. This could result in an undesirable shortage of trained personnel in the near-term and a possible long-term loss of "corporate memory" and training capability for new employees.

Both the MP and the SRS also support the design laboratories in storage programs concerned with long term safety and integrity of gas transfer systems, process development issues and help in Testing, Research and Development (TR&D) studies. Due in part to the MP's CEO capability and long standing process development effort, these support efforts have been well integrated into the overall laboratory function at the MP. At the SRS, the separation between the production facilities and SRTC has resulted in less integration and a sharper interface between the two organizational functions.

Consolidation actions that end specific activities at a donor site before the receiver site has shown equivalent performance pose some technical risk.

For the MP-to-SRS option, the closure of MP in 1995 implies a period of about two years before the SRS could fully assume transferred tasks. This gap would mainly affect programmatic schedules and surveillance activities, which are current MP activities. Although the lack of CEO for about eighteen months in 1989-90 appears to have been absorbed by the WR Complex without adverse effects, schedules may need to be adjusted to minimize this concern. For data intensive programs, such as gas transfer system process development and stockpile evaluation, the ability to show comparability of data would be affected for the SRS option, early in the transition.

C. TRANSPORTATION

In the comparison of the SRS and the MP, the important transportation considerations are moving tritium stockpile inventories, surveillance reservoirs, LLCEs and low-level/classified waste. The transportation costs are divided into start-up and operational costs.

Should the mission go to the MP, there would be a one-time start-up transportation cost incurred to ship SRS's tritium stockpile and reservoir inventories. The reservoir inventories include WR, full reservoirs awaiting unloading, empty WR reservoirs and SRS surveillance reservoirs. The exact quantities to be transported is dependent on SRS's ability to consolidate the number of items to be shipped and their ability to reduce the tritium stockpile inventories. The tritium stockpile inventories would be reduced through LLCE operations before the MP is operational. The operational costs at the MP would be expected to increase because of the increased volumes of offsite shipments. This cost would be primarily due to low-level classified waste transportation. The MP uses offsite disposal facilities for low-level classified wastes.

The MP will continue to ship its low-level/classified waste offsite to either the SRS or Nevada.

The controversy with interstate low-level radioactive waste shipments may be a concern. This controversy could disrupt normal operations at either site. However, the MP's waste shipments would be more vulnerable to an offsite low-level/classified waste transportation disruption. Should the mission go to the SRS, there would be a start-up transportation cost incurred to ship the MP's tritium stockpile and reservoir inventories. The exact quantity of shipments to be transported is dependent on the MP's ability to consolidate the number of items to be shipped.

D. RELATIONSHIP TO TR&D AND OTHER PROGRAMS

Although the NCP is focused on the production functions of the DOE weapons complex, the production agencies are currently an important resource used by the design laboratories for modernization/new production functions. This is a cost effective and efficient way to use the unique capabilities available in the production agencies. Furthermore, this integration of design and production activities enhances Production and Surveillance (P&S) functions. This dual-use approach becomes even more important as tritium facilities at the design laboratories are closed or reduced in mission scopes in response to budgetary pressures (e.g., Sandia TRL and LLNL building 331). Therefore, the capabilities at the consolidated tritium processing site of choice will significantly affect the viability of existing process development and TR&D activities and is an important consideration for the consolidation process. As stated in the preceding section, design laboratory support activities have been well integrated into the overall laboratory function at the MP and could naturally expand at this site without an adverse impact on project schedules. Following consolidation at the SRS, the facilities and organizational structure should support both the development and production missions.

In another tritium-related activity, ICF target fabrication is critical to achieving programmatic milestones in DP Inertial Confinement Fusion programs. The capability to load ICF targets, now at the MP, would need to be transferred to the SRS if consolidation occurred at that site.

E. WASTE GENERATION

Both the SRS and the MP have stated that if consolidation occurs at their site, there would be no new waste streams generated under the new mission assignments.

F. DISPOSAL

A tritiated water recovery system is currently available at the MP to recover tritium from tritiated water. This operation is also used to recover tritium from water from other DP laboratories. The SRS stated it does not need such a system and it is not included in the SRS CDR. If the MP is not the consolidation site, then other sites, such as the WETF facility at LANL, will need to dispose of its aqueous scrap by suitable means.

All DOE sites must assure proper treatment and disposal of wastes following all federal, state, and local requirements. This responsibility will continue to exist at any DOE facility, despite consolidation activities.

The two sites differ in waste disposal management. The MP built the TAWRS to recover tritium from tritiated water generated by MP and other DOE sites. The effluent from this process is sufficiently stripped of tritium to allow release to the environment through the T building stack (about one Curie per year.) While SRS does not have a facility specifically designed for recovery of tritiated water, use of electrolysis and a cryogenic still in building 232-H will detritiate water. SRS could accept tritiated water from other facilities if given the mission assignment; however, there is no current plan to assign this to SRS.

G. BURST TESTING FACILITIES

Historically, two methods have been used in reservoir burst testing, pneumatic and hydraulic. New reservoirs (quality assurance sampling) and WR surveillance reservoirs have been burst tested by the hydraulic method at MP. Selected reservoirs and SRS surveillance reservoirs have been burst tested by pneumatic method.

The MP has both pneumatic and hydraulic burst testing capabilities. Currently, the WR surveillance reservoir program has been maintained at the MP.

The SRS has pneumatic burst testing capabilities and plans to establish hydraulic testing capabilities.

APPENDIX A

FACILITIES, PROCESSES, AND SCHEDULES

APPENDIX A

FACILITIES, PROCESSES, AND SCHEDULES

A. Introduction

This section describes tritium facility operations, schedules and events needed to transfer the tritium mission to the selected facility. A comparison of the MP Operations/Facilities and the SRS Operations/Facilities was made from available information.

B. Mound Plant Background

The MP sits on a 306-acre site in southern Montgomery County in southwestern Ohio. The site is within the southern boundary of the Miamisburg, Ohio city limits, ten miles south-southwest of Dayton and thirty-one miles north-northeast of Cincinnati. At the MP, there are two main tritium facilities, the T Building and the SW/R Building Tritium Complex. Both facilities use physical barriers, operational controls and other systems to confine, capture and recover tritium releases.

The Technical Building (T Building) was built in 1948. It houses most of the tritium-related projects and facilities. The T Building was refurbished in the 1970's to include a Tritium Effluent Control Laboratory. Several research activities were conducted in this laboratory on advanced engineering systems and processes for capturing and enriching tritium waste streams.

In 1980, construction began on a state-of-the-art tritium component production facility for producing reservoirs planned for new weapon systems. This facility now serves as a location for making limited numbers of prototype components that supply tritium in nuclear weapons. All tritium operations are conducted within glovebox confinement. Additional confinement of unloading operations is provided by metal bell jars inside the gloveboxes. Operations that involve loading tritium parts are monitored and supported by an electronic data acquisition system. This production facility also uses a tertiary confinement system.

The Savannah River Operations Contingency (SROC) facility is also located in T Building. The facility was designed and built as a backup for critical component loading operations for strategic weapon systems. Demonstration loadings of tritium gas have been completed, including pinch welding of prototype reservoirs. Other activities conducted in T Building include tritium, solid storage research and development, laser fusion support, tritium enrichment and filling containers for commercial customers. The enrichment facilities include a cryogenic distillation system and a gas phase, thermal diffusion cascade. T Building operators load hydride traps containing up to 29,000 Curies (2.9 grams) of tritium and gas cylinders containing less than 1,000 Curies of tritium. The total sales are approximately 600,000 Curies/year of tritium gas for shipment to commercial customers worldwide.

The T Building is an original building at the MP. The tritium operations now occupy about 55,000 square feet. The building is an underground reinforced concrete structure containing two functional floors. The floor space is approximately 173,000 square feet. The building was originally designed for the production of polonium-210 components. Polonium operations were stopped in the 1960's, and the building was decontaminated and decommissioned and returned to productive use.

Construction was completed in 1985 on a major renovation of the T building, which included the installation of the KYLE and SROC production facility. This renovation provided a production capability to assemble, reclaim, and load equilibrium and solid storage reservoirs. Tritium, triple confinement concepts were developed and proven feasible at MP before 1980. These concepts were incorporated into the design of the KYLE/SROC facility and all other subsequent projects, where applicable. During the 1980's, additional systems and equipment were added to this building to support mission assignments. These include the Hydrogen Isotope Separation System (HISS), the Tritium Aqueous Waste Recovery System (TAWRS), W-76 Cold Production, tritium, solid-storage system production and assembly and the Tritium Engineering Development Laboratory (TEDL). The functions of these systems are to purify isotopically tritium, recover tritium from aqueous waste and conduct tritium-based advanced development experiments, respectively. Further construction projects are under way to add tritium-based systems to the building. These include a new Tritium Effluent Reduction Facility (TERF) that will provide more (100 ft^3/min) tritium effluent removal capacity.

The Semi Works (SW) Building and the west side of the Research (R) Building (constructed in 1950) are the SW/R Tritium Complex. In the last twenty years there have been thirteen major modifications and upgrades made to this complex. New function test stations in rooms SW-208 and SW-219 triply confine the tritium in the unit being tested. Most of the facilities in SW/R complex use tritium double confinement concepts. None of the operations in SW/R have the same type of triple confinement as the T Building, though MP could add this with additional funding.

The SW/R Complex, having about 42,000 square feet of floor space, consists of four major operations: Process Development, Component Evaluation Operations (reservoir surveillance), Tritium Recovery, and Materials Analysis. The Process Development activities are carried out in laboratories that support research and development on many tritium compounds and tritium solid storage efforts. The Reservoir Surveillance function (called Component Evaluation Operations at MP) conducts environmental simulations and function testing of tritium-filled reservoirs and conducts Production Stream Sampling for solid storage reservoirs loaded with tritium at the SRS. Performance tests are conducted that are designed to evaluate the effects of mechanical shock, vibration, accelerations, and thermal transients. Tritium Recovery Operations recovers tritium from a variety of solid, aqueous, and gaseous scrap generated at MP and at other DOE sites. The building also houses the Effluent Removal System (ERS) that captures tritium effluent from process and glovebox operations and maintenance operations that require breaching secondary confinement. Materials Analysis provides analytical and metallurgical support for all the tritium operations in both the SW/R Complex and the T Building.

C. Savannah River Site Background

The SRS is located in parts of Aiken, Barnwell and Allendale counties of South Carolina and is about 25 miles southeast of Augusta, Georgia. The nearly circular 300 square miles site is bounded by the Savannah River on the south. Tritium facilities are approximately seven miles from the site boundary. The SRS was constructed in the early 1950's, and has existing facilities for the extraction, separation, unloading, reservoir reclamation, loading and packaging of tritium to support the WR stockpile. Other activities include inert gas loading, byproduct loading, life storage testing, materials compatibility studies and process development.

The 232-H Extraction and Tritium Purification Facility (Line 1) was completed in 1955. There was a major upgrade to include the current processing equipment (Line 2) for producing essentially pure tritium in 1958. The 232-F laboratory scale tritium facility that was operational in 1954 was abandoned in place following successful operation of 232-H. Additional modifications within the 38,000 ft^2 reinforced-concrete portion of the 232-H facility included the capability for extraction of extruded targets (Line 3) in 1962, installation of a cryogenic still for improved isotope separation in 1965, addition of a second still in 1974 and installation of a high capacity process stripper and recovery system in 1985. Approximately 14,000 ft^2 of the conventional industrial portion of the building was converted for reservoir life storage testing beginning in the mid-1960's.

Building 234-H is a single-story structure supported by a steel frame, with an insulated steel roof deck and built-up roofing. The 234-H reservoir loading and packaging facility became operational in 1958. Its function was to receive tritium from 232-H for reservoir loading, packaging and shipment to support the weapon stockpile. The facility also included the capability to unload reservoirs, except the W-87, returned from the field to recover and purify the tritium for reuse. In 1984 loading operations were expanded to include the ability to load non-tritium-filled (inert) reservoirs. The Materials Test Facility (MTF) laboratories in Building 232-H include KYLE reservoir functional testing, life storage of loaded reservoirs for further evaluations, metallography of metal samples and failure analysis of reservoirs. Pressure isotherms of tritium and deuterium are measured in different metal hydride beds and small reservoir material samples are examined.

Building 238-H, built in 1969, is a single-story structure similar to Building 234-H. It was built to rebuild empty reservoirs for reloading. Previous practice was to dispose the empty units as radioactive waste.

Building 236-H is also a single story structure similar to Building 234-H. The building was upgraded in 1987 to provide pneumatic burst testing of contaminated reservoirs at pressures up to 125,000 psi. The facility also can purify helium-3 by removing tritium and other contaminants and can load the product into compressed gas cylinders for storage.

All tritium handling equipment in the above facilities is located inside air ventilated hoods. These are designed with sufficient airflow to sweep any tritium released from the process systems directly to the stack. This feature prevents migration to occupied areas and possible assimilation by operating personnel. In 1978 all of the loading room and compressor hoods were modified to transfer exhaust air to a 6,500 ft^3 containment volume for eventual recovery of any tritium released by accident.

The Replacement Tritium Facility (RTF), Building 233-H, will provide for loading and unloading reservoirs and enriching tritium for reuse. Tritium operations are scheduled to begin 1993. All process operations and directly-related support equipment are located within the 38,000 ft^2 reinforced concrete, underground structure. An additional 5,000 ft^2 can be made available by construction of a mezzanine in a space provided for future expansion. Process equipment and operations are contained within nitrogen blanketed gloveboxes that provide secondary containment for any tritium released from the process system. When the RTF is operational many process operations with tritium will be moved from 234-H into the RTF. This move should reduce total losses from tritium operation releases by 90-95%. These will be less than 10,000 Curies (one gram) per year.

D. **Operations/Processes**

This section describes present operational/processing capabilities and proposed adjuncts at the MP and the SRS to effect the necessary functions of a reconfigured, weapons-production tritium facility.

The MP and the SRS have their individual missions for tritium activities within the present nuclear weapon production complex. Sometimes duplication of missions was instituted as a matter of policy.

The following section briefly describes each process/operation that supports tritium activities, the current capabilities of each facility, the modifications needed to meet the workload, the required capital cost (TEC) and operations funded cost (OPC), and the associated schedule for completed construction. Note that "start up" activities such as Operational Readiness Reviews and Tool Made Samples are not included in the capital cost. However, they are included in the "other project cost." The costs listed are in escalated dollars. (See Appendix B, page B-12, for escalation rates.) There is a schedule for completion of any needed modification of the associated facility and a separate schedule for facility operational date.

1. Inspection/Reservoir Storage Description: The inspection/reservoir storage facilities accommodate shipping containers that will be unloaded and loaded each year. Personnel in these facilities will receive and store incoming shipping containers, unpack and pack shipping containers, inspect hardware, disassemble and assemble hardware, store reservoirs, and store empty shipping containers and packing materials.

    a. Mound Plant

        1). Existing Capabilities: Areas exist in T Building for receipt, unpacking, and disassembly of reservoir shipping containers. Storage space now exists in T Building for reservoir storage, based on assignments to date.

        2). Required Modifications: Room modifications would be necessary to store the quantity of reservoirs to be returned to the MP. A second level will be added to the storage room of T Building to hold storage cabinets and gloveboxes. Other room up-grades such as cooling and double and triple confinement systems would be added to the storage area to enhance environmental protection and safety.

3). Cost of Modifications

a). Capital Cost - $2,100,000

b). Other Project Cost - $1,000,000

4). Schedule

a). Facility Modification - October 1995

b). Operational - April 1996

b. Savannah River Site

1). Existing Capabilities: This function is now performed in Building 234-H, including storage of the tritium inventory, these operations will be continued in Building 234-H.

2). Required Modifications: None required

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of meeting expected processing capacity.

2. Reservoir Unloading Description: Unload reservoirs returned from the military and assay the contents.

a. Mound Plant

1). Existing Capabilities: The SROC Facility now has unloading capacity in the T Building. This includes one bell jar in Room T-59 with a laser unloading system and two laser unloading stations in Room T-48. All facilities are configured for laser drilling with associated tanks and pumping systems. Two other unloading stations now exist in SW Complex.

2). <u>Required Modifications</u>: A twenty-seven (27) foot long glovebox line will be added in Room T-275 to accommodate any requirements for larger capacity unloading. This line will include three (3) bell jars to service six (6) stations in each bell jar. Each bell jar will have all necessary gas handling systems, pumping systems, lasers, and associated electrical and instrumentation. Necessary analytical support is available within existing facilities.

3). <u>Cost of Modifications</u>

a). Capital Cost - $2,800,000

b). Other Project Cost - $1,200,000

4). <u>Schedule</u>

a). Facility Modification - October 1995

b). Operational - April 1996

b. Savannah River Site

1). <u>Existing Capabilities</u>: Reservoirs returned from the military are currently unloaded in Building 234-H using mechanical shearing.

2). <u>Required Modification</u>: None - Once operational, the RTF will unload reservoirs using a 400 watt laser. A series of pinpoint laser firings will create a gradually increased opening in the reservoir fill stem, allowing gas to expand into the receiving tank. This laser system will be more versatile and reliable than the currently used method in Building 234-H.

3). <u>Cost of Modifications</u>

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of meeting expected processing capacity.

3. Chemical Separation Description: To separate the tritium decay product, helium-3, and other minor contaminant gases from the hydrogen isotopes recovered from unloaded reservoirs.

a. Mound Plant

1). Existing Capabilities: The MP can store about 11,000 liters of hydrogen isotopes on solid U-beds. These beds will preferentially absorb hydrogen isotopes and simultaneously reject helium.

2). Required Modifications: To operate on a one shift basis, additional, thermodynamically faster, chemical separation capacity will be required. A metal hydride primary separator and a multi-stage palladium diffuser, patterned after SRS designs will be installed. This equipment could process 400 liters per hour of gas from returned reservoirs. The equipment and associated process piping and support equipment will be housed in a twenty-one (21) foot long, inert gas purged, glovebox in Room T-270. Existing analytical support is adequate.

3). Cost of Modifications

a). Capital Cost - $1,500,000

b). Other Project Cost - $700,000

4). Schedule

a). Facility Modification - November 1995

b). Operational - April 1996

b. Savannah River Site

1). Existing Capabilities: The gas recovered in the unloading system is processed through a diffuser to remove non-hydrogen isotopes. The hydrogen isotopes are collected and sent to Building 232-H for enrichment.

2). Required Modifications: None - When RTF is operational there will be a capacity for storage of a minimum of 27,000 liters of purified hydrogen isotopes on hydride beds. Separation and enrichment will be done entirely within the RTF using flow-through hydride beds, diffuser and Thermal Cycling Absorption Process (TCAP) systems.

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of meeting expected processing capacity requirements. The TCAP system has not been demonstrated with tritium.

4. Isotope Separation Description: Used to separate the three isotopes of hydrogen, and to purify the tritium isotope to varying purity concentrations through 99%.

a. Mound Plant

1). Existing Capabilities: The MP has fifteen (15) thermal diffusion columns, operated in cascade and three cryogenic distillation columns (mounted in a single vacuum jacket). Existing equipment can provide tritium at the desired enrichments.

2). Required Modifications: An additional helium compressor and refrigeration system will be provided, in parallel, to the existing helium system. To allow continuous reservoir unloading and cryogenic still operation on a one shift basis, an additional product storage tank will be installed. The tank will be housed in tritium gloveboxes being installed by the unloading subproject.

3). Cost of Modifications

a). Capital Cost - $1,900,000

b). Other Project Cost - $800,000

4). Schedule

a). Facility Modification - February 1995

b). Operational - October 1995

b. Savannah River Site

1). Existing Capabilities: This function is currently performed in Building 232-H using two cryogenic stills.

2). Required Modifications: None - Once RTF becomes operational this function will be performed by the TCAP within RTF. This will result in improved operating efficiency with a more compact process package.

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of meeting expected processing capacity requirements.

5. Gas Mixing Description: Used to blend and store accurate mixtures of tritium and deuterium required for reservoir loads.

a. Mound Plant

1). Existing Capabilities: The MP has gas mixing capacity to support the Savannah River Contingency Program (SROC) in T Building.

2). Required Modifications: To support the workload, on a one shift basis, more storage tanks (volumes) are required for the various "mixes" of gas to support the mission. Ten (10) tanks (volumes) of nominal 100 liters each allow up to ten different isotopic mixes at a time. These will be installed in an existing tritium safe glovebox in T Building that has existing services and analytical support. A pump and manifold system will be added to move material to the SROC system for subsequent reservoir loading.

3). Cost of Modifications

a). Capital Cost - $600,000

b). Other Project Cost - $300,000

4). Schedule

a). Facility Modification - July 1994

b). Operational - October 1995

b. Savannah River Site

1). Existing Capabilities: This function is now performed in Building 234-H using ten independent storage tanks (volumes). The mixture is varied by mass spectrometric analysis before loading the reservoirs. Gas mixing will be moved to RTF when RTF becomes operational.

2). Required Modifications: None required

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of meeting expected processing capacity requirements.

6. Analytical System Description: Perform routine analyses of hydrogen isotopes, helium-3 and selected impurities.

a. Mound Plant

1). Existing Capabilities: The MP has capability to analyze hydrogen isotopes and related gases of interest, with six (6) existing mass spectrometers.

2). Required Modifications: To analyze samples from the unloading, isotope enrichment, and reservoir loading areas on a one shift basis, instruments must be replaced. These instruments are capable of rapid analysis and have advanced manipulation and diagnostics capabilities. Existing tritium safe glovebox access to process sample capillary lines are adequate to effect the upgrade.

3). Cost of Modifications

a). Capital Cost - $1,700,000

b). Other Project Cost - $800,000

4). Schedule

a). Facility Modification - March 1995

b). Operational - October 1995

b. Savannah River Site

1). Existing Capabilities: Seven mass spectrometers currently are operational at the SRS Tritium facilities.

2). Required Modifications: None - Two additional mass spectrometers are planned to become operational with RTF. These are included in the CDR capital cost.

3). <u>Cost of Modifications</u>

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). <u>Schedule</u>

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both the MP and the SRS will have analytical system (mass spectrometer) capabilities.

7. <u>Loading and Finishing Description</u>: To load reservoirs, pinch weld, and finish reservoirs in preparation of final packaging.

a. Mound Plant

1). <u>Existing Capabilities</u>: The MP can load and finish tritium reservoirs for five systems as originally established in support of strategic weapon systems in the Savannah River Operations Contingency (SROC) facility (T Building). This facility has ten (10) SRS-type pinch welders, and similar compressors. Four (4) high-pressure compressors, fed from three (3) existing SROC mix tanks are available to service the ten (10) pinch welders. The pinch welders can be grouped together or in separate gas mixes of five, four and one station during simultaneous loadings if needed. Finishing Operations are readily supported by existing facilities that are used to produce the KYLE and SROC tritium reservoirs.

2). <u>Required Modifications</u>: To support the workload, an additional four (4) pinch welders will be installed in an existing tritium safe glovebox with associated loading process piping. These four separate pinch welders will assure continued production capability should a common fault develop in the system serving the existing ten pinch welders. Based on discussions, DOE directed Mound to include a cost estimate for 16 additional welders, for a total of 30, based on the SRS experience of not previously accomplishing more than one weld per day. Mound in a production mission assignment had accomplished multiple welds per day.

3). <u>Cost of Modifications</u>

a). Capital Cost - $2,000,000
DOE directed - $3,700,000

b). Other Project Cost - $1,200,000

4). <u>Schedule</u>

a). Facility Modification - March 1996

b). Operational - September 1996

b. Savannah River Site

1). <u>Existing Capabilities</u>: War Reserve (WR) Loading and Finishing are now performed in Building 234-H. This facility can currently load, finish and ship WR reservoirs at a significantly greater production rate than currently projected future needs. Building 234-H's loading facilities can load reservoirs to high pressures with diaphragm compressors. After all reservoir fill parameters have been met, the fill stem is pinched by electrodes, a predetermined force is applied and the weld is made by a semi-automatic process started by an operator. The weld integrity is then checked by non-destructive testing, including x-ray and/or weld measurement methods. All reservoirs loaded in Building 234-H are also processed in the finishing operation. The reservoirs are finished according to design agency requirements, including nubbin (fill connector) removal, hot air decontamination, automatic leak detection, weighing, calorimetry measurements, inspection, installation of other weapons components and preparation for shipment.

2). <u>Required Modifications</u>: None - When RTF becomes operational, processing also will be able to exceed all forecasted production schedules and potential sprint requirements. RTF loading facilities could load reservoirs to high pressures with diaphragm compressors.

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None Required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of handling this mission.

8. Inert Loading Description: To receive, proof test, fill, and perform finishing operations with inert gas reservoirs.

a. Mound Plant

1). Existing Capabilities: The MP can load non-tritium gas reservoirs on two development and training pinch welding systems without WR rigor. These systems could be converted to WR with program certification.

2). Required Modifications: To allow required tritium reservoir, pinch weld development and training, on a one shift basis, and to minimize the operational problems of using WR equipment for development, new inert loading facilities are proposed. This equipment will be similar to that for tritium reservoir loading with mix systems and glovebox enclosures. Two (2) SRS-type pinch welders will be serviced by two (2) high pressure (non-tritium) compressors. This equipment with associated weld controllers, instrumentation and non-tritium analytical equipment will be installed in Room T-8 in T Building.

3). Cost of Modifications

a). Capital Cost - $2,400,000

b). Other Project Cost - $1,000,000

4). Schedule

a). Facility Modification - March 1996

b). Operational - July 1996

b. Savannah River Site

1). Existing Capabilities: Loading and finishing of all non-tritium bearing reservoirs now in use in the stockpile are performed in Building 234-H. This operation is separated from the tritium loading area. The equipment consists of two loading manifolds and compressors and twelve welders, accommodating six different gases.

2). Required Modifications: None required

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will be capable of performing this activity.

9. Reclamation Description: To prepare emptied tritium reservoirs for reuse. This involves replacing the fill stem of the reservoir and recertifying the reservoir for reloading in the tritium loading area.

a. Mound Plant

1). Existing Capabilities: The Reclamation Facility was provided under the Savannah River Operational Contingency (SROC) program to serve as a backup to SRS operations.

2). Required Modifications: Another subproject provides extension of the Emergency Containment

System (ECS, triple confinement). Miscellaneous tooling and fixtures are needed.

3). Cost of Modifications

a). Capital Cost - $200,000 (Equipment)

b). Other Project Cost - $300,000

4). Schedule

a). Facility Modification - None required

b). Operational - October 1994

b. Savannah River Site

1). Existing Capabilities: The reclamation of reservoirs is performed in Building 238-H. The reclamation process replaces the reservoir fill stem, then pressure tests and inspects the reservoir to ensure that it is equivalent to a new reservoir. This facility can reclaim more than thirty different types of reservoirs. A storage hood capable of containing more then 20,000 empty reservoirs is used for temporary storage of reclaimed reservoirs.

2). Required Modifications: None required

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

c. **Comparison**: Both sites will meet the expected capacities for this operation.

10. Neutron Generator Loading Description: The June 1992 revision shows plans to move this operation to LANL.

11. Helium-3 Recovery Description: To remove residual amounts of tritium from the helium-3 decayed product stream separated by the chemical separation subproject.

a. Mound Plant

1). Existing Capabilities: The MP can provide non-radioactive (tritium free) helium-3 to the DOE and commercial sector. Mound's Isotope Sales Group has developed a proven technology of removing traces of tritium in helium-3 using cryogenic activated carbon beds to purify the recovered helium-3.

2). Required Modifications: Mound included replacement of these facilities in its project because the current facility is nearing the end of its useful life. New helium-3 purification facility will be installed in T Building so trace amounts of tritium recovered are returned to the tritium process through the ERS system. The purification equipment will be enclosed in gloveboxes purged with non-tritium gas. This practice protects operating personnel and the environment.

3). Cost of Modifications

a). Capital Cost - $600,000

b). Other Project Cost - $200,000

4). Schedule

a). Facility Modification - Sept. 1995

b). Operational - April 1996

b. Savannah River Site

1). Existing Capabilities: The 236-H facility has the capability for purification of helium-3, to remove tritium and other contaminants, and load into compressed gas cylinders. Purification is accomplished by passing the gas through liquid-nitrogen cooled Z-beds to remove traces of tritium and other impurities.

2). Required Modifications: None required

3). <u>Cost of Modifications</u>

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). <u>Schedule</u>

a). Facility Modification - None required

b). Operational - Ongoing

c. **Comparison:** Both sites will meet the expected capacities for this operation.

12. <u>Component Evaluation Operations (CEO)</u>: To assess the quality, reliability and safety of the tritium reservoir systems. This includes production and pre-production evaluations, gas transfer system functions, material testing and product acceptance testing.

a. Mound Plant

1). <u>Existing Capabilities</u>: The MP now has CEO facilities and the required analytical, metallurgical, and research facilities to support DOE evaluation programs. Capabilities exist to provide environmental simulation of transports and WR environments before function testing. Also, function testing is conducted at WR temperatures. The operations are performed in the SW/R Complex.

2). <u>Required Modifications</u>: CEO environmental and function testing facilities could be duplicated in T Building using new equipment. Rooms housing this equipment would be connected to the ECS to provide triple confinement.

3). <u>Cost of Modifications</u>

a). Capital Cost - $0.0 ($10.7M in T-Bldg.)

b). Other Project Cost - $0.0 ($4.5M in T-Bldg.)

4). <u>Schedule</u>

a). Facility Modification - None required

b). Operational - On-going

b. Savannah River Site

1). Existing Capabilities: One function tester located in Building 232-H has component evaluation capability. The existing pneumatic burst testing facility in Building 236-H is available for component evaluations.

2). Required Modifications: A mezzanine would be installed in the spare bay of the north end of the RTF. Three (3) more, 50% capacity exhaust fans will be added to the RTF HVAC system. One centrifuge, one vibration tester, one drop tester, three (3) function testers and bell jars, and associated piping and electronics would be installed in the RTF. One function tester located in Building 232-H has the capability of component evaluation. The pneumatic burst testing facility in Building 236-H would be used for component evaluation.

3). Cost of Modifications

a). Capital Cost - $35,100,000

b). Other Project Cost - $8,900,000

4). Schedule

a). Facility Modification - April 1996

b). Operational - September 1997

c. **Comparison**: Both sites will be capable of handling this mission.

13. Commercial Sales/ICF Loading: Encompasses precise high and low pressure commercial tritium loading of containers, hydride beds, and Inertial Confinement Fusion (ICF) microspheres (commercial sales are not a Defense Programs mission. ICF loading is a Defense Programs mission).

a. Mound Plant

1). Existing Capabilities: Commercial amounts of tritium are routinely loaded for customers in the T Building using the KYLE/SROC area. Special tritium loadings for Inertial Confinement Fusion customers are made in the

Tritium Engineering Development Laboratory (TEDL).

2). Required Modifications: None required

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - On-going

b. Savannah River Site

1). Existing Capabilities: Tritium loading of containers for shipment to Mound is currently performed in Building 234-H

2). Required Modifications: All loading of ICF units and commercial units would be performed in the RTF.

3). Cost of Modifications

a). Capital Cost - $700,000

b). Other Project Cost - $1,800,000

4). Schedule

a). Facility Modification - May 1995

b). Operational - June 1996

c. **Comparison**: Both sites will be capable of performing this mission.

14. Life Storage Description: War reserve (WR) and non-WR tritium storage test units are stored in environmental chambers and evaluated periodically.

a. Mound Plant

1). Existing Capabilities: The MP can store tritium reservoirs and prototypes. Existing glovebox space is available to store non-WR Tritium storage test units. With the planned reduction of process development samples (with concurrence by the Design Laboratories), Mound will have sufficient space to accommodate both Mound's and SRS's Life Storage Test Samples.

2). <u>Required Modifications</u>: None required

3). <u>Cost of Modifications</u>

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). <u>Schedule</u>

a). Facility Modification - None required

b). Operational - On-going

b. Savannah River Site

1). <u>Existing Capabilities</u>: Thirty-five WR reservoirs and two hundred eighty non-WR test reservoirs are now stored in Building 232-H. They are surveyed as required. All non-WR units are stored in secondary containers.

2). <u>Required Modifications</u>: Transfer of 150 Life Storage units from MP will require six new environmental chambers that will be housed in air hoods in Building 232-H. This is part of the "Gas Transfer Systems" section in the SRS CDR.

3). <u>Cost of Modifications</u>

a). Capital Cost - $1,000,000

b). Other Project Cost - $300,000

4). <u>Schedule</u>

a). Facility Modification - January 1996

b). Operational - January 1997

c. **Comparison**: Both sites will be able to assume this mission.

15. Scrap Recovery Description: To remove residual tritium from solids in scrap metal, liquids, and gases.

a. Mound Plant (Solids, Aqueous, Gaseous tritium Recovery)

1). Existing Capabilities: The MP has experience and capabilities for Process Development including material studies, hardware fabrication, function testing and tritium process technology. MP has synthesized compounds and has developed the monitoring measuring and testing techniques used to follow the behavior of these materials in long-term storage and prototype testing. This experience has shown differences between tritiated compounds and those containing protium or deuterium. MP provides solid aqueous, gaseous recovery services for both its site and other DOE sites.

2). Required Modifications: None required

3). Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4). Schedule

a). Facility Modification - None required

b). Operational - Aqueous recovery will be operational December 1992. Additional gas recovery will be operational September 1993.

b. Savannah River Site (Solids and Gaseous tritium Recovery)

1). Existing Capabilities: Gas recovery in Building 234-H is provided by a stripper system that removes the tritium from the gas.

2). Required Modifications: Tritium recovery from solids will be performed in the RTF as part of the "Gas Transfer System" mission in the SRS CDR. A stripper system will be employed in the RTF once it is operational. Modifications include installation of a vacuum bakeout system in an argon glovebox and a mass spectrometer to analyze the off gas.

3). Cost of Modifications

a). Capital Cost - $2,000,000

b). Other Project Cost - $600,000

4). Schedule

a). Facility Modification - January 1996

b). Operational - January 1997

c. **Comparison**: The SRS was directed to provide for a solid scrap recovery system only in its CDR. MP has historically provided this service to other DOE sites (LANL, SNLL, and LLNL) for processing solid and aqueous scrap. Additional capital costs and/or operating costs will be necessary at other sites, notably LANL, to process aqueous and solid scrap materials or burial.

16. Process Development Description: To develop technologies that would be used for weapons production and to ensure that these technologies are successfully transferred to production.

a. Mound Plant

1) Existing Capabilities: The MP has experience and capabilities for Process Development endeavors, including materials studies, hardware fabrication and testing, and tritium processing technology in SW/R Complex.

2) Required Modifications: None.

3) Cost of Modifications

a). Capital Cost - $0.0

b). Other Project Cost - $0.0

4) Schedule

a). Facility Modification - None required

b). Operational - On-going

b. Savannah River Site

1) Existing Capabilities: The Savannah River Technology Center's (SRTC) Weapons Technology Group supports the site's tritium production missions and performs research and development projects to improve the technology for safe, efficient processing of tritium and weapon components.

2) Required Modifications: Establishment of a downsized operation like Mound's KYLE facility would be required which will consist of modifications to Building 735-11A and installation of an argon glovebox in the RTF. Equipment changes will consist of installing a mass spectrometer in Building 773-A, modifying a loading manifold in RTF for R&D units, and moving pinch weld and related equipment from existing Loading Line 1 to Loading Line 6 in the RTF.

3) Cost of Modifications

a). Capital Cost - $13,900,000

b). Other Project Cost - $10,000,000

4) Schedule

a). Facility Modification - January 1996

b). Operational - January 1997

c. Comparison: Both sites will be capable of performing this mission.

17. Container Management Facility Description: This facility provides a stacker/retriever, and a leak testing and certification facility for the H1616 shipping container.

a. Mound Plant

1). Existing Capability: The MP has limited capacity for receiving, storage, testing and loading of shipping containers.

2). Required Modification: The required modifications to support this task are included in the Inspection/Reservoir Storage section.

3). <u>Cost of Modifications</u>

a). Capital Cost - Included in D.1.a.

b). Other Project Cost - Included in D.1.a.

4). <u>Schedule</u>

a). Facility Modification - Included in D.1.a.

b). Operational - Included in D.1.a.

b. Savannah River Site

1). <u>Existing Capabilities</u>: Storage of H1616 shipping containers is currently performed in Building 234-H.

2). <u>Required Modifications</u>: An existing $6,000,000 project entitled "Container Management Facility" (S-4655) is under construction.

3). <u>Cost of Modifications</u>

a). Capital Cost - $800,000

b). Other Project Cost - $0.0

4). <u>Schedule</u>

a). Facility Modification - None required

b). Operational - Ongoing

c. <u>Comparison</u>: Both sites will be capable of handling this mission.

Table A.1

EXISTING CAPABILITIES & MODIFICATION REQUIREMENTS
SAVANNAH RIVER SITE

FACILITY, PROCESS and OPERATIONS REQUIREMENTS	CURRENT STATUS BUILDING(S)	MODIFICATION COSTS (TEC)	MODIFICATIONS COMPLETED	OPERATIONAL DATE
1. INSPECTION/RESERVOIR STORAGE	MEETS WORKLOAD 234-H	$0.0	NOT APPLICABLE	ON-GOING
2. RESERVOIR UNLOADING (SEE NOTE 1)	MEETS WORKLOAD 234-H	$0.0	NOT APPLICABLE	ON-GOING
3. CHEMICAL SEPARATION (SEE NOTE 1)	MEETS WORKLOAD 232-H	$0.0	NOT APPLICABLE	ON-GOING
4. ISOTOPE SEPARATION (SEE NOTE 1)	MEETS WORKLOAD 232-H	$0.0	NOT APPLICABLE	ON-GOING
5. GAS MIXING (SEE NOTE 1)	MEETS WORKLOAD 234-H	$0.0	NOT APPLICABLE	ON-GOING
6. ANALYTICAL SYSTEM (SEE NOTE 1)	MEETS WORKLOAD 232/234-H	$0.0	NOT APPLICABLE	ON-GOING
7. LOADING and FINISHING (SEE NOTE 1)	MEETS WORKLOAD 234-H	$0.0	NOT APPLICABLE	ON-GOING
8. INERT LOADING	MEETS WORKLOAD 234-H	$0.0	NOT APPLICABLE	ON-GOING
9. RECLAMATION	MEETS WORKLOAD 238-H	$0.0	NOT APPLICABLE	ON-GOING
10. NEUTRON GENERATOR LOADING (SEE NOTE 2)	NO CAPABILITY Now going to LANL	$13,100,000 (removed from SRS estimates)		

COSTS IN ESCALATED DOLLARS

Table A.1 (continued)

EXISTING CAPABILITIES AND MODIFICATION REQUIREMENTS SAVANNAH RIVER (CONTINUED)

FACILITY, PROCESS and OPERATIONS REQUIREMENTS	CURRENT STATUS / BUILDING(S)	MODIFICATION COSTS (TEC)	MODIFICATIONS COMPLETED	OPERATIONAL DATE
11. HELIUM-3 RECOVERY	MEETS WORKLOAD / 236-H	$0.0	NOT APPLICABLE	ON-GOING
12. COMPONENT EVALUATION OPERATIONS (SEE NOTE 2)	LIMITED CAPABILITY / 234-H	$35,100,000	APRIL 1996	SEPTEMBER 1997
13. COMMERCIAL SALES/ICF LOADING (SEE NOTE 2)	LIMITED CAPABILITY / 234-H	$700,000	MAY 1995	JUNE 1996
14. LIFE STORAGE (SEE NOTE 2)	MEETS WORKLOAD / 232-H	$1,000,000	JANUARY 1996	JANUARY 1997
15. RECOVERY (SOLID, LIQUID, GAS) (SEE NOTE 2)	LIMITED CAPABILITY / 234-H	$2,000,000	JANUARY 1996	JANUARY 1997
16. PROCESS DEVELOPMENT	LIMITED CAPABILITY	$13,900,000	JANUARY 1996	JANUARY 1997
17. CONTAINER MANAGEMENT FACILITY	LIMITED CAPACITY	$800,000	NOT AVAILABLE	NOT AVAILABLE
TOTAL CAPITAL EXPENSE (BASE SUBPROJECTS 1-17 ONLY) NO NGL		$53,500,000	COSTS IN ESCALATED DOLLARS	

NOTE 1: WHEN SRS'S RTF IS OPERATIONAL IT IS PLANNED FOR ALL THOSE OPERATIONS/PROCESSES TO BE MOVED INTO THAT FACILITY. THE COST IN ESCALATED DOLLARS FOR THE COMPLETION OF RTF IS $39,000,000 AND IS IN SECTION V - COMPARATIVE LIFE CYCLE COST

NOTE 2: THE TOTAL OTHER PROJECT COST (ESCALATED OPC) FOR THE PROCESSES/OPERATIONS (1-17) AMOUNT TO $21,600,000 WITHOUT NGL. THIS DOES NOT INCLUDE ALL OF THE ASSOCIATED OPC WITH RTF (NOTE 1).

CALORIMETRY IS NOT INCLUDED ABOVE AND IS ASSUMED TO GO TO LANL.

Table A.2

EXISTING CAPABILITIES and MODIFICATION REQUIREMENTS MOUND PLANT				
FACILITY, PROCESS and OPERATIONS REQUIREMENTS	CURRENT STATUS BUILDING(S)	MODIFICATION COSTS (TECC)	MODIFICATIONS COMPLETED	OPERATIONAL DATE
1. INSPECTION/RESERVOIR STORAGE	LIMITED CAPACITY T	$2,100,00	OCTOBER 1995	APRIL 1996
2. RESERVOIR UNLOADING (SEE NOTE 1)	LIMITED CAPACITY T/SW	$2,800,000	OCTOBER 1995	APRIL 1996
3. CHEMICAL SEPARATION	LIMITED CAPACITY T	$1,500,000	NOVEMBER 1995	APRIL 1996
4. ISOTOPE SEPARATION	LIMITED CAPACITY T	$1,900,000	FEBRUARY 1995	OCTOBER 1995
5. GAS MIXING	LIMITED CAPACITY T	$600,000	JULY 1994	OCTOBER 1995
6. ANALYTICAL SYSTEM	LIMITED CAPACITY T/SW	$1,700,000	MARCH 1995	OCTOBER 1995
7. LOADING & FINISHING (SEE NOTE 1)	MEETS WORKLOAD T/SW	$2,000,000	MARCH 1996	SEPTEMBER 1996
8. INERT LOADING	LIMITED CAPACITY T	$2,400,000	MARCH 1996	JULY 1996
9. RECLAMATION	MEETS WORKLOAD T	$200,000	NOT APPLICABLE	OCTOBER 1994
10. NEUTRON GENERATOR LOADING	LIMITED CAPABILITY Now going to LANL	$4,100,000 (removed from MP est.)		

COSTS IN ESCALATED DOLLARS

Table A.2 (continued)

EXISTING CAPABILITIES and MODIFICATION REQUIREMENTS
MOUND PLANT (continued)

FACILITY, PROCESS and OPERATIONS REQUIREMENTS	CURRENT STATUS BUILDING(S)	MODIFICATION COSTS (TECC)	MODIFICATIONS COMPLETED	OPERATIONAL DATE
11. HELIUM-3 RECOVERY (SEE NOTE 1)	MEETS WORKLOAD HH	$600,000	SEPTEMBER 1995	APRIL 1996
12. COMPONENT EVALUATION OPERATIONS (SEE NOTE 1)	MEETS WORKLOAD SW	$10,700,000	(SEE NOTE 2)	ON-GOING
13. COMMERCIAL SALES/ICF LOADING	MEETS WORKLOAD T	$0.0	NOT APPLICABLE	ON-GOING
14. LIFE STORAGE	MEETS WORKLOAD SW	$0.0	NOT APPLICABLE	ON-GOING
15. RECOVERY (SOLID, LIQUID, GAS)	MEETS WORKLOAD T/SW	$0.0	NOT APPLICABLE	ON-GOING
16. PROCESS DEVELOPMENT (SEE NOTE 1)	MEETS WORKLOAD SW	(SEE NOTE 3)	NOT APPLICABLE	ON-GOING
17. CONTAINER MANAGEMENT FACILITY	LIMITED CAPACITY T	INCLUDED IN 1. ABOVE	NOT APPLICABLE	NOT APPLICABLE
TOTAL CAPITAL EXPENSE (BASE PROJECTS 1-17 ONLY, NO NGL)		$30,200,000*		

Note 1: After consolidation, these operations will be performed in T Building. This cost does not include $3.7M for additional pinch welders.

Note 2: CEO is currently located in SW building and is a fully operational facility. If funded modifications will be completed February 1998 and operational in August 1998. This project's capital cost is $10,700,000, see Section V - comparative life cycle cost.

Note 3: Process development (nuclear facility modernization project) was curtailed by the DOE. Outstanding TEC to complete the project is $18,300,000, see Section V.

*Does not include CEO modifications, process development, or other related projects.

APPENDIX B

DETAILED COST DATA INCLUDING
REFERENCES AND SOURCES

APPENDIX B

DETAILED COST DATA INCLUDING

REFERENCES AND SOURCES

B.1 TEC/OPC/TPC in Escalated Dollars

Tables B.1 and B.2 present the year-by-year outlays for the TEC/OPC/TPC only for SRS and MP respectively in escalated dollars. The April 1992 SRS CDR presented all the TEC and OPC data in escalated dollars. In order to prepare parts of Table 2, the CDR-based Table B.1 values had to be de-escalated. MP provided most of their data in constant dollars, therefore the Table 3 TEC/OPC/TPC data had to be escalated to prepare Table B.2. This Appendix also shows the DOE/PR-24 escalation factors used for both SRS and MP. Tables B.3 and B.4 reference the data sources for Tables 2, 3, B.1, and B.2.

B.2 Total Project Cost (TPC) and Other Project Cost (OPC)

Appendix Table B.5 shows the TEC, OPC, and TPC for the 17 Appendix A Subprojects for both SRS and MP on the same Table. All numbers are in escalated dollars. If a subproject already exists or is not needed at a site, it carries no cost. These individual subproject values are for the base consolidation mission only and do not include other related non-production projects (such as safety upgrades) now deemed necessary for the tritium mission assignment. For the bottom line TEC/OPC/TPC, calorimetry is zeroed in the SRS breakout and the NGL activity is zeroed in the MP and SRS columns. The generic activities included in OPC for both sites include feasibility studies, CDRs, construction data sheets, Quality Assurance and management plans, start-up activities, initial spares, and ORR costs.

B.3 Detail Life-Cycle Costs

Table B.6 was used to provide the tritium consolidation and "keep both plants" options described in this report. It deals in most detail with operation costs and also reports annual FTE's. It should be noted that M&O contractor accounting differences in allocating FTE's to direct or indirect functions accounts for the large difference in direct FTE's to do the same task. The total direct plus indirect annual staffing costs are much closer together, as expected.

TABLE B.1

ESCALATED DOLLAR TEC/TPC ANNUAL OUTLAYS FOR TRITIUM CONSOLIDATION AT SRS

Unescalated Costs	Total (M)	Total (M)	1992	1993	1994	1995	1996	1997	APP DOC KEY
NON-CAPITAL PART OF TEC (OPC)									
Consolidation Mission	20.74	24.12		0.71	4.62	6.89	11.90	0.00	z
Miscellaneous Projects	0.30	0.32		0.21	0.11	0.00	0.00	0.00	aa
RTF Completion	27.40	28.93		28.27	0.66	0.00	0.00	0.00	bb
Total OPC	48.44	53.37		29.19	5.39	6.89	11.90	0.00	
CAPITAL (CONSOLIDATION MISSION)									
Engineering Design & Inspection	12.16	13.25		7.48	3.76	2.02	0.00	0.00	cc
Construction	22.17	24.96		0.59	17.50	6.86	0.00	0.00	dd
Project Management	3.91	4.54		1.35	1.50	0.93	0.75	0.00	ee
Contingency	9.72	10.73		4.03	4.28	2.26	0.15	0.00	ff
TEC (MP CONSOLIDATION MISSION)	48.96	53.48		13.45	27.05	12.08	0.90	0.00	gg
OTHER CAPITAL									
Miscellaneous Projects	1.10	1.10		0.60	0.50	0.00	0.00	0.00	hh
RTF Completion	11.00	11.10		11.10	0.00	0.00	0.00	0.00	ii
TEC (CONS. MISSION + OTHER)	60.06	65.68		25.15	27.55	12.08	0.90	0.00	
TPC (SRS)	108.49	118.96		54.82	32.71	18.79	12.64	0.00	

DOC KEY refers to sources listed on Appendix Table B.3

Constant Dollar cash flows shown on Table 2 (some SRS escalation factors are slightly different than DP/PR-24 factors).

TABLE B.2

ESCALATED DOLLAR TEC/TPC ANNUAL OUTLAYS FOR TRITIUM CONSOLIDATION AT MOUND

Unescalated Costs	Total ($M)	Total ($M)	1992	1993	1994	1995	1996	1997
NON-CAPITAL PART OF TPC (OPC)								
Other Project Costs (Pre-Authorization & Preops)	11.97	13.84		0.87	4.95	3.22	1.28	3.52
CAPITAL								
Engineering Design & Inspection	3.70	4.01		1.91	0.35	1.25	0.25	0.25
Construction	14.57	16.25		0.48	9.53	1.35	4.14	0.75
Project Management	0.60	0.60		0.12	0.12	0.12	0.12	0.12
Contingency	5.40	5.64		0.67	2.36	0.71	1.10	0.80
TEC (MP MISSION INC. CEO)	24.27	26.50		3.18	12.36	3.43	5.61	1.92
OTHER RELATED PROJECTS	20.06	21.70		7.05	7.36	7.29	0.00	0.00
ADDITIONAL PINCH WELDERS	3.30	3.70		0.50	2.00	0.40	0.55	0.25
Total TEC incl add'l weld.& other proj	49.52	51.90		10.73	21.72	11.12	6.16	2.17
TPC (MP)	59.59	65.74		11.60	26.67	14.34	7.44	5.69

Constant dollar cash flows shown on Table 3

DOC KEY refers to sources listed on Appendix Table B.4

TABLE B.3

Documentation Key for Tables 2 and B.1 (Life Cycle Cost and TEC/TPC Cash Flow Spreadsheets for Relocation to SRS)

(a)	Cash flows from Revision 3 were proportionally reduced to reflect removal of $5.6M and $2.5M for NGL and Calorimetry OPC respectively. (Actual removal of above esc $OPC was done in (z). These entries are de-escalated from line (z) using DOE-ICE escalation factors.
(b,c)	Original line (a) and present lines (b) and (c) are from spreadsheet provided by SRS dated 8/11/92 ("Life Cycle Cost Summary")
(d-g)	Cash flows from Revision 3 were proportionally reduced to reflect removal of $13.1M and $5.1M for NGL and Calorimetry TPC respectively. (Actual removal of above esc $OPC was done in (cc)-(gg). These entries are are de-escalated from lines (cc)-(gg) using DOE-ICE escalation factors. Original cash flows before NGL and Calorimetry removal are from same SRS spreadsheet as (b,c) above.
(h,i)	These entries are from SRS spreadsheet cited in (b,c) above.
(j)	Rampdown entries (1993-1996) reduced by $1M/yr each from Rev 3 to reflect removal of anticipated NGL and Calorimetry missions. Revised steady state staffing cost based on 318 FTEs rather than Rev 3's 375 FTEs. Annual cost reduction was proportional to FTEs. Original (Rev 3) staffing cash flows based on SRS data from (b,c) above. 318 FTE # based on letter from C. Czuchna (DOE-SR) to R. Hagan (DP-642). 10/2/92. # of indirect FTEs is equal to # of direct FTEs (159 FTEs @).
(k)	Same SRS spreadsheet as (b,c) above. Items included in "site overhead" were not listed. Presumably most overhead FTEs would be in line (j), but some may be here, also.
(l)	New data provided 11/12/92 by C. Czuchna, DOE-SR. (Letter to R. Hagan; "Tritium Feasibility Study"; 11/13/92.
(m)	Same SRS spreadsheet as (b,c) above. Contaminated wastes are assumed to be buried on SR Reservation.
(n)	Same SRS spreadsheet as (b,c) above. Capital upgrades from 1997-2046 were increased from $4M/yr to $6M/yr per letter from C. Czuchna (DOE-SR) to R. Hagan (DP-642) "Tritium Feasibility Study Concerns"; 10/2/92
(o)	$11M/yr safe shutdown cost provided by Mound. Additional $150K in 1995 is for transfer of H-1616 shipping containers.
(oo)	Calculated by ratioing from SRS to MP inventory transfer costs
(p)	Same SRS spreadsheet as (b,c) above. D&D scope is that of preparing building for takeover by DOE/EM.
(q)	These cash flows do not include costs for relocating other MP NN activities.

* DOC KEY letters from Table 2

TABLE B.3 (CONTINUED)
Documentation Key for Revised Tables 2 and B.1 (Life Cycle Cost and TEC/TPC Cash Flow Spreadsheets for Relocation to SRS): (continued)

(q1)	Calorimetry front-end costs based on $7.6M TPC (esc) or $6.9M TPC (92$) distributed over FYs 93-96.
(r)	Overhead burden of $1M/yr is assumed for MP activities transferred to KCP.
(u-v)	These front end costs for relocation of MP's other (non-T3) non-nuclear activities were obtained from preliminary CDR data from DP-40 provided by J. Lampley of DOE-AL. (chart "Non-Nuclear Reconfiguration Cost Progression"; 9/1/92). The Mound to LANL TPC is $12.48M in const $ or $14.4M in esc $. The Mound to Kansas City TPC is $9.6M in const $ or $10.7M in esc $. The cash flows are from DP-40/AL chart "Relocation of MP non-T,non-nuclear Activities". Additional indirect (site overhead) life cycle costs at these receiver sites are assumed negligible, since these sites already have many operations supporting their overhead.
(w)	The $71M figure was provided by Mound (letter from T.W.Hughes, MP, to E.G.Lazur, DP-66; paragraph 2; "Tech Transfer from Mound and Safe Shutdown Costs for Other Non-Nuclear Operations"; 9/22/92.
(x)	This row gives total cost adjustments for transferring activities from MP only. These are added to row (q) to give row (y)
(y)	Net life cycle cost to DOE including costs of MP shutdown plus consolidation at SRS.
(z-ii)	These values are in escalated $. The lump sum $ on the left represent the the usual from in which TEC/TPC values were reported by MP and SRS. The references are the same as for corresponding rows (a)-(i). Rows (a) through (i) were de-escalated from these numbers. These entries have NGL and Calorimetry deleted.

^ DOE KEY is for letters from Table B.1

TABLE B.4

Documentation Key for Revised Tables 3 and B.2 (Life Cycle Cost and TEC/TPC Cash Flow Spreadsheets for Relocation to Mound)

(a)	New cash flow data from MP was used. It was dated 15 Oct 92 and had the NGL deleted. (Data was faxed from MP to Karen Boardman, DAO, and by her to K. Williams at ORNL on 10/20/92)
(b–f)	Letter from T.Hughes, EG&G, to K.Boardman,DAO, "Comments on Report ...", October 28, 1992.
(g)	Other related projects are listed on revised Table B.6. Cash flows are from 8/18/92 Mound–suppled spreadsheet.
(g1)	16 add'l pinch welders cost $37M(esc TEC) or $3.3M(const$ TEC). The time-phasing was provided in letter from T. Hughes,EG&G, to K.Boardman,DAO. Letter is dated Oct 21, 1992.
(h.)	New staffing & overhead data provided by letter from T. Hughes, MP, to R. Hagan, DP–642; November 19, 1992.
(i–k)	Consumables, waste, & cap. upgrade cash flows provided in same MP data package cited in (a) above.
(l)	Time–phasing of $70.3M safe shutdown cost prov.by SRS. Additional $150K in 1995 is for transfer of H–1616 shipping containers. (SRS reference is Appendix D of letter from D.E.Ward, WSRC, to C. Czuchna, DOE–SR; "Response to Action Items ..."; 8/8/92. Inventory & pre-build costs are not incl.
(m)	Even if T3–cons. goes to Mound there will be some SRS–RTF costs to DP (even if T3 is never introduced into RTF). Data from item #7 of letter from C.Czuchna,DOE–SR, to R. Hagan, DP–642, "Tritium Feasibility Study Questions"; 10/2/92.
(m1)	Letter from T.Hughes,EG&G, to K.Boardman, DAO; Oct 14,1992; and letter from C.Czuchna,DOE–SR, to R.Hagan,DP–642; "Tritium Feasibility Study Question", 10/9/92. Also same ref. as for (b) above.
(n)	Same Mound spreadsheet as (h) above. D&D scope is that of preparing building for takeover by DOE/EM.
(o)	These cash flows do not include non–tritium activities at MP.
(p)	Total DP overhead (does not include EM overhead) at MP is $49.9M/yr for years 1998–2012 and $85.3M/yr for years 2013–2047. After removing the T–3 overhead which is in the $2.71B consolidation LCC, $2.68B remains for other NN activities. The cash flows are as follows: $28.4M/yr for years 1998–2012 and $64.3M/yr for years 2013–2047.
(q)	Costs to DP after MP overhead burden is factored in.
^ DOC KEY letters are for Table 3	
(r–x)	These values are in escalated $. The reference is the same as for corresponding rows (a)–(i). Rows (r)–(x) were escalated from (a)–(i) using DOE/DP escalation factors.
^ DOC KEY letters are for Table B.2	

TABLE B.5

COMPARISON OF TEC, OPC, AND TPC BY SUBPROJECT

SP #	SUBPROJECT	****** SRS ****** TEC	OPC	TPC	****** MOUND **** TEC	OPC	TPC
01	INSPECT/RESERV STORAGE	0.0	0.0	0.0	2.1	1.0	3.1
02	RESERVOIR UNLOAD	0.0	0.0	0.0	2.8	1.2	4.0
03	CHEMICAL SEPN	0.0	0.0	0.0	1.5	0.7	2.2
04	ISOTOPE SEPN	0.0	0.0	0.0	1.9	0.8	2.7
05	GAS MIXING	0.0	0.0	0.0	0.6	0.3	0.9
06	ANALYTICAL SYSTEM	0.0	0.0	0.0	1.7	0.8	2.5
07	LOADING & FINISHING	0.0	0.0	0.0	2.0	1.2	3.2
07	(ADD'L PINCH WELDERS FOR S-P 07)	NA	NA	NA	3.7	0.0	3.7
08	INERT LOADING	0.0	0.0	0.0	2.4	1.0	3.4
09	RECLAMATION	0.0	0.0	0.0	0.2	0.3	0.5
10	NEUTRON GEN LOADING	13.1	5.6	18.7	4.1	1.9	6.0
11	HE-3 RECOVERY	0.0	0.0	0.0	0.6	0.2	0.8
12	COMP EVALUATION OPS	35.1	8.9	44.0	10.7	4.5	15.2
13	COMMERCIAL SALES/ICF LOAD	0.7	1.8	2.5	0.0	0.0	0.0
14	LIFE STORAGE	1.0	0.3	1.3	0.0	0.0	0.0
15	RECOVERY (S,L,G)	2.0	0.6	2.6	0.0	0.0	0.0
16	PROCESS DEVT	13.9	10.0	23.9	0.0	0.0	0.0
17	CONTAINER MGT FACILITY	0.8	0.0	0.8	0.0	0.0	0.0
		66.6	27.2	93.8	34.3	13.8	48.1
	CALORIMETRY BREAKOUT	5.1	2.5	7.6	N/A	N/A	N/A
	REV TOTAL(DEC 91 RECONFIG OPTION; other rel proj.not incl.	71.7	29.7	101.4	34.3	13.8	48.1
	REMOVAL OF NGL PER 6/92 OPTION	-13.1	-5.6	-18.7	-4.1	-1.9	-6.0
	REMOVAL OF CALORIMETRY AT SRS PER 6/92 RECONFIG. OPTION	-5.1	-2.5	-7.6	na	na	na
	REV TOTAL(JUNE 92 REVISED OPTION; other rel projects not incl.	53.5	21.6	75.1 *	30.2	11.9	42.1
	OTHER RELATED PROJECTS (ESC $M)	12.1	29.3	41.4	21.7	0.0	21.7
	OTHER ADJUSTMENTS NOT DETAILED	0.0	2.5	2.5	0.0	1.9	1.9
	GRAND TOTALS	65.6	53.4	119.0	51.9	13.8	65.7

$M ESCALATED INCLUDING CONTINGENCY
SRS GRAND TOTALS INCLUDE RTF FUNDING
EFFECT OF SRS CALORIM. TO LANL SHOWN IN ADJS. TO TABLE 2
NA: NOT APPLICABLE
* SRS DATA BASED ON ADJ TO 4/92 CDR. EQUIV NOV 92 CDR ESC TOTAL IS $83.1M.
tabb5.wk1
11/20/92

TABLE B.6 DETAIL LIFE CYCLE COSTS

STEADY-STATE ANNUAL COSTS	MOUND PLANT CONSOLIDATED T-MISSION FOR P&PD 92-1A (ANN COST DURING STEADY-STATE YEARS 1998-2047)	MOUND PLANT 50-YR CUM COST FOR 1998-2047 ($M)	MOUND PLANT PRESENT T-MISSION FOR P&PD 92-1A (ANN COST DURING STEADY-STATE YEARS 1998-2047) (BASIS FOR AVOIDED COSTS)	MOUND PLANT 50-YR CUM COST FOR 1998-2047 ($M)
DIRECT STAFF COUNT (FTEs)	248		158	
DIRECT STAFF ANNUAL COST ($M/YR)	12.80	640	8.15	408
CONSUMABLES ANNUAL COST ($M/YR)	2.24	112	1.50	75
WASTE & TRANS. ANNUAL COST ($M/YR)	0.96	48	0.96	48
CAPITAL UPGRADE ANN. COST ($M/YR)	5.96 -----	298 -----	5.96 -----	298 -----
TOTAL DIRECT COST ($M/YR)	21.96	1098	16.57	829
INDIRECT STAFF COUNT (FTEs) ($M/YR)	376		240	
INDIRECT STAFF ANNUAL COST ($M/YR)	15.40	770	-	-
PLANT OVERHEAD ANN COST ($M/YR)	9.10 -----	455 -----	- -----	- -----
TOTAL INDIRECT COST ($M/YR)	24.50 =====	1225 =====	20.87 =====	1043 =====
TOTAL ANNUAL COST ($M/YR)	46.46	2323	37.44	1872
OTHER LIFE CYCLE COSTS:				
TPC FOR CONS. OR SPEC. PROJ. ($M)	N/A	60	N/A	20
TRANSITION COSTS ($M)	N/A	85	N/A	0
D&I OPS FOR NON-STDY STATE YRS 1993-1997 (CUM $M)	N/A	239	N/A	227
D&D	N/A	3 =====	N/A	0 =====
GRAND TOTAL LIFE CYCLE		2710		2119

TABLE B.6 DETAIL LIFE CYCLE COSTS (CONT'D)

STEADY-STATE ANNUAL COSTS (const 1992$) annuals.wk1	SAVANNAH RIVER SITE CONSOLIDATED T-MISSION FOR P&PD 92-1A (ANN COST DURING STEADY-STATE YEARS 1998-2047)	SAVANNAH RIVER SITE 50-YR CUM COST FOR 1998-2047 ($M)	SAVANNAH RIVER SITE PRESENT T-MISSION FOR P&PD 92-1A (ANN COST DURING STEADY-STATE YEARS 1998-2047) (BASIS FOR AVOIDED COSTS)	SAVANNAH RIVER SITE 50-YR CUM COST FOR 1998-2047 ($M)
DIRECT STAFF COUNT (FTEs)	159		141	
DIRECT STAFF ANNUAL COST ($M/YR)	18.00	900	16.85	843
CONSUMABLES ANNUAL COST ($M/YR)	2.25	113	2.25	113
WASTE & TRANS. ANNUAL COST ($M/YR)	0.30	15	0.30	15
CAPITAL UPGRADE ANN. COST ($M/YR)	6.00	300	6.00	300
	-----	-----	-----	-----
TOTAL DIRECT COST ($M/YR)	26.55	1328	25.40	1270
INDIRECT STAFF COUNT (FTEs) ($M/YR)	159		141	
INDIRECT STAFF ANNUAL COST ($M/YR)	18.00	900	16.85	843
PLANT OVERHEAD ANN COST ($M/YR)	9.10	455	7.2	360
	-----	-----	-----	-----
TOTAL INDIRECT COST ($M/YR)	27.10	1355	24.05	1203
	=====	=====	=====	=====
TOTAL ANNUAL COST ($M/YR)	53.65	2683	49.45	2473
OTHER LIFE CYCLE COSTS:				
TPC FOR CONS. OR SPEC. PROJ. ($M)	N/A	109	N/A	40
TRANSITION COSTS ($M)	N/A	55	N/A	0
D&I OPS FOR NON-STDY STATE YRS 1993-1997 (CUM $M)	N/A	389	N/A	359
D&D	N/A	16	N/A	0
		=====		=====
GRAND TOTAL LIFE CYCLE		3252		2872

TABLE B.6 (CONT'D)

STEADY-STATE ANNUAL COSTS: (KEEP BOTH PLANTS OPEN)	
DIRECT STAFF COUNT (FTEs)	
DIRECT STAFF ANNUAL COST ($M/YR)	1250
CONSUMABLES ANNUAL COST ($M/YR)	188
WASTE & TRANS. ANNUAL COST ($M/YR)	63
CAPITAL UPGRADE ANN. COST ($M/YR)	598 -----
TOTAL DIRECT COST ($M/YR)	2099
INDIRECT STAFF COUNT (FTEs) ($M/YR)	
INDIRECT STAFF ANNUAL COST ($M/YR)	
PLANT OVERHEAD ANN COST ($M/YR)	-----
TOTAL INDIRECT COST ($M/YR)	2246 =====
TOTAL ANNUAL COST ($M/YR)	4344
OTHER LIFE CYCLE COSTS:	
TPC FOR CONS. OR SPEC, PROJ. ($M)	60
TRANSITION COSTS ($M)	0
D&I OPS FOR NON-STDY STATE YRS 1993-1997 (CUM $M)	586
D&D	0 =====
GRAND TOTAL LIFE CYCLE	4990

DP ESCALATION FACTORS RECOMMENDED BY PR-24 AND USED IN THIS STUDY

1992 (BASE YEAR)

TO	FACTOR
1992	1.0
1993	1.055
1994	1.101
1995	1.151
1996	1.204
1997	1.261

APPENDIX C

DESCRIPTION OF OPERATIONS

APPENDIX C

DESCRIPTIONS OF OPERATIONS

A primary mission of the DOE is the production and stockpile support of nuclear weapons. Tritium, tritium handling capability, and tritium component fabrication are vital to the function of nuclear weapons. This study examines the tritium handling capabilities at the MP and the SRS.

Tritium capabilities involve two functions; stockpile production/maintenance and stockpile dismantlement. Stockpile production/maintenance is any operation, procedure, or producible assembly required to maintain nuclear weapons on a ready or operational basis. Within this category, there are three groups: limited life component exchanges (LLCEs), reservoir surveillance and retrofits or modernization/new production. Stockpile dismantlement involves the retirement and transfer of weapons from the Department of Defense (DOD) to inventory to the DOE followed by the proper dispositioning of disassembled components from retired weapons by DOE.

A. Limited Life Components Exchanges (LLCEs)

Tritium reservoirs are limited life components. These items have a limited shelf-life because the contained radioactive tritium decays with time and because the components themselves fatigue over long periods. Tritium is unloaded from the reservoir and recycled. The tritium reservoirs are reclaimed, if possible, for future use.

The military returns reservoir systems to a DOE facility. These are unpacked from special shipping containers and are properly receipted. Depending on the weapon type, the valves/actuators may be removed from the reservoir systems. All components are inspected for normal wear and damage. The reservoir gas is removed and recycled. Empty reservoirs may be reclaimed or destroyed. Reclamation is dependent on reservoir design, military requirements (i.e., the need for the reservoir) and the reservoir's age). If reservoirs are reclaimed, they undergo physical inspection, restemming, proof testing and leak testing. Reclaimed reservoirs will be reloaded according to the weapon specifications and the valves/actuators will be attached, if necessary. The reclaimed reservoir systems will be packaged and shipped to the military.

B. Surveillance

Component evaluation operations (CEO) are part of the weapon stockpile surveillance function. The objective of surveillance is to verify and evaluate safety, reliability and quality. This study examines CEO's role in the surveillance of tritium weapon components and tritium gas transfer systems testing.

Reservoir surveillance consists of examining and functionally testing pre-production and production reservoir systems. The pre-production reservoir systems are tritium-loaded systems that are stored under various temperature conditions. These systems lead production so that problems may be identified before they become a problem in the field. Production reservoir systems are samples from the production stream or from the military. Both the pre-production and production reservoir systems are examined and tested in the laboratory. These examinations include physical inspection, tritium gas analysis and metallographic analysis. In addition, selected reservoir systems are functionally tested. Environmental preconditioning (acceleration, mechanical shock, thermal conditioning, or vibration) may precede functional testing. Simulations include weapon system, electrical signal outputs, and pressures. The function test examines the system delivery characteristics and the quality of gas delivered. Environmental testing and function testing are performed in a tritium safe handling system.

C. Retrofit and Modernization/New Production

Retrofit and modernization/new production involve the fabrication and testing of replacement reservoir components. Reservoirs have a limited service life due to the decay of tritium diffusing into the reservoir wall and due to fatigue from repeated high pressurizations. The resulting damage requires reservoir components to be replaced by either the same design or an improved reservoir.

When replacements are needed, the DOD, the DOE, the design agencies, and the production agencies define the requirements. Then the design criteria are established. The design criteria consider the weapon type, current manufacturing capability and technologies, safety, reliability, cost and the DOD's performance requirements.

During the production development cycle, the design agency and the production agency define the production acceptance criteria and review the processing requirements. Additional tasks include production process development, fixturing, tooling, documentation, testing and quality assurance. As a system nears pilot production, the design agency analyzes the data and compares the product against the product specification. After design agency approval, the production facility will produce the War Reserve (WR) product.

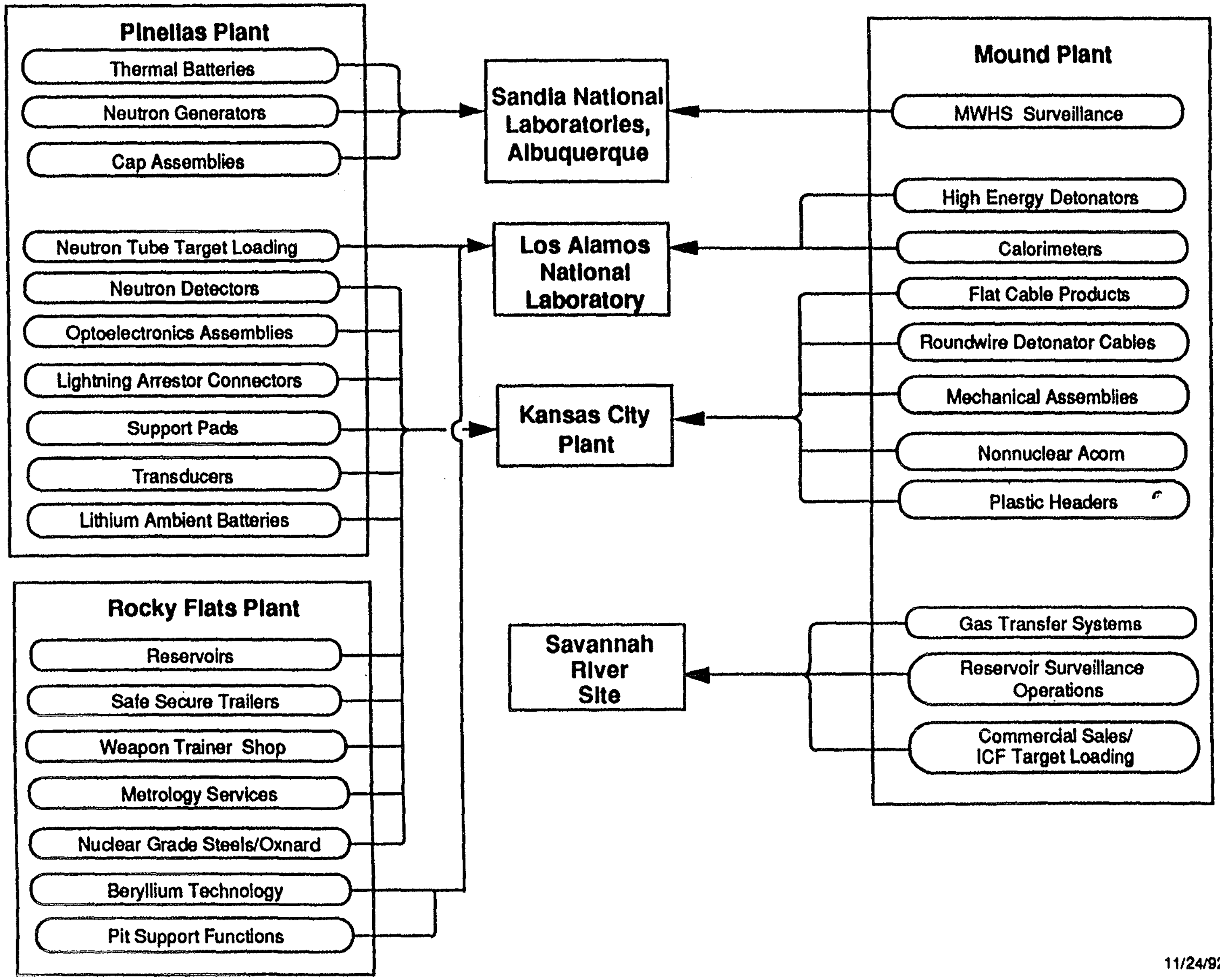
D. Stockpile Dismantlement

Many weapon systems will be dismantled in the near-term. The reservoir systems will be received by the tritium site from the military or Pantex. These reservoir systems will be inspected and all materials that are usable will be recycled (primarily the tritium and selected valves). Items that are not recycled, such as, empty reservoir bodies from obsolete weapons or from reservoirs at the end-of-life will be properly dispositioned.

APPENDIX D

ACTIVITY TRANSFERS

Revised Preferred Alternative



APPENDIX E

LIST OF ABBREVIATIONS AND ACRONYMS

APPENDIX E

LIST OF ABBREVIATIONS AND ACRONYMS

A

AL . . . . see DOE-AL
ALARA . . . . As-Low-As-Reasonably-Achievable

C

CDR . . . . Conceptual Design Report
CEO . . . . Component Evaluation Operations
CFR . . . . Code of Federal Regulations

D

D . . . . Deuterium
DAO . . . . see DOE-DAO
D&D . . . . Decontamination and Decommissioning
DBA . . . . Design Base Accident
DoD . . . . Department of Defense
DOE . . . . Department of Energy
DOE-AL . . . . Albuquerque Field Office
DOE-DAO . . . . Dayton Area Office
DOE-PAO . . . . Pinellas Area Office
DOE-SR . . . . Savannah River Field Office
DOT . . . . Department of Transportation
DP . . . . Office of Defense Programs
DP-20 . . . . Deputy Assistant Secretary for Military Applications
DP-40 . . . . Deputy Assistant Secretary for Weapons Complex Reconfiguration
DP-60 . . . . Deputy Assistant Secretary for Facilities
DP-64 . . . . Director, Office of Production Facilities

E

EA . . . . Environmental Assessment
ED&I . . . . Engineering, Design and Inspection
ECS . . . . Effluent Containment System
EM (DOE) Office of Environmental Restoration and Waste Management
ES&H . . . . Environment, Safety and Health
ERS . . . . Effluent Removal System
ETS . . . . Effluent Treatment System
ES&H . . . . Environment, Safety and Health

F

FTE . . . . Full-Time Equivalent (staffing)
FONSI . . . . Finding Of No Significant Impact
FSAR . . . . Final Safety Analysis Report

G

G&A . . . . General and Administrative
GFM . . . . Government Furnished Materials

H

HISS . . . . Hydrogen Isotope Separation System
HVAC . . . . Heating, Ventilation, and Air Conditioning

I

ICE . . . . Independent Cost Estimate
ICF . . . . Inertial Confinement Fusion

K

KDL . . . . KYLE Development Laboratory
KMF . . . . KYLE Manufacturing Facility

L

LANL . . . . Los Alamos National Laboratory
LCC . . . . Life Cycle Costs
LLC . . . . Limited Life Component
LLCE . . . . Limited Life Component Exchange
LLNL . . . . Lawrence Livermore National Laboratory

M

M&O . . . . Management and Operation (contractor)
MP . . . . Mound Plant
MSSA . . . . Master Safeguards and Security Agreement
MTF . . . . Material Tritium Facility

N

NCP . . . . Nonnuclear Consolidation Plan
NEPA . . . . National Environmental Policy Act
NFM . . . . Nuclear Facility Modernization
NGL . . . . Neutron Generator Loading
NPR . . . . New Production Reactor
NTS . . . . Nevada Test Site

O

OPC . . . . Other Project Costs
ORE . . . . Operational Readiness Evaluation
ORNL . . . . Oak Ridge National Laboratory
ORR . . . . Operational Readiness Review

P

PAO . . . . see DOE-PAO
P&S . . . . Production and Surveillance
PIDAS . . . . Perimeter Intrusion Detection and Alarm System
PR . . . . (DOE) Office of Procurement, Assistance and Program Management
PR-24 . . . . Director of Program/Project Management Division
PSO . . . . Program Secretarial Official

R

R&D . . . . Research and Development
RCRA . . . . . Resource Conservation and Recovery Act
REPF . . . . Replacement Extraction and Purification Facility
RTF . . . . Replacement Tritium Facility
RTPF . . . . Replacement Tritium Purification Facility

S

SAR . . . . Safety Analysis Report
SNL . . . . Sandia National Laboratories
SNLL . . . . Sandia National Laboratories at Livermore
SROC . . . . Savannah River Operations Contingency
SR . . . . see DOE-SR
SRS . . . . Savannah River Site
SRTC . . . . Savannah River Technology Center
SSSP . . . . Site Safeguard and Security Plan
SW/R . . . . Semi-Works/Research (Complex, Mound)

T

T . . . . Technical (Building, Mound) or tritium when not preceding the word building
TCAP . . . . Thermal Cycling Absorption Process
TAWRS . . . . Tritium Aqueous Waste Recovery System
TEC . . . . Total Estimated Cost
TEDL . . . . Tritium Effects Development Laboratory
TERF . . . . Tritium Effluent Reduction Facility
TPC . . . . Total Project Cost
TRL . . . . Tritium Research Laboratory (SNL, Livermore)

W

WBS . . . . Work Breakdown Structure
WETF . . . . Weapons Engineering Tritium Facility (Los Alamos)
WSRC . . . . Westinghouse Savannah River Company
WR . . . . War Reserve

APPENDIX F

April 27 Memorandum from DP-40 to DOE-AL, "Two-Site Nonnuclear Consolidation Study"

May 1 Memorandum from DP-40 to DOE-AL, "Comparative Analysis"

May 29 Memorandum from DP-42 to DP-642, "Scope of Tritium Study"

United States Government

Department of Energy

memorandum

DATE: APR 27 1992

REPLY TO
ATTN OF: DP-40 (JNicks:61537)

SUBJECT: Two-Site Nonnuclear Consolidation Study

TO: Bruce G. Twining, Manager, DOE Albuquerque Field Office

The Nonnuclear Consolidation Plan (NCP) was completed in September 1991. It was released to the public in March 1992, along with an addendum that discussed work load sensitivities. The NCP provided analysis for selection of a single dedicated nonnuclear plant.

An additional study for a two-plant option is required to assure that the nonnuclear consolidation decision will be based upon the most favorable combination of the performance criteria used in the NCP. To this end, the DOE Albuquerque Field Office (AL) is directed to study alternatives that would consolidate nonnuclear manufacturing activities at any two of the current three dedicated nonnuclear plants: Mound, Kansas City, and Pinellas. The following guidelines are provided:

a. Define the activities to be transferred between the donor and receiver sites for each of the three alternatives.

b. Measure each alternative against all of the performance criteria used in the NCP.

c. Address the work load assumptions of the NCP and the addendum. All other assumptions of the NCP remain. Provide an update for the FY 1993 budget work load assumptions.

d. Use the same input data provided for the NCP. Data may be normalized, if necessary, but adequate explanations must be provided.

e. Assume that all new space requirements will be met by construction within the boundaries of Department property.

f. Estimate and compare the annual operating costs for the 3 two-site alternatives with the Kansas City alternative presented in the NCP.

As a subset of this study, AL is also directed to prepare a comparative analysis for consolidating the filling and emptying of gas transfer systems and reservoir surveillance activities at either the Savannah River Site or the Mound Plant using the following guidelines:

a. Measure the alternatives against all of the performance criteria used in the NCP.

b. Address the work load assumptions of the NCP and the addendum.

c. If required, obtain new or additional data from the Savannah River Site and the Mound Plant.

d. Assume that the relocation of these activities from the Mound Plant will facilitate its closure. Determine what operations at the Savannah River Site can be terminated as a result of these relocations.

e. Assume that the new tritium supply capability will be available no earlier than FY 2005 and that K Reactor and the associated infrastructure must be retained at Savannah River as a production contingency until that time.

f. If an alternative requires that radioactive material be introduced into a previously uncontaminated facility, then the costs for eventual decontamination and decommissioning (D&D) must be treated as decision costs. Costs for D&D of previously contaminated facilities must be incurred at the time the facilities are no longer required for the program and therefore are not to be considered decision costs.

This study should be submitted to my office in draft no later than May 29, 1992, and in final form by June 12, 1992.

Howard R. Canter
Deputy Assistant Secretary
for Weapons Complex Reconfiguration

United States Government **Department of Energy**

memorandum

DATE: May 1, 1992

REPLY TO ATTN OF: DP-40 (Canter 6-2700)

SUBJECT: Comparative Analysis of the Savannah River Site and Mound Plant for Tritium Reservoir Filling and Surveillance

TO: Bruce Twining, Manager, DOE Albuquerque Field Office

My memorandum dated April 27, 1992, on the Two-Site Nonnuclear Consolidation Study also requested that you perform a comparative analysis for consolidating the filling and emptying of gas transfer systems and reservoir surveillance activities either at the Savannah River Site or the Mound Plant.

As a result of limitations on manpower and resources in the Albuquerque Office, you have asked for relief from this task. As discussed in our telephone conversation on April 30, 1992, this task will be performed by Headquarters. The Albuquerque Field Office will be involved and will provide certain input and reviews. However, Headquarters will be responsible for this task.

This memorandum confirms the above referenced telephone conversation.

Howard R. Canter
Deputy Assistant Secretary
for Weapons Complex Reconfiguration

cc: R. Claytor
E. Beckner
J. Nicks
A. Cygelman

nemorandum

DATE: May 29, 1992

EPLY TO ATTN OF: DP-42 (Cygelman 6-8814)

SUBJECT: Scope of Tritium Study

TO: R. Hagan, DP-642

Per your request to Jim Nicks, on May 29, 1992, the following provides documentation of the scope of the tritium study which had been discussed previously.

Scope of Work

Perform a comparative analysis for consolidating tritium processing activities which include loading and unloading of reservoirs, reservoir reclamation, component evaluation operations, evaluation of gas transfer systems, and neutron generator loading at either the Savannah River Site or the Mound Plant. The basis for the comparative analysis should be the work load that reflects weapons stockpile requirements defined in the March 30, 1991, Claytor to Barker classified letter, regarding current plans for sizing Complex 21.

Provide a total estimated cost that is supportable for performing the tritium activities defined above at either Savannah River or at Mound. The cost estimate for each site/plant should be on the same basis and will be used to compare the difference in costs in performing the defined activities. The cost estimates do not have to be budget quality nor do they require to be validated.

Not in Scope of Work

Note tritium production and tritium extraction functions are not in the scope of work. Note also that performing component evaluation operations at Los Alamos also are not in the scope of work.

Andre Cygelman
Technical Director
Office of Engineering
and Program Management
Office of Weapons Complex Reconfiguration

cc: H. Canter
J. Nicks
D. Knuth
L. Chan