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ICPP MULTIPLE FUELS PROCESSING PROGRAM

FY 1978 SUPPLEMENT DOCUMENT

June 1978

Allied Chemical
IDAHO CHEMICAL PROGRAMS
IDAHO NATIONAL ENGINEERING LABORATORY
DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE UNDER CONTRACT EY-76-C-07-1540

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by

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IDAHO CHEMICAL PROGRAMS - OPERATIONS OFFICE

Prepared for the
DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
Under Contract EY-76-C-07-1540

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TABLES

FIGURES

SUMMARY

This report updates plans for the Multiple Fuels Processing Program (MFPP), ICPP's dynamic plan for processing and managing assigned nuclear fuels and the resulting radioactive wastes.

The Baseline Program involves a total cost of $764 million and recovery of 15,209 kg of ^{235}U worth $689 million during the study period: FY 1979 through FY 1990. In comparison to a scenario in which fuels in inventory and scheduled for receipt would be shipped to another site and in which remaining liquid wastes would be calcined, additional product worth $669 million will be recovered for an additional or incremental cost at ICPP of $530 million. Total incremental cost to the government would be less than the $530 million at the ICPP because costs for receipt and storage of spent fuels at some other site were not taken into account. Assuming a 10% discount rate, present (FY 1979) values of the $669 million incremental benefit and $530 million incremental ICPP cost are approximately equal. Thus, the MFPP continues to provide a satisfactory means of reprocessing a wide variety of irradiated nuclear fuels for which there are no other existing suitable facilities. Completion of this program will require integrating into the existing ICPP facilities about $400 million worth of line-item facilities on which construction is in progress or is planned.

Production funding required for the Baseline Program for FY 1980, the highlighted year in the report, is about $8.7 million higher than for FY 1979 because:

(1) Cost escalation, projected to be 8%, accounts for about $2.2 million total increase.

(2) An added $1.4 million is required for testing and startup of the New Waste Calcining Facility (NWCF).

(3) Manpower must expand in support of the increased capital expenditures and the increased number of facilities.

(4) Expansion of R & D effort in two areas, process monitoring and remote maintenance, will increase cost about $0.7 million.

(5) The cost for purchase of the spent fuel from the Fort St. Vrain reactor is projected to increase $0.4 million.

Funding required for operations and R & D in FY 1980 is compared to that required for FY 1979 in the following tabulation:

Item	JM 03 (No.)	FY 1979 $000	FY 1980 $000	Differences $000
Separations	01 22 1	15,010	19,415	4,405
Startup	01 51 1	1,000	900	(100)
Conceptual Engineering	01 53 1	900	1,445	545
Other	01 53 5	400	580	180
Separations Subtotal		17,310	22,340	5,030
Solidification	03 22 0	8,130	9,205	1,075
Startup	03 31 1	600	2,050	1,450
Conceptual Engineering	03 33 1	200	250	50
Solidification Subtotal		8,930	11,505	2,575
Operations Subtotal		26,240	33,845	7,605
Research & Development	02 21 0	600	1,215	615
Waste Mgmt. Develop.	03 23 0[a]	570	660	90
R & D Subtotal		1,170	1,875	705
Production Total		27,410	35,720	8,310
Procurement of Reactor Products	01 30 0	500	900	400

These costs were taken from the FY-1980 budget submission; the FY-1980 costs are the minimum of the three alternatives submitted.

The following capital projects are essential to the production plans in the Baseline Program:

Capital Line Items[a]	First FY of Funding	Approximate Beneficial Use	Total Estimated Cost ($\$10^6$)	Estimated Obligation After FY 1978 ($\$10^6$)
Calcined Solids Storage				
Fifth set of bins	1978	Jul 1981	12.5	0.0
Sixth set of bins and	1981[b]	Apr 1984	45	45
seventh set of bins and transfer facility		Oct 1985	-	-
Eighth set of bins	1986	Apr 1990	35	35
New Waste Calcining Facility	1976	Apr 1981	77.25[c]	25.5
Priority Utilities	(c)	Sept 1979	3.75	0.5
Fluorinel Dissolution Process & Fuel Receiving Improvements	1977	Jul 1983	116	105.4
Safeguards & Security Upgrade	1977	Sep 1979	2.3	0.8
Personnel Protection & Support Facility	1977	FY 1979	10.5	0.0
Utilities Expansion	1979	Oct 1982	10.5	10.5
Steam Generation	1980	Jul 1983	24	24
Plant Analytical Chemistry Building	1980	Apr 1983	20	20
Renovation of Process Cells	1980	Oct 1985	60	60

(a) Projects for which construction is expected to be complete before the start of Fy 1979 are not listed here. Line-item construction projects in the JM 03 Program that are included in the INEL Long Range Plan[12] but excluded from this document are Sodium Waste Solidification Facility, which probably will not be necessary and is assumed not necessary in this document, and TRU Waste Retrieval and Treatment Facility, which is not within the scope of this document.

(b) The sixth and seventh sets of bins and the calcine transfer facility are all parts of the same project which has the title "Calcine Transfer and Storage Project." Some design funds will be needed in advance of FY 1981 for this project.

(c) The Priority Utilities Project was funded from NWCF Project contingency funds; total estimated cost for the NWCF project is therefore \$81 million, the sum of \$77.25 and \$3.75 million.

If any of these projects are delayed or omitted, the production goals of the Baseline Program could probably not be met.

The most important milestones and projected events of the Baseline Program are as follows:

(1) Successful Rover fuel processing beginning in January, 1980.

(2) Operation of the existing Waste Calcining Facility (WCF) for about 11 months during the first two years of the study period.

(3) Hot operation of the NWCF (April 1981).

(4) Operation of the Fluorinel Process beginning in July, 1983.

(5) Availability of the Plant Analytical Chemistry Building in FY 1983.

The most difficult contingencies to recover from would be: a leaking waste tank, no more waste calcination from the WCF, and delay in availability of the NWCF.

If further operation of the WCF is not possible, a significant reduction in fuel processing would occur until the NWCF becomes available.

A one-year delay of the NWCF would not cause a delay in fuel processing campaigns provided the Rover waste can be left in storage until about one year after NWCF startup; however, mixing of low-heat and fluoride wastes would be necessary. No fuel storage problems would occur for any reasonable delay.

A delay in the Fluorinel (FAST) Project would cause delay in processing most fuels. For any reasonable delay, there would be ample storage space for those Fluorinel fuels that can be accepted and stored in the existing basin.

I. INTRODUCTION

1. Purpose and Content of this Document

The Multiple Fuels Processing Program (MFPP) for the Idaho Chemical Processing Plant (ICPP) is a long-range plan for receiving, storing, and reprocessing nuclear fuels from those research, test, and prototype reactors for which no suitable facilities are available elsewhere in the USA or for which the ICPP has a special capability. Wide varieties of reactor fuel are being used or are planned for DOE and other programs. Most of these fuels are becoming available in quantities too small to be economically processed in either commercial or other DOE fuel reprocessing plants. With its demonstrated multi-fuel reprocessing capability ICPP is able with capital expenditures in some cases to process these fuels. Likewise, the NWCF will be capable of converting all highactivity liquid waste to retrievable solids suitable for long-term storage. A complete statement of the mission of Allied Chemical Corporation - Idaho Chemical Programs (ACC-ICP) and of the objectives for ACC-ICP in the nuclear fuel cycle is given in Appendix A.

This report updates the ICPP MFPP originally fully documented as CI-1088 in April 1968.[1] The MFPP was orginally approved in September 1968 as Special Analytical Study 68-1, subject to the annual budgeting process. Supplemental documents to CI-1088 have been published annually.[2,3,4,5,6,7,8,9,10] The purpose of these documents is to assist Allied Chemical and DOE personnel in:

1. Overall program planning and budgeting for the ICPP under the direction of DOE.

2. Guiding associated R&D programs.

3. Managing the storage and recovery of fissile material.

4. Managing radioactive waste.

5. Determining facility requirements and priorities for competing programs and activities.

6. Establishing fuel reprocessing charges.

Justification for estimated capital and operating funds required in FY 1980 is highlighted in this document. A 12-year study period starting with FY 1979 is used in economic calculations; present values are taken to FY 1979. The best overall program to follow at the ICPP during the next several years is described, and the consequences of some contingencies are presented. A construction schedule, along with milestone charts for completing the primary required efforts in a timely manner, is presented for the recommended program. A major part of the overall economic benefit from the program is described by comparisons to a scenario in which expenditures were reduced to a minimum for site shutdown and surveillance. Additional information on the MFPP is provided by the following appendices:

A Mission and objectives of ACC-ICP.

B Bases and assumptions used in this MFPP supplement.

C Processing schemes for all MFPP fuels (Figure C-1).

D Improvements in computerized methods made this year.

E Major accomplishments in FY-78.

F Logic diagram for preparing the next MFPP supplemental document.

2. How to Identify Fuels and Processes

In this report fuels are identified by numbers and processes either by number or in a few figures by letters assigned to groups of fuel numbers. The names of these fuels and processes and a few characteristics of the fuels are listed in the Materials Management Plan[11], a classified document issued by DOE-ID.

II. BASELINE PROGRAM

1. OPERATIONS IN THE BASELINE PROGRAM

In the baseline program, recovery of 15,209 kg of ^{235}U is projected during the 12-year study period. Fuel processing and other operations are projected to generate about 19,600 cubic metres of high-level radioactive liquid wastes. Calcining of about 23,600 cubic metres of high-level liquid wastes is planned, which will reduce the inventory from 10,200 cubic metres to 6,200 cubic metres; the 3,400 cubic metres of solids produced by the calcining will bring the total calcine inventory to about 5,100 cubic metres.

The first few years of the projected operating schedule are illustrated in considerable detail by Figure 1. Figures 2 and 3 show days spent in fuel processing and waste calcining; the resulting fuel storage requirements are illustrated in Figures 4 and 5. Projected liquid waste and calcine storage requirements and capacities are presented in Figures 6 and 7. A detailed annual summary of operations is given in Table I.

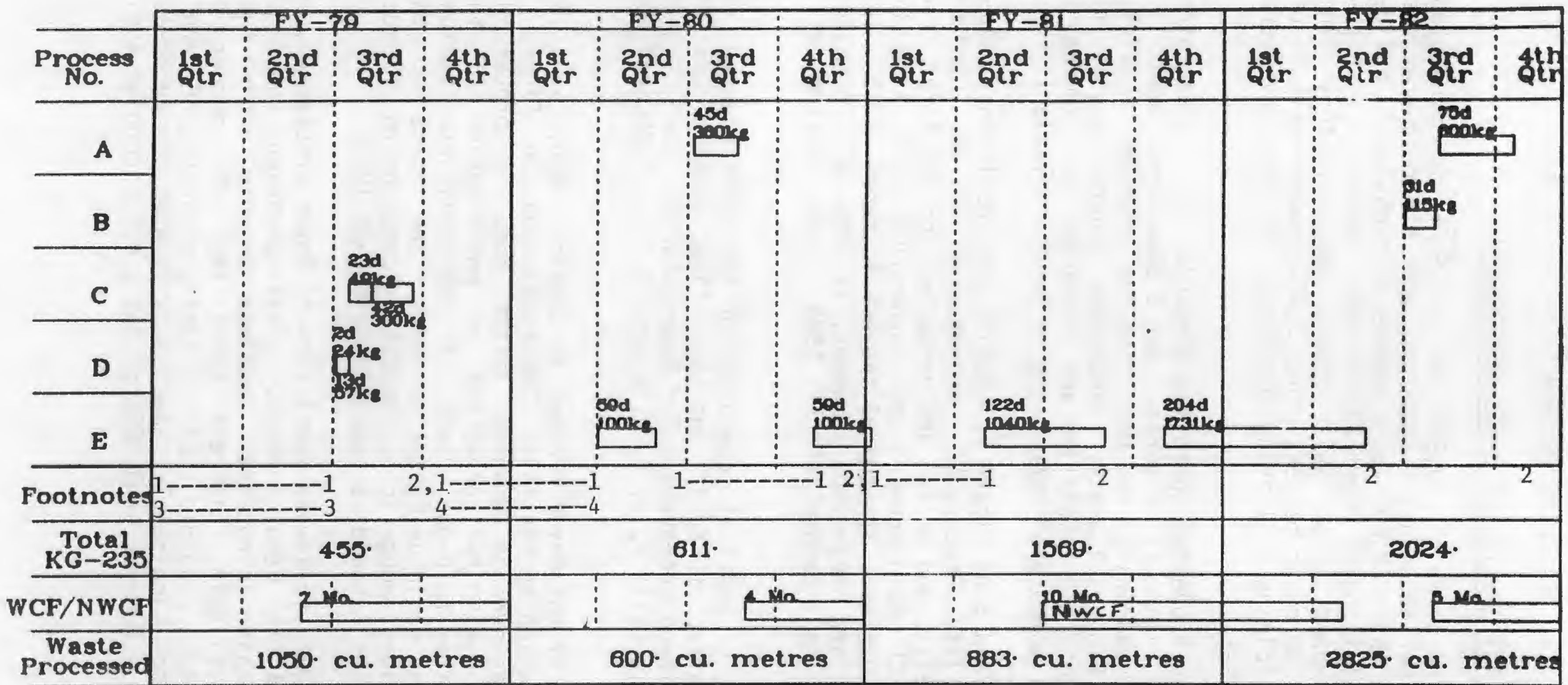
As stated in Footnotes 1 and 3 of Figure 1, testing and deficiency correction in the Rover facility (Process E), decontamination and project work in E, G, J, and K cells, and Cell-5 are projected for the first two quarters of FY 1979. A WCF maintenance and turnaround will also be completed in the second quarter. Startup of the WCF in March 1979, and seven months of operation are projected. However, if the WCF campaign currently in progress can be extended into FY 1979, this startup will occur later.

Processing of fuels 4, 5, 6, and 7 is scheduled for the third quarter of FY 1979. In the last quarter of FY 1979 and the first quarter of FY 1980, there will be continued preparation for Rover startup, vent tunnel modifications, and work in cells P, Q, S, V, W and Y, as indicated by footnotes 1 and 4.

The initial cold startup of the Rover process in January 1980, will be followed by as much operation as feasible. The prediction in Figure 1 of two two-month operating periods in which little fuel is processed, each followed by several months for correction or modification of the process, is a selection from a broad range of possibilities. Actual performance of the process could be better or worse. The first of the two shutdown periods is long enough to accommodate a campaign on Process A. Processing of Rover fuel should be complete by mid-FY 1982.

In the last half of FY 1982, following completion of Rover processing, a campaign on fuels 3 and 1 has been planned. This campaign could be postponed if Rover processing is not then complete because ample fuel storage space would be available. Figure 4 shows that the number of non-zirconium fuel positions required would be rising rapidly and would have exceeded the 1,100-position non-Zr capacity by 9% when the processing of fuel No. 1 starts. However, only 65% of the 1,425 zirconium fuel

ICPP OPERATING SCHEDULE



Process
A-fuels 1
B-fuels 2,3,30
C-fuels 4,5,11
D-fuels 6,7,8
E-fuels 9,25

BASELINE PROGRAM–REVISED 4–3–78

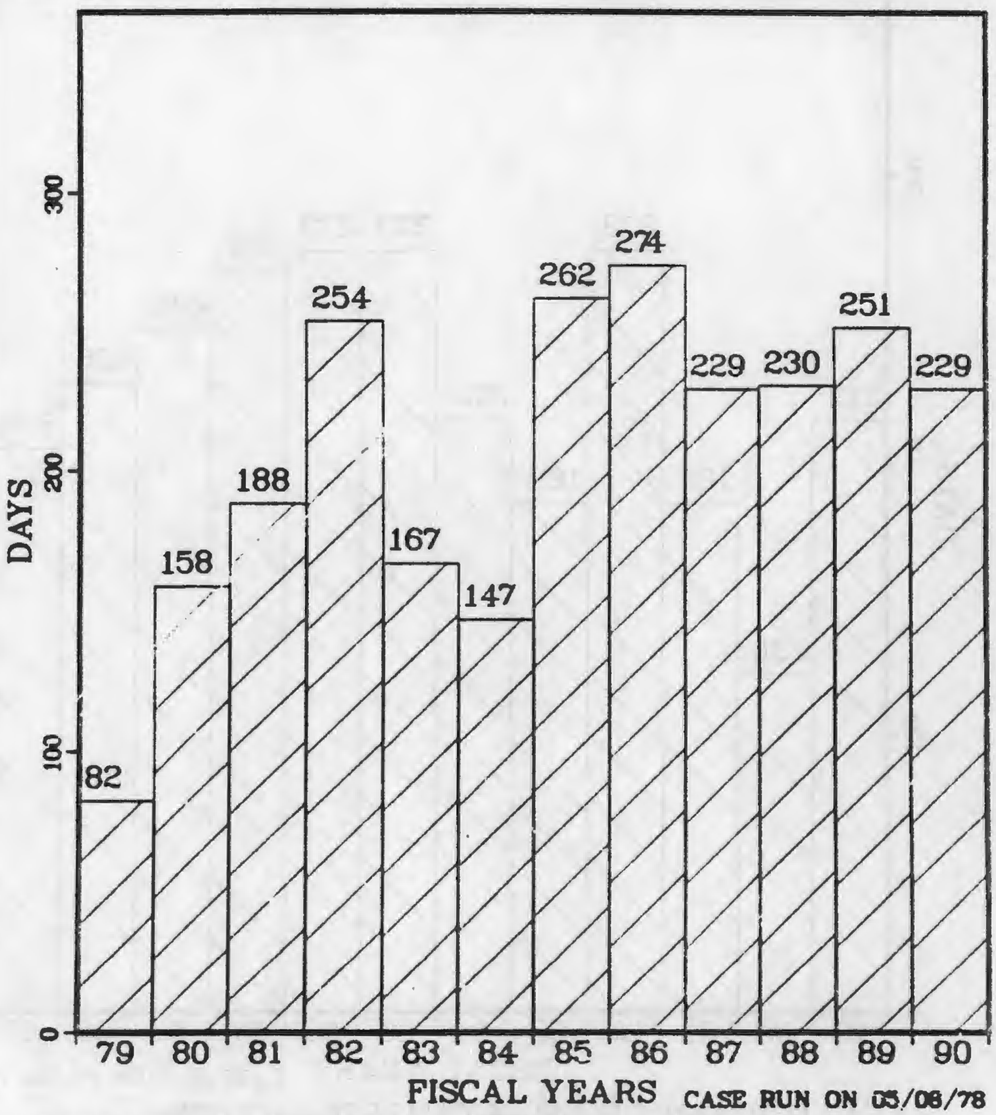
FIG. 1

CASE RUN ON 05/08/78

Fuels not included--10,19,29,33,12,13,14,15,16,17,18,21,22,23,26,27,28,34,35.

1. Testing or deficiency correction in the Rover facility will be in progress during these periods.
2. Approximate timing for uranium sweepdown is indicated.
3. Decontamination of E, G, J, and K cells, centrifuge tie-ins and checkout, work on sample stations, cell entry liners and cell sump jets, and cell 5 turnaround are planned during this period.
4. Intensive operator training for the Rover startup, CPP-601 west vent tunnel modifications and maintenance turnarounds in cells P, Q, S, V, W and Y are scheduled for this period.

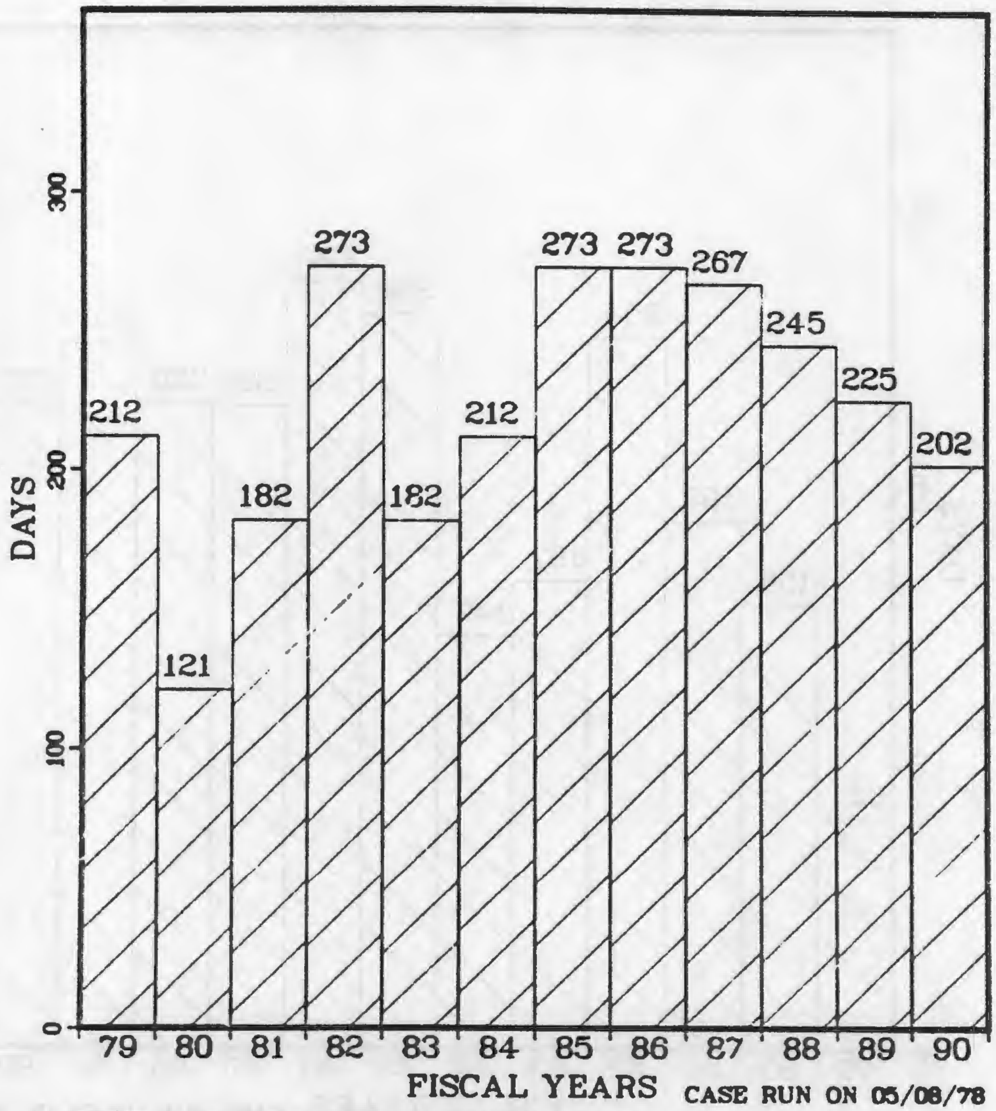
FUEL PROCESSING DAYS



BASELINE PROGRAM-REVISED 4-3-78

FIG. 2

WASTE CALCINING DAYS

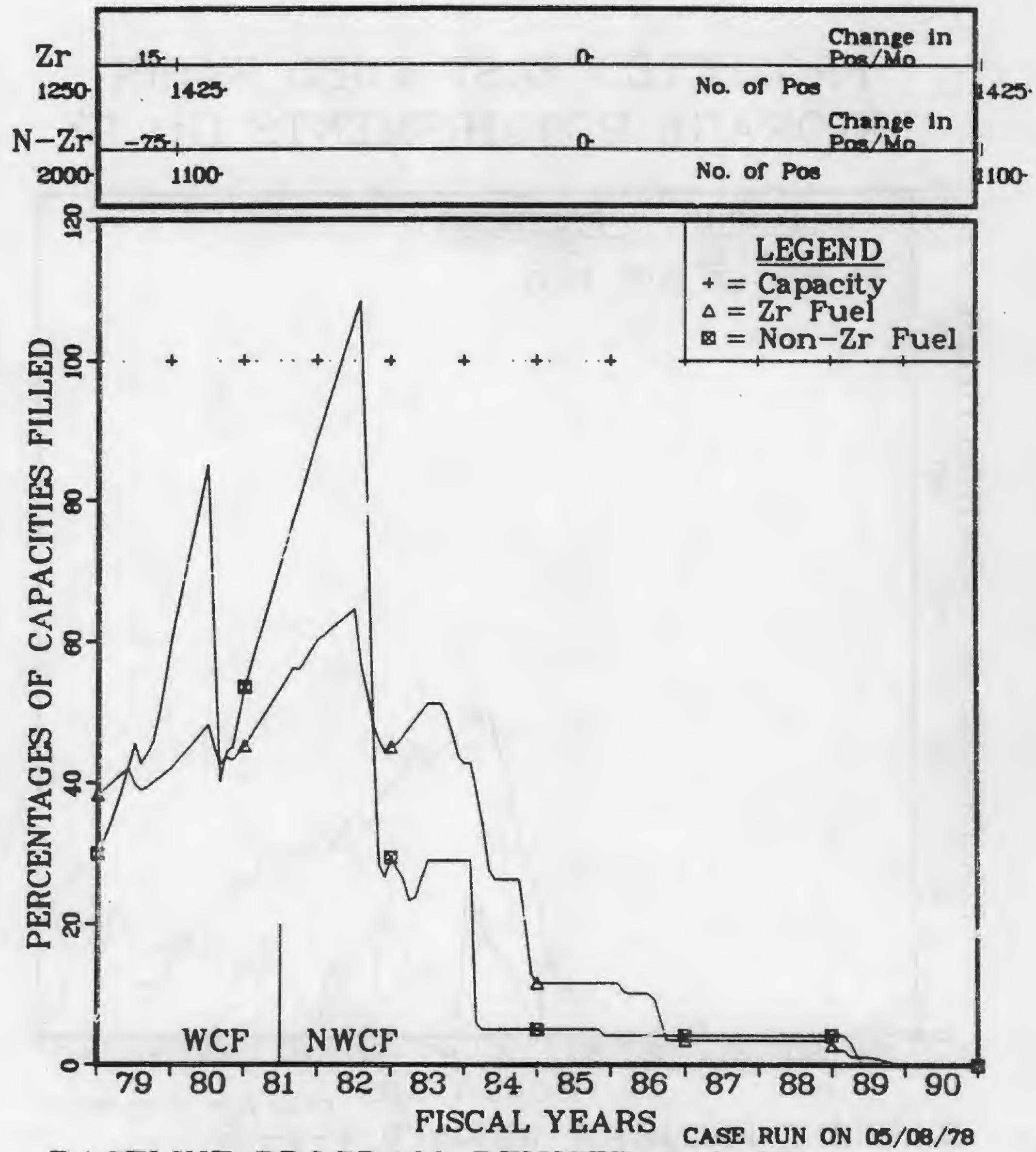


BASELINE PROGRAM–REVISED 4–3–78

FIG. 3

PLOT 6 16.08.19 TUE 09 MAY, 1978 JOB-HESB CP. ISSCO, DISSPLA VER 4.11

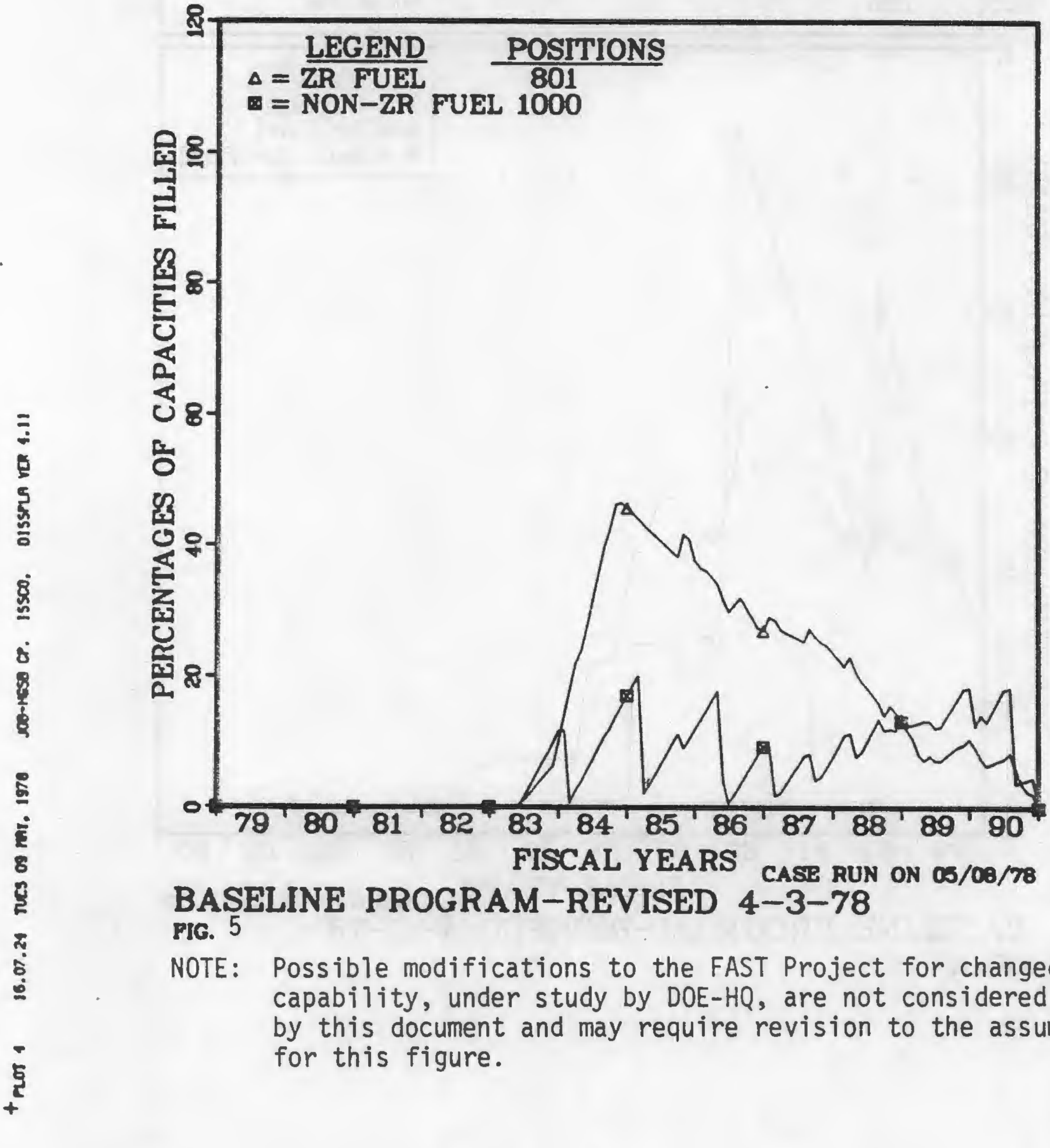
PROJECTED FUEL BASIN STORAGE REQUIREMENTS (in %)



BASELINE PROGRAM-REVISED 4-3-78

FIG. 4

PROJECTED FAST FUEL BASIN STORAGE REQUIREMENTS (in %)

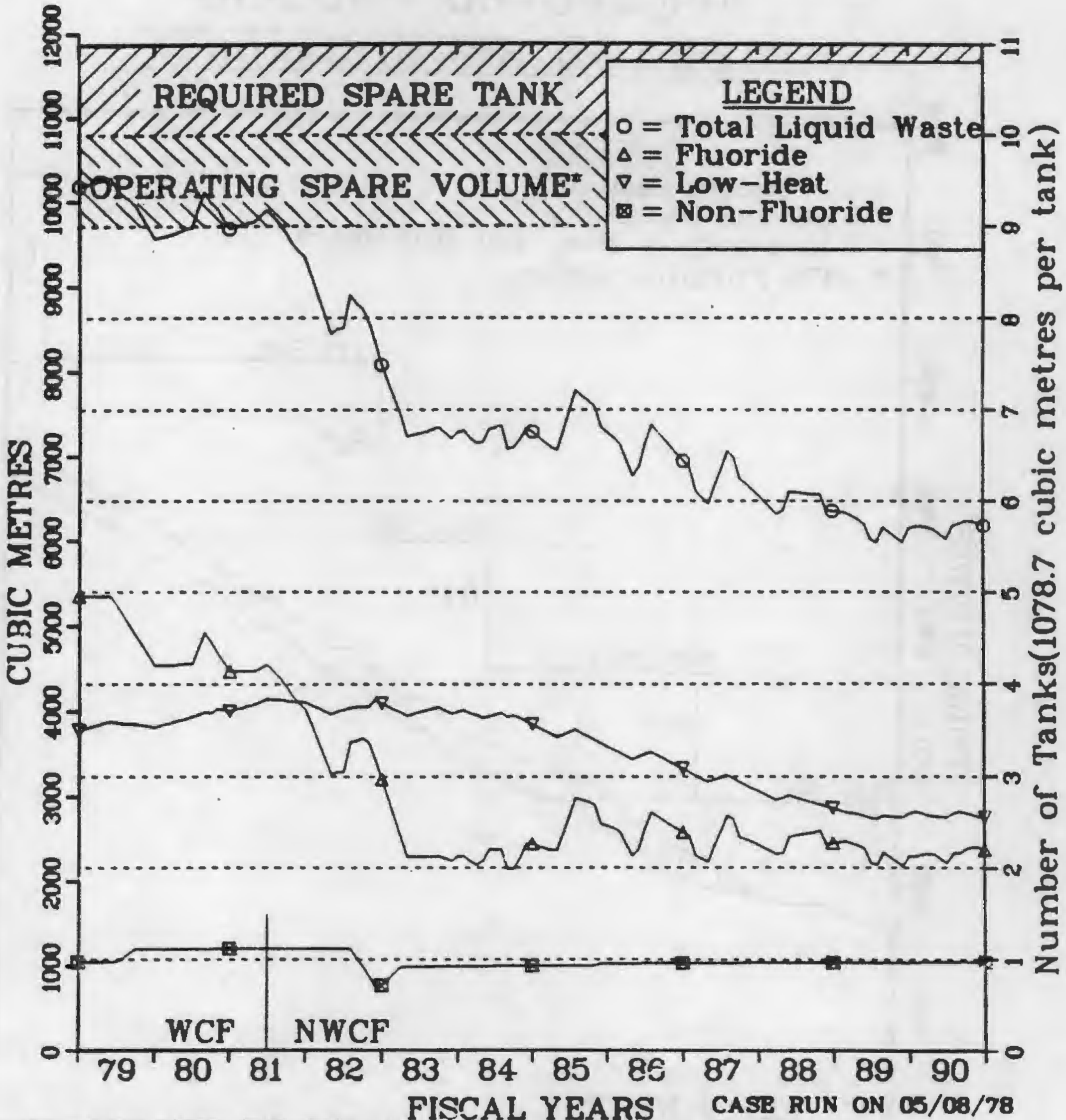


BASELINE PROGRAM-REVISED 4-3-78

FIG. 5

NOTE: Possible modifications to the FAST Project for changed capability, under study by DOE-HQ, are not considered by this document and may require revision to the assumptions for this figure.

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY



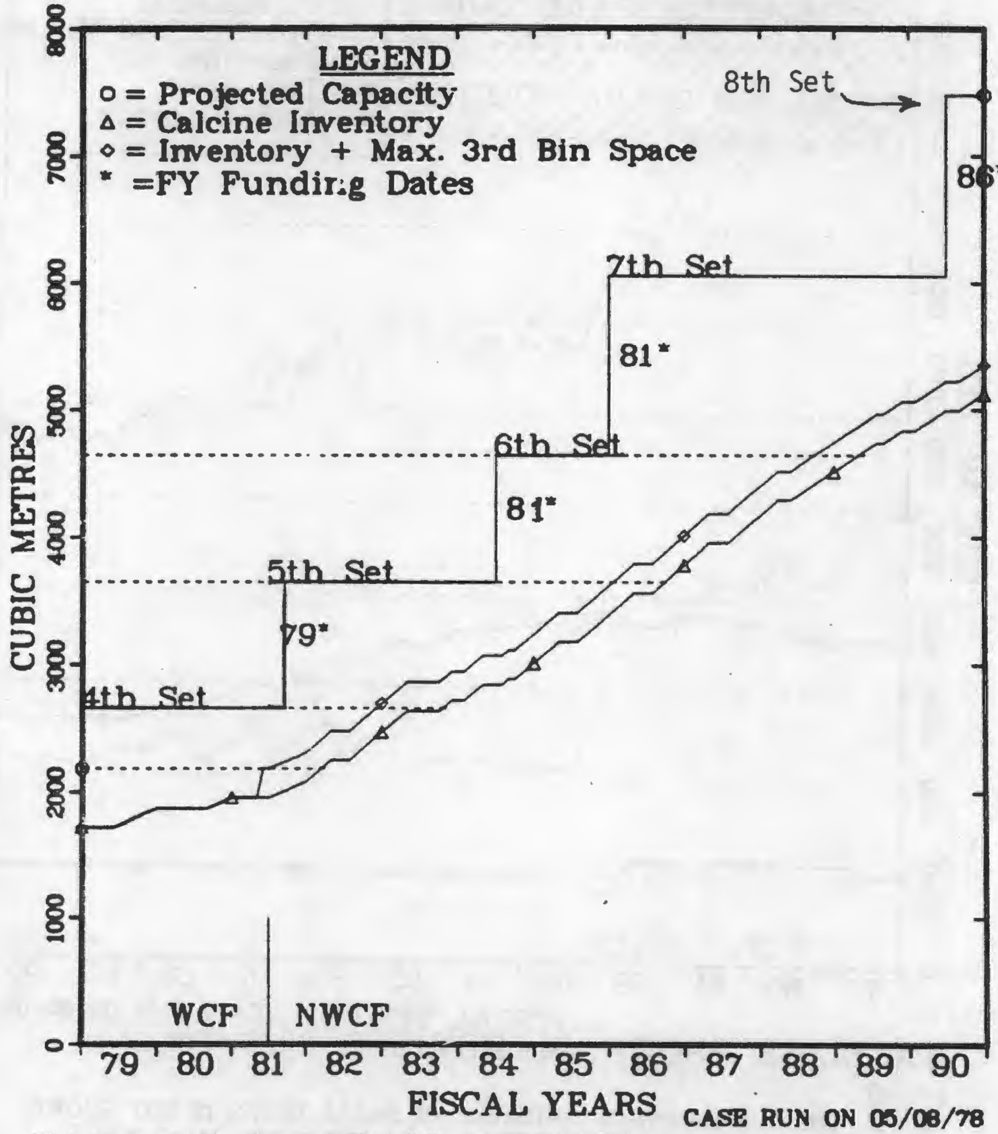
BASELINE PROGRAM–REVISED 4-3-78

FIG. 6

*NOTE: 285 CUBIC METRES AVAILABLE IN SMALL TANKS IS NOT SHOWN.

PLOT 1 16.04.30 TUES 09 MAY, 1978 JOB-H658 CP. ISSCO. DISSPLA VER 4.11

PROJECTED CALCINE STORAGE REQUIREMENTS



BASELINE PROGRAM–REVISED 4–3–78

FIG. 7

+PLOT 3 16.06.50 TUES 09 MAY, 1978 JOB-HESB CP. ISSCO, DISSPLA VER 4.11

TABLE I ANNUAL SUMMARY OF OPERATIONS

BASELINE PROGRAM-REVISED 4-3-78

CASE RUN ON 05/12/78

NO.	NAME OF FUEL	RECOVERY PROCESS	STARTUP DATE MO YR	START INVEN	FISCAL 1979 KG REC	FISCAL 1979 KG PROC	FISCAL 1979 KG INV	FISCAL 1980 KG REC	FISCAL 1980 KG PROC	FISCAL 1980 KG INV	FISCAL 1981 KG REC	FISCAL 1981 KG PROC	FISCAL 1981 KG INV	FISCAL 1982 KG REC	FISCAL 1982 KG PROC	FISCAL 1982 KG INV	FISCAL 1983 KG REC	FISCAL 1983 KG PROC	FISCAL 1983 KG INV	FISCAL 1984 KG REC	FISCAL 1984 KG PROC	FISCAL 1984 KG INV
1	FUEL NUMBER 1	PROCESS 1		0	0	0	0	0	359	0	0	0	0	0	599	0	0	0	0	0	318	0
2	FUEL NUMBER 2	PROCESS 2		154	69	0	223	225	0	184	146	0	330	150	0	41	144	0	185	168	0	118
3	FUEL NUMBER 3	PROCESS 2		139	149	0	287	103	0	294	128	0	422	42	114	188	21	0	209	62	132	47
4	FUEL NUMBER 4	PROCESS 3		246	162	299	108	151	0	259	200	0	458	0	0	458	0	458	0	0	0	0
5	FUEL NUMBER 5	PROCESS 3		49	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	FUEL NUMBER 6	PROCESS 3		24	0	23	0	3	0	3	17	0	19	2	0	21	0	21	0	0	0	0
7	FUEL NUMBER 7	PROCESS 3		57	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	FUEL NUMBER 8	PROCESS 3		5	5	0	9	5	0	14	5	0	19	5	0	24	5	24	4	5	0	9
9	FUEL NUMBER 9	PROCESS 4	1 80	2971	0	0	2971	0	189	2781	0	1554	1226	0	1226	0	0	0	0	0	0	0
10	FUEL NUMBER 10	PROCESS 10		100	0	0	100	0	45	54	0	0	54	12	59	6	12	0	18	0	18	0
11	FUEL NUMBER 11	PROCESS 3		0	63	0	63	49	0	111	47	0	158	19	0	177	3	158	21	27	0	48
12	FUEL NUMBER 12	PROCESS 5	7 84	12	0	0	12	0	0	12	0	0	12	0	0	12	0	0	12	0	0	12
13	FUEL NUMBER 13	PROCESS 5	7 84	0	0	0	0	58	0	57	201	0	258	104	0	362	359	240	480	306	0	783
14	FUEL NUMBER 14	PROCESS 5	7 84	9	2	0	10	0	0	10	2	0	12	11	0	23	2	0	25	0	0	25
15	FUEL NUMBER 15	PROCESS 5	7 84	63	0	0	63	0	0	63	0	0	63	0	0	63	0	0	63	382	0	444
16	FUEL NUMBER 16	PROCESS 5	7 84	0	0	0	0	0	0	0	0	0	0	10	0	9	4	0	13	13	0	26
17	FUEL NUMBER 17	PROCESS 5	7 84	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	20	21	0
18	FUEL NUMBER 18	PROCESS 5	7 84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0
19	FUEL NUMBER 19	PROCESS 10		25	10	19	14	10	9	14	10	9	14	10	15	8	10	9	8	10	16	2
20	FUEL NUMBER 20	PROCESS 16		60	0	0	60	0	0	60	0	0	60	0	0	60	0	0	60	0	0	60
21	FUEL NUMBER 21	PROCESS 7	7 83	85	0	0	85	0	0	85	0	0	85	0	0	85	0	84	0	0	0	0
22	FUEL NUMBER 22	PROCESS 5	7 84	0	0	0	0	0	0	0	0	0	0	82	0	81	32	0	113	72	0	185
23	FUEL NUMBER 23	PROCESS 5	7 84	12	0	0	12	7	0	18	0	0	18	0	0	18	0	0	18	0	0	18
24	FUEL NUMBER 24	PROCESS 16		0	0	0	0	0	0	0	0	0	0	0	0	0	414	0	414	89	0	502
25	FUEL NUMBER 25	PROCESS 4		0	0	0	0	2	0	1	2	0	3	17	0	20	30	0	50	0	0	50
26	FUEL NUMBER 26	PROCESS 5	7 84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	924	125	798
27	FUEL NUMBER 27	PROCESS 5	7 84	2	0	0	2	60	0	62	0	0	62	6	0	68	0	0	68	70	0	137
28	FUEL NUMBER 28	PROCESS 5	7 84	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	99	0	0	99
29	FUEL NUMBER 29	PROCESS 9		14	0	1	12	0	1	10	0	1	8	0	1	6	0	1	4	0	1	2
30	FUEL NUMBER 30	PROCESS 2		6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	5	0
31	FUEL NUMBER 31	PROCESS 16		46	16	0	61	28	0	89	43	0	132	49	0	181	65	0	246	57	0	303
32	FUEL NUMBER 32	PROCESS 16		230	69	0	299	55	0	353	51	0	404	38	0	442	28	0	470	16	0	486
33	FUEL NUMBER 33	PROCESS 9		21	0	2	18	0	2	15	0	2	12	0	2	9	0	2	6	0	2	3
34	FUEL NUMBER 34	PROCESS 5	7 84	396	0	0	396	0	0	396	0	0	396	0	0	396	0	0	396	0	395	0
35	FUEL NUMBER 35	PROCESS 5	7 84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0

NO.	FISCAL 1985 KG REC	FISCAL 1985 KG PROC	FISCAL 1985 KG INV	FISCAL 1986 KG REC	FISCAL 1986 KG PROC	FISCAL 1986 KG INV	FISCAL 1987 KG REC	FISCAL 1987 KG PROC	FISCAL 1987 KG INV	FISCAL 1988 KG REC	FISCAL 1988 KG PROC	FISCAL 1988 KG INV	FISCAL 1989 KG REC	FISCAL 1989 KG PROC	FISCAL 1989 KG INV	FISCAL 1990 KG REC	FISCAL 1990 KG PROC	FISCAL 1990 KG INV	TOTALS KG REC	TOTALS KG PRC
1	0	231	0	0	221	0	0	0	0	0	0	0	0	0	0	0	118	0	0.	1851.
2	140	0	93	134	0	55	123	0	35	147	0	84	121	0	125	147	0	0	1714.	0.
3	82	0	63	0	0	0	11	0	10	23	0	33	0	0	33	0	0	0	621.	248.
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	513.	759.
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	49.
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22.	46.
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	57.
8	5	14	0	5	0	5	5	0	10	5	0	15	5	0	20	5	0	25	60.	40.
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	2971.
10	0	0	0	0	0	0	0	0	0	10	10	0	10	5	4	10	10	3	54.	151.
11	9	57	0	0	0	0	15	0	15	0	0	15	0	0	15	0	0	15	232.	216.
12	0	0	12	0	0	12	0	0	12	0	0	12	0	11	0	0	0	0	0.	12.
13	472	0	1255	338	680	907	770	922	698	307	966	0	445	264	148	306	379	0	3666.	3454.
14	2	0	27	0	0	27	2	0	29	0	0	29	2	31	0	0	0	0	23.	32.
15	0	0	444	0	444	0	0	0	0	0	0	0	0	0	0	0	0	0	382.	445.
16	0	0	26	0	0	26	0	0	26	12	0	38	0	38	0	0	0	0	39.	39.
17	0	0	0	0	0	0	1	0	0	21	21	0	0	0	0	0	0	0	44.	44.
18	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	10.	10.
19	10	12	0	10	4	5	10	13	1	10	11	0	10	5	4	10	10	3	120.	142.
20	0	0	60	0	0	60	0	0	60	0	0	60	0	0	60	0	0	60	0.	0.
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	85.
22	0	0	185	55	0	240	74	0	314	54	0	368	0	130	238	0	120	118	369.	250.
23	0	0	18	0	0	18	0	0	18	0	0	18	0	18	0	0	0	0	7.	19.
24	0	0	502	0	0	502	0	0	502	0	0	502	0	0	502	0	0	502	503.	0.
25	60	0	110	0	110	0	20	0	19	0	19	0	0	0	0	0	0	0	131.	131.
26	936	1571	163	0	163	0	261	239	21	222	243	0	0	0	0	0	0	0	2343.	2343.
27	49	0	186	41	0	227	0	0	227	0	31	196	0	196	0	0	0	0	226.	228.
28	0	0	99	150	187	62	0	62	0	0	0	0	0	0	0	159	158	0	409.	409.
29	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	14.
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	6.
31	55	0	358	56	0	414	0	0	414	0	0	414	0	0	414	0	0	414	369.	0.
32	17	0	503	15	0	518	0	0	518	0	0	518	0	0	518	0	0	518	289.	0.
33	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	21.
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	396.
35	0	0	0	0	18	0	0	200	0	0	136	0	0	112	0	0	262	0	0.	741.

FISCAL YEAR	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
FUELS RECEIVED,KILOGRAMS U-235	546.	756.	852.	557.	1230.	2226.	1837.	804.	1292.	816.	593.	637.	12146
FUELS PROCESSED,KILOGRAMS U-235	455.	611.	1569.	2024.	1005.	1056.	1892.	1833.	1439.	1446.	817.	1062.	15209
FUELS INVENTORY,KILOGRAMS U-235	4817.	4962.	4245.	2778.	3003.	4173.	4118.	3089.	2942.	2313.	2089.	1663.	
NON-F WASTE PRODUCED, CU. METRES	156.	3.	3.	5.	220.	5.	30.	1.	4.	3.	2.	3.	436
NON-F WASTE PROCESSED, CU. METRES	0.	0.	0.	437.	0.	0.	0.	0.	0.	0.	0.	0.	437
NON-F WASTE INVENTORY, CU. METRES	1206.	1209.	1212.	780.	1000.	1005.	1035.	1037.	1041.	1044.	1046.	1049.	
FLUORIDE WASTE PRODUCED, CU. METRES	6.	395.	240.	1159.	463.	1749.	2280.	1981.	1865.	1862.	1549.	1599.	15148
FLUORIDE WASTE PROCESSED, CU. METRES	816.	467.	687.	1974.	1374.	1603.	2061.	2061.	2012.	1846.	1697.	1528.	18127
FLUORIDE WASTE INVENTORY, CU. METRES	4540.	4469.	4022.	3206.	2295.	2441.	2660.	2580.	2432.	2448.	2299.	2371.	
LOW-HEAT WASTE PRODUCED, CU. METRES	264.	325.	303.	400.	293.	313.	331.	328.	310.	325.	419.	394.	4004
LOW-HEAT WASTE PROCESSED, CU. METRES	233.	133.	196.	414.	393.	458.	589.	589.	575.	527.	485.	436.	5029
LOW-HEAT WASTE INVENTORY, CU. METRES	3811.	4003.	4110.	4096.	3996.	3851.	3593.	3332.	3067.	2865.	2798.	2755.	
TOTAL WASTE PRODUCED, CU. METRES	427.	723.	545.	1564.	976.	2067.	2641.	2310.	2179.	2191.	1969.	1996.	19589
TOTAL WASTE PROCESSED, CU. METRES	1050.	600.	883.	2825.	1767.	2061.	2650.	2650.	2587.	2373.	2182.	1964.	23593
TOTAL WASTE INVENTORY, CU. METRES	9558.	9681.	9344.	8082.	7291.	7297.	7288.	6948.	6540.	6357.	6143.	6175.	
SOLIDS WASTE PRODUCED, CU. METRES	154.	88.	126.	389.	252.	294.	379.	390.	381.	349.	321.	289.	3413
SOLIDS WASTE INVENTORY, CU. METRES	1864.	1953.	2079.	2468.	2721.	3015.	3394.	3783.	4164.	4513.	4834.	5123.	
DAYS OF FUEL PROCESSING	82	158	188	254	167	147	262	274	229	230	251	229	
DAYS OF WASTE CALCINING	212	121	182	273	182	212	273	273	267	245	225	202	

positions would be filled at that time and at least three positions of non-Zr fuel can be stored in each unused Zr position. In addition, only 48 of the 80 racks that could be installed are assumed to be installed in the Baseline Program. Each of these 80 racks contains 15 Zr positions; thus 480 additional Zr positions or an equivalent 1440 additional non-Zr positions could be made available. Racks will not be placed underwater until their need is imminent.

At the top of Figure 4, the changes in positions available in FY 1979 represent the replacement of existing poisoned aluminum racks in the south basin with the new stainless steel racks as well as provisions for storing non-Zr fuels on some of the hangers in the north and middle basins.

The new metal-clad fuel storage basin to be provided by the FAST project is projected to become available for use in April 1983. As shown in Figure 5, use of the FAST basin is assumed to begin then; all fuels received thereafter that require underwater storage are assumed to be stored there.* A fuel will not be taken for processing from the inventory in the FAST basin until the inventory of that fuel is exhausted from the existing basin. No transfers from the existing basin to the new basin are planned other than when required for Fluorinel processing soon thereafter.

Cold operation of the Fluorinel process is projected for completion in July of 1983; hot operation is expected to begin then and would continue for several months, if possible. However, the need for shutdown for a ten-month period has been assumed to follow the first two months of operation. Thereafter, the process was assumed operable an average of about 235 days per year. The "second crew expansion" to permit concurrent operation of headend and tailend processes was assumed to coincide with the beginning of this second Fluorinel hot operating period, which is projected to start in July 1984. The crew has been assumed to be retained until the end of FY 1990 and by that time will have reduced the processable fuel inventory to 164 Kg of ^{235}U, a very low figure. Unless large receipts should be expected in FY 1991, the second crew would be terminated at the end of FY 1990, or perhaps up to a year earlier.

Projected shipments of product to Oak Ridge (Y-12) and Portsmouth are listed in Table II. The shipments include product in inventory at the start of FY 1979 and exclude 184 kg of U-235 recovered in the latter part of FY 1990.

The WCF is expected to operate the equivalent of about 11 months at normal average rates during the 24-month period starting with FY 1979 and ending at the start of FY 1981, when cold operation of the NWCF is scheduled to begin. Figure 1 shows the 11 months are divided into two campaigns of 7 and 4 months. However, every reasonable effort will be made to minimize WCF downtime. The WCF will not be shut down when

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*Possible modifications to the Fast Project for changed capability under study by DOE-HQ, are not considered by this document and may require revisions to these assumptions.

TABLE II

PROJECTED PRODUCT SHIPMENTS IN THE BASELINE PROGRAM

FISCAL YEAR	SHIPMENTS TO Y-12			SHIPMENTS TO PORTSMOUTH				TOTAL
	U_T	U-235	U-236	U_T^*	U-235 *	U_T	U-235	U-235
1979	1526	1105	107			0	0	1105
1980	436	360	36			0	0	360
1981	0	0	0			1416	1316	1316
1982	870	715	75			1859	1731	2446
1983				739	458			
				446	388			
	0	0	0			1185	846	846
1984	1064	875	91			0	0	875
1985	2375	2001	164			0	0	2001
1986				271	249			
				77	22			
	1994	1613	201			348	271	1884
1987	1680	1413	123			0	0	1413
1988	1786	1507	123			0	0	1507
1989				113	100			
				3072	186			
	898	717	98			3185	286	1003
1990	919	761	81			3763	151	912
TOTALS	13548	11067	1099			11756	4601	15668

* These are subtotals indicating segregation of annual shipments to prevent blending of uranium having different enrichments.

operation at near-normal rate can be safely continued. Therefore, actual operation achieved may differ considerably from that shown in Figure 1. The 1,650 cubic metres (436,900 gallons) of liquid waste projected for WCF calcining was assumed to be a 3.5:1 volume blend of fluoride and sodium-containing low-heat wastes. Operation with this ratio has been successful so far although a reduction in net rate has been necessary; a 12% reduction has been assumed.

Liquid waste inventories are shown in Figure 6. Rover wastes are included with the fluoride wastes in this figure and in Table I. Rover wastes will be given priority for calcining because they cause precipitates when mixed with other wastes and to the extent not calcined or produced, will have to be stored temporarily in unvaulted tanks WM-103, -104, -105 and -106. The capacities of these four tanks, 115 cubic metres each, are not included in Figure 6.

Not less than the first and second quarters of FY 1981 will be required for NWCF testing and cold operation. The NWCF is projected to start operating with hot wastes in April 1981. Fluoride waste will be calcined in blends with Rover waste, with non-fluoride waste and with low-heat sodium-containing waste. The sharp drop in non-fluoride waste inventory in Figure 6 shows the timing assumed for the only campaign on the blend with that waste.

Wastes from Fluorinel processing are all fluoride-containing wastes but will be different from the fluoride wastes produced currently because cadmium and possibly other elements will be used as neutron absorbers in Fluorinel dissolutions. A flowsheet for calcining Fluorinel waste is being developed. For the Baseline Program, Fluorinel waste has been assumed calcined with low-heat waste in a 3.5:1 volume ratio. If such calcining should be found not feasible, adding aluminum nitrate to the blend would be explored; this is discussed further in Section III.

2. PROGRAMS AND ASSOCIATED COSTS

This document is intended to cover all operations necessary to the recovery of the uranium in spent fuels, including the solidification and storage of the associated radioactive wastes at the ICPP. Therefore, the document covers all operations and construction items for the JM 03 Program (Special Materials Production) at ICPP except: (1) those dealing with post-storage reprocessing and final disposal methods for the high-level solid waste (JM 03 03 41 0), (2) Effluent Monitoring Methods (JM 03 03 44 0), and (3) for the Airborne Waste Management Program (JM 03 03 44 0). The annual cost of these excluded programs is typically $7 to $10 million. One research and development budget item which is within the definition of covered operations was excluded because the work almost certainly will not be necessary: Sodium Waste Alternative Development (I-005); an associated construction project was also excluded.

2.1 Operations-Funded Programs

Funding required for operations and R & D in FY 1980 is compared to that required for FY 1979 in the following tabulation:

Item	JM 03 (No.)	FY 1979 $000	FY 1980 $000	Differences $000
Separations	01 22 1	15,010	19,415	4,405
Startup	01 51 1	1,000	900	(100)
Conceptual Engineering	01 53 1	900	1,445	545
Other	01 53 5	400	580	180
Separations Subtotal		17,310	22,340	5,030
Solidification	03 22 0	8,130	9,205	1,075
Startup	03 31 1	600	2,050	1,450
Conceptual Engineering	03 33 1	200	250	50
Solidification Subtotal		8,930	11,505	2,575
Operations Subtotal		26,240	33,845	7,605
Research and Development	02 21 0	600	1,215	615
Waste Mgmt. Develop.	03 23 0	570	660	90
R & D Subtotal		1,170	1,875	705
Production Total		27,410	35,720	8,310
Procurement of Reactor Products	01 30 0	500	900	400

These costs were taken from the FY-1980 budget submission; the FY-1980 costs are the minimum of the three alternatives submitted.

Escalation accounts for about $2.2 million of the $8.3 increase in production costs. Preparation for NWCF testing and startup is the major reason for the $1.4 million increase in startup costs. The remaining $4.7 million of increase results from a variety of increases in the scope of work, principally, as follows:

(1) The increased number of line item, general plant, and capital equipment projects require increased work on review, liaison, safety analysis reports, technical and operating manuals, and startup tests and plans.

(2) Increased effort will be applied to the health physics upgrade program and other safety activities.

(3) The increased number of buildings and utilities systems require additional service and maintenance personnel.

(4) Expansion of R & D effort is proposed in two new budget items: Process Monitoring Systems (I-006) and Remote Maintenance Development (I-456).

Further discussion of Operations-funded programs that support the Baseline Program is in Section VII, Process Development and Support.

Costs for production activities for every year of the study period are shown in Table III. Operating costs are in the upper half of the table, and capital costs or construction in the lower half. The capital cost is discussed in Section 2.2, which follows.

TABLE III

ICPP-WCF COST DATA BEGINNING WITH 1979
(DOLLARS ARE IN THOUSANDS) CASE, RUN ON 05/12/78

BASELINE PROGRAM-REVISED 4-3-78

FISCAL YEAR	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	POST	TOT
A. COSTS OF PRODUCTION														
OPERATION	26240	33850	35450	34900	35450	33730	34960	34810	34500	34470	34380	34300	0	407040
R AND D (KZ02)	1170	1870	2130	2170	2220	2300	2200	2000	1800	1600	1400	1400	0	22260
KZ PRODUCTION	27410	35720	37580	37070	37670	36030	37160	36810	36300	36070	35780	35700	0	429300
U-233 PURCHASE (KZ01-03)	500	900	1290	1470	1950	1710	1650	1680	0	0	0	0	0	11150
B. CAPITAL COSTS														
CALCINE STORAGE ***	500	6500	16000	22000	0	0	0	5000	15000	15000	0	0	-58170	21830
NEW WCF	25500	0	0	0	0	0	0	0	0	0	0	0	0	25500
PRIORITY UTILITIES	500	0	0	0	0	0	0	0	0	0	0	0	0	500
FLUORINEL & FUEL STG	49000	31000	21000	4400	0	0	0	0	0	0	0	0	-21080	84320
SECURITY UPGRADE	800	0	0	0	0	0	0	0	0	0	0	0	0	800
UTILITIES EXPANSION	10500	0	0	0	0	0	0	0	0	0	0	0	0	10500
STEAM GENERATION ***	1500	22500	0	0	0	0	0	0	0	0	0	0	0	24000
ANAL. CHEM. BLDG	0	3000	17000	0	0	0	0	0	0	0	0	0	-2000	18000
RENOV. OF CELLS ***	0	12000	0	48000	0	0	0	0	0	0	0	0	-12000	48000
LINE NOT USED	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINE NOT USED	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINE NOT USED	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINE NOT USED	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINE NOT USED	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN. PLANT PROJECTS	2510	3630	4000	4000	4000	4000	4000	3500	3000	3000	3000	3000	-21920	19720
CAPITAL EQ.-PRODN.	4410	5730	4500	4500	6500	6500	6000	4000	4000	4000	4000	4000	-24900	33240
CAPITAL EQ.-JM R & D	320	480	170	160	190	180	150	120	100	100	100	100	-670	1500
TOTAL CONSTRUCTION	95540	84840	62670	83060	10690	10680	10150	12620	22100	22100	7100	7100	******	287910

TOTAL POST: -140740

THE FUEL PROCESSING HEADEND AND TAILEND OPERATE CONCURRENTLY BETWEEN THESE DATES: 6- 1-84 AND 11-90
ALL COSTS ARE IN THOUSANDS. COSTS BEYOND FY 1980 ARE NOT ESCALATED.
POST COLUMN SHOWS CREDITS FOR UNDEPRECIATED VALUES OF NEW EQUIPMENT.
DEPRECIATION IS EXPLAINED IN APPENDIX B, ITEM 13.

2.2 Projects

Funding for capital line-items included in the Baseline Program and the approximate dates of beneficial use are as follows:

Capital Line Items[a]	First FY of Funding	Approximate Beneficial Use	Total Estimated Cost ($\$10^6$)	Estimated Obligation After FY 1978 ($\$10^6$)
Calcined Solids Storage				
Fifth set of bins	1978	Jul 1981	12.5	0.0
Sixth set of bins and	1981[b]	Apr 1984	45	45
seventh set of bins		Oct 1985	-	-
and transfer facility				
Eighth set of bins	1986	Apr 1990	35	35
New Waste Calcining Facility	1976	Apr 1981	77.25[c]	25.5
Priority Utilities	(c)	Sept 1979	3.75	0.5
Fluorinel Dissolution Process & Fuel Receiving Improvements	1977	Jul 1983	116	105.4
Safeguards & Security Upgrade	1977	Sep 1979	2.3	0.8
Personnel Protection & Support Facility	1977	FY 1979	10.5	0.0
Utilities Expansion	1979	Oct 1982	10.5	10.5
Steam Generation	1980	Jul 1983	24	24
Plant Analytical Chemistry Building	1980	Apr 1983	20	20
Renovation of Process Cells	1980	Oct 1985	60	60

(a) Projects for which construction is expected to be complete before the start of Fy 1979 are not listed here. Line-item construction projects in the JM 03 Program that are included in the INEL Long Range Plan[12] but excluded from this document are Sodium Waste Solidification Facility, which probably will not be necessary and is assumed not necessary in this document, and TRU Waste Retrieval and Treatment Facility, which is not within the scope of this document.

(b) The sixth and seventh sets of bins and the calcine transfer facility are all parts of the same project which has the title "Calcine Transfer and Storage Project." Some design funds will be needed in advance of FY 1981 for this project.

(c) The Priority Utilities Project was funded from NWCF Project contingency funds; total estimated cost for the NWCF project is therefore $81 million, the sum of $77.25 and $3.75 million.

These line-item projects must receive funding as indicated in order to complete the Multiple Fuels Processing Program as presented in this document.

Table III shows the funding periods and the amounts of obligations necessary each year of the study period for each line item. Cost that were obligated prior to the study period are not included in Table III.

Figure 8 highlights the schedule of each line item, and Section VII details the project schedule, the technical schedule, and the milestones, and gives a brief description of each line-item project. Section VII also lists General Plant Projects for FY 1978 and FY 1979.

There are three FY-1980 line-item projects shown in Table III: Plant Analytical Chemistry Building, Steam Generation, and Renovation of Process Cells.

2.2.1 Plant Analytical Chemistry Building (PACB)

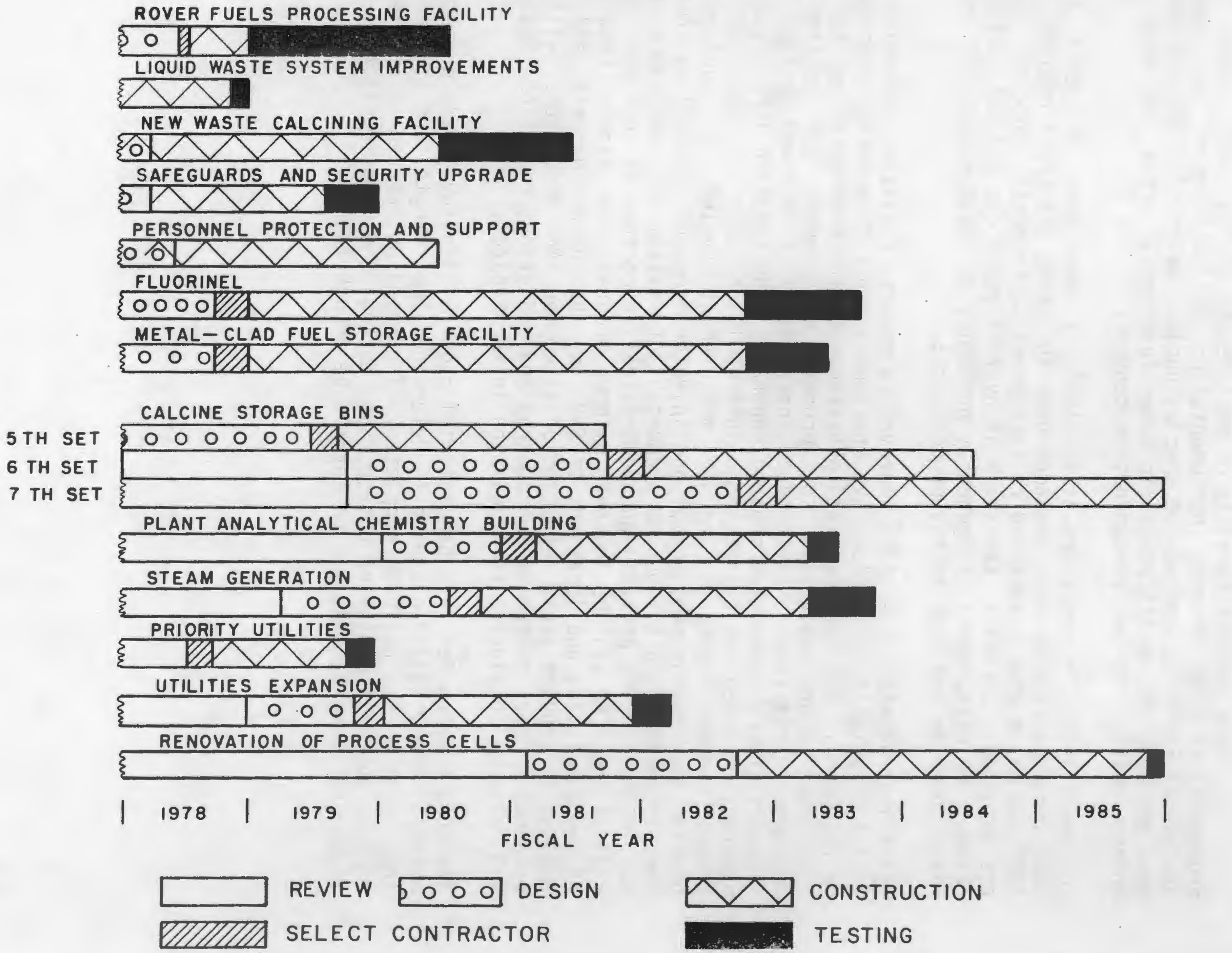
Projections of laboratory space requirements at ICPP based on the INEL Long-Range Program Plan[12] show a shortage of greater than 1860 net usable square metres (NUSM) (20,000 sq ft) for FY 1979. This shortage is projected to continue at this level or higher throughout the period covered by the plan. The anlytical laboratories have been in operation for over 25 years in buildings that do not meet the physical or environmental requirements necessary for satisfactory operation of the highly sensitive instrumentation and analysis equipment now used. Failure to build the PACB will result in reduced quality of analyses, curtailment of analytical services to the special materials production program and other programs at INEL, and higher costs to production support activities.[15]

The PACB will be a one-story structure with a gross area of approximately 6180 square metres (66,500 sq ft). The facility will house 1,765 NUSM of laboratories and 1,347 NUSM of associated offices and support activities. It will provide structural features and environmental conditions of the type and quality required to meet the precision and accuracy requirements for scientific measurements.

2.2.2 Steam Generation Project

Production facilities currently being designed and built will cause maximum steam requirements to exceed existing capacity after FY 1983. Additional generating facilities are thus required to permit operation at all times as planned. This project provides for the construction of a coal-fired steam-generating facility containing two 30,600 kg/h (67,500 lb/hr) boilers. This faciity, together with oil-fired boilers retained, will enable all ICPP facilities to operate during winters, will prevent unplanned shutdowns due to boiler malfunction, will save oil, and provide a 25% contingent capacity permitting some additions of facilities not now planned.

FIGURE 8–MULTIPLE FUELS PROCESSING PROGRAM CONSTRUCTION SCHEDULE



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2.2.3 Renovation of Process Cells

This project consists of replacement of the ICPP stack, improvements to plant process instrumentation, modification of the Remote Analytical Facility, upgrade of special nuclear material (SNM) measurement systems, and modifications to other functional areas in order to enhance reliability and contamination control.

Equipment initially installed at the ICPP is now over 25 years old. Some instruments have been replaced over the years and, as a result, the ICPP now has a widely assorted collection of instruments, many of which are outdated. Likewise, the stack is over 25 years old and has deteriorated. SNM measurement is presently performed by measurement of materials entering and leaving the process area.

Plant instrumentation must be improved to reduce radiation exposure by isolating potentially radioactive instrument lines from areas frequented by personnel. The instrumentation systems require modernization to improve quality and reliability of process measurement and monitoring. Instrument improvements may include installation of improved sensing and transmitting equipment and control consoles. The existing ICPP stack is severely corroded and contaminated internally and must be replaced before it becomes a hazard. The SNM measurement system is required to provide the uranium measurement and inventory control capability necessary to implement a safeguards accountability system in compliance with DOE IMD 6104. The physical and administrative control of nuclear material at the ICPP will be improved by more accurate and timely knowledge of the quantities and locations of SNM in the plant process and the ability to provide early detection of attempted SNM diversions will be enhanced. Other contamination control and radiation reduction measures will also be considered for inclusion in the project.

The construction for this project will require lengthy fuel processing outages; the detailed planning to determine the length and timing of these outages has not been completed. The Baseline Program is projected to have about 16 months of outage time during the construction period shown in Figure 8; this may or may not be enough time.

III. CONSEQUENCE ANALYSIS

Unscheduled delays may occur in both construction activities and in process operations during the 12-year period studied for the Baseline Program. Such delays can be caused by equipment failures, budget limitations, accidents, strikes, a reordering of priorities, or, possibly, other significant events. The consequences of several postulated occurrences are discussed below. The probabilities of these occurrences have not been evaluated in depth.

1. WASTE MANAGEMENT

1.1 Leaking Tank

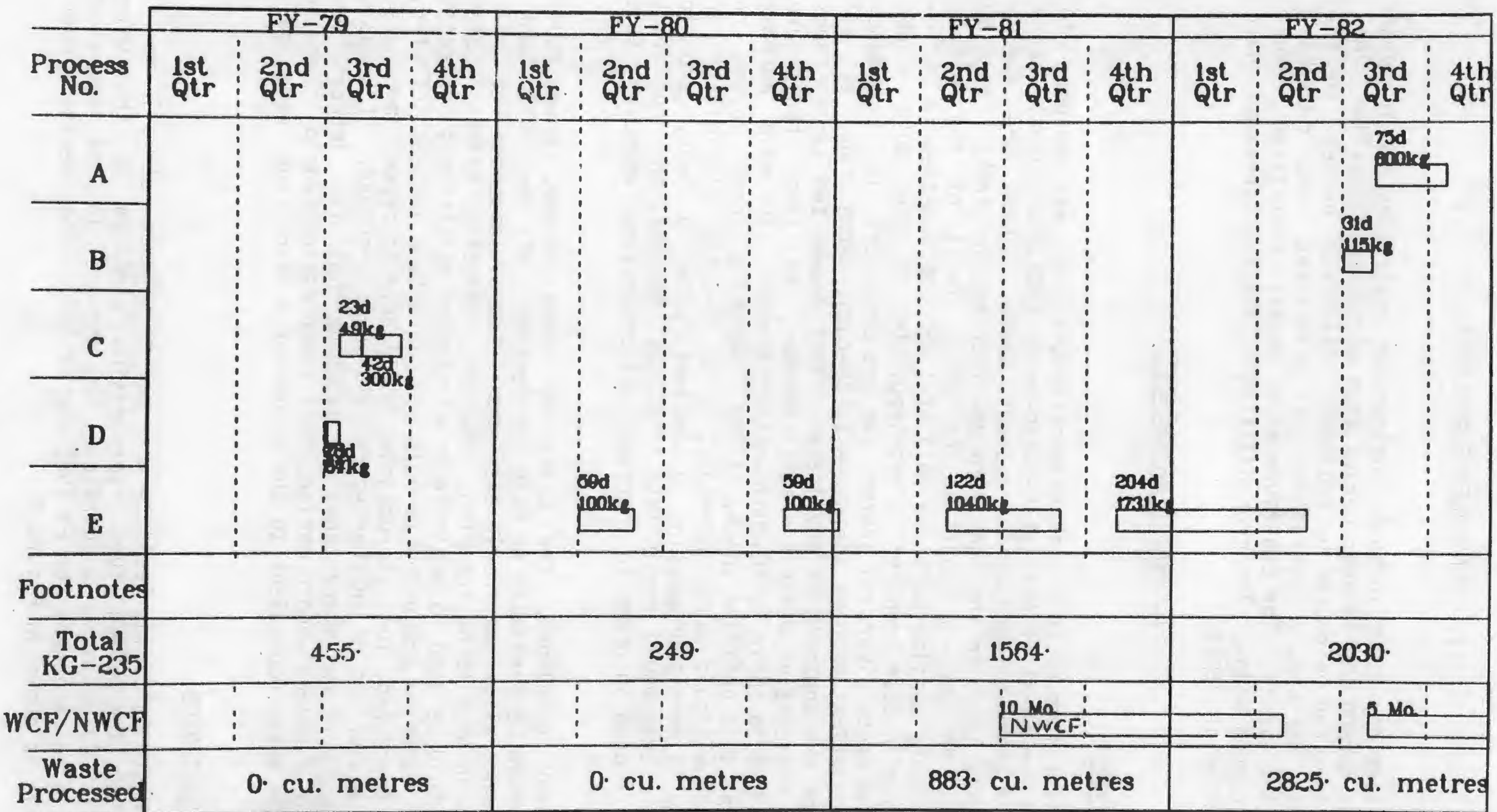
In the first item of this risk examination, a leak was assumed to develop in one (or more) of the 1,135-cubic-metre (300,000-gallon) storage tanks for high-level radioactive aqueous waste. There are twelve 1,135-cubic-metre tanks in the tank farm and four smaller tanks totaling 265 cubic metres in concrete vaults at the lowest level of the plant. The large tanks are considered to be full at 1,080 cubic metres to allow for jet dilution in case transfer is required. One of the large tanks is used for the waste diversion system. We are committed in accordance to Federal regulations to have one spare 1,135-cubic-metre tank at all times to accept the contents of any leaker. This leaves ten large tanks available for radioactive waste storage. However, the large tanks are not always filled to their 1,080-cubic-metre capacity. The main purpose for maintaining this unfilled space, called operating spare volume on figures that show liquid waste inventory, is to provide flexibility in waste storage, to permit processing to continue after a leak, and to segregate waste that would precipitate if mixed. However, the operating spare volume is used in order to increase fuel processing, whenever this is feasible.

If a second leak developed, the operating spare volume, when fully maintained, would be available to hold the contents of one full tank. If this emergency situation should ever occur, the consequences of mixing wastes would have to be accepted. However, existing solution stability data would be used to minimize or eliminate deleterious effects. If there were capacity amounting to only one spare tank instead of two, and a leaker developed, fuel reprocessing would have to cease immediately until the equivalent of another spare tank were provided. Likewise, with the capacity of two spare tanks and assuming that two leakers developed within a several-month period, fuel reprocessing would have to stop until the waste equivalent to the volume of a spare tank were calcined.

1.2 No WCF Calcining

If the Waste Calcining Facility were not to operate at all in FY 1979 or FY 1980, the 360-kg fuel reprocessing campaign in the third quarter of FY 1980 would be eliminated; no changes in the operating schedule would be necessary for FY 1981 and FY 1982. The revised operating schedule is shown in Figure 9.

ICPP OPERATING SCHEDULE



Process
A=fuels 1
B=fuels 2,3,30
C=fuels 4,5,11
D=fuels 6,7,8
E=fuels 9,25

NO WCF CALCINING

FIG. 9

CASE RUN ON 05/08/78

Fuels not included--10,19,29,33,12,13,14,15,16,17,18,21,22,23,26,27,28,34,35, In Figure 10, total waste inventory appears to call for use of the required spare tank but actually would not do so because of Rover waste put into tanks WM-103, 4, 5 and 6 and also because of use of the 265-cubic-metre capacity in small tanks. However, low-heat waste in excess of four tanks (Figure 10) would have to be mixed with fluoride wastes.

To accomodate the fuel inventory, plans for installation of 48 new racks would require change. For Figure 11, about 70 of the new racks have been assumed installed, which would be more than enough, as the Figure shows.

1.3 Delay in NWCF Startup

Effects on waste inventories of a 12-month delay in NWCF startup are shown in Figure 12. Another significant assumption for this case is that the WCF calcines the same quantity of waste as in the Baseline Program. Assuming that Rover wastes in tanks WM-103, 4, 5 and 6 can be left there until a few months after the end of the NWCF calcining campaign (on a blend of non-fluoride waste in tank WM-183 with fluoride waste) planned for the latter part of FY 1982, fuel processing could proceed as in the Baseline Program. If Rover waste were processed without delay, a campaign on fuels 4, 6 and 8 projected for the first quarter of FY 1983 would have to be postponed until after Fluorinel startup, and product delivery would be reduced. In either case, fuel storage capacity planned for the Baseline Program would be adequate.

Low-heat waste in excess of four tanks (Figure 12) would have to be mixed with fluoride waste, as in the no-WCF-calcining case. If the WCF were assumed to operate longer than in the Baseline Case, this mixing might not be required.

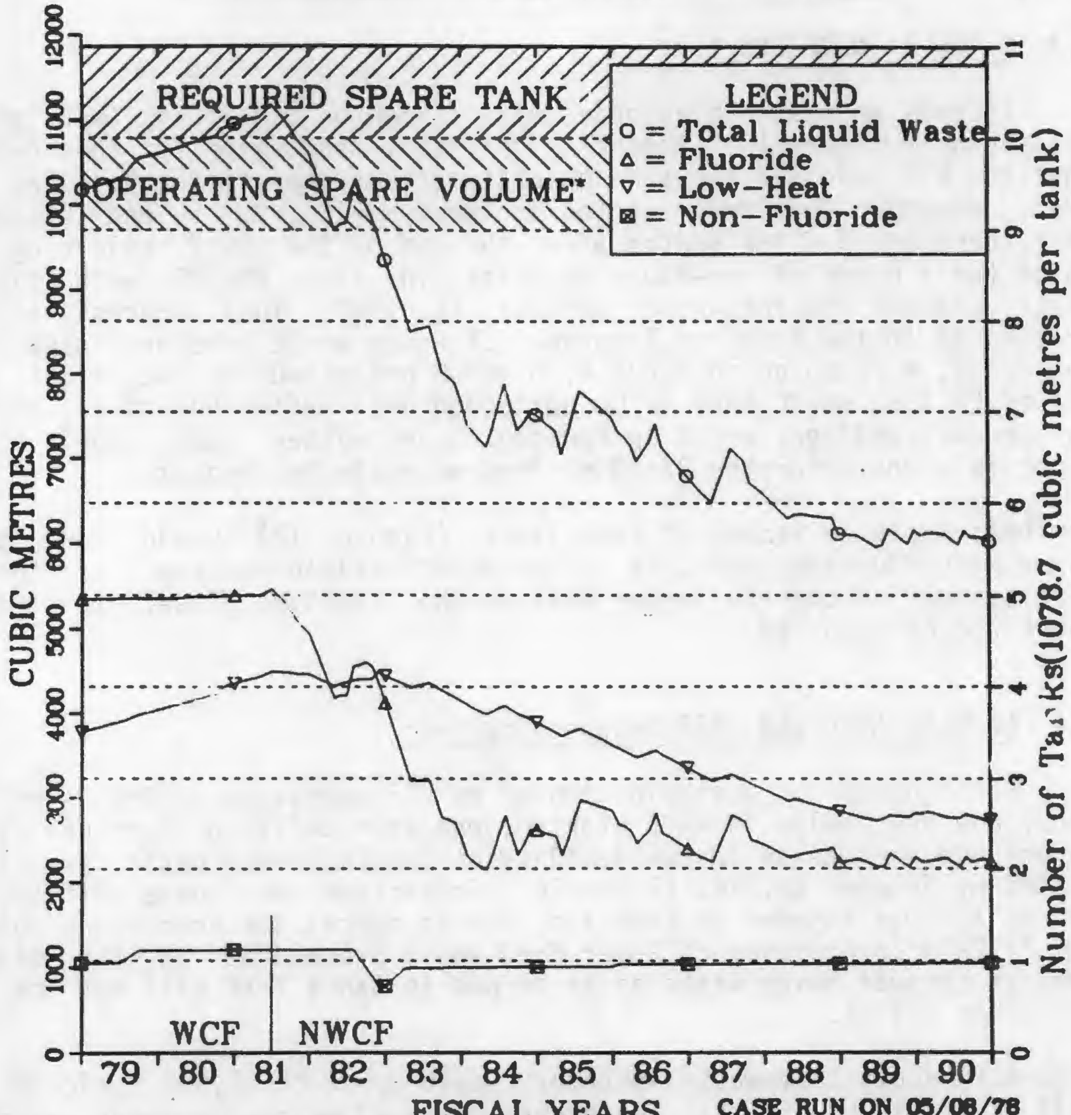
1.4 No WCF; NWCF and FAST Delayed One Year

Consequences of a combination of no WCF operation in the study period, one year delay in NWCF startup, one year delay in Fluorinel startup and one year delay in availability of the FAST fuel basin are illustrated by Figures 13, 14, 15 and 16. Prediction of these difficulties and delays was assumed to come too late to cancel the processing planned for FY 1979; processing of Rover fuel would proceed as in the Baseline Program because Rover waste is to be put in tanks that will not be used for other wastes.

Figure 14 shows that waste inventory would approach 11,900 cubic metres, well in excess of limits. The excess after allowing for Rover waste in tanks WM-103, 4, 5 and 6 and for the 265 cubic metres of small tanks, is 360 cubic metres. To avoid storage of waste in the required spare tank, boildown of the nonfluoride waste in tank WM-183 to about 67% of its current volume and putting low-heat waste in the space made available would be necessary and is believed to be feasible.

Fuel processing was assumed to resume in November 1982; restart a few months earlier would be possible. Fuel storage capacity would be made adequate by installing additional racks; Figure 15 is based on 70 racks, the same as in Figure 11. Comparison of Figures 16 and 5 shows the additional space in the FAST basin that would be used.

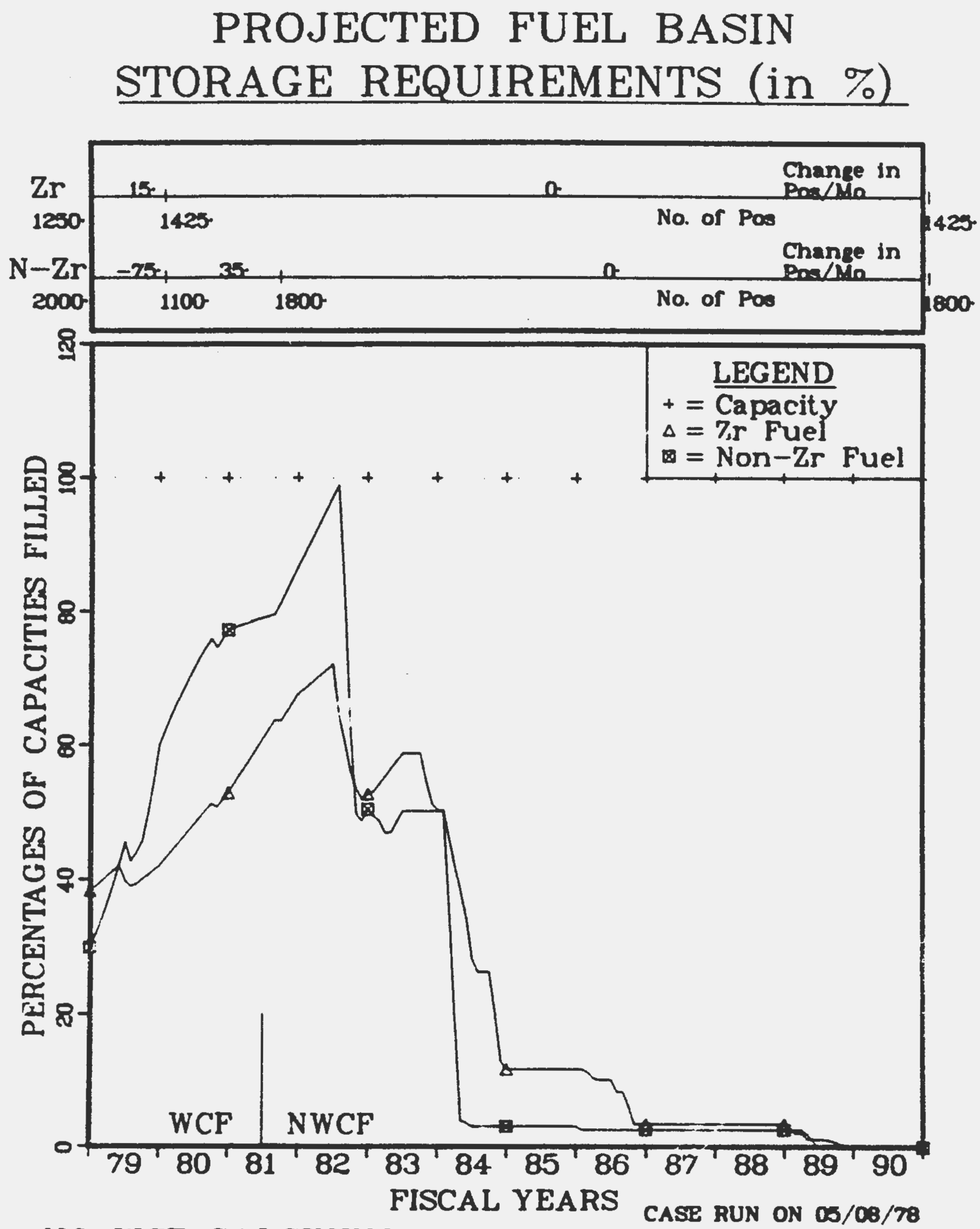
PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY



NO WCF CALCINING

FIG. 10

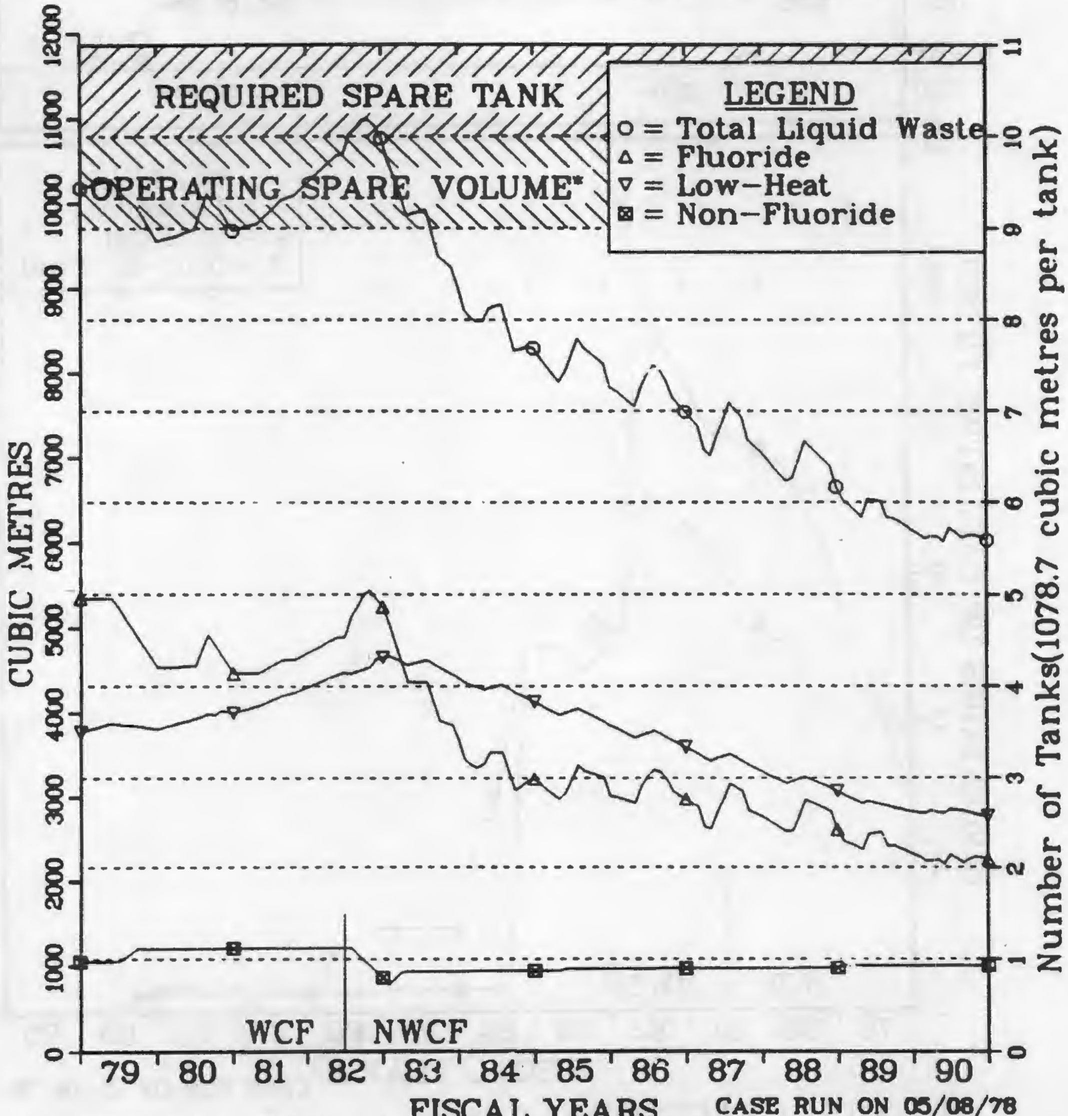
*NOTE: 265 CUBIC METRES AVAILABLE IN SMALL TANKS IS NOT SHOWN.



NO WCF CALCINING

FIG. 11

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY



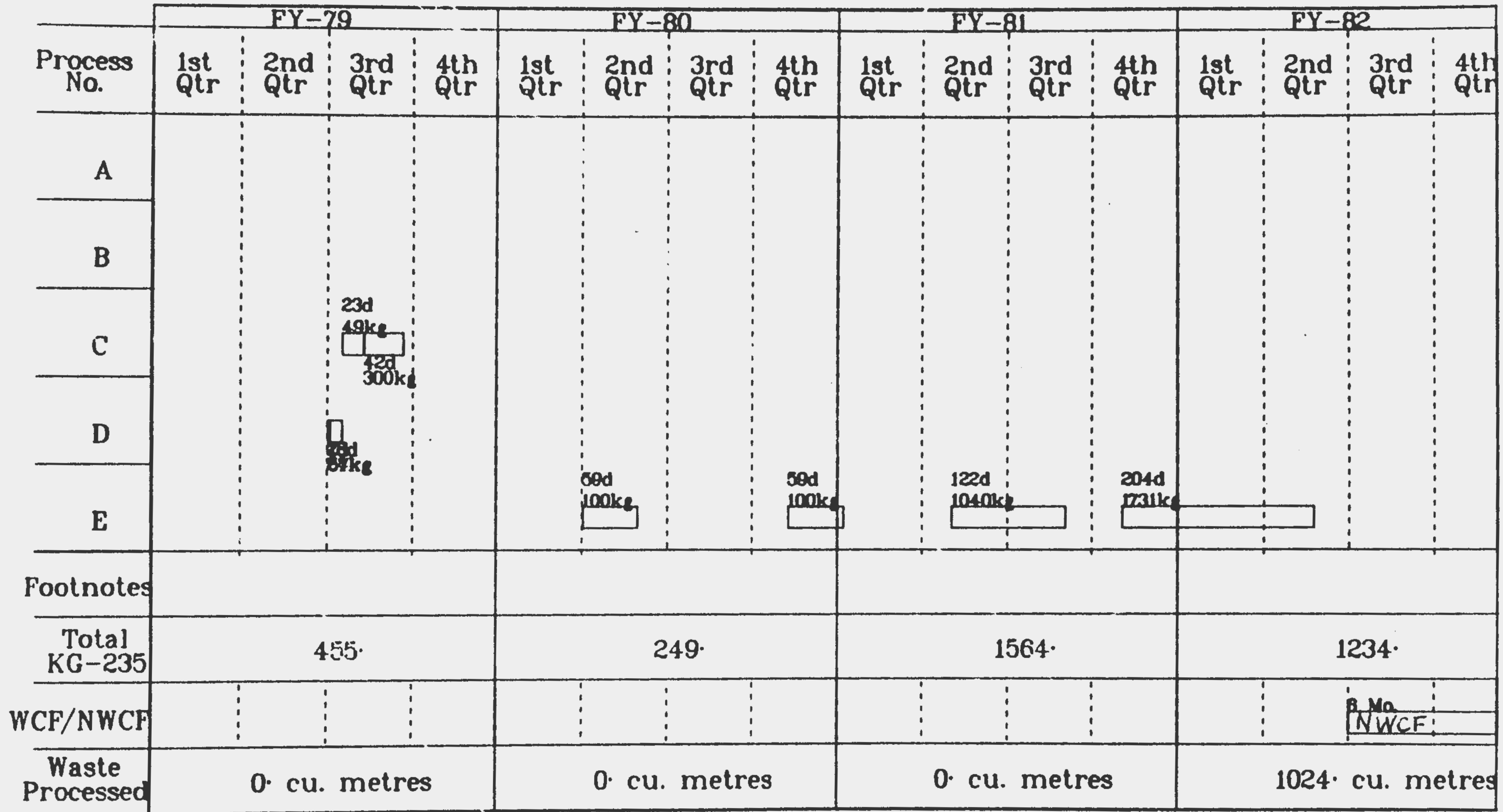
NWCF DELAYED 12 MONTHS

FIG. 12

*NOTE: 285 CUBIC METRES AVAILABLE IN SMALL TANKS IS NOT SHOWN.

NOTE: WCF Calcining as in the Baseline Program is assumed.

ICPP OPERATING SCHEDULE



Process
A=fuels 1
B=fuels 2,3,30
C=fuels 4,5,11
D=fuels 6,7,8
E=fuels 9,25

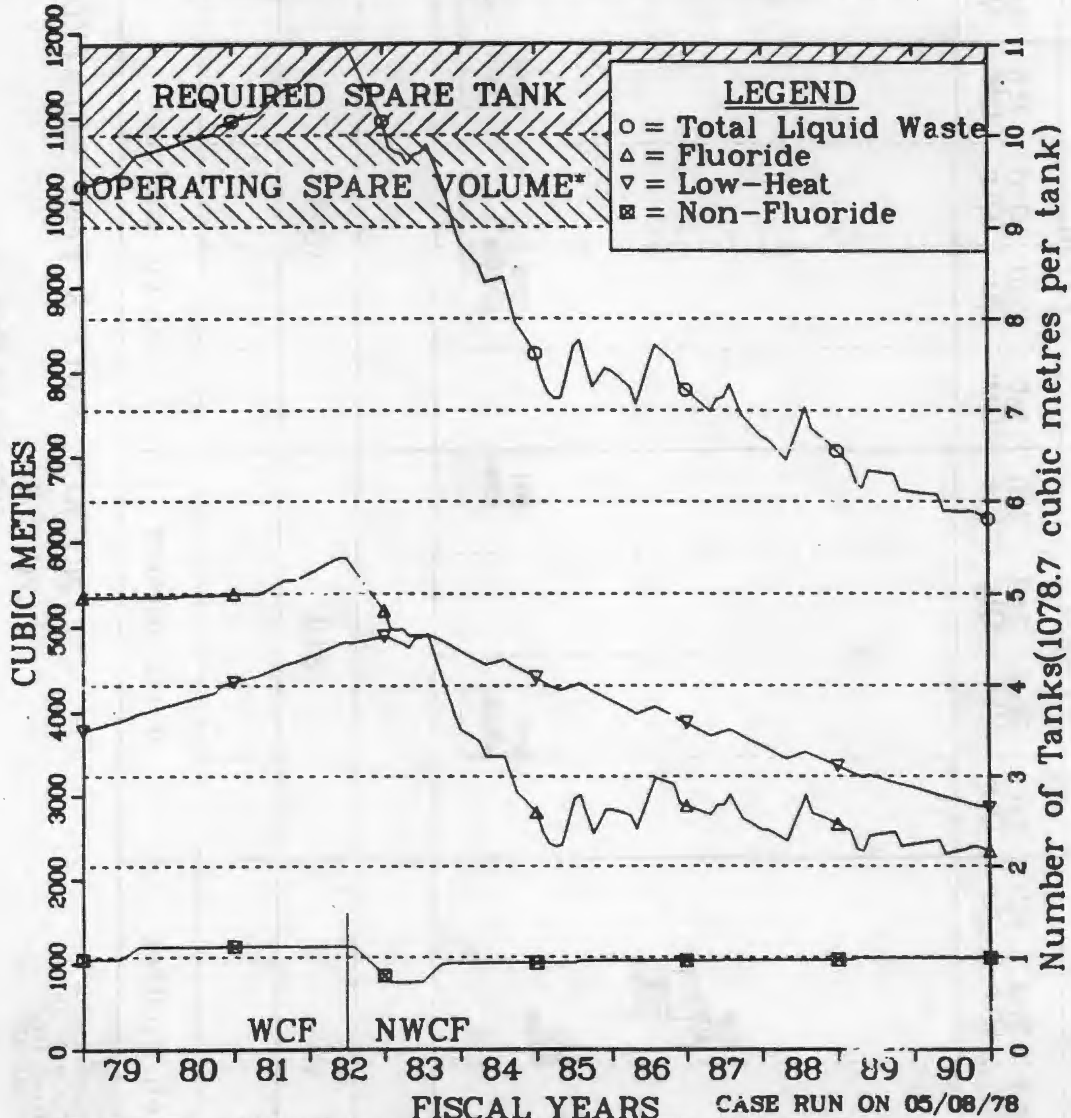
NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 13

CASE RUN ON 05/08/78

Fuels not included--10,19,29,33,12,13,14,15,16,17,18,21,22,23,26,27,28,34,35,

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY

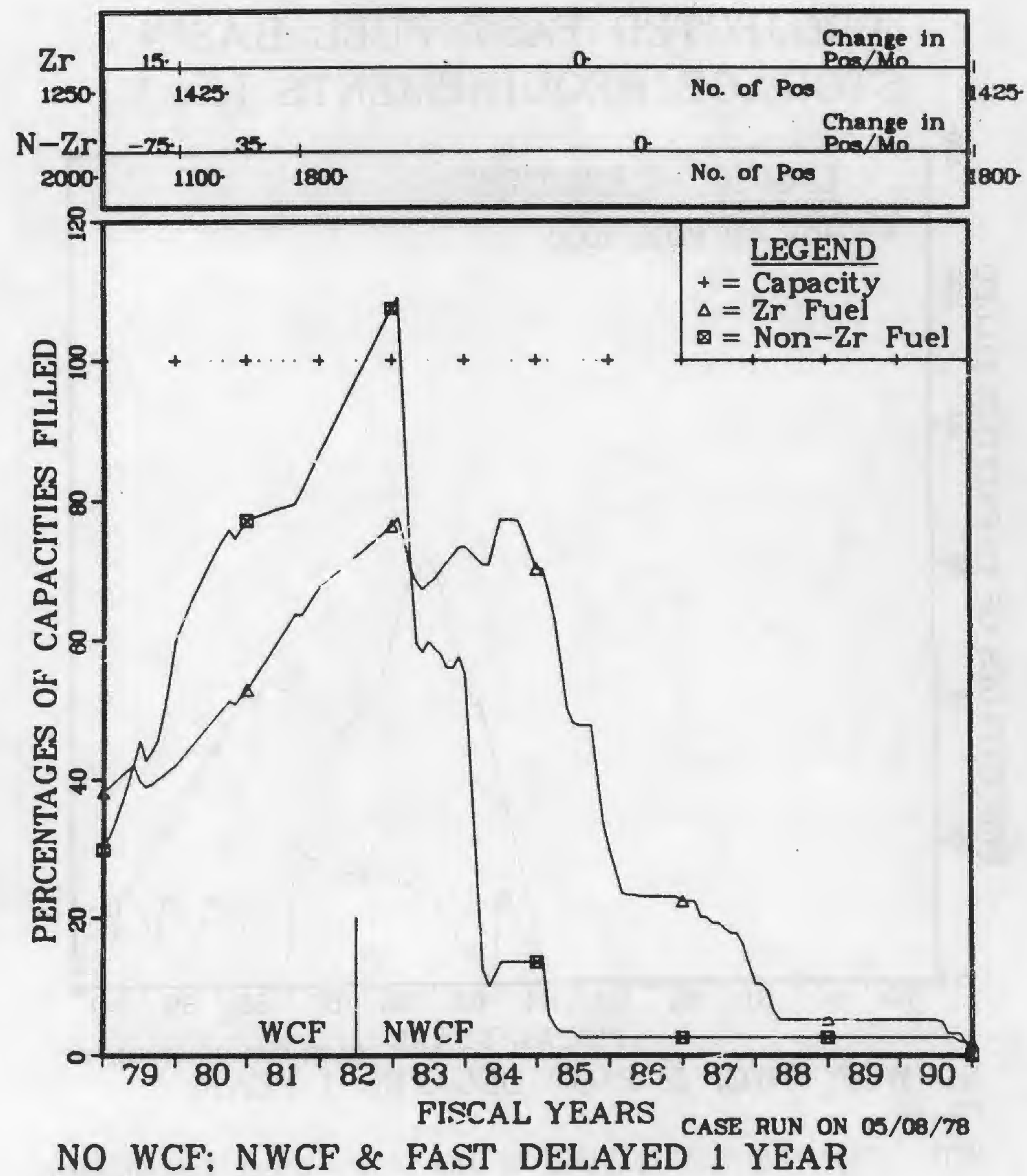


NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 14

*NOTE: 265 CUBIC METRES AVAILABLE IN SMALL TANKS IS NOT SHOWN.

PROJECTED FUEL BASIN STORAGE REQUIREMENTS (in %)



NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 15

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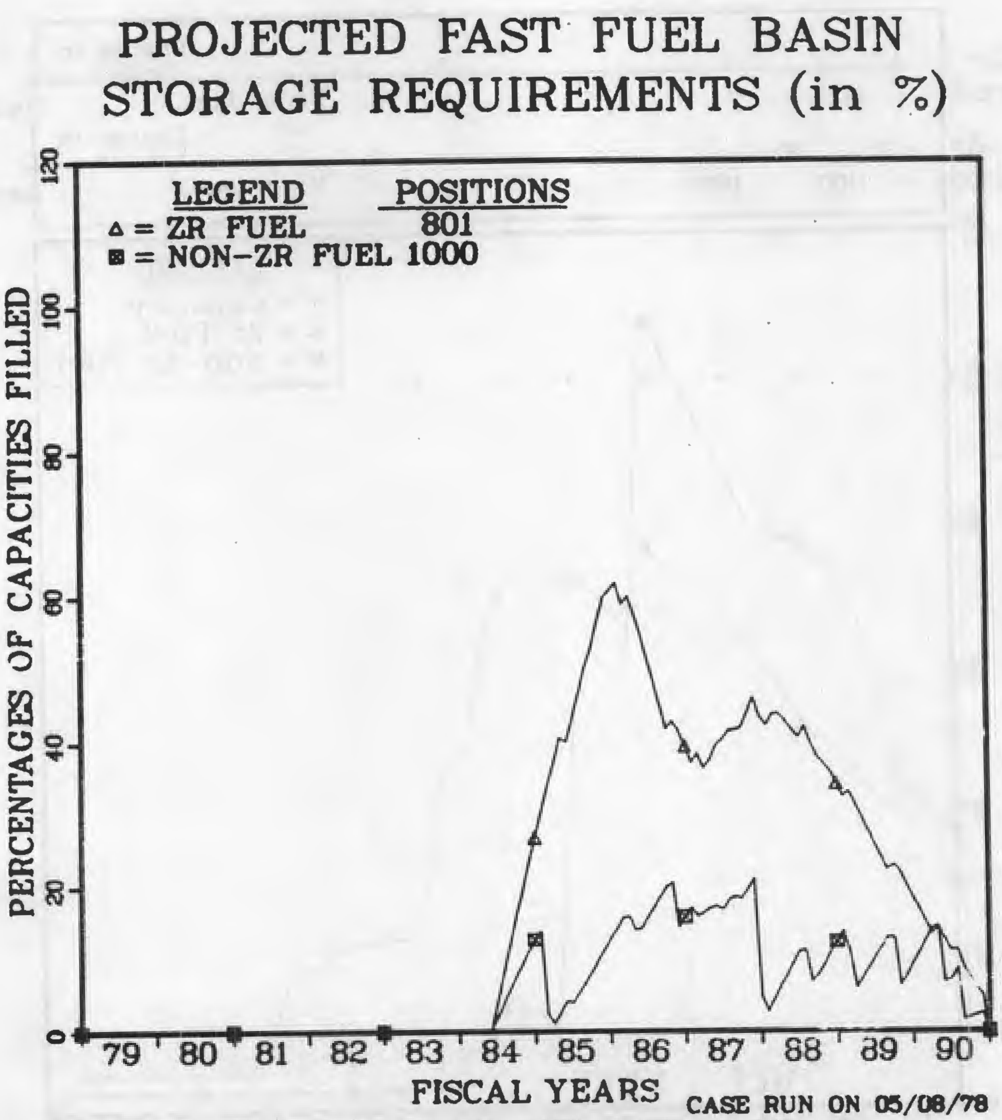

NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 16

NOTE: Possible modifications to the FAST Project for changed capability, under study by DOE-HQ, are not considered by this document and may require revision to the assumptions for this figure.

1.5 Sodium Waste Solidification Using Aluminum Nitrate

In the Baseline Program, a 3.5:1 volume ratio of Fluorinel and sodium-containing low-heat waste is calcined after Fluorinel waste becomes available. Purchase and addition of some aluminum nitrate to this blend may be necessary. A very conservative "worst case" has been simulated based on the following assumptions:

(1) Fluorinel waste must be calcined with an additive which reduces the net liquid-to-solid volume ratio by about 14%.

(2) For calcining, low-heat waste must be blended with purchased aluminum nitrate in a 2.5:1 mole ratio of aluminum to sodium. The volume ratio of low-heat liquid to total solids for this calcining would be 2.2:1.

(3) Fuel processing would be the same as in the Baseline Program.

Liquid and solid waste inventories projected in this simulation are in Figures 17 and 18. After rising between FY 1984 and FY 1989 while large reductions are being made in fuel inventories, fluoride waste inventories are nearly constant thereafter. Figure 18 shows that the projected capacity of calcine bins, which is the same as in the Baseline Program, would be adequate under these extreme assumptions.

2. CHANGES IN FUEL RECEIPTS

A 25% increase in receipts of all fuels associated with operating reactors could easily be accommodated in the Baseline Program. The largest increase that could be acommodated was not determined because an increase larger than 25% is not considered credible.

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY

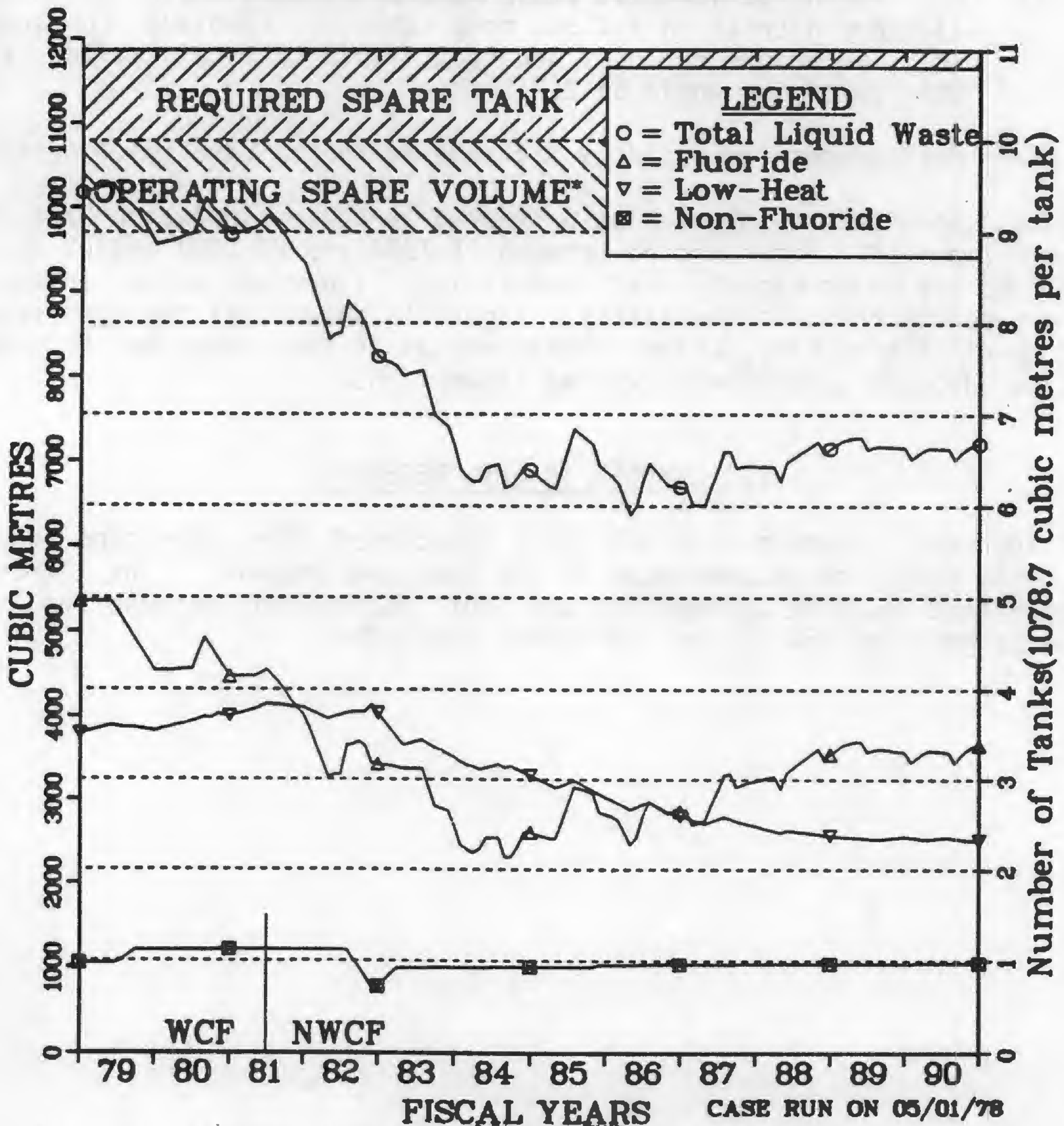

Fig. 17 - Assumes Aluminum Nitrate Used In Calcining Low-Heat Waste

*NOTE: 265 CUBIC METRES AVAILABLE IN SMALL TANKS IS NOT SHOWN.

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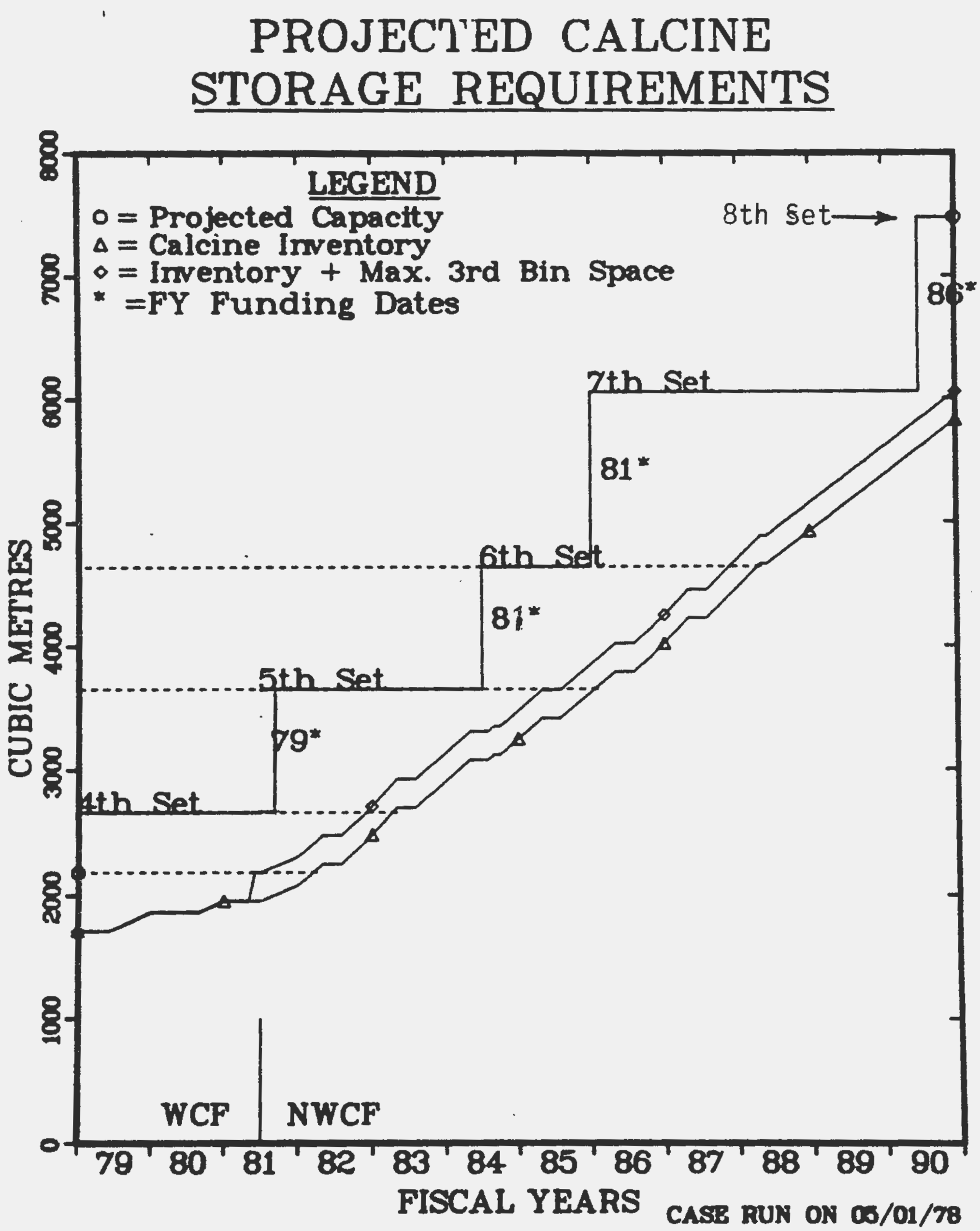

FIG. 18 - Assumes Aluminum Nitrate Used in Calcining Low-Heat Waste

IV. SCENARIO FOR MINIMUM ICPP COST

An ICPP operating scenario intended to achieve minimum costs at the ICPP is described in this section; the ICPP costs and product values estimated for the scenario are presented.

The Minimum-Cost Scenario is herein always called a scenario and not called the Minimum-cost Case, while the Baseline Program is also called the Baseline Case, to caution the reader against applying the usual interpretation to the incremental dollar quantities obtained by comparisons of the two. In comparison of two cases or two alternatives, the usual assumption is that the cases are complete and fully comparable. In other words, the usual assumption is that all significant costs and benefits associated with each alternative have been determined and used to make the comparisons, and that all other (unstated) costs are the same in each case. Previous MFPP documents have presented Irreducible-Expenditure Cases having this characteristic.

Adoption of the Minimum-Cost Scenario would require operations and expenditures at other sites to receive and then either store or process the spent fuels. The Scenario does not define other-site operations nor include these other-site costs.

The Minimum-Cost Scenario is useful for supplying the ICPP portion of the costs and production data needed for determining such things as (a) the overall economic value of fuel reprocessing at the ICPP and (b) the total economic loss or gain that would result if the Scenario, along with some scenario for revised or added operations at other sites, were to be adopted.

Detailed assumptions for the ICPP Scenario are:

(1) Fuel shipments to the ICPP would stop at the end of FY 1979.

(2) Eleven shipping casks and fuel handling equipment would be purchased for an estimated cost of $8.0 million. Rover fuel would be shipped in existing Government-owned casks.

(3) Shipment of fuels in the ICPP inventory to a location assumed to be 2500 km distant would begin with Rover fuel in FY 1980 and FY 1981. Cask design for shipment of other fuels would start by mid FY 1979 and the new casks would be available by FY 1982.

(4) Freight was estimated to cost $0.055 per tonne km ($0.0803 per ton mile).

(5) The inventory of radioactive liquid waste would be calcined and stored at the ICPP.

(6) The following line-item projects would be halted, and would not incur capital costs during the study period: FAST, Utilities

Expansion, Steam Generation, Plant Analytical Chemistry Building, and Renovation of Process Cells. The Calcine Transfer and Storage Project would be reduced in capacity from 2,400 to 1,350 cubic metres (85,000 to 47,700 cubic feet) and the transfer facility would not be built; the revised cost was roughly estimated to be $15 million.

(7) Unused equipment would be decontaminated and left in place.

(8) The utility operation and housekeeping required for nonproduction programs would be continued.

(9) Appropriate surveillance of the facilities and calcined wastes would be maintained.

(10) A small crew would handle the receipt, evaporation, and storage of wastes from other INEL facilities. However, costs for this work has been excluded from the Scenario.

The operations schedule for this Scenario is presented in Table IV, and the costs are described in Table V.

TABLE IV

ICPP-WCF PROCESSING SCHEDULE

CASE 2 -- MINIMUM-COST SCENARIO

	FY-79	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	FY-90	Totals
Fuels, kg													
Received	546	0	0	0	0	0	0	0	0	0	0	0	546
Processed	455	0	0	0	0	0	0	0	0	0	0	0	455
Inventory	4817	(Being reduced by shipments out)					0	0	0	0	0	0	
Non-Fluoride Waste, m^3													
Produced	156	0	0	0	0	0	0	0	0	0	0	0	156
Processed	0	0	0	1206	0	0	0	0	0	0	0	0	1206
Inventory	1206	1206	1206	0	0	0	0	0	0	0	0	0	
Fluoride Waste, m^3													
Produced	9	0	0	0	0	0	0	0	0	0	0	0	9
Processed	819	466	687	1820	1567	0	0	0	0	0	0	0	5359
Inventory	4540	4074	3387	1567	0	0	0	0	0	0	0	0	
Low Heat Waste, m^3													
Produced	264	240	240	240	240	240	200	200	200	200	180	180	2624
Processed	253	133	156	107	704	1070	1070	1070	1070	0	0	0	5633
Inventory	3811	3918	4002	4086	3622	2792	1922	1052	182	382	562	742	
Solid Waste, m^3													
Produced	154	89	125	409	404	486	486	486	486	0	0	0	3125
Inventory	1864	1953	2078	2487	2891	3377	3863	4349	4835	4835	4835	4835	
Days of Fuel Processing	82	0	0	0	0	0	0	0	0	0	0	0	82
Days of Calcining	212	121	182	273	273	273	273	273	273	0	0	0	2153

TABLE V

ICPP - WCF COST DATA

CASE 2 -- MINIMUM-COST SCENARIO

	FY-79	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	FY-90	Totals
A. Cost of Production													
Operation	26,240	16,000	17,000	16,000	15,000	15,000	14,000	13,000	13,000	6,000	3,000	3,000	157,240
R&D Costs	1,170	300	300	0	0	0	0	0	0	0	0	0	1,770
Freight	0	300	600	1,700	1,700	1,500	200	0	0	0	0	0	6,000
Production	27,410	16,600	17,900	17,700	16,700	16,500	14,200	13,000	13,000	6,000	3,000	3,000	165,010
B. Capital Costs													
Calcine Storage	500	6,500	8,000										15,000
NWCF	25,500												25,500
Priority Utilities	500												500
Security Upgrade	800												800
Casks and Handling Equip.		4,000	4,000										8,000
General Plant Projects	2,510	1,000	1,000	1,000	1,000	1,000	1,000	200	100	100	100	100	9,110
Capital Equip. - Prodn.	4,410	1,000	1,000	1,000	1,000	500	500	200	100	100	100	100	10,010
Capital Equip. - R&D	320	50	0	0	0	0	0	0	0	0	0	0	370
	34,540	12,550	14,000	2,000	2,000	1,500	1,500	400	200	200	200	200	69,290

V. CASH FLOW EVALUATIONS AND COMPARISONS

The cash flow evaluations for the Baseline Program and for the Minimum-Cost Scenario are presented in Tables VI and VII, respectively. In each table the quantity of product, its value in dollars (the benefit), ICPP costs, and the difference between these benefit and costs, which is called nondiscount cash flow, are listed. Present values of the dollar quantities are also shown.

A comparison of the Baseline Case and the Minimum-Cost Scenario is presented in Table VIII. The table summarizes the comparison for the 12-year period: FY 1979 through FY 1990. For an annual comparison at a 10% discount rate, refer to Figure 19.

The nondiscounted costs for the Baseline Case and the Minimum-Cost Scenario are $764 million and $234 million, respectively. The nondiscounted benefits for the Baseline Case and the Minimum-Cost Scenario are $689 million and $20 million; respective quantities of ^{235}U recovered are projected to be 15,209 and 455 kg. Thus, relative to the Minimum-Cost Scenario, the Baseline Case will recover 14,754 additional kilograms worth $669 million for an additional cost at ICPP of $530 million. The corresponding nondiscounted benefit-to-cost ratio is 1.26. Total incremental cost of the recovered uranium to the Government would be less than $530 million because costs for receipt and storage of spent fuels at some other site have not been included in the Minimum-Cost Scenario. As shown in Table VIII and Figure 19, corresponding present values (discounted at 10%) for the incremental ICPP benefits, costs, and net cash flows are $394, $393, and $1.5 million.

TABLE VI

ICPP-WCF CASH FLOW EVALUATIONS BEGINNING WITH FY 1979
(DOLLARS ARE IN THOUSANDS) CASE RUN ON 05/12/78

BASELINE PROGRAM-REVISED 4-3-78

FISCAL YEAR	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	POST	TOT
A. PRODUCTION														
1. PRODUCT, KG														
U-235	454	610	1569	2023	1005	1056	1891	1832	1439	1445	817	1062	0	15208
U-233	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NORMAL & DEPL. U	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	454	610	1569	2023	1005	1056	1891	1832	1439	1445	817	1062	0	15208
2. NON-DISC BENEFIT	19600	27700	71170	91780	45590	47910	85790	83110	65260	65570	37060	48170	0	688710
B. NON-DISCOUNTED COSTS														
PRODUCTION	27410	35720	37580	37070	37670	36030	37160	36810	36300	36070	35780	35700	0	429300
CONSTRUCTION	95540	84840	62670	83060	10690	10680	10150	12620	22100	22100	7100	7100	-140740	287910
WASTE ADJ.	0	0	0	0	0	0	0	0	0	0	0	0	46710	46710
TOTAL	122950	120560	100250	120130	48360	46710	47310	49430	58400	58170	42880	42800	-94030	763920
C. CASH FLOW ANALYSIS														
NON-DISC CASH FLOW	-103360	-92870	-29090	-28360	-2780	1200	38480	33680	6860	7400	-5830	5370	94030	
PRESENT WORTH AT 10.0 %	-103360	-84420	-24040	-21310	-1900	750	21720	17290	3200	3140	-2250	1890	29970	
CUMULATIVE PRESENT WORTH	-103360	-187780	-211820	-233120	-235010	-234270	-212550	-195270	-192070	-188940	-191180	-189300	-159330	-159330

D. SUMMARY

PERCENT DISCOUNT	TOTAL DISCOUNTED BENEFITS	TOTAL DISCOUNTED COSTS	DISCOUNTED BENEFIT-TO-COST RATIO	TOTAL PRESENT VALUE OF NET CASH FLOW
0.0	688670.	763920.	0.90	-75240.
7.50	464510.	611470.	0.76	-146950.
10.00	413920.	573240.	0.72	-159320.
12.50	371450.	539770.	0.69	-168310.
15.00	335540.	510330.	0.66	-174790.
20.00	278720.	461280.	0.60	-182550.

TABLE VII

ICPP-WCF CASH FLOW EVALUATIONS

CASE 2 -- MINIMUM COST SCENARIO

	FY-79	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	FY-90	Totals
A. Production													
1. U-235, kg	455	0	0	0	0	0	0	0	0	0	0	0	455
2. Nondiscounted Benefit	19,590	0	0	0	0	0	0	0	0	0	0	0	19,590
B. Nondiscounted Costs ($000)													
Production	27,410	16,600	17,900	17,700	16,700	16,500	14,200	13,000	13,000	6,000	3,000	3,000	165,010
Construction	34,540	12,550	14,000	2,000	2,000	1,500	1,500	400	200	200	200	200	69,290
Total	61,950	29,150	31,900	19,700	18,700	18,000	15,700	13,400	13,200	6,200	3,200	3,200	234,300
C. Cash Flow Analysis ($000)													
Nondiscount Cash Flow	-42,360	-29,150	-31,900	-19,700	-18,700	-18,000	-15,700	-13,400	-13,200	-6,200	-3,200	-3,200	-214,710
Present Worth @ 10%	-42,360	-26,500	-26,364	-14,800	-12,772	-11,177	- 8,862	- 6,876	-6,158	-2,629	-1,234	-1,122	-160,854

D. Summary

% Discount	Benefits	Costs	Present Value of Net Cash Flow
0.0	19,590	234,900	-214,710
7.5	19,590	190,950	-171,360
10.0	19,590	180,444	-160,854
12.5	19,590	171,338	-151,748

TABLE VIII

SUMMARY OF ICPP DATA FOR BASELINE PROGRAM AND MINIMUM-COST SCENARIO

FY 1979 THROUGH FY 1990

	BASELINE PROGRAM (CASE 1)	MINIMUM ICPP COST SCENARIO (CASE 2)
PRODUCTION, KG		
U-235	15208	455
U-233	0	0
ENDING INVENTORIES		
LIQUID WASTE,1000 GAL	617.5	0.7
SOLID WASTE,1000CU FT	5.1	4.8
CAPITAL COSTS ($000)		
LINE ITEMS	326700	49800
GPP	41640	9110
RCE	60310	10380
ENDING CAPITAL CREDIT	-140740	0
ENDING WASTE COST	46710	0
PRODUCTION COST	429300	165010
TOTAL ICPP COST($000)	763920	234300(A)
PRESENT ICPP COST	573240	180444
FULL PRODUCT VALUE	688670	19590
PRESENT PRODUCT VALUE	413920	19590
ICPP CASH FLOW (ICF)	-75250	-214710
PRESENT VALUE OF ICF	-159320	-160854
INCREMENTAL TO SCEN. 2		
PRODUCT VALUE	669080	0
ICPP COST	529620	0
ICPP CASH FLOW	139460	0
ICPP BEN./ICPP COST	1.263	0.0
INCREMENTAL TO SCEN. 2 AND PRESENT VALUES AT 10% DISCOUNT RATE		
PRESENT PROD. VALUE	394330	0
PRESENT ICPP COST	392796	0
PRESENT VALUE OF ICF	1534	0
ICPP BEN./ICPP COST	1.004	0.0

(A) THE MINIMUM-COST SCENARIO EXCLUDES COSTS AT OTHER SITES.

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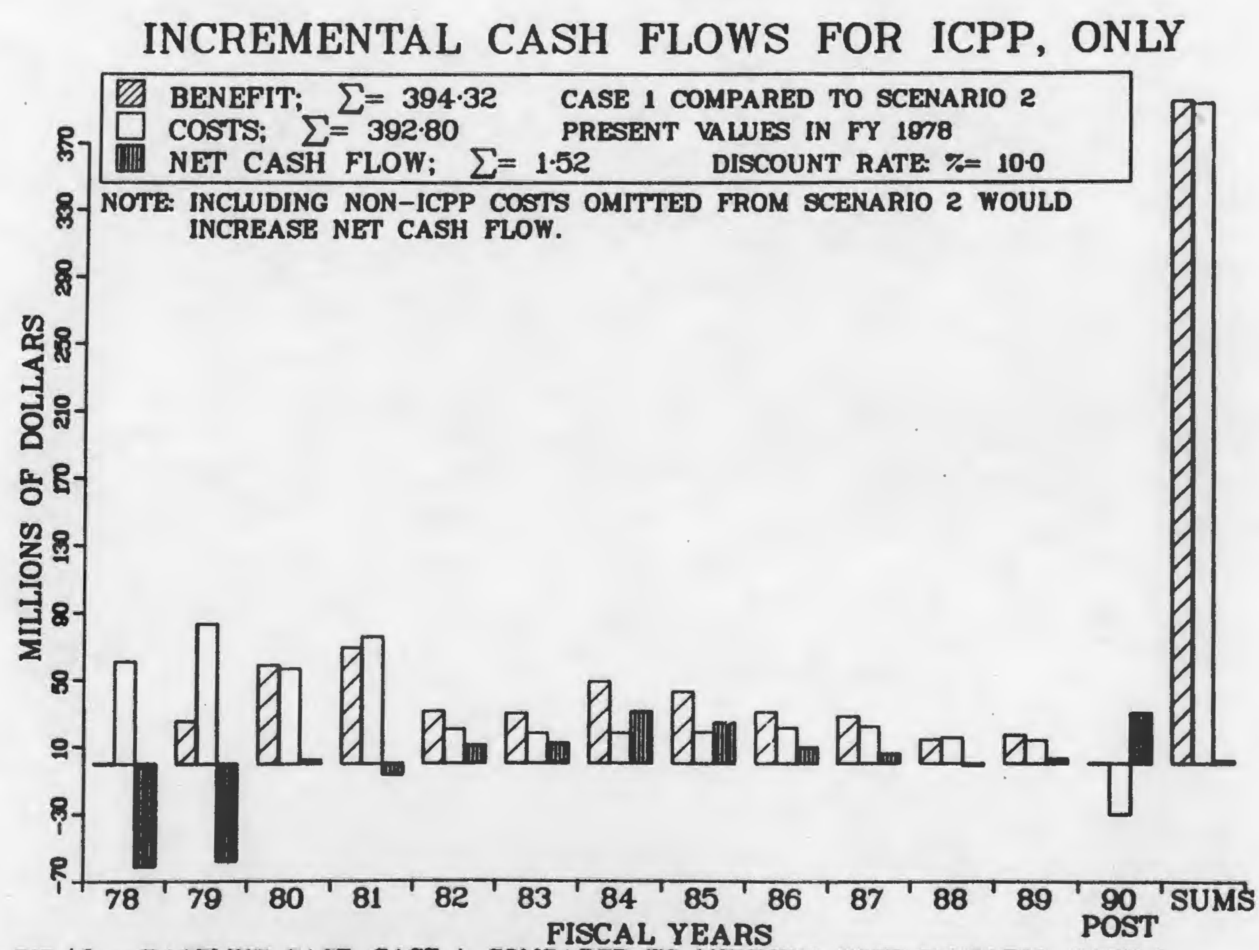


FIG. 19 --BASELINE CASE, CASE 1, COMPARED TO MINIMUM-COST SCENARIO, CASE 2

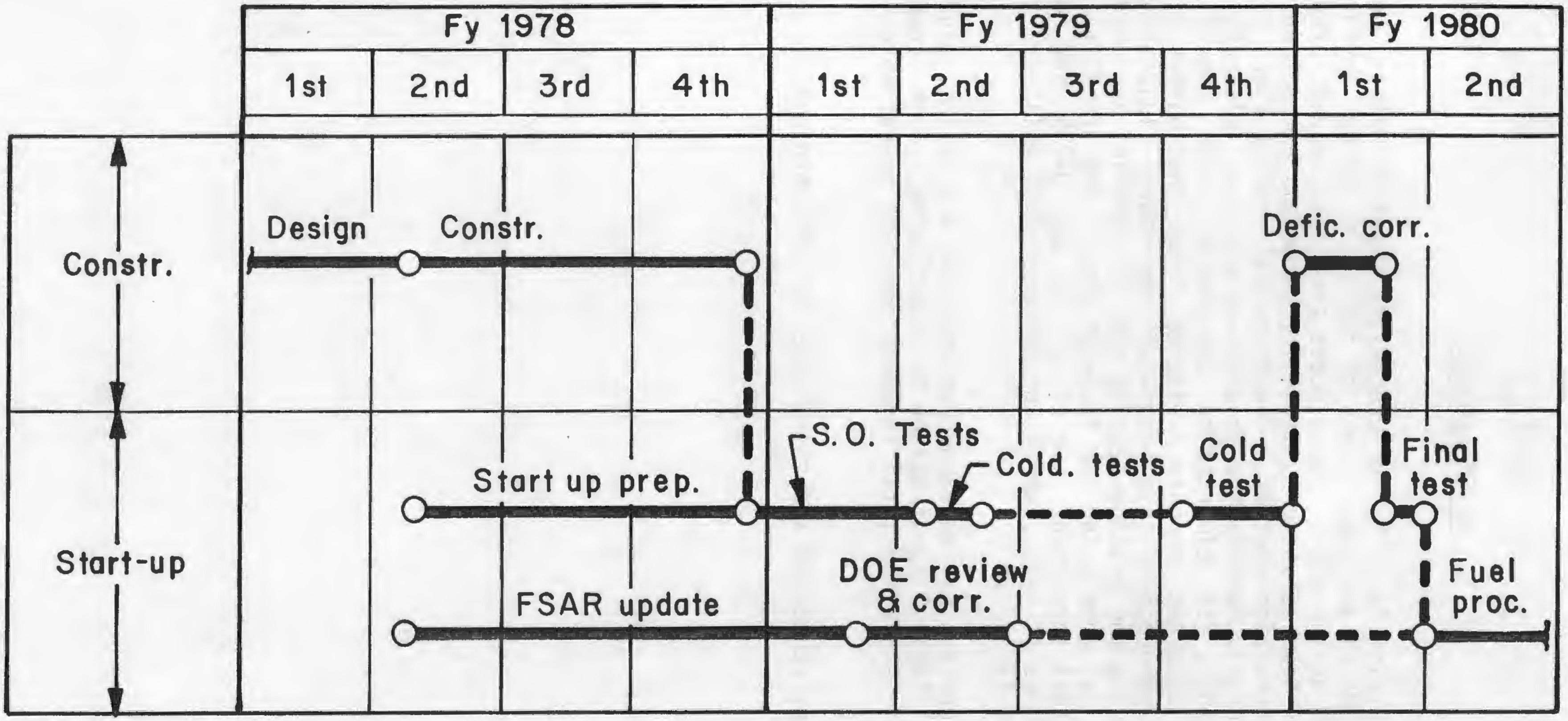
VI. PROJECTS

1. ROVER PROJECT

A Rover Fuels Processing Facility for processing graphite-matrix Rover (nuclear rocket), UHTREX and other graphite fuels is being installed in Building CPP-640 at the ICPP. The process provides headend preparation of an aqueous feed solution suitable for uranium extraction in existing solvent extraction systems. The principal process steps consist of (a) continuously burning the graphite-matrix fuel elements in a fluidized-bed burner, (b) elutriating the metal oxide combustion products and small unburned graphite particles from the burner, (c) burning the remaining graphite in a batch-fed secondary fluidized-bed burner, (d) dissolving the uranium-bearing ash in nitric and hydrofluoric acids, and (e) complexing the fluoride ion. The facility is designed for a nominal throughput rate of 30 kg of U-235 per day. Approximately 3,100 kg of U-235, worth an estimated $140 million, will be processed in the facility.

The Rover headend process was developed at the ICPP via pilot studies beginning in 1966. Phase-2 construction is continuing, with completion expected in FY 1978. The total construction cost is estimated at $7.875 million.

Figure 20 summarizes schedules and milestones for this project.



Rover Phase 2 Planning Network

FIGURE 20

2. NWCF

Description

A New Waste Calcining Facility (NWCF) is being provided at the ICPP to replace the existing Waste Calcining Facility (WCF). The NWCF is scheduled for hot operation in April 1981. The facility will incorporate the latest available technology in the areas of calcination, off-gas cleanup, remote operation, and decontamination. Design features will minimize personnel radiation exposures and adverse environmental impacts while achieving high on-line availability. The NWCF will be used to process blends of aluminum nitrate, zirconium fluoride, stainless steel nitrates, and other miscellaneous wastes generated during the solvent extraction recovery of uranium from spent nuclear fuels. These liquid wastes will be solidified by spraying the solution into a heated bed of particles fluidized with air. A net processing rate of at least 11.36 m^3/d (3,000 gpd) will be possible in the new facility.

History

The existing Waste Calcining Facility was built in the early 1960s as a pilot plant unit to demonstrate the solidification (calcination) of highly radioactive liquid waste in a heated, fluidized bed. Since its completion, the WCF has served as a production facility and has been used to convert some 12,000 m^3 of liquid waste into 1700 m^3 of solids. Recent operating experience (frequent shutdowns for repair) with the existing facility, however, has shown that if the total volume of liquid waste presently stored at the ICPP plus that continually being produced by fuel reprocessing operations is to be processed, a new calcining facility must be constructed. This new facility will provide a number of process and facility improvements, which experience with the existing facility has shown are needed, including a higher waste throughput; more corrosion-resistant materials of construction; better cleanup of effluent streams; more effective contamination control; and, most important, significant remote maintenance and equipment replacement capability.

Justification

A waste calcining facility is essential to solidify radioactive wastes, reduce volume, and thus make space available in existing liquid waste storage tanks for interim storage of fresh waste generated when processing irradiated fuels to recover ^{235}U. The existing WCF was designed and operated to demonstrate fluidized-bed solidification of radioactive aluminum nitrate wastes. However, the facility also has been used to process highly corrosive zirconium fluoride wastes which have increased corrosion to the process system and have resulted in increasingly frequent equipment failures and high residual radiation fields. All these conditions lead to high annual personnel radiation exposures and have limited the life of the WCF.

Cost Data

The total estimated cost of the NWCF Project is $76 million, based on a negotiated cost estimate of $72.75 million for the NWCF and on an allowance of $3.25 million for utilities services called the Priority Utilities Project (PUP - see Section VI-3). Of the $72.75 million, approximately $13.1 million is for engineering design, $1.3 million for project management and remote mockups, $57.05 million for construction, and $1.3 million for contingency. In addition to the $76 million estimated cost, the Department of Energy is maintaining an additional contingency for management reserve of $4.5 million for the NWCF and $0.5 million for the PUP; thus, total obligations for the project are to be $81 million: $77.25 million for the NWCF itself and $3.75 for the PUP. Obligations of $55 million have been authorized as of the end of FY 1978 and, as shown in Table III, obligations of $25.5 million for the NWCF and $0.5 million for the PUP are requested for FY 1979.

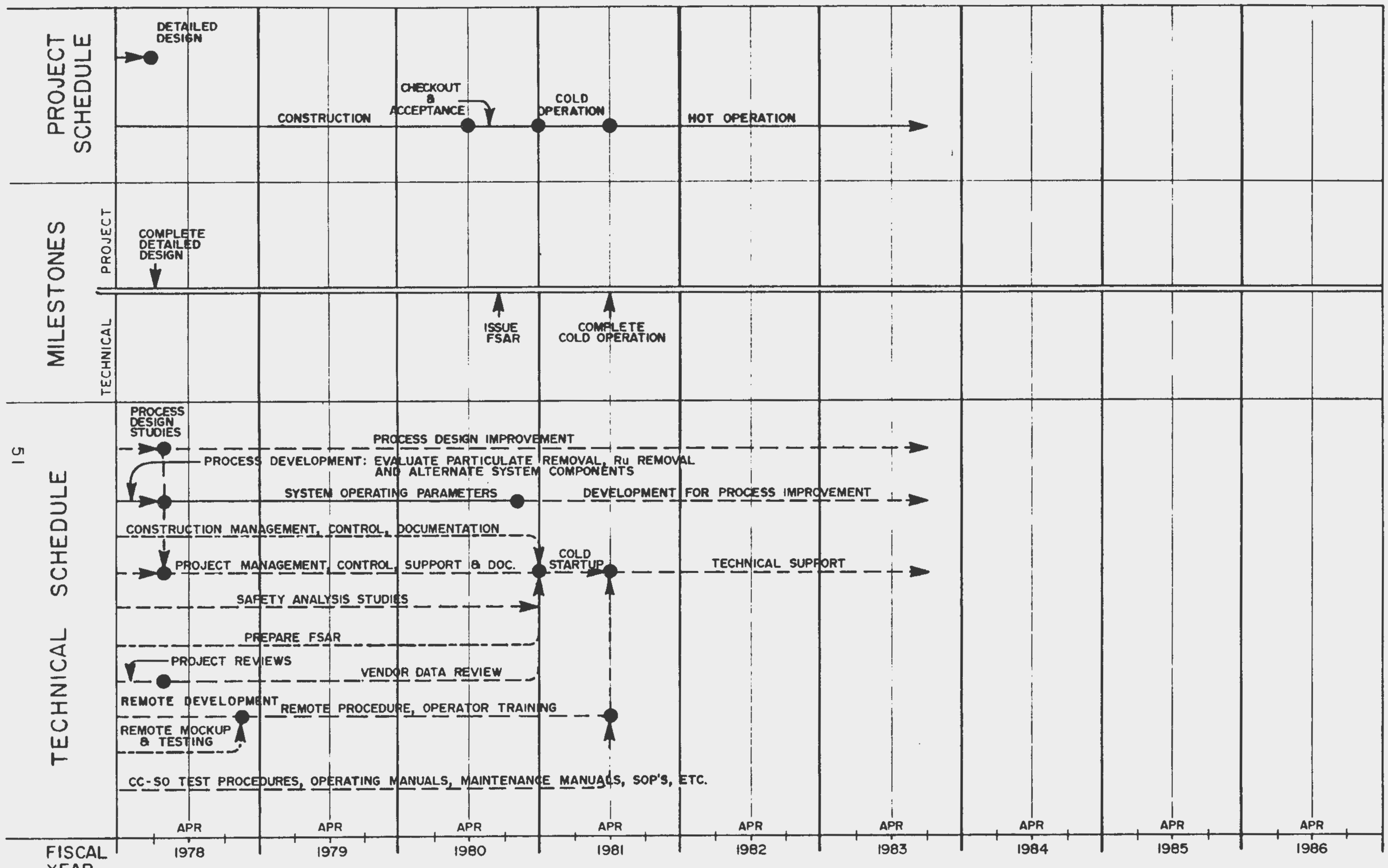
Design Requirements

Conceptual design of the NWCF began in February 1974 and was completed in February 1976. Approximately $1 million was spent in this effort.

Title I design began in February 1976 and was completed in July 1976. Title II design started in July 1976 and was completed in December 1977.

Schedule

The major milestones associated with this project are shown in the diagram (Fig. 21) and indicate a design completion date of January 1978 and a construction and checkout completion date of about October 1980. Checkout will be followed by six months in which readiness for hot operation will be proved by periods of operation with cold feed. Hot operation is scheduled to begin in April 1981.



PROJECT MILESTONE CHART
NEW WASTE CALCINING FACILITY
FIGURE 21

3. PRIORITY UTILITIES PROJECT

Description

This Project consists of installing additional utility production and distribution capacity to support startup and operation of the NWCF and heating of the new maintenance building. Included are utility tunnels, a new boiler, a new demineralizer, a new degassifier, and distribution piping for steam, air, water, oxygen, nitric acid, and sewage.

History

The project was authorized in August 1977 when it was recognized that utilities from the Utilities Replacement and Expansion Project would not be available in time to support NWCF Startup. The Priority Utilities Project was authorized from NWCF contingency funds. Conceptual design was completed October 1977. Detail design was completed April 1978. The project was divided into two construction contracts with the underground CPFF portion being started in March 1978. The mechanical portion is currently in the bidding process.

Justification

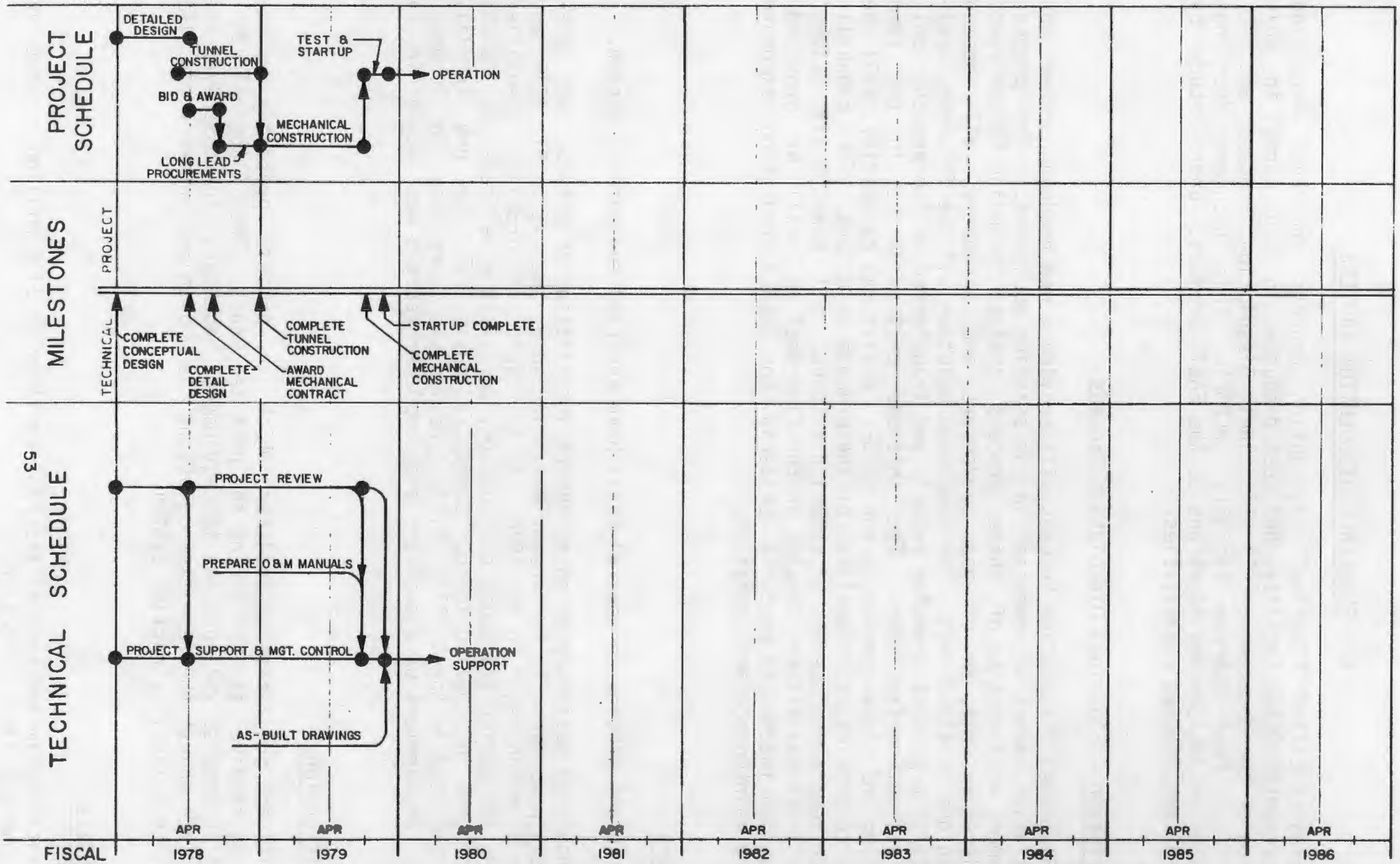
The Utility production capacity available from this project is needed to support startup of NWCF, the New Maintenance Building and FAST construction. The needs of these projects cause current plant utility production capacity to be exceeded.

Cost Data

The total estimated cost of this project is $3.75 million.

Schedule

Figure 22 shows the schedule and milestones for this project.



PROJECT MILESTONE CHART
PRIORITY UTILITIES PROJECT
FIGURE 22

4. FLUORINEL DISSOLUTION PROCESS

The project called "Fluorinel Dissolution Process and Fuel Receiving Improvements" (FAST Facility) has been discussed in two parts in this section of the document: (1) Fluorinel Dissolution Process and (2) Metal Clad Fuel Storage Facility (MCFSF). This document does not consider or include modifications to the FAST project, under study by DOE-HQ, for changed capabilities.

Description - Fluorinel Dissolution Process

The Fluorinel Dissolution Process will provide a new headend system for fuels which cannot be processed in the existing equipment. The process equipment will consist of three process trains including dissolvers, complexer vessels, and off-gas condensers and scrubbers, all located within one shielded cell. The complexed solution will be filtered, collected in a product transfer vessel, and transferred to the present solvent extraction facilities. The shielded cell will be in the same building and close-coupled to the MCFSF. Analytical capability will be added to provide rapid analyses of the process solutions. The capability for remote replacement of vessel dip-tubes, all pumps, all valves, and all off-gas filters located in the Fluorinel cell will be provided. The design intends to meet the criteria for ALARA radiation exposure during maintenance and operation.

History

Pilot plant studies on several fuels have verified the process design.

A conceptual design based on equipment installation in CPP-601 was previously prepared. R. M. Parsons was selected as the A-E in FY 1976 and Title I design began in May 1976. As a result of problems identified during the design and model costruction, decisions were made to locate the process in a new building. Conceptual design for the new facility was completed in April 1977. Title I design was completed in December 1977. Procurement of dissolvers and complexer vessels was begun in FY 1978.

Justification

Significant quantities of fuel for which no process presently exists will be received at ICPP during the next ten years. The Fluorinel Dissolution Process will provide the equipment necessary to dissolve the fuels and adjust the resulting solutions for uranium recovery in the existing solvent extraction system.

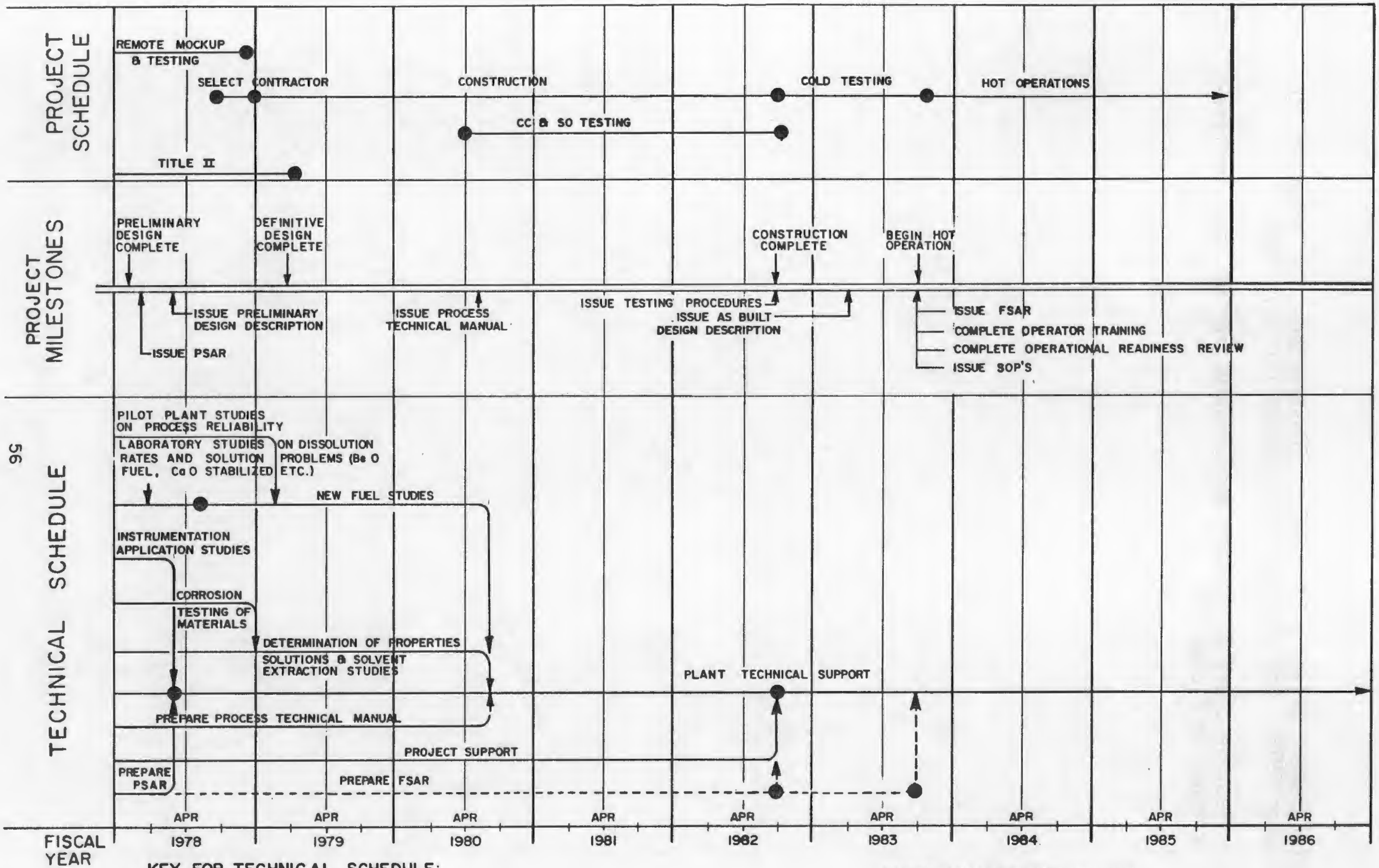
Cost Data

The total estimated cost of the FAST Facility is $116 million, based on 35%-complete Title II design.

Schedule

Long-lead procurement began in FY 1978. Construction is expected to start in October 1978. Hot startup is projected for July 1983.

The project milestone chart for design and construction of the processing system is shown in Figure 23.



KEY FOR TECHNICAL SCHEDULE:
—— PROJECT SUPPORT FUNDING
---- PROJECT FUNDING

PROGRAM MILESTONE CHART
FLUORINEL PROGRAM
FIGURE 23

5. METAL-CLAD FUELS STORAGE FACILITY

Description

The Metal-Clad Fuels Storage Facility (MCFSF) will provide a new and versatile facility for the receipt, storage, and preparation of irradiated metal-clad nuclear fuels that are scheduled for future receipt at the ICPP. The MCFSF will be located adjacent to the new Fluorinel Head-end Process and the two facilities will be integrated into one building. It will be a stainless-steel-lined, deep-water basin using wet unloading, wet cutting, and water-filled transfer-canal concepts. Storage will be provided for about 1800 fuel units. This document does not consider or include modifications to the FAST project, under study by DOE-HQ, for changed capabilities.

History

The existing storage facility at CPP-603 is used to store the irradiated fuel presently received at the ICPP. New fuel handling and storage capabilities are required to provide for future irradiated metal-clad fuels. The original concept was an additional "North Transfer Basin" to be located adjacent to the existing basins; however, various alternatives were evaluated, and the present concept was selected.

Justification

This new storage facility will replace the existing storage facility because of the present inadequate water depth, crane capacity, or clear height necessary to receive, store, and handle the future assigned fuels. In addition, the existing facility was not designed to today's seismic standards for this area, has only single confinement of fuel, has a history of increasing personnel radiation exposure, has increasing problems of contamination control, and requires increasing maintenance effort, all of which are attributable to the expanded scope and operating charter of a facility designed to the requirements of over 25 years ago. The MCFSF will provide improved personnel safety, personnel radiation exposure, maintainability, and operability. The MCFSF design will comply with current applicable codes, standards, and regulations.

Cost Data

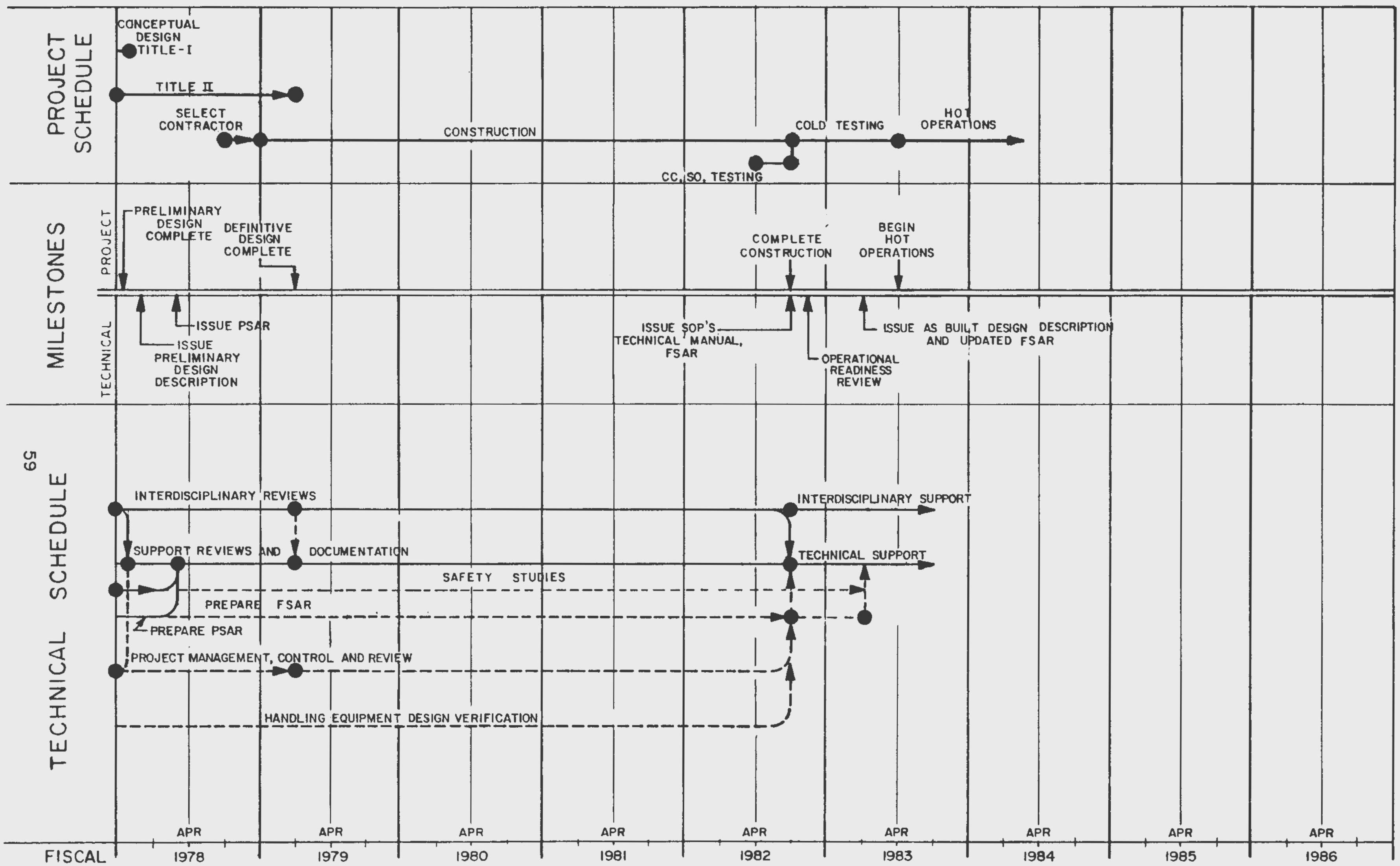
The total estimated cost of the FAST facility is $116 million based on 35%-complete Title II design.

Conceptual Design Requirements

Conceptual design for the MCFSF began in the first quarter of FY 1977 and was completed the second quarter of FY 1977. Approximately $128,000 was spent in FY 1977 to complete the conceptual design.

Schedule

The project and technical milestone chart for design and construction of the MCFSF is shown in Figure 24 along with the project and technical schedules.



KEY FOR TECHNICAL SCHEDULE:
——— OPERATING FUNDS
– – – – CAPITAL FUNDS

PROJECT MILESTONE CHART
METAL-CLAD FUELS STORAGE FACILITY
FIGURE 24

6. SAFEGUARDS AND SECURITY UPGRADE PROJECT

Description

The Safeguards and Security Upgrade Project at the ICPP upgrades and improves the physical security and safeguards systems for the protection of special nuclear material. Provided are (1) a new guardhouse with a centralized monitoring station, (2) remotely located surveillance and alarm equipment, (3) new and upgraded physical barriers, (4) control of personnel access to security areas, and (5) personnel surveillance at the plant entrance (through the new guardhouse). The two-mile plant perimeter will be equipped with an intrusion alarm system and an improved lighting system along the perimeter security fence.

Justification

This project accomplishes the highest priority tasks in the area of upgrading and improving safeguards and security at the ICPP. This first phase is directed at providing the capability for the prevention or timely detection of attempted diversions of special nuclear materials and the response to any attack by armed intruders in compliance with requirements of DOE IMD 6103 and 6104. Additional phases of this program are currently being defined to assure full compliance with DOE requirements.

Cost Data

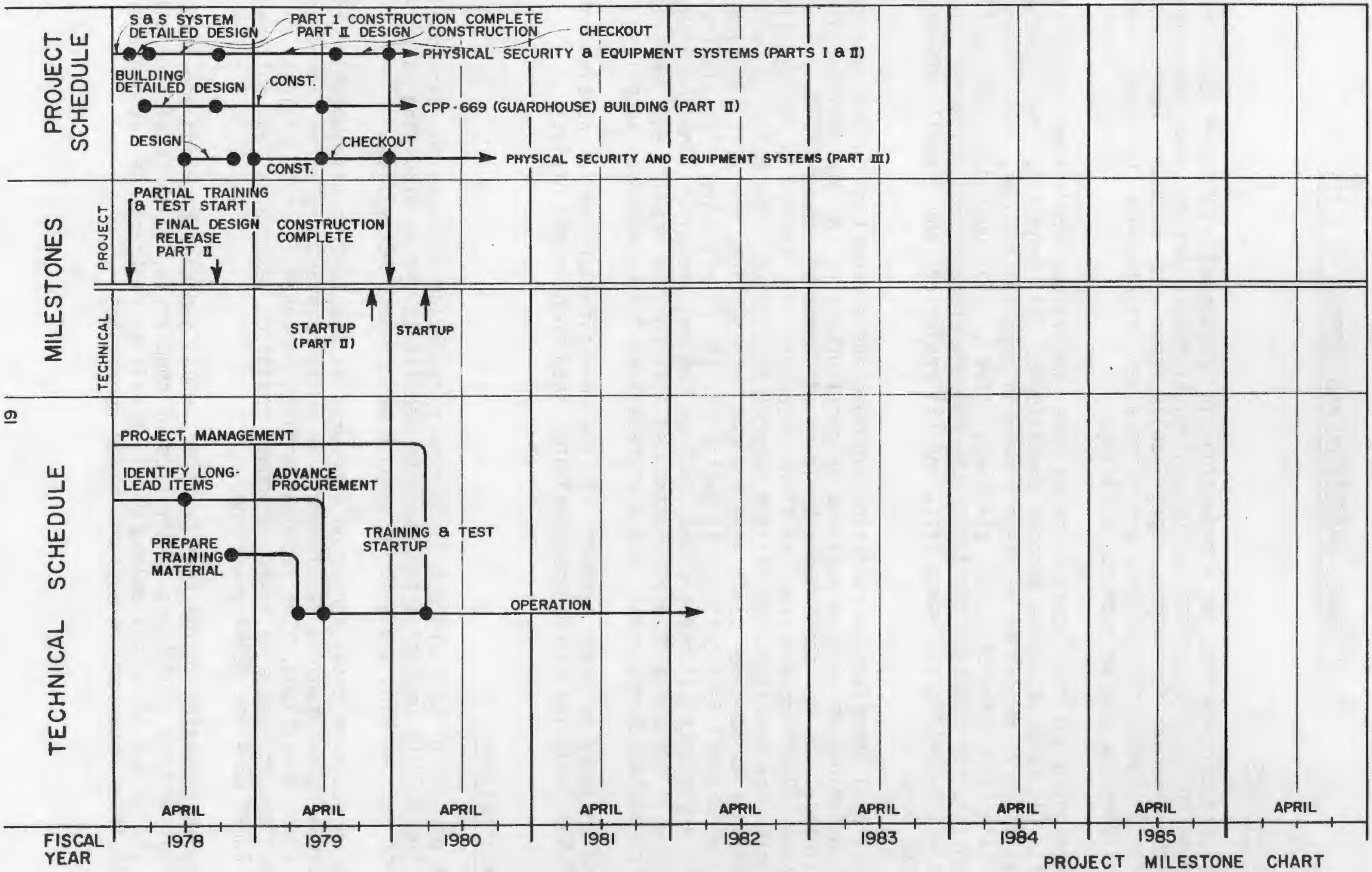
The total estimated cost of the Safeguards and Security Upgrade Project is $2.3 million. Of this amount, approximately $0.3 million is for engineering services, $0.9 million is for construction, and $0.8 million is for electronics equipment. The remaining $0.3 million is for project administration and contingency.

Design

Conceptual design started in 1974 and was completed initially in 1975. Since that time, the project has been redefined several times. Conceptual design was completed in June 1977, and detailed design was started then. The design and construction was divided into three parts. Part I was completed on February 10, 1978; Part II design was completed in May 1978; Part III design is scheduled to start in May 1978 and scheduled to be completed by September 1978. Part II design will include a new entrance road and a bus parking lot.

Schedule

The major milestones associated with this project are shown in the companion diagram (Figure 25) and indicate a construction completion date of about September 1979.



PROJECT MILESTONE CHART
SAFEGUARD & SECURITY UPGRADE

FIGURE 25

7. PERSONNEL PROTECTION AND SUPPORT FACILITY

Description

This project provides for a reduction in personnel radiation exposure and an increase in contamination control by modernization and upgrading of the existing facilities. Specifically, this will include: providing certain plant modifications, providing a new maintenance building, and modifying the old maintenance building.

The eight plant modifications being done to reduce radiation exposure are: (1) relocating the process centrifuges, (2) upgrading the sample stations, (3) providing an in-cell surveillance hatch cover, (4) lining certain cell entrances with stainless steel, (5) upgrading the cell lighting, (6) remotely monitoring the primary process HEPA filters, (7) replacing certain cell-sump jets, and (8) replacing the E-cell off-gas scrub pump.

Additional decreases in radiation exposure and a reduction in the spread of contamination will be achieved by construction of a new maintenance building. The new maintenance building will provide about 5480 square metres (59,000 square feet) of floor space and is sized to house all maintenance functions and related support facilities. The building will contain a maintenance craft area divided into sections for (1) welding, (2) structural fabrication, (3) machining, (4) pipefitting, (5) instrument and electrical repair, and (6) mechanical repair. The building also will contain a separate controlled area for the repair and testing of contaminated equipment, and a storage area for maintenance supplies.

Also included in this project is the modification of a portion of CPP-630 (existing maintenance building) into much-needed offices.

Justification

The purpose of this project is to reduce radiation exposure to personnel at the ICPP by upgrading the existing facilities and by providing sufficient safe working space for expanding maintenance activities.

The increase in total radiation exposures at the ICPP is attributable to increasing maintenance requirements in an aging plant and to an increase in plant operations. The remedial actions proposed in this project reflect the principle of lower personnel radiation exposures as outlined in ERDAM 0524 and ALARA guidelines.

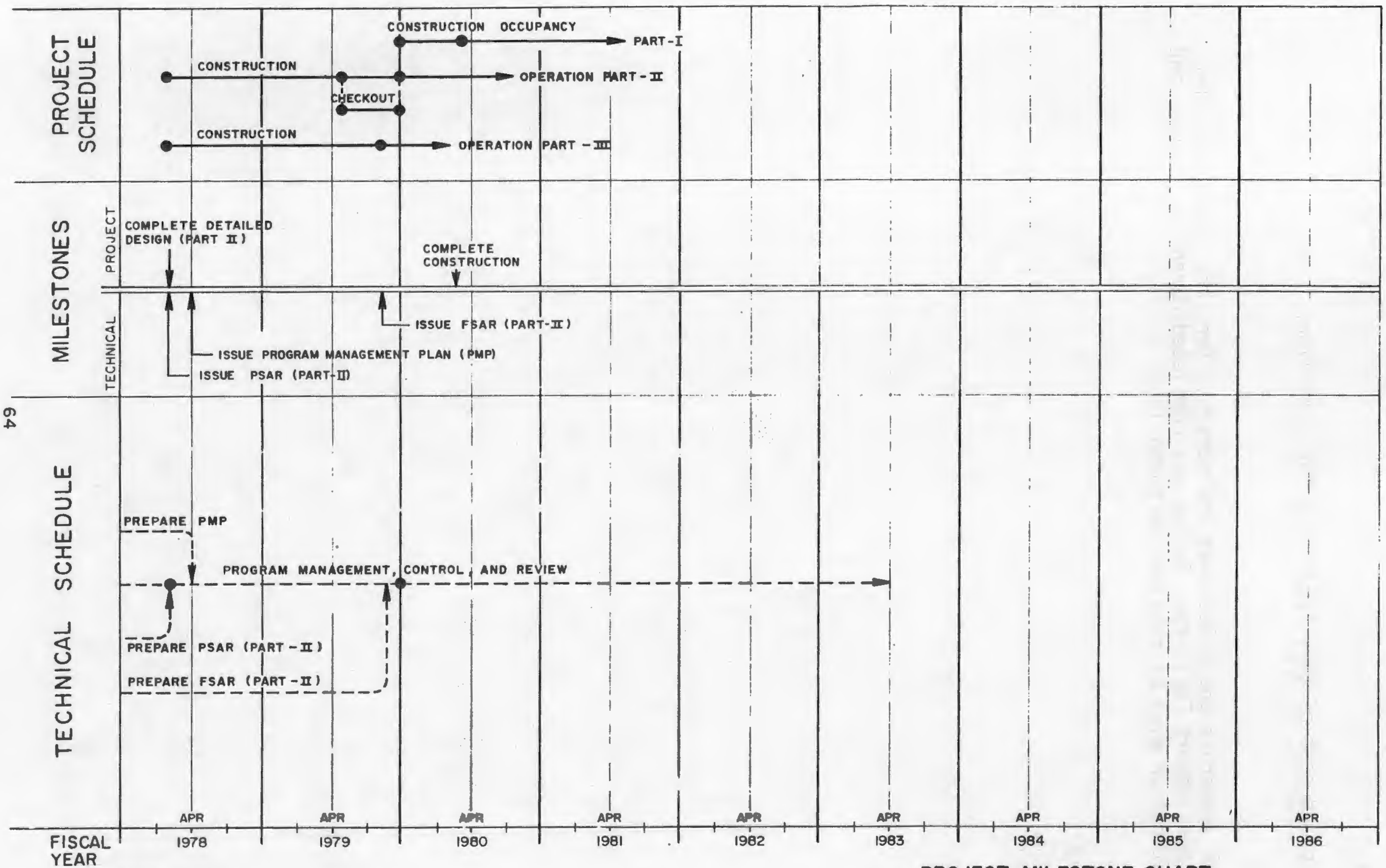
Program expansion in the next few years would increase crowding and hazardous working conditions in the present shop areas, which would result in violations of safety codes (OSHA) as well as restrict the maintenance activities necessary to support normal operations.

Cost Data

The estimated cost of this project is $10.5 million.

Schedule

Figure 26 summarize the milestones and schedule for the Personnel Protection and Support Facility. Design was completed March 3, 1978, and all construction will be complete in March 1980.



KEY

PART I - CPP-630 MODIFICATIONS
PART II - PERSONNEL PROTECTION MODIFICATIONS
PART III - NEW MAINTENANCE BUILDING

PROJECT MILESTONE CHART
FIGURE - 26
PERSONNEL PROTECTION AND SUPPORT FACILITY

8. UTILITIES REPLACEMENT AND EXPANSION

Description

The Utilities Replacement and Expansion Project provides for the replacement and expansion of existing utility production and distribution systems that have deteriorated. Buildings and structures needed to house utility production systems will also be expanded.

Included in this project are the following:

(1) A tunnel system for routing utilities to the various facilities
(2) An additional deepwell and pumphouse
(3) Additional storage vessels for raw water, fuel oil, oxygen, and nitrogen
(4) A centralized propane system
(5) An expanded sanitary sewage treatment plant
(6) An expansion of the substation transformer area and control house

Utility production and distribution systems will be expanded and modernized. These systems include steam, compressed air, various water systems, sanitary and service waste, nitrogen, oxygen, propane, normal and emergency power, and communications. Energy conservation will be an objective in the design of this project.

Justification

The ICPP was built in 1951 and has undergone a series of expansions and modifications. The originally installed utility systems have deteriorated to a point that the systems are unreliable, and there is little spare capacity to serve plant growth. This project is necessary to replace these deteriorated systems and provide reliable, efficient systems to serve this multipurposed fuel reprocessing plant. When these utilities are replaced, added capacity will be built into each system to provide for normal and specific plant expansion such as Fluorinel Dissolution Process and Fuel Receiving Improvements.

The utility systems at the ICPP are the center of operations. Without them the plant cannot function. Plant operating functions such as fuel receiving, fuel storage, headend dissolution, solvent extraction, final product, waste treatment, waste storage, process support, auxiliary services, and many more will cease to operate if a utility system fails or is inadequate. Shutdown of one process has a direct effect on the continued operations of all other associated processes as well as potential effects on supporting facilities. Therefore, this project is needed to provide reliable, modern utility systems for continued plant operation and production.

Cost Data

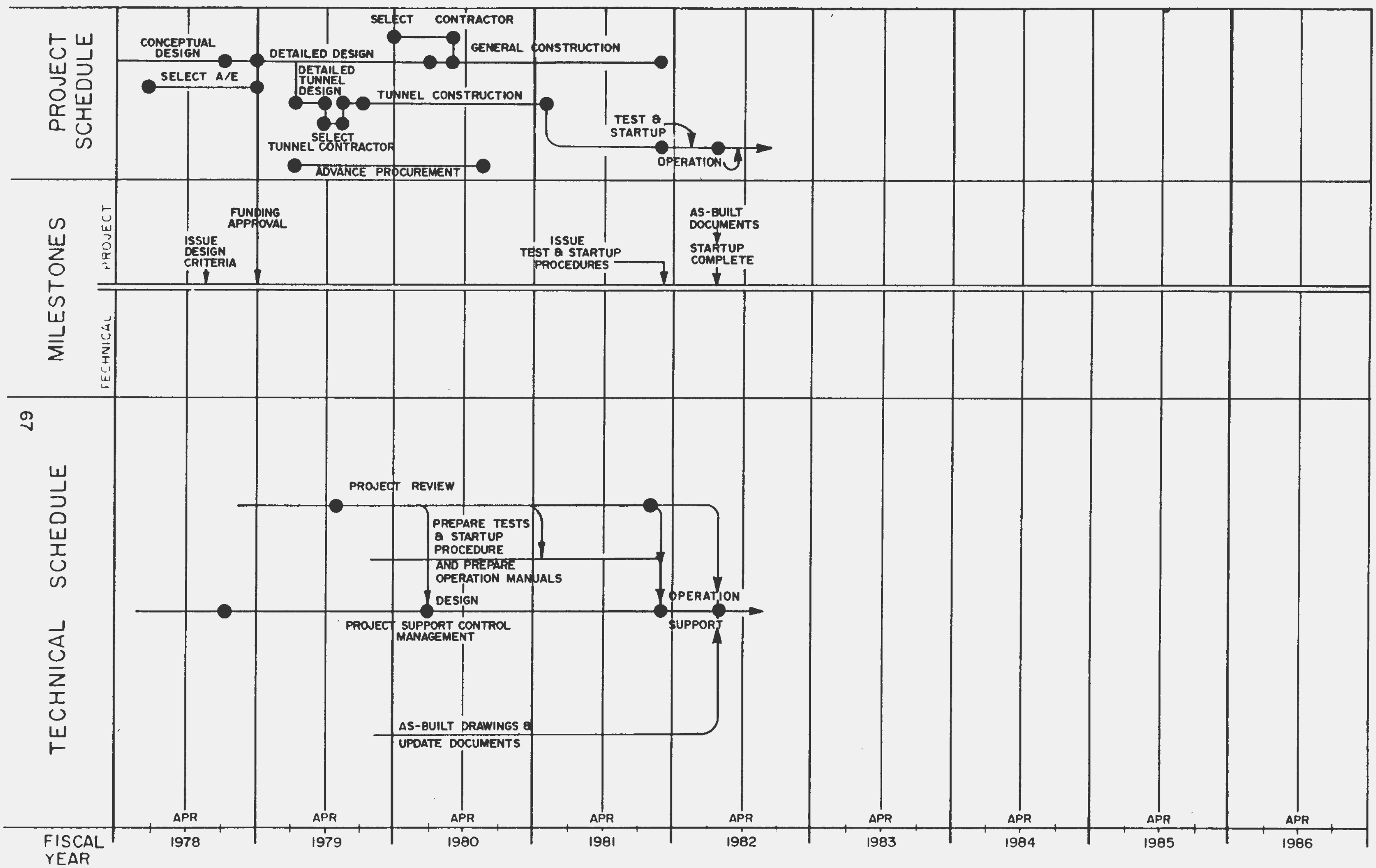
The total estimated cost for the Utilities Replacement and Expansion Project is $10.5 million, based on conceptual design estimates. Of this amount, approximately $1.1 million is for engineering design, $0.3 million is for project administration, and $6.7 million is for construction. The remaining $2.4 million is contingency.

Design Requirements

Conceptual design of the Utilities Replacement and Expansion Project began in November 1976, and will continue through September 1978, at which time Title I design will begin. Title I design is scheduled for completion in May 1979. Title II design will start in May 1979 and will be completed in December 1979.

Schedule

The major milestones associated with this project are shown in the accompanying diagram (Figure 27). This diagram indicates that construction on this project is scheduled to begin in February 1980 and is to be completed in August 1981.



PROJECT MILESTONE CHART
UTILITIES REPLACEMENT AND EXPANSION
FIGURE 27

9. STEAM GENERATION

Description

This project provides for the design and construction of a coal-fired steam generation facility containing two 30,600 kg/h (67,500 lb/hr) boilers. The steam generation equipment, together with the oil-fired system, will be sized to meet maximum projected requirements at the ICPP through FY 1985, plus a 25% contingency factor to allow for possible increases beyond those currently planned. With this large contingency, and also because ICPP steam usage is usually below peak requirements, little operation of the oil-fired facility should be needed unless the contingency eventuates.

In addition to the two boilers, the project will include a building and the equipment for waste treatment, air pollution control, solid waste disposal, liquid waste treatment and coal receipt, handling and storage.

Justification

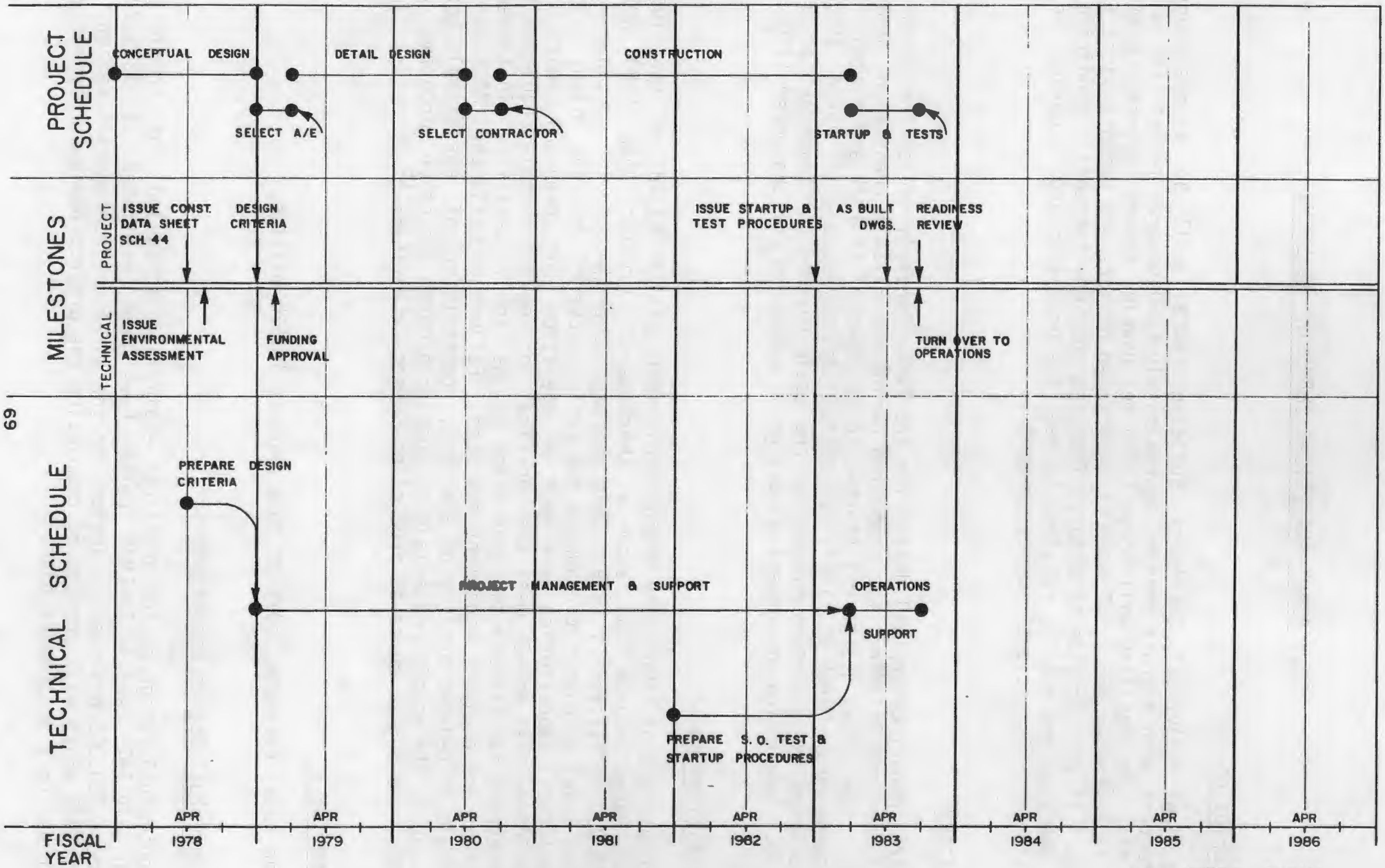
New production facilities currently being designed and built will cause maximum steam requirements to exceed existing capacity by about 25% after FY 1983. Additional generating facilities are thus required to permit operation as planned. The coal-fired facility, as sized, will enable all ICPP facilities to operate during the winters, will prevent unplanned shutdowns due to boiler malfunctions, will save oil, and will provide a contingent capacity permitting some additions of facilities not now planned.

Cost Data

The total estimated cost for this project is $24 million.

Schedule

The schedule and milestones for this project are shown on Figure 28.



COAL FIRED STEAM GENERATION

FIGURE 28

10. PLANT ANALYTICAL CHEMISTRY BUILDING

Description

The Plant Analytical Chemistry Building (PACB) will be a one-story structure with a gross area of approximately 6180 square metres (66,500 sq ft). The facility will house 1,765 net usable square metres (NUSM) of laboratories and 1,347 NUSM of associated offices and support activities. It will provide structural features and environmental conditions of the type and quality required to meet the precision and accuracy requirements (for scientific measurements).

History

A preliminary conceptual design for the PACB (formerly called the Chemical Services Building) was completed during the FY-1976 transition quarter. Conceptual design was started in November of FY-1977 and placed in suspension on March 31, 1977. Conceptual design resumed in April 1977, proceeded for a three-month period and again resumed in November of FY 1978. Completion of conceptual design is scheduled for September 1979.

Justification

Projections of laboratory space requirements at ICPP based on the INEL Long-Range Program Plan show a shortage of greater than 1860 NUSM (20,000 sq ft) for FY 1979. This shortage is projected to continue at this level or higher throughout the period covered by the plan. The analytical laboratories have been in operation for over 25 years in buildings that do not meet the physical or environmental requirements necessary for satisfactory operation of the highly sensitive instrumentation and analysis equipment now used. Failure to build the PACB will result in reduced quality of analyses, curtailment of analytical services to the special materials production program and other programs at INEL, and higher costs to production support activities.[15]

Cost Data

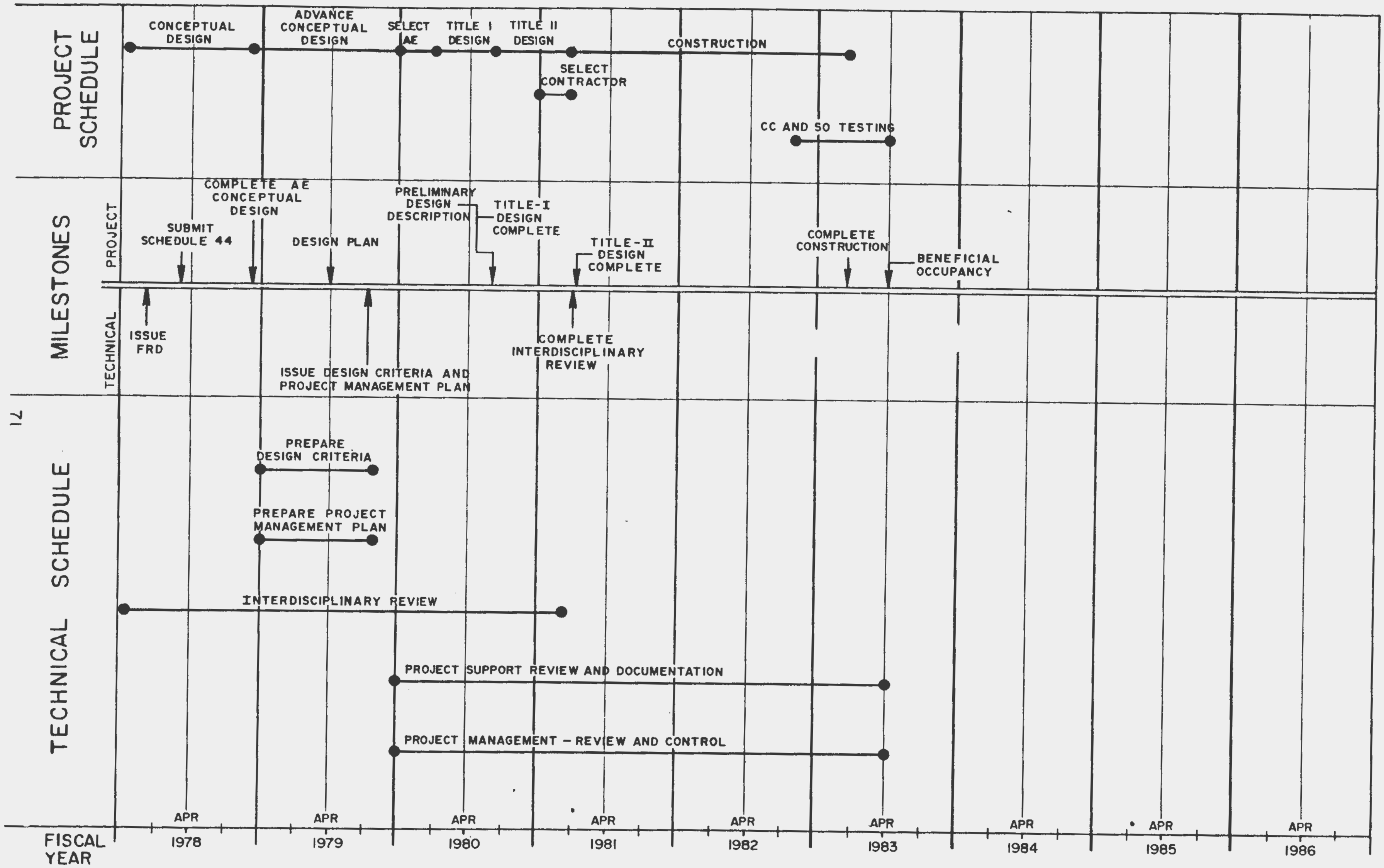
The total estimated cost of this project is $20 million.

Conceptual Design Requirements

Conceptual design by the architect engineer is scheduled for completion in July 1978, and in FY-1978 costs have been estimated at $235,000. About $30,000 has been estimated for the advanced conceptual design in FY 1979 which will consist of completing the project design criteria and preparing a management plan.

Schedule

Figure 29 shows the schedule and milestones for this project.



PROJECT MILESTONE CHART
PLANT ANALYTICAL CHEMISTRY BUILDING
FIGURE 29

11. RENOVATION OF PROCESS CELLS

Description

This project consists of replacement of the ICPP stack, improvements to plant process instrumentation, modification of the Remote Analytical Facility, upgrade of special nuclear material (SNM) measurement and surveillance systems, and modifications to other functional areas in order to enhance reliability and contamination control.

History

Equipment initially installed at the ICPP is now over 25 years old. Some instruments have been replaced over the years and, as a result, the ICPP now has a widely assorted collection of instruments, many of which are outdated. Likewise, the stack is over 25 years old and has deteriorated. SNM measurement is presently performed by measurement of materials entering and leaving the process area.

Justification

Plant instrumentation must be improved to reduce radiation exposure by isolating potentially radioactive instrument lines from areas frequented by personnel. The instrumentation systems require modernization to improve quality and reliability of process measurement and monitoring. Instrument improvements may include installation of improved sensing and transmitting equipment and control consoles. The existing ICPP stack is severely corroded and contaminated internally and must be replaced before it becomes a hazard. The SNM measurement system is required to provide the uranium measurement and inventory control capability necessary to implement a safeguards accountability system in compliance with DOE IMD 6104 requirements. The physical and administrative control of nuclear material at the ICPP will be improved by more accurate and timely knowledge of the quantities and locations of SNM in the plant process and the ability to deter or provide early detection of attempted SNM diversions will be enhanced. Other contamination control and radiation reduction measures will also be considered for inclusion in the project.

Cost Data

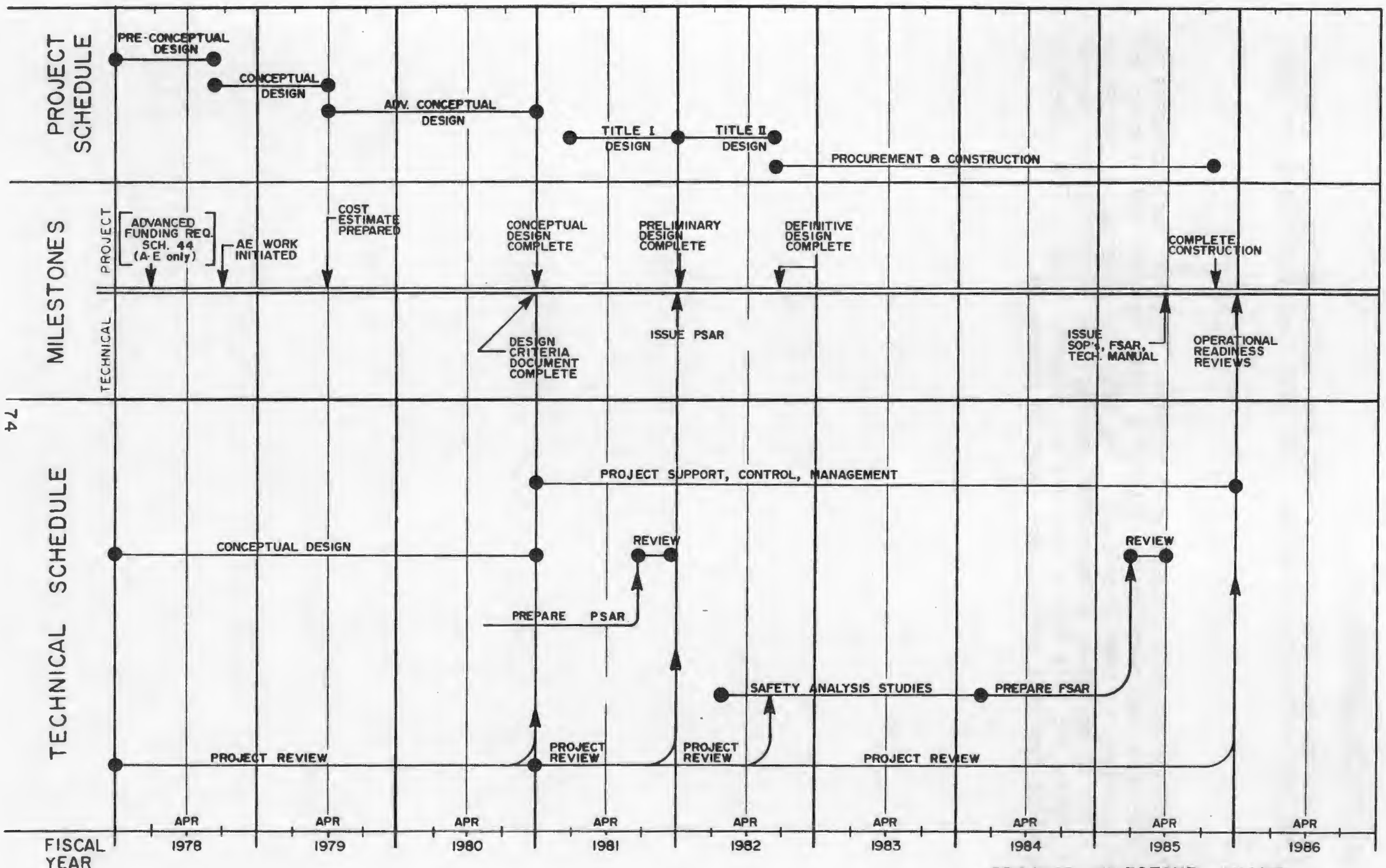
The total estimated cost for renovation of Process Cells project is $60 million. This is an order of magnitude estimate and will be verified during conceptual design. A data sheet requesting $12 million for Title I and Title II design has been submitted. A data sheet covering the remainder of the project will be submitted in FY 1980.

Conceptual Design Requirements

Conceptual design costs for this project are estimated to be approximately $295,000 in FY 1978, $340,000 in FY 1979, and $460,000 in FY 1980.

Schedule

The construction for this project will require lengthy fuel processing outages; the detailed planning to determine the length and timing of these outages has not been completed. The Baseline Program is projected to have about 16 months of outage time during the construction period shown in Figure 30; this may or may not be enough time. The schedule and milestones for this project are shown in Figure 30.



PROJECT MILESTONE CHART
RENOVATION OF PROCESS CELLS
FIGURE 30

12. CALCINED SOLIDS STORAGE BINS PROJECTS

Description

The calcined-solids-storage-bin projects provide for safe containment of radioactive solids produced by calcining the high-level radioactive liquid wastes. Four bin sets have been constructed in the past and the fifth, sixth and seventh bin sets and a calcine transfer station are in detailed or conceptual design. All calcined-solids-storage-bin projects use the same general design and each consists of stainless storage bins enclosed in a reinforced concrete vault. The stainless steel bins provide the primary containment of the solids and the concrete vaults provide secondary containment and radiation shielding. Calcined solids are pneumatically transported to the storage bins and the transport air is returned to the calciner facility. The storage vaults are anchored to bedrock 40 to 50 feet below grade.

The transfer station will receive solids from the NWCF transport system. The transfer station will consist of stainless steel transfer bins for primary containment, a concrete vault for secondary containment and radiation shielding, and a transport system for conveying the solids to the storage bins.

The first two sets of bins have been filled, and the third set is being filled from the WCF. Construction of the fourth set is complete. The fourth and future bin sets will be filled by the NWCF. Design of the fifth set will be completed in FY 1979 and construction will be complete in FY 1981. Conceptual design of the sixth and seventh bin sets and the transfer station will be completed in FY 1979, and Title I design will start in FY 1979.

Capacities and Costs

Current volumes of stored calcine waste and projected storage volume requirements are shown in Figure 7. Capacities and total estimated cost for the sets are as follows:

Bin Set	Approximate Capacity		Total Estimated Cost, Millions $	Scheduled Completion
	ft^3	m^3		
1st, 2nd, 3rd, 4th	94,000	2662	-	-
5th	35,000	991	8.75	1981
6th	35,000	991	10	1984
7th & Transfer Station	50,000	1416	35	1985
8th	50,000	1416	35	1990

The total estimated cost for the fifth set of bins, based on the conceptual design completed in FY 1977, is $8.75 million. A total of $12.5 million, which includes $3.75 million for future construction, was authorized for this project.

The total estimated cost for the sixth set of bins, which will be identical to the fifth bin set, is $10 million. The cost estimate for the sixth set of bins is based on the completed conceptual design of the fifth set of bins.

The rough order-of-magnitude cost estimate for the seventh bin set and transfer station is $35 million. The very rough cost estimate for the eighth set of bins is $35 million.

Conceptual Design Requirements

Conceptual design for the fifth set of bins was completed in FY 1977 at a cost of $253,000.

Conceptual design for the sixth set of bins, seventh set of bins, and transfer station began in FY 1978, and as of March 31, 1978, $84,000 had been spent. Approximately $540,000 more will be spent in FY-1979 on conceptual design and advance conceptual design.

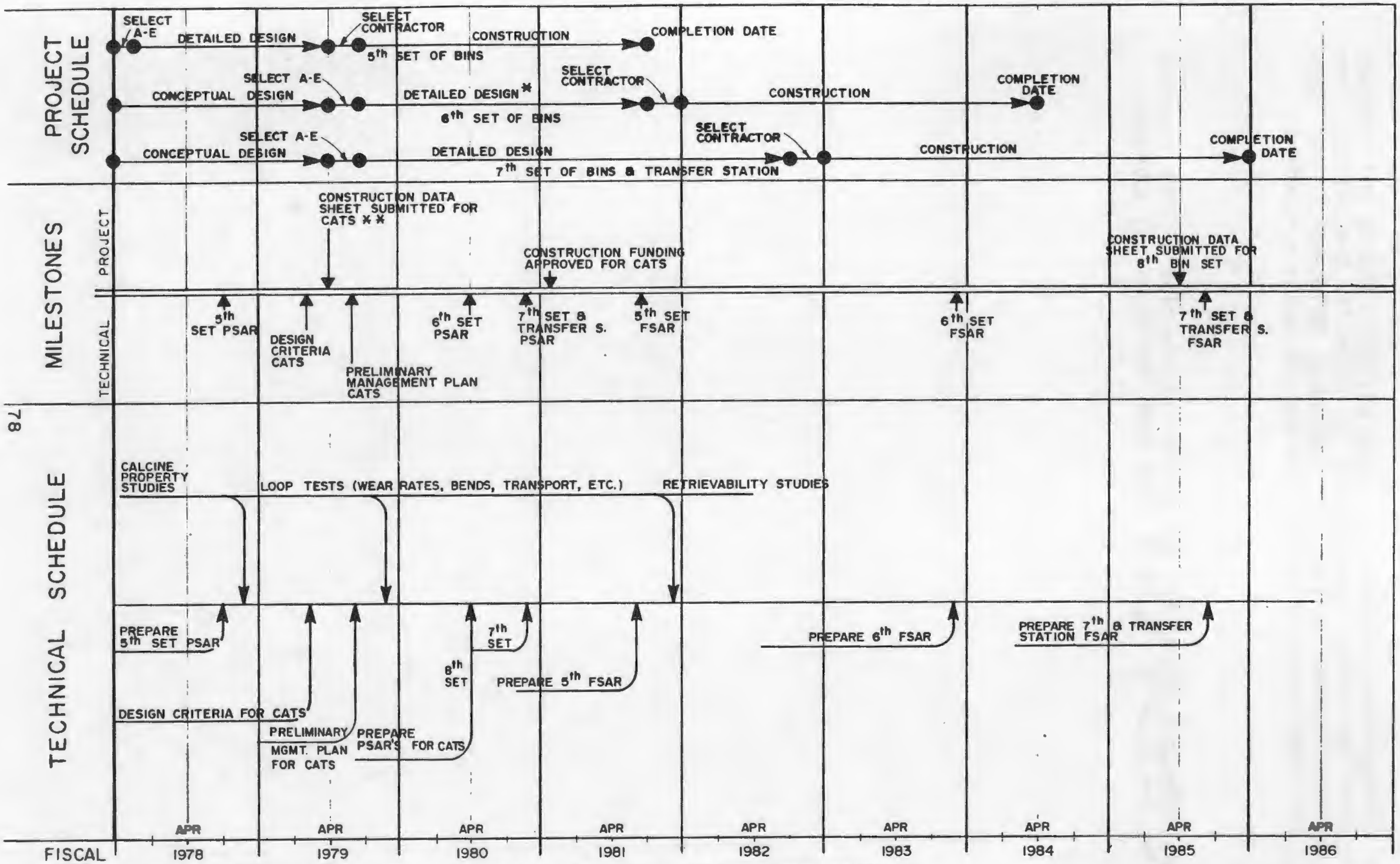
Justification

To avoid the costs of building additional tanks to store liquid radioactive wastes, and to reduce the probability of liquid waste leaks, all high-level radioactive wastes resulting from fuel reprocessing at the ICPP are being solidified. If fuel processing is to continue at the ICPP, either additional calcined solids storage facitlities or additional radioactive liquid storage tanks must be provided.

Conversion of high-level radioactive liquid wastes to solids and storage in the bins provides greater assurance of isolation of the wastes from man's environment, minimal reliance on continued maintenance and surveillance, and lower overall costs for radioactive waste management.

Schedule

The project milestone charts for design and construction of the various sets of bins are shown in Figure 31 along with the technical schedule.



* DETAILED DESIGN IS EXTENDED TO ALLOW TIME FOR BIN PROCUREMENT AFTER FUNDS HAVE BEEN APPROVED

** CATS = CALCINE TRANSFER & STORAGE PROJECT (6^{th}, 7^{th} SETS & TRANSFER STATION)

PROJECT MILESTONE CHART
CALCINED SOLIDS STORAGE BINS
FIGURE 31

13. GENERAL PLANT PROJECTS (GPP)

The FY-1979 GPPs are:

	Project Title	Estimated Costs ($000)
1.	CPP-601 West Vent Tunnel Modifications	315
2.	O-Cell Modifications	15
3.	CPP-604 Condensate Cell Floor Liner	110
4.	CPP-620 High Bay Laboratory	440
5.	ICPP Road Program	250
6.	Animal Barrier and Alarm Fence	170
7.	Modular Guard Station	50
8.	CPP-627 Filter and Exhaust Modifications	400
9.	Waste Transfer Line from CPP-709 to Injection Well	130
10.	General Office Building III	575
11.	Minor GPPs	50
		2505

The conceptual design efforts ($200,000) for these FY-1979 projects is scheduled to commence during the second quarter of FY-1978. Title I & II design for all of these GPPs will require some architect-engineering effort starting the first quarter of FY-1979. The start of construction is dependent upon the level of design effort necessary. The milestone schedule for FY-1979 GPPs is shown in Figure 32.

Table IX lists the FY-1980 candidate GPP projects. The conceptual design effort for DOE-ID approved projects is scheduled to commence during the second quarter of FY-1979. Title I and II design for these selected projects is projected to start during the first quarter of FY-1980. Schedules for design and construction have not yet been prepared for these projects.

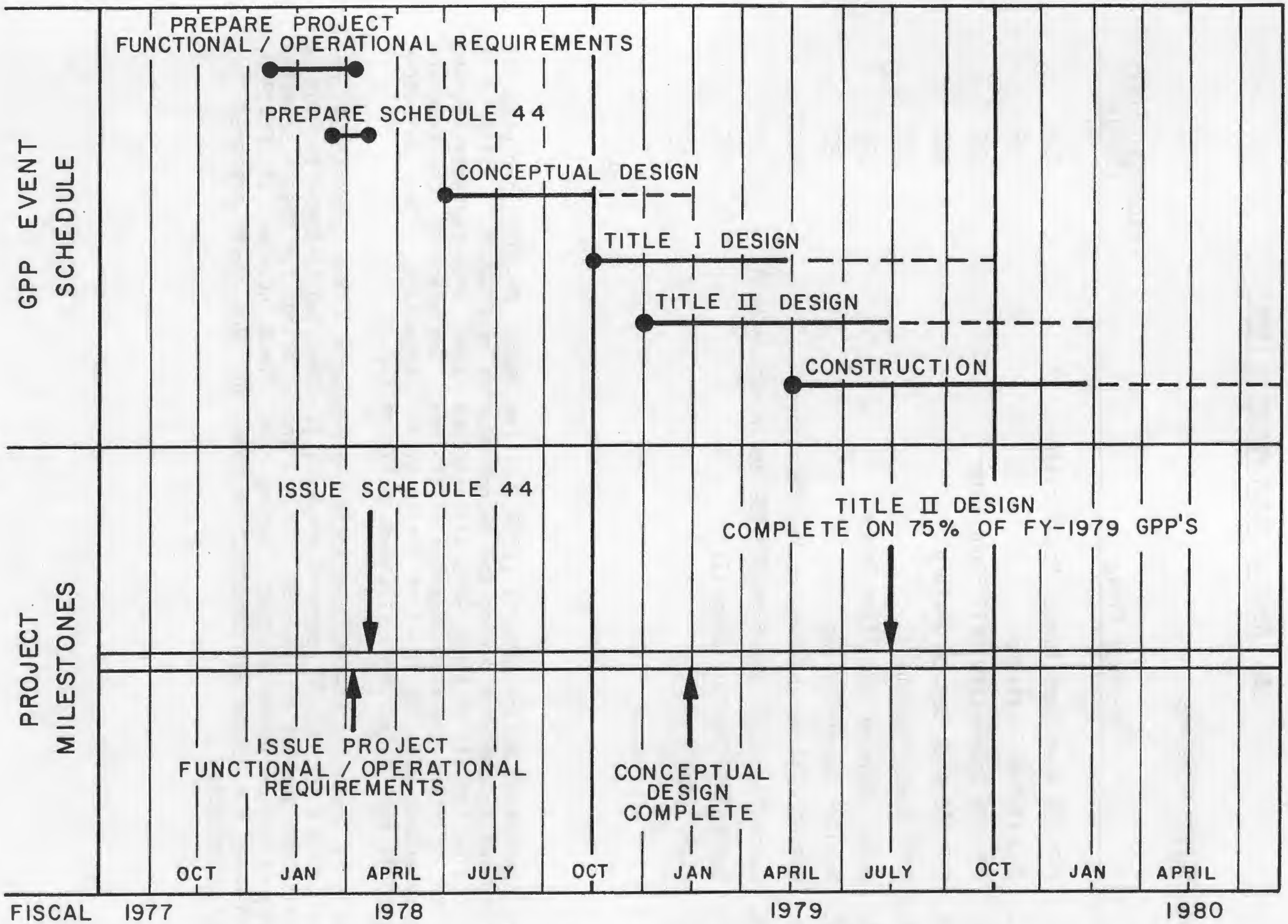


FIGURE 32: FY-1979 GENERAL PLANT PROJECTS

TABLE IX
FY-1980 GPP CANDIDATE PROPOSALS

	Project Title	Rough Order of Cost Magnitude ($000)
1.	Bulk Chemical Receiving Area Modifications	50
2.	Shift Laboratory Expansion	100
3.	CPP-601 Ventilation Modifications	400
4.	ICPP Road Program	150
5.	SNM Security Room for Multicurie Cell	200
6.	CPP-637 Low Bay Laboratory Modifications	525
7.	CPP-601 G-Cell Fuel Charging Cave Modifications	500
8.	General Office Building IV	650
9.	Analytical Chemistry Waste Handling Facility	650
10.	CPP-649 Filter Modifications	200
11.	Waste Transfer Line from CPP-709 to Injection Well*	130
12.	Hatch for PEW Evaporator Pump Pit	75
		3630

*This project was advanced to the FY-1979 GPP list too late to revise the $3.63 million GPP total in Table III.

VII. PROCESS DEVELOPMENT AND SUPPORT

1. Technical Support to Fuel Receipt and Storage

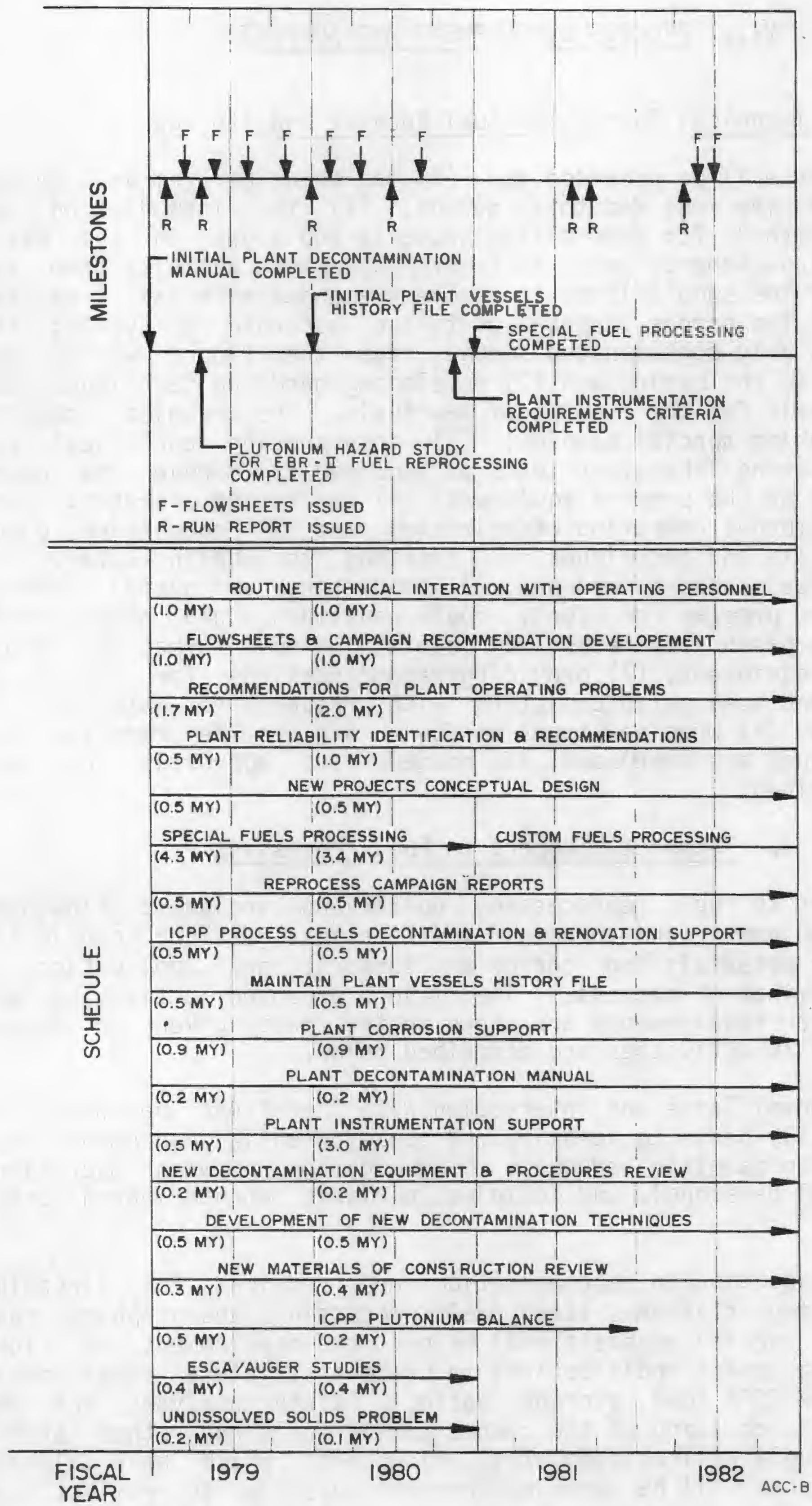
Technical support will be provided to: (1) the chloride removal system for removing chloride ions and total solids; (2) the installation and testing of new methods for controlling bacteria and algae in the basin water; (3) the ion-exchange units to remove beta/gamma activity from the basin water; (4) the sand filters to remove suspended material from the basin water; (5) the proper disposal of filter backwash effluents; (6) the removal of highly contaminated sludge from the floor, walls, and understructures in the basin; and (7) developing handling techniques and obtaining approvals for the receipt of new fuels. The technical support includes: (1) taking special samples; (2) interpreting analytical results; (3) conducting laboratory tests as required to improve the operating efficiency of the process equipment; (4) monitoring operating data and records to improve operating efficiencies; and (5) specifying quantities of chemicals and techniques for treating the basin water. In addition, technical support includes: (1) conducting an overall corrosion surveillance program for fuel, fuel canisters, and other metal equipment in the basin fuel racks; (2) maintaining an information record on corrosion of equipment; (3) providing recommendations for design of fuel canisters and fuel scrap canisters with respect to materials of construction; and (4) when new types of fuels are to be received new handling techniques are developed, if needed, and approvals for fuel receipt are obtained.

2. Technical Support to Fuel Processing

Technical support to fuel reprocessing operations includes: flowsheet development; equipment and process modifications design; continuing safety analyses; materials and corrosion support; and application of improved decontamination methods. The major proposed activities and estimated manpower requirements are shown in the chart given in Figure 33. Specific FY-79 activities are described below.

1. Technical surveillance and interaction with Operations personnel is done on a daily basis to identify and scope potential equipment modifications, to maintain adequate communication between Operations and Technical personnel, and to solve periodic unanticipated problems.

2. Flowsheets and campaign recommendations are required for zirconium fuel processing, stainless steel fuels processing, and graphite fuel processing. Special emphasis will be put on development of flowsheets and equipment modifications to process stainless steel fuels stored in the ICPP fuel storage basin. Safety analyses for the electrolytic processing of the canned EBR-II fuels and other stainless steel fuels will be completed. Flowsheets which have already been established will be improved wherever possible to reflect new information from laboratory studies or plant surveillance and testing.



ACC-B-2607

TECHNICAL SUPPORT TO FUEL PROCESSING

FIGURE 33

3. Numerous plant operating problems are identified each year. A continuous technical effort is required to evaluate and recommend plant equipment or operating changes that will solve these problems.

4. An increasing effort will be made for improving plant reliability. This effort entails identification of problem areas and recommendations for upgrading.

5. Furnish technical input for the preparation of specifications, design criteria, and conceptual design for new RCE, GPP, and line items.

6. The Special Fuels Disposal Plan will be revised as additional information becomes available. This plan outlines all the work required to prepare flowsheets, complete safety analyses, and design equipment modifications for processing or disposal of the fuels at the ICPP. Work described in the plan will probably continue through 1980. Fuels located elsewhere in the USA that are compatible with ICPP reprocessing equipment will also be investigated.

7. Campaign reports for ICPP reprocessing activities from FY-74 to the present will be published.

8. Several of the ICPP process cells will be decontaminated and renovated in FY-79. Technical assistance will be provided for decontamination and to design vessel and piping modifications.

9. A plant vessels history file will be initiated to provide easily accessible and up-to-date information on the status of each process vessel. This file will be useful for planning capital equipment purchases and corrosion inspection schedules.

10. Routine plant corrosion support will become more substantial beginning in FY-79 to provide assistance as required.

11. The plant decontamination manual will be revised and updated as appropriate to include new procedures and plant process systems. Procedures for operating the decontamination facility at the NWCF will be developed.

12. The plant instrumentation support will be increased to provide continuous updating and improvement of plant instrumentation. Many areas of the plant are years behind the state-of-the-art in new technology and increasingly stringent regulations for process control are requiring more accurate and dependable instruments. An increasing effort is necessary for replacing or upgrading instrumentation which can no longer fulfill plant requirements. Budget item JM 03 02 21 0 - Process Monitoring Systems (I-006) is included in this effort.

13. New decontamination equipment and methods are developed each year. An ongoing effort at the ICPP is required to keep abreast of these innovations. Specific examples include high-pressure water spraying, ultrasonic cleaning with portable probes, and electropolishing as a surface decontamination technique.

14. New materials of construction must be reviewed continuously for possible use at the ICPP due to the corrosive and erosive nature of the plant processes and the high degree of reliability required.

15. The plutonium balance study for the ICPP will be continued through FY-79. Process modeling, hazards analyses, plutonium pathways to operating personnel, and equipment modifications design will be included in this study.

16. A program will be continued in which the effects of process exposure and decontamination treatments on the chemistry and metallurgy of metal surfaces will be examined with an ESCA/Auger electron spectrometer. Data from these studies will greatly increase understanding of the mechanisms of contamination and decontamination. This information will aid in making choices of materials of construction and decontamination methods.

17. Undissolved solids cause severe problems in the decontamination of headend fuel processing systems. An intensive effort will be continued to more accurately characterize the undissolved solids resulting from fuel dissolution and headend solution adjustments. With this information better control can be achieved over undesirable spread of undissolved solids during operation and decontamination of the fuel headend systems.

Projected Costs and Man-Years

	Fiscal Year			
	1979	1980	1981	1982
Man-Years	14.2	16.3	17.5	18.0
$000	790	970	1080	1210

3. Technical Support to the WCF

The technical support provided to the WCF will include: (1) close technical liaison with Operations; (2) thorough sampling and analysis of process streams during operation; (3) chemistry studies as needed in support of decontamination or operation; (4) pilot-plant testing of equipment and process conditions; (5) computerizing WCF operating data and characteristics; and (6) writing campaign reports.

Technical liaison is necessary to provide effective support. Personal observation of operating problems and familiarity with the WCF system aids technical personnel in helping to solve problems.

Effective sampling is needed to determine: (1) the flowpaths of radionuclides (particularly ruthenium); (2) the decontamination factors across particular pieces of off-gas equipment to aid in better equipment design or more effective equipment operation; (3) combustion efficiencies to allow more effective operation of the fuel nozzles to reduce the quantity of unburned hydrocarbons in the off-gas; and (4) the corrosiveness of the off-gas to prevent premature equipment failure.

Chemistry studies are needed to determine: (1) the most effective decontaminating solutions; (2) how to dissolve solids which plug process piping; (3) methods to reduce or eliminate precipitates or other undesirable properties of waste feed; and (4) other methods of improving general calciner operation such as reducing the rate of fines generation.

Pilot-plant testing is needed before changes are made in WCF equipment or flowsheets. This prevents errors being made which could seriously affect WCF equipment.

Computerizing the WCF data and operation would allow more efficient and complete tracking of WCF operating characteristics which would be an aid to maximizing on-stream time.

Campaign reports are needed to provide a summary of accomplishments and problems.

Projected Costs and Man-Years

	Fiscal Year						
	1978	1979	1980	1981	1982	1983	1984
Man-Years	7.1	10.6	11.5	11.5	11.5	11.5	11.5
$000	370	600	650	650	650	650	650

Milestone List

Milestones	Dates
Issue H-7 Calcining Campaign Report	10-78
Issue H-8 Campaign Report	2-79
Issue H-9 Campaign Report	12-79
Issue H-10 Campaign Report	12-80
Begin NWCF Support	1-81

4. JM 03 R and D - ICPP Fuel Processing (I-007)

The manpower and operating costs for the JM Special Materials Production efforts in the area of fuel processing research and development are given in the following tabulation. This program provides for improvements in the existing ICPP processes beyond the scope of direct plant support and for design verification of new production processes for the ICPP. The program consists of three main tasks: (1) Rover process design verification, (2) Fluorinel process design verification, and (3) existing process improvement studies. The Rover process design verification task consists of completing remaining design verification work and identifying process modifications for the Rover Process. The Fluorinel process design verification task consists of design and flowsheet verification for the ICPP Fluorinel dissolution process and process support activities during the testing and startup phase of the Fluorinel project. The task for existing process improvement provides technical information for existing processes at the ICPP. Due to the high priority of the Rover and Fluorinel tasks, work in this area has been deferred until FY 1980.

	Fiscal Year						
	1978	1979	1980	1981	1982	1983	1984
Man-Years	12	11	12	15	15	15	16
$000	625	600	650	845	845	895	975

5. JM 03 R and D - ICPP Waste Management (I-008)

Waste management development is defined as long-term development in support of the tank farm, WCF, NWCF, and calcined solids storage bins at ICPP. The development also extends to related work such as alternate methods of solidifying sodium wastes. The work includes planning and conducting laboratory and pilot-plant tests, interpreting the data, and reporting the result of the studies. The major emphasis in the program is the development of flowsheets and improvement of process techniques and equipment related to waste solidification.

The major tasks for the I-8 program during FY 1978 are: (1) develop flowsheets for calcination of WM-183 and sodium-bearing wastes by blending with zirconium fluoride waste, continue development work on fluidized-bed calcination of sodium-bearing waste by addition of additives, and begin development work on flowsheets for electrolytic and Fluorinel wastes; (2) evaluate and test feed flowmeters and valves for use in the NWCF; and (3) test alternate startup bed materials for WCF use, and determine methods to reduce solids precipitation in WCF feed.

The major tasks in FY 1979 are: (1) continue development of a calcination flowsheet for sodium-bearing and Fluorinel wastes as necessary and verify flowsheets for WM-188 and WM-189 wastes when blended with sodium-bearing waste; (2) complete design and begin the construction of a new 30-cm calciner; and (3) begin development work on methods to reduce fines generation during fluidized-bed calcination.

The major tasks in FY 1980 are: (1) continue pilot-plant calciner tests with blends of Fluorinel and sodium-bearing wastes using new 30-cm calciner; (2) complete testing of dense phase and dilute phase systems for pneumatic transport of calcine to bins; and (3) complete construction of a new 30-cm calciner.

Estimated manpower and operating costs for this program are as follows:

	Fiscal Year						
	1978	1979	1980	1981	1982	1983	1984
Man-Years	10	11	12	13	14	14	14
$000	470	570	660	720	760	760	760

6. JM 03 R and D - ICPP Remote Maintenance (I-456)

The manpower and operating costs for the ICPP remote maintenance development efforts are given in the following table.

The major tasks for this new 189 during the period FY 1980 through FY 1983 are: (1) procurement of additional euqipment for remote application and modification; (2) fabrication of remote mockups; (3) initial remote testing; and (4) initiation of failure studies.

	Fiscal Year			
	1980	1981	1982	1983
Man-Years	4	4	4	4
$000	295	295	295	295

7. Operational and Environmental Safety Support

Health Physics Upgrade Program

Technical health physics support to the ICPP program will be provided to raise the radiation and contamination control programs to state-of-the-art levels. The overall objectives are to correct unacceptable conditions resulting from long-term deterioration and current design deficiencies and to provide a strong control program to maintain the upgraded position. The opportunity to advance the state of the art in areas unique to the ICPP is recognized and accepted as an obligation of a competent, technical health physics program. A partial listing of specific objectives and planned areas of upgrade is shown below.

1. Plant contamination source identity and reduction:

    a. Complete the contamination survey of all blue areas (inside and outside of buildings).

    b. Complete the decontamination of the white areas.

    c. Reduce the number and size of blue areas creating more white areas to allow more unrestricted plant access.

2. Personnel Monitoring and Contamination Control

    a. Increase emphasis on personnel self-monitoring program.

    b. Increase the number of portal monitor locations in the plant.

    c. Improve the Red/White/Blue program to provide improved contamination control.

    d. Install shielded self-monitoring cubicles throughout the plant.

3. Effluent Monitoring and Reduction

    a. Install continuous monitoring stations in ducts for the Atmospheric Protection System, process off-gas and ventilation off-gas.

    b. Computerize "real-time" effluent monitoring signals.

    c. Install SO_2 monitoring on the steam boiler gaseous effluent.

    d. Improve the ^{3}H, ^{129}I and ^{85}Kr stack monitoring capability.

    e. Develop a gross alpha monitor for monitoring stack effluents.

4. Personnel Radiation Exposure Control and Reduction

    a. Maintain plant exposures to ALARA levels through improved pre-planning and job control.

b. Start a computerized system for tracking the origin and amount of radiation exposure received at ICPP, i.e., various pumps, valves, tanks, etc.

c. Maintain individual exposures at an ALARA level.

d. Continue an aggressive ALARA program.

5. Personnel External Dosimetry

a. Continue assistance on the development of an improved personnel dosimeter.

b. Complete development of improved portable survey instruments.

c. Continue to modify and improve the computerized dosimetry records system.

d. Start an improved extremity-exposure monitoring program.

e. Use RF dosimetry system more extensively.

f. Develop program using audible dosimeters to reduce personnel exposures.

6. Personnel Internal Dosimetry

a. Improve in-plant air monitoring program for long-lived alpha and beta emitters.

b. Complete implementation of the routine bioassay program.

c. Improve computer programs for calculating and documenting internal exposures.

d. Develop a standardized format for documenting internal exposures.

7. Environmental Monitoring

a. Develop a routine air monitoring program for the vicinity near ICPP.

b. Analyze soil samples taken near ICPP.

c. Continue to document the impact of ICPP on the surrounding environment.

d. Develop an instrument for routine monitoring of ICPP roads, walkways, etc.

8. Instrumentation

a. Continue development of new portal monitor.

b. Computerize plant "real-time" HP signals.

9. Emergency Response

   a. Install new emergency staging areas.

   b. Continue emergency training exercises.

   c. Continue upgrading of emergency response manual.

10. Procedures

    Revise and update current safety procedures.

11. Training

    a. Revise HP handbooks and manuals.

    b. Upgrade HP training program.

VIII. CONCLUSIONS

1. Satisfactory progress of the Multiple Fuels Processing Program in FY 1979 requires funding of $27.4 million for production, $95 million of obligational authority for capital facilities and equipment, and $0.5 million for reactor product purchase.

2. Funding will be needed for the MFPP in FY 1980 as follows:

Production	$35.7 million
Capital	$84.8 million
Reactor Product Purchase	$ 0.9 million

3. Capital line-items requiring initial funding in FY 1980 and their total estimated costs are as follows:

Plant Analytical Chemistry Building	$20 million
Steam Generation (Coal Fired)	$24 million
Renovation of Process Cells	$60 million

   Delay in funding these projects would be highly undesirable.

4. The Baseline Program will recover product worth $669 million for an incremental cost at ICPP of $530 million. These increments were obtained by comparison to a Minimum-Cost Scenario in which fuels in inventory and to be received were assumed shipped to another site and remaining wastes were calcined and stored at ICPP. Total incremental cost to the government would be less than $530 million because costs at other sites were not taken into account by the Scenario. Present values for these ICPP increments are approximately equal, assuming a 10% discount rate.

IX. REFERENCES

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APPENDIX A

MISSION AND OBJECTIVES

Mission of ICP

General To produce results satisfying the needs of DOE's National Plan for Energy Research, Development, and Demonstration, with the major effort being in the nuclear fuel cycle area. Achievements attained in other areas covered will use the base of experience gained and expertise developed while producing results for the nuclear fuel cycle program.

Nuclear Area To process economically and safely fissile materials from all irradiated fuels assigned to the ICPP; to develop processes as required for other irradiated fuels for which no adequate or economical processing facilities now exist; to manage all resulting radioactive wastes in the most economical manner that meets all requirements for adequate protection of the environment and; to maintain the technical expertise necessary to solve operating problems and to develop new technology as necessary.

Nuclear Fuel Cycle Objectives of ACC-ICP

1. Fuel Receipt, Handling, and Storage To provide systems and facilities that ensure safe receipt, handling, and storage of fuels, and minimize personnel exposure and radioactive contamination.

2. Fuel Processing To process fuel economically, safely, and on schedule.

3. Waste Management To solidify wastes safely and on schedule.

4. To accomplish all fuel processing activities and other current assignments on schedule.

5. To use economics as the criterion for establishing optimum recovery efficiencies and optimum timing of recovery of fissile materials for return to DOE channels.

6. To maintain a high degree of operating continuity through systematic and orderly upgrading of plant facilities and equipment.

7. To use overall DOE program considerations to determine the timing for applied research and development, capital expenditures, and operations activities.

8. To process at the ICPP only those fuels which cannot be recovered more economically elsewhere.

9. To maintain high standards of nuclear and operational safety in all phases of fuel reprocessing and waste disposal operations at the ICPP.

10. To demonstrate effective optimization of multiple fuel reprocessing.

11. To develop criteria for storage, burial, or reprocessing of irradiated fuels requiring DOE action.

12. To demonstrate satisfactory process technology, reliable equipment performance, and economical plant operation for all fuels requiring DOE action.

13. To make maximum use of reprocessing technology developed at all DOE laboratories.

14. To provide valuable data, as requested, to reactor operators and fuel development programs through the analysis of gas and liquid streams from the reprocessing of specific fuels.

APPENDIX B

BASES AND ASSUMPTIONS

The following bases and assumptions were used in developing the FY 1980 Baseline Program. Changes from assumptions made for the previous MFPP document are indicated.

1. The period covered for the production schedule and economic analysis is FY 1979 through FY 1990. Last year the period was FY 1978 through FY 1989.

2. Fuel receipts are as specified by DOE.[13] The fuel numbers and process numbers are identified in the Materials Management Plan, a classified document.[11] Total receipts projected for the FY-1979-90 study period for fuels to be reprocessed at the ICPP are about 4.4% (500 kg U-235) below those projected last year for the FY 1978-89 period.

3. The fuel processing and waste generation rates are as listed in Table B-1 on the following page. Changes from last year were made in processing rates for Fuels 4, 13, 16, 21, 22, 26, 27 and 28 as well as for new and renumbered fuels. Waste rates for Fuels 4, 10, 15, and 16 were revised. The processing rates are expressed in kg U-235 per flowsheet day. The conversion between flowsheet days and calendar days shown in Figures 1, 2 and 3, and Table I was specified in computer input to be 0.85; this means that (flowsheet days)/0.85 equals calendar days.

4. Until June 1983, the coprocessing process uses aluminum and zirconium fuel at an average ratio of 2.725 kg U-235 in aluminum fuel to 1 kg of U-235 in zirconium fuel. Thereafter, the ratio was 2.5:1.0. Fluorinel coprocessing employs a ratio of 2.5:1.0.

5. Processing of Rover fuel will begin in January 1980. This is a six-month delay from the prediction made last year.

6. Of the 12 large (1,135 cubic metre; 300,000-gallon) tanks, one is used as the required safety spare and is kept empty, and one is used to collect diverted contaminated service waste. The assumed working volume of each tank is 1,079 cubic metres, allowing 56 cubic metres (5%) for dilution during emergency transfer to the safety spare tank. Additional space is usually maintained to permit waste management flexibility, to enable segregation of different types of wastes, and to permit continued fuel processing if a leak should occur. However, this additional space, which is called "operating spare volume" is used in order to increase product recovery.

7. Low-heat wastes are assumed blended with fluoride wastes in a 1:3.5 volume ratio for calcining. Last year the ratio was 1:3.0. Nonfluoride wastes are assumed blended with fluoride wastes in a 1:2 volume ratio for calcining. Last year, nonfluoride waste was assumed calcined alone.

TABLE B-1

FUEL PROCESSING RATES AND WASTE GENERATING RATES

		Kg ^{235}U per Flowsheet Day*		Waste, litres/kg ^{235}U		
Fuel No.	Special Applica-bility Dates	Before 2nd Crew Expansion	After 2nd Crew Expansion	Non-Fluoride	Fluoride	Low Heat
1	None	9.4	13.0		1000	40
2	None	13.0	20.0	550		40
3	None	4.4	5.1		3200	40
4	None	8.4	13.0	340		65
5	None	2.5		380		40
6	None	15.0		340		40
7	None	5.0		380		40
8	None	1.7	2.0	1200		40
9	<11/80	2.0			150	40
9	>11/80	10.0			150	40
10	None	37.0	37.0			1360
11	None	13.0	20.0	150		40
12	None	5.0	5.5		850	40
13	None	5.6	6.7		1400	50
14	None	1.8	2.4		2500	170
15	None	5.7	7.0		600	50
16	None	1.2	2.5		2600	500
17	None	7.3	11.0		600	110
18	None	24.0	37.0		180	40
19	None	30.0	30.0	300		40
20	None	Not Appl	Not Appl		Not Appl	
21	None	5.6	6.7		1400	50
22	None	0.76	1.44		4200	800
23	None	0.85	1.5		3400	700
24	None	Not Appl	Not Appl		Not Appl	
25	None	13.0	20.0		600	40
26	None	6.5	8.1		1300	50
27	None	5.6	6.7		1400	50
28	None	6.5	8.1		1300	50
29	None	37.0	37.0		1300	50
30	None	4.4	5.1		3200	40
31	None	Not Appl	Not Appl		Not Appl	
32	None	Not Appl	Not Appl		Not Appl	
33	None	37.0	37.0		1300	50
34	None	7.6	10.0		2000	50
35	None	8.0	10.5		900	40

*(Flowsheet days)/(0.85) = calendar days.

8. Projected radioactive liquid fluoride waste inventories, as shown in Figure 6 and Table I, include the waste from first-cycle extraction of Rover fuel. This low-activity waste will actually be stored in Tanks WM-103 to -106 (115 cubic metres each), which are not normally used for radioactive waste storage. The Rover waste will be calcined in a 1:1 ratio with other fluoride waste as soon as possible after generation so as to minimize the storage period. This blended calcining was not specially simulated, with the result that low-heat and fluoride waste inventories are under and over estimated, respectively, by up to 200 cubic metres.

9. Miscellaneous wastes are assumed to total 240 cubic metres (63,408 gallons) per year; last year, about 43,000 gallons per year was assumed. Miscellaneous wastes are combined with wastes from third-cycle extractions and are called low-heat wastes.

10. Liquid-to-solid ratios assumed for calcining of the wastes are as follows: nonfluoride-fluoride blend - 7.8:1; low-heat blend with conventional fluoride - 7.0:1; low-heat blend with fluoride from Fluorinel process which was assumed to start with FY 1986 - 6.8:1. Lower ratios were used last year. The fluoride-Rover blend was not simulated with the result that solids actually formed will be a little less than calculated. In the Minimum-Cost Scenario, some of the low-heat waste must be calcined without fluoride waste; the use of a 2.5:1 mole ratio of aluminum to sodium is assumed. The aluminum would be obtained by purchasing aluminum nitrate; a low-heat liquid volume of 2.2 was assumed to give 1.0 volume of solids.

11. In the economic analysis, capital amounts are assumed to be cash outflows in the years of obligation. In the Baseline Program, the undepreciated values of these capital amounts are credited (are cash inflows) in the year following the end of the study period. For purposes of calculating these credits, capital expenditures are depreciated as follows:

    a. Line items (other than calcine storage) at 10% per year after the last year of funding.

    b. General Plant Projects at 10% per year starting with second year after funding.

    c. Capital Equipment at 10% per year starting the first year after funding.

    d. Calcine storage -- only for space used.

12. Discounting will begin in FY 1980, i.e., all present valuing will be to FY 1979. Last year, discounting began in FY 1979.

13. Hot operation of the NWCF will begin on April 1, 1981.

14. Hot operation of the Fluorinel process will begin in July, 1983; this is a delay of 21 months from last year, and is due to limitations to obligational authority.

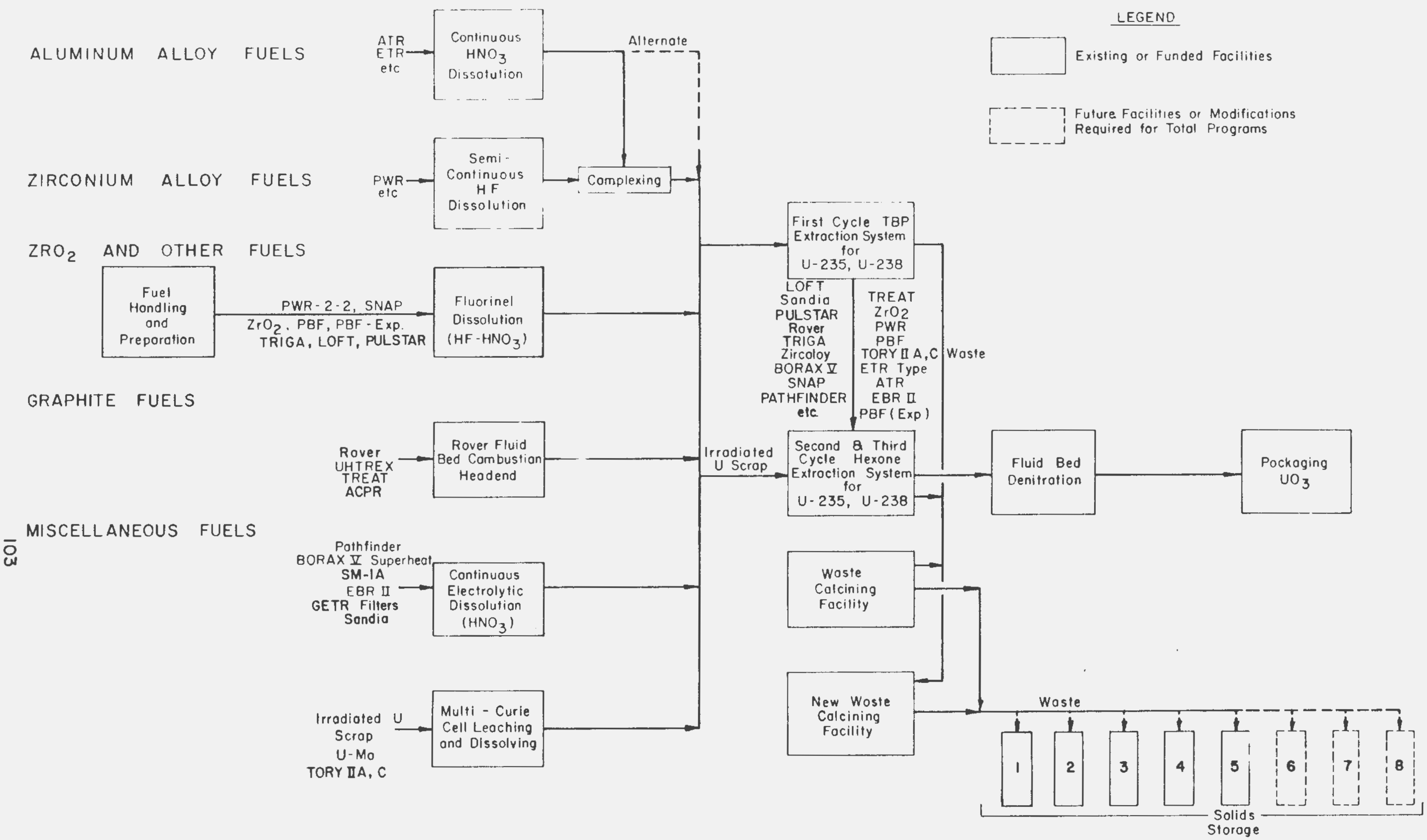
15. A waste adjustment charge is added in post-FY-1990 in each cash flow analysis to reflect and to normalize unequal waste inventories which unavoidably occur at the end of FY 1990 for the various processing schedules. This cost or normalizing factor is necessary since a premise of this study requires that all liquid waste must be converted to solid calcine for long-term storage. The waste adjustment costs amount to $5,200 per cubic metre of fluoride waste, $10,000 per cubic metre of low-heat wastes and $6,500 per cubic metre of nonfluoride waste. Last year waste adjustment charges were $5,020, $5,812 and $3,567 per cubic metre for the three categories of wastes. These costs include both calcining and solid storage costs for the wastes. All costs in the post-FY-1990 column were assumed to occur in FY 1991 for discounting purposes. The waste adjustment charge was assumed to be zero in the Minimum-Cost Scenario.

16. The unit values of U-235 are as follows.[14]

Fiscal Year	U-235 Value ($/g)
1979	43.06
1980 and thereafter	45.35

17. In the simulations, additional personnel that would allow concurrent operation of the headend and tailend parts of the fuel processing were added with timing optimized for maximum present value of net cash flow. The cost of these personnel is estimated to be $2,000,000 per year. This is the "second crew expansion." The use of this second crew can be stopped at the end of any month, in which case, the cost for the crew is assumed to stop one month later.

18. The maximum quantity of U-235 will be recovered consistent with the other bases and assumptions. Achieving the maximum present value of net cash flow is the goal in this regard.



APPENDIX C

FIGURE C-1
PROCESSING SCHEMES FOR FUELS INVOLVED IN THE MULTIPLE FUELS PROCESSING PROGRAM

ACC-C-2651

APPENDIX D

IMPROVEMENTS IN COMPUTER SOFTWARE FOR MFPP SIMULATION AND ANALYSIS

During the past year, several improvements have been made in the computer program used to simulate and illustrate ICPP production activities (CPPSIM). A list of changes and additions to CPPSIM follows:

(1) English units were converted to metric units.

(2) Calculation of ^{85}Kr was added.

(3) The CPPSIM program was split into two parts; the graphics subroutines were made into a new program, called GRAPH.

(4) Provisions were made to simulate the calcining of a mixture of non-fluoride and fluoride wastes.

(5) Calculation of positions occupied in the new fuel storage basin was added to CPPSIM. Assumptions for this addition were that all fuels to be stored underwater and received after April 1, 1983 would be put in the new basin and that each fuel would be entirely processed from the old basin before being taken from the new one. Corresponding changes were made to the simulation of the old-basin inventories. Software for a graph on the new basin was added to GRAPH.

(6) A second line was added to the projected calcine inventory to show maximum unused space in the third bin set. The line is based on the assumption that the WCF will not be operated after startup of the NWCF.

APPENDIX E

MAJOR FY 1977 ACCOMPLISHMENTS

The purpose of this appendix is to compare actual results for the first six months of FY 1978 with the plans for FY 1978 presented in the FY 1977 Supplement Document for the MFPP. In this comparison, fuel dissolution is considered synonymous with fuel processing for purposes of associating dates with fuel processing; i.e., dates for extractions and denitration of the product are disregarded. The following tabluation summarizes fuel processing and waste calcining.

	Planned for FY-1978	Actual through 5/31/78	Revised Estimate
Fuel processing, kg U-235	646	0	515
Net liquid waste calcining, cubic metres (allows for WCF decontaminating solutions)	1,022	950	1,490

The estimate for fuel processing was reduced because difficulties with fissium and solids carried over to extraction columns made desirable the postponement of a 306-kg campaign on processes C and D until a new centrifuge has been installed. To compensate for the 306-kg reduction, the campaign on process B formerly and still planned for the third quarter of FY 1978 will be enlarged to the extent permitted by waste space made available by concurrent calcining. The revised estimate is 515 kg of U-235. Process B produces about 8 times as much waste per unit product as processes C and D.

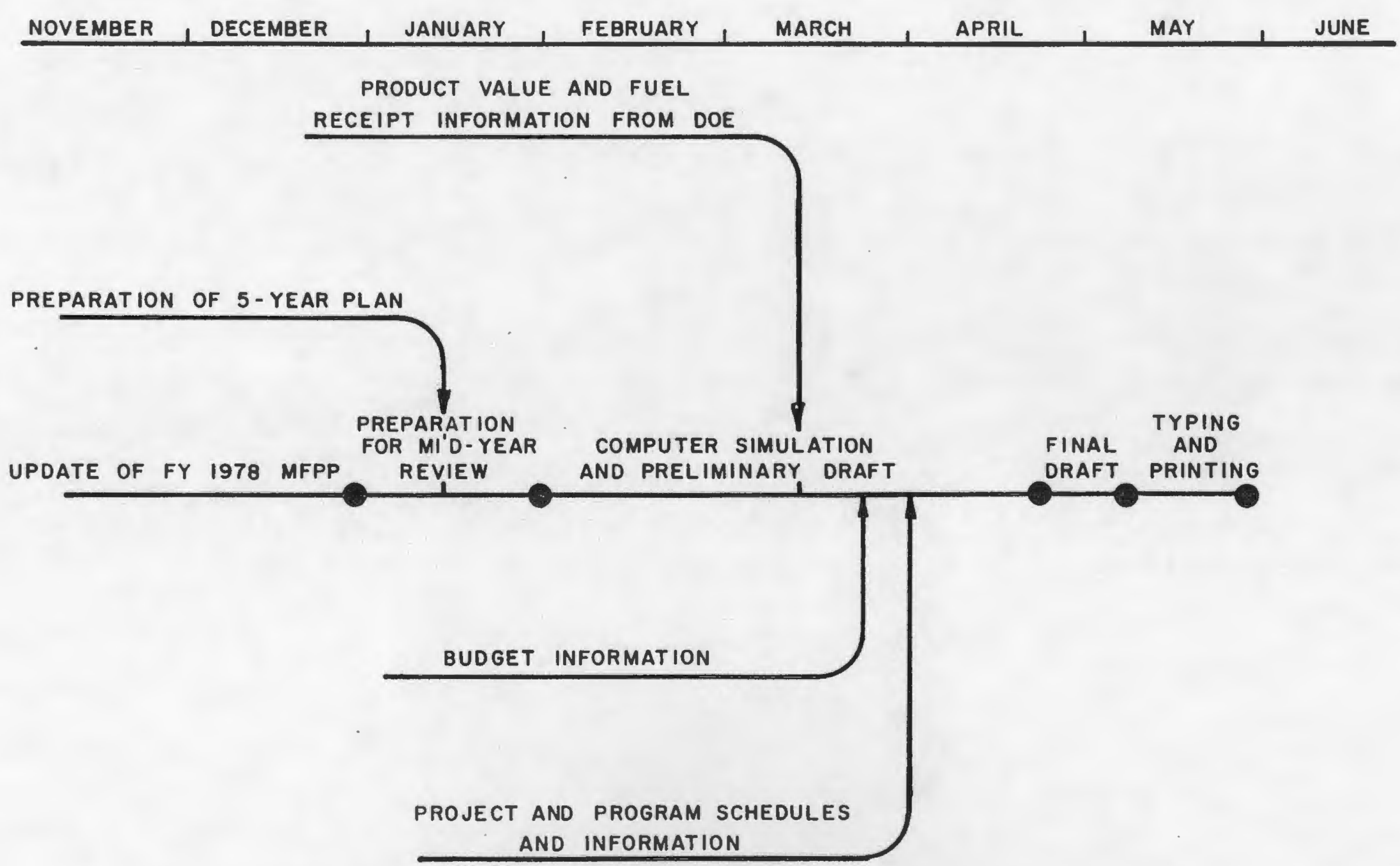
Following is a list of other major goals in the Baseline Program for FY 1978 and the status of the work to accomplish them:

Preliminary conceptual design of PACB:	Completed
Construct General Office Building II:	On Schedule
Complete initial removal of sludge from fuel storage basin:	Delayed about 3 months
Issue preliminary design descriptions and PSAR for the FAST project:	Completed
Complete Rover Phase-2 Construction:	About 10% behind schedule
Demonstrate pilot-plant calcinations of nonfluoride (WM-183) and sodium-bearing wastes:	Completed

Calcine blend of sodium-bearing and fluoride wastes in the WCF:	Initial Test Complete
Calcine blend of nonfluoride (WM-183) and fluoride wastes in WCF:	On Schedule
Complete NWCF Title II design:	Completed
Complete Title II design for Personnel Protection and Support Facility:	Completed
Complete Title I design and PSAR for Fifth Set of Calcine Storage bins:	On Schedule
Complete Radioactive Liquid Waste System Improvements Project:	On Schedule and nearly complete

APPENDIX F

PLAN FOR PREPARATION OF FY 1979 MFPP



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- A. G. McGuire - 4
- F. L. McMillan - 9
- B. C. Musgrave - 8
- R. S. P'Pool
- K. L. Rohde
- H. G. Spencer
- B. R. Wheeler

ACC-Morristown
- J. C. Bishop
- R. I. Newman