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ICPP MULTIPLE FUELS PROCESSING PROGRAM FY 1979 SUPPLEMENT DOCUMENT

May 1979

Allied Chemical
IDAHO CHEMICAL PROGRAMS

ENERGY SAFETY ENVIRONMENT

IDAHO NATIONAL ENGINEERING LABORATORY

DEPARTMENT OF ENERGY

IDAHO OPERATIONS OFFICE UNDER CONTRACT DE-AC07-76IDO1540

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ICPP MULTIPLE FUELS PROCESSING PROGRAM

FY-1979 SUPPLEMENT DOCUMENT

by

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ALLIED CHEMICAL CORPORATION
IDAHO CHEMICAL PROGRAMS - OPERATIONS OFFICE

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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 $884 million and recovery of 14,960 kg of ^{235}U worth $678 million during the study period: FY 1980 through FY 1991. To help show the economic significance of this program to the government, costs at the ICPP were estimated for a minimum program: a scenario in which fuel processing would not be resumed. Instead, all fuels in inventory were assumed to shipped to another site at ICPP expense, and fuels scheduled for receipt were assumed to be sent from all shippers to the other site without cost to the ICPP. Costs for calcining the inventory of liquid wastes and wastes generated by remaining ICPP operations were also included in the scenario. The incremental cost between the Baseline Program and the minimum-cost scenario would be the cost, at ICPP only, assignable to the recovered ^{235}U. Total estimated cost at ICPP for the scenario was $260 million, $624 million less than the $884 million total cost for the Baseline Program. The total cost to the government at all sites for the scenario would be considerably larger than $260 million, because of the additional non-ICPP fuel shipping costs and the additional operating costs for receipt and storage or other treatment of the fuel. Thus, the additional costs to the government for recovery of 14,960 kg of ^{235}U at ICPP, valued at $678 million, will be less than the $624 million difference in ICPP costs between the Baseline Program and the minimum-cost scenario. 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. Assuming a 10% discount rate, present (FY 1980) values of the $678 million incremental benefit and $624 million incremental ICPP cost are $390 million and $440 million, respectively. Completion of the Baseline Program will require integrating into the existing ICPP facilities about $460 million worth of line-item facilities on which construction is in progress or is planned.

Funding in FY 1981 required for the ICPP operations covered in this document is compared to that required for FY 1980 in the following tabulation:

		Dollars in Thousands		
B & RC No.	Brief Titles	FY 1980	FY 1981	Differences
JM 03 01 221	Separations	20,440	25,410	4,970
JM 03 01 311	Startup	1,100	1,340	240
JM 03 01 361	Conceptual Engineering	950	3,030	2,080
KN 03 70 000	Energy Management	150	510	360
	Subtotal(JM 03,KN 03)	22,640	30,290	7,650
JM 05 01 031	Waste Solidification	14,055	12,000	(2,055)
JM 05 01 032	Startup	2,050	4,550	2,500
JM 05 01 033	Conceptual Engineering	350	700	350
	Subtotal(JM 05)	16,455	17,250	795
Total for ICPP Production		39,095	47,540	8,445

These costs were taken from the FY 1981 budget submission; the FY 1981 costs are the minimum of the three alternatives submitted.

Production funding required for the Baseline Program for FY 1981, the highlighted year in the report, is about $8.4 million higher than for FY 1980. The major elements of the increase are about $3.5 million for escalation, $2.0 million for extensive conceptual engineering studies of alternatives for plant upgrade, and $2.7 million for startup activities, principally for the New Waste Calcining Facility (NWCF) and the Rover facility.

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

Capital Line Items	First FY of Funding	Approximate Beneficial Use	Total Estimated Cost ($$10^6$)	Estimated Obligation After FY 1979 ($$10^6$)
Calcined Solids Storage				
Sixth set of bins	1981[(a)]	Nov 1984	16	15.5
Seventh set of bins	1986	Apr 1989	30[(c)]	30
Fluorinel Dissolution Process & Fuel Receiving Improvements	1977	Jul 1983	150	87.4
Utility Replacement and Expansion	1979	Aug 1981	10.5	5.5
Steam Generation	1980[(b)]	Sep 1983	24	23.5
Plant Analytical Chemistry Building	1981	Apr 1984	25	25
Renovation of Process Cells	1981	Mar 1986	85[(c)]	85
RAF Upgrade and Expansion	1981	Dec 1983	11	11

(a) PE&D funds of $500,000 in FY 1979 and $500,000 in FY 1980 are included in the $16 million total estimated cost.

(b) The $24 million includes $500,000 PE&D funds in FY 1979.

(c) These are order-of-magnitude estimates.

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 September 1981.

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

(3) Operation of the Fluorinel Process and availability of the new fuel storage basin beginning in July 1983.

(4) Availability of the Plant Analytical Chemistry Building in FY 1984.

(5) Completion of process-cell renovation in FY 1986.

The most difficult contingencies to recover from would be: (1) a leaking waste tank, (2) no more waste calcination from the WCF combined with a delay in availability of the NWCF, and (3) severe damage to the existing fuel storage basin by an earthquake.

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 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 highly radioactive liquid wastes 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 originally 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.[2,3,4,5,6,7,8,9,10,11] 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 wastes.
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 1981 is highlighted in this document. A 12-year study period starting with FY 1980 is used in economic calculations; present values are taken to FY 1980. 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 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-1979

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[12], a classified document issued by DOE-ID.

II. BASELINE PROGRAM

1. OPERATIONS IN THE BASELINE PROGRAM

In the baseline program, recovery of 14,960 kg of ^{235}U is projected during the 12-year study period. Fuel processing and other operations are projected to generate about 17,600 cubic metres of high-level radioactive liquid wastes. Calcining of about 21,500 cubic metres of high-level liquid wastes is planned, which will reduce the inventory from 9100 cubic metres to 5200 cubic metres; the 3500 cubic metres of solids produced by the calcining will bring the total calcine inventory to about 5200 cubic metres.

The first few years of the projected operating schedule are illustrated in considerable detail in 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 C), construction work, and work in several cells are projected for the first three quarters of FY 1980. Processing of fuels 1 and 3 is scheduled for the fourth quarter of FY 1980 and the first two quarters of FY 1981. Following will be intensive preparation for Rover startup.

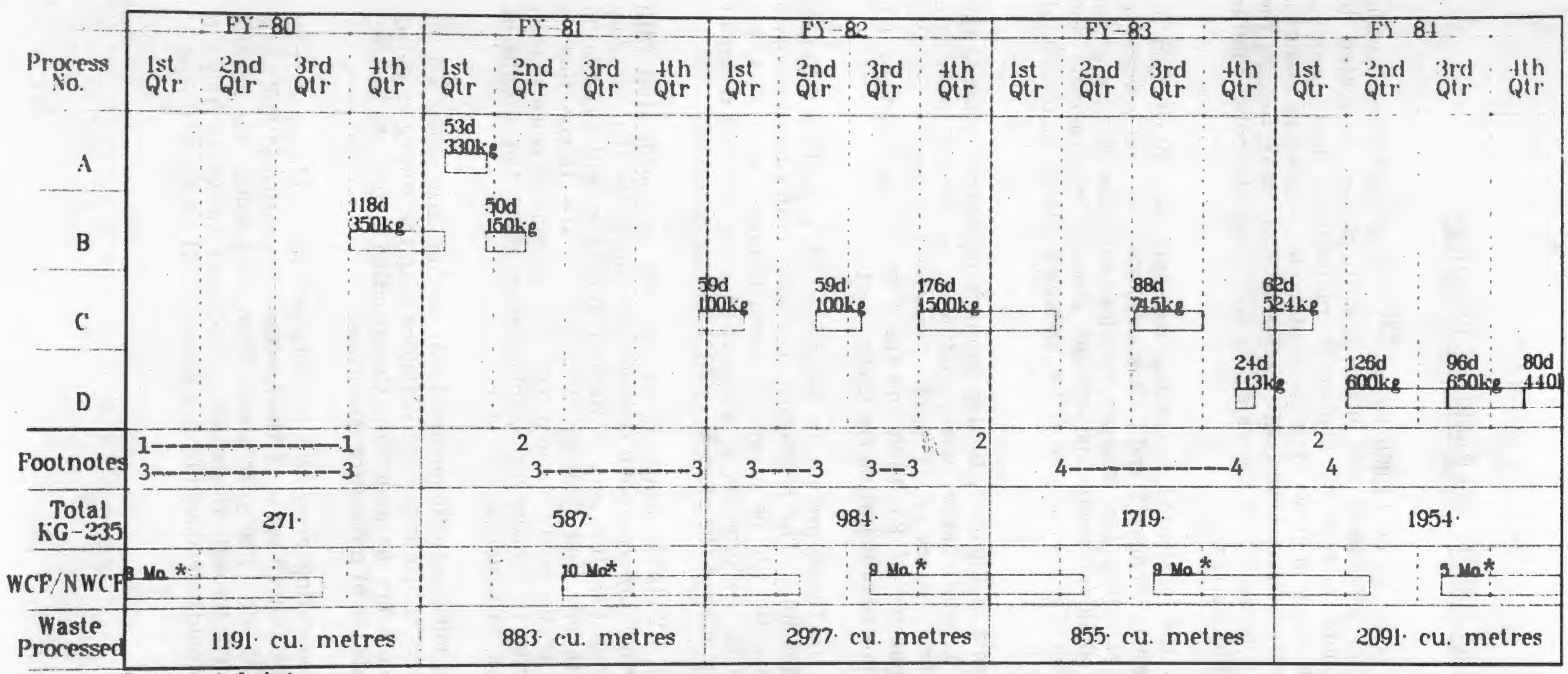
The initial cold startup of the Rover process in September 1981, will be followed by as much operation as feasible. The prediction in Figure 1 of two two-month operating periods in which little fuel is processed, each followed by periods for correction or modification of the process, is a selection from a broad range of possibilities. Actual performance of the process could be better or worse.

After the first quarter of FY 1983, Rover operation will be coordinated with preparations for the Fluorinel process cold startup and run projected for July 1983. The second quarter and the first part of the fourth quarter will be devoted exclusively to Fluorinel training and testing. The last of the Rover fuel is projected for processing after the cold Fluorinel run. The schedule (Figure 1) then calls for hot Fluorinel startup in January 1984, followed by about ten months of operation of this new process, to November.

For the sixteen months beginning with November 1984, no fuel processing will be done if the Renovation of Process Cells project is funded with the timing assumed, and construction requirements are as assumed. Construction under the project may require more than 16 months of processing downtime.

After the renovation, the operating crew will be enlarged to enable concurrent operation of the headend and tailend parts of the process. Operation in this mode for an average of about 235 days per year should then be possible for several years, and has been assumed through the study period. As shown in Table I, unprocessed fuel inventory would be reduced from a peak of 7221 kg of ^{235}U (and

ICPP OPERATING SCHEDULE



Process A=fuels 1
B=fuels 2,3,30
C=fuels 9,25
D=fuels 12,13,14,15,16,17,18,21,22,23,26,27,28,34,35

BASE CASE REVISED 4-9-79

FIG. 1

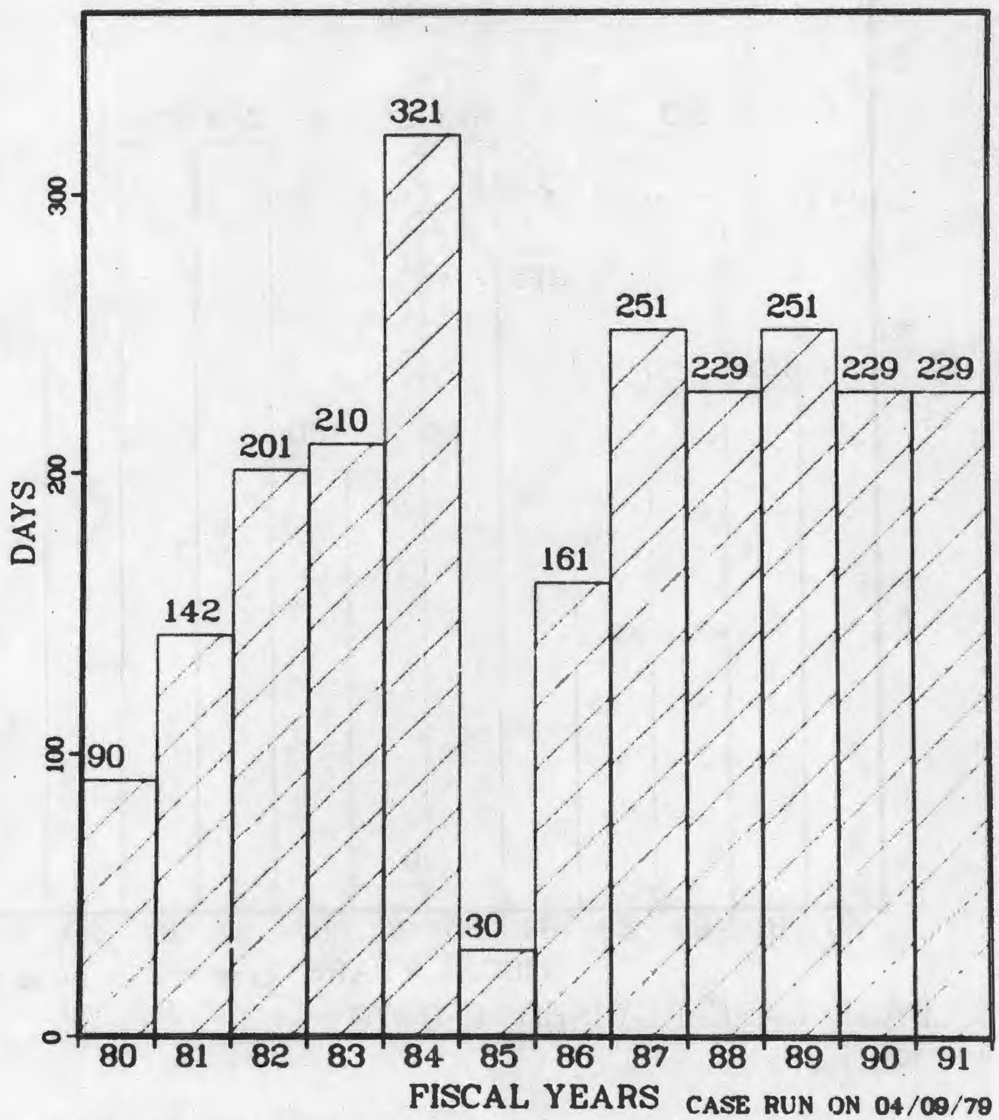
CASE RUN ON 04 10 79

Fuels not included 4,5,11,6,7,8,10,19,29,33.

1. Work during this period includes turnarounds in G, E, J, K, and tailend cells, denitrator modifications, west vent tunnel modifications and sampler construction.
2. The approximate timing for uranium sweepdowns is indicated.
3. Testing or deficiency correction in the Rover facility will be in progress during these periods.
4. Training and testing in preparation for Process D startup during these periods.

* These bars show projected availability of the waste calcining facilities. Days spent calcining are shown in Figure 3, and in some years are less than available days because at some times, fluoride waste is unavailable or is not sufficiently cooled.

FUEL PROCESSING DAYS

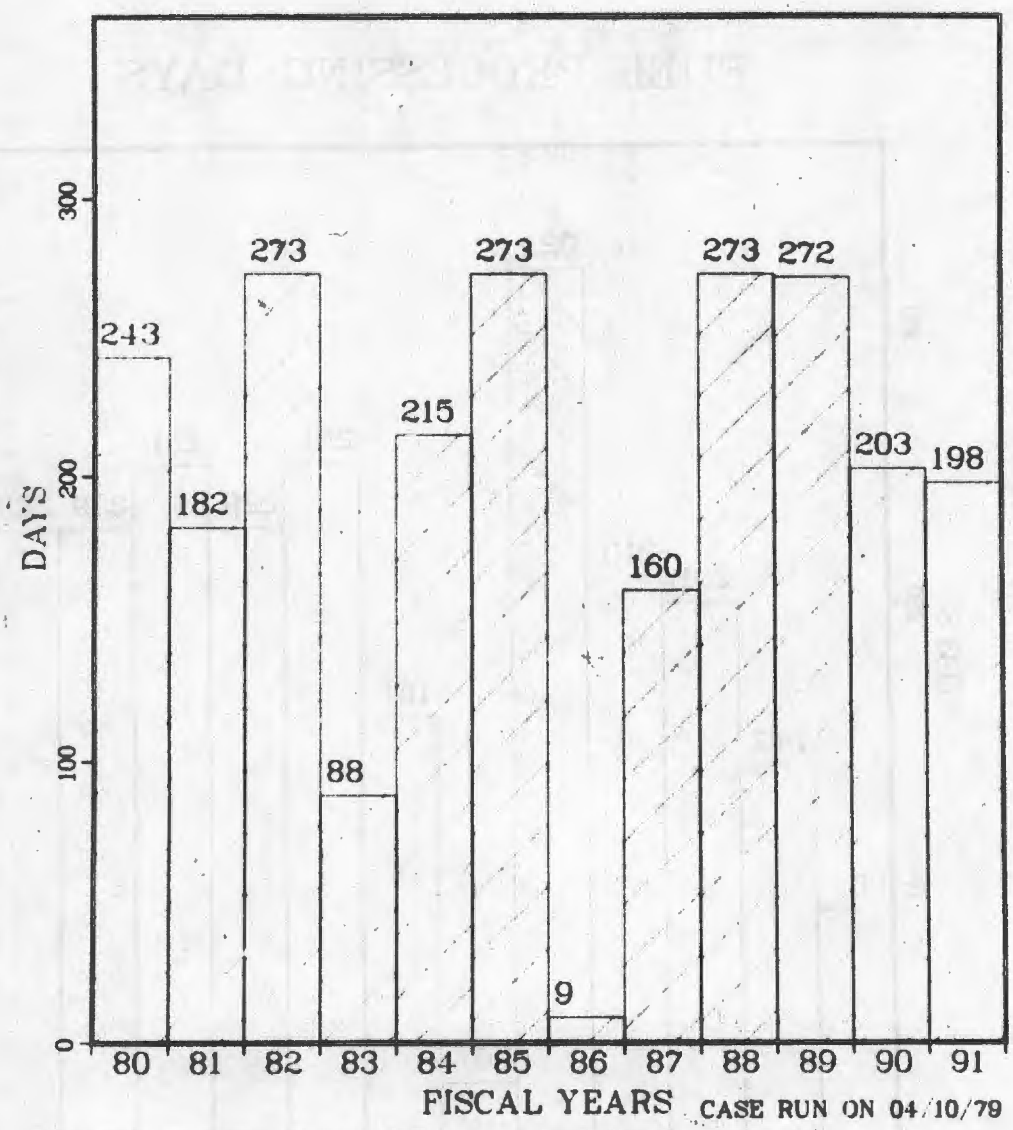


BASE CASE REVISED 4-9-79

FIG. 2

PLOT 5 15.49.23 MON 09 APR, 1979 JOB-MGSI CP. ISSCO. DISSPLA VER 4.11

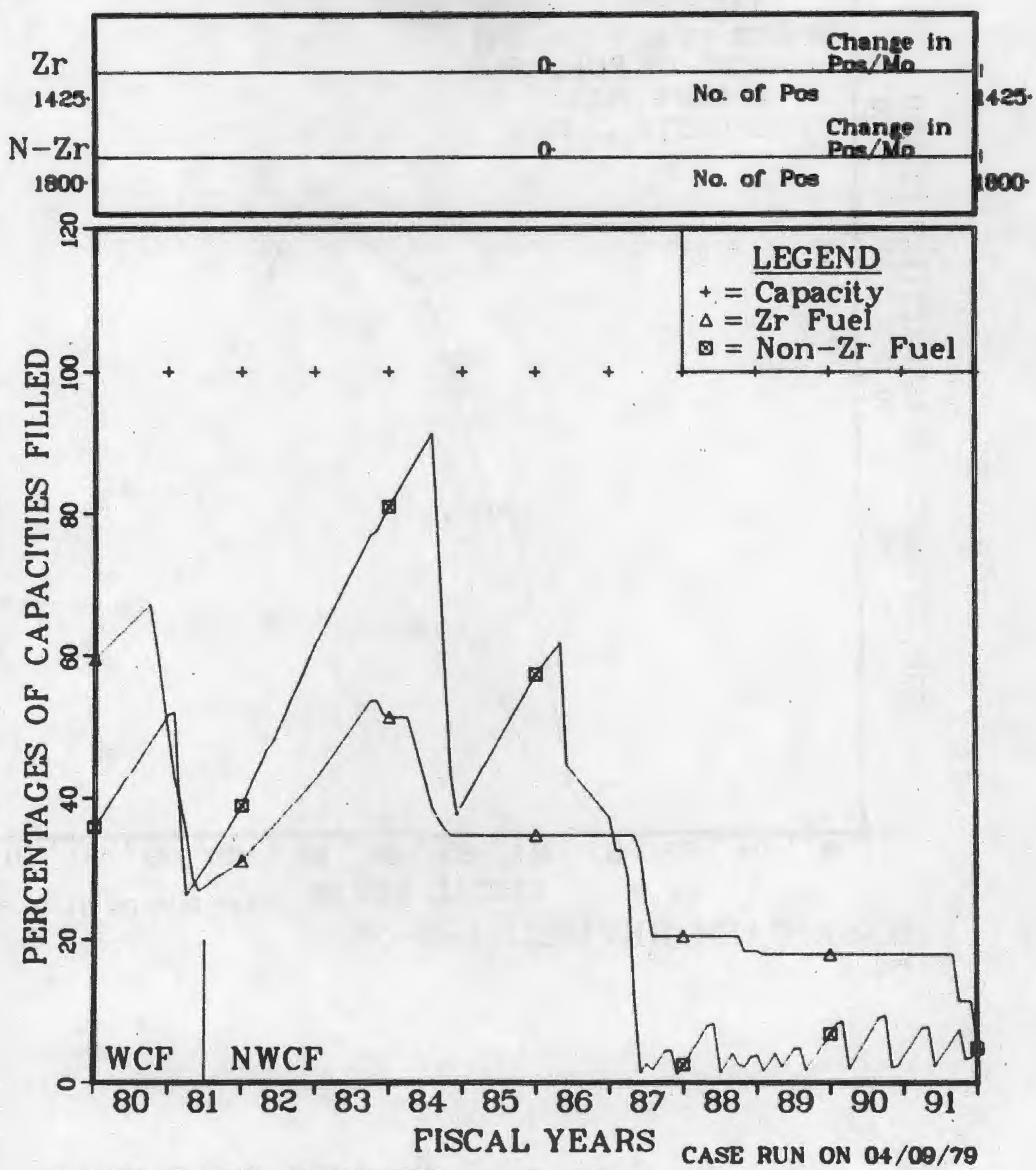
WASTE CALCINING DAYS



BASE CASE REVISED 4-9-79

FIG. 3

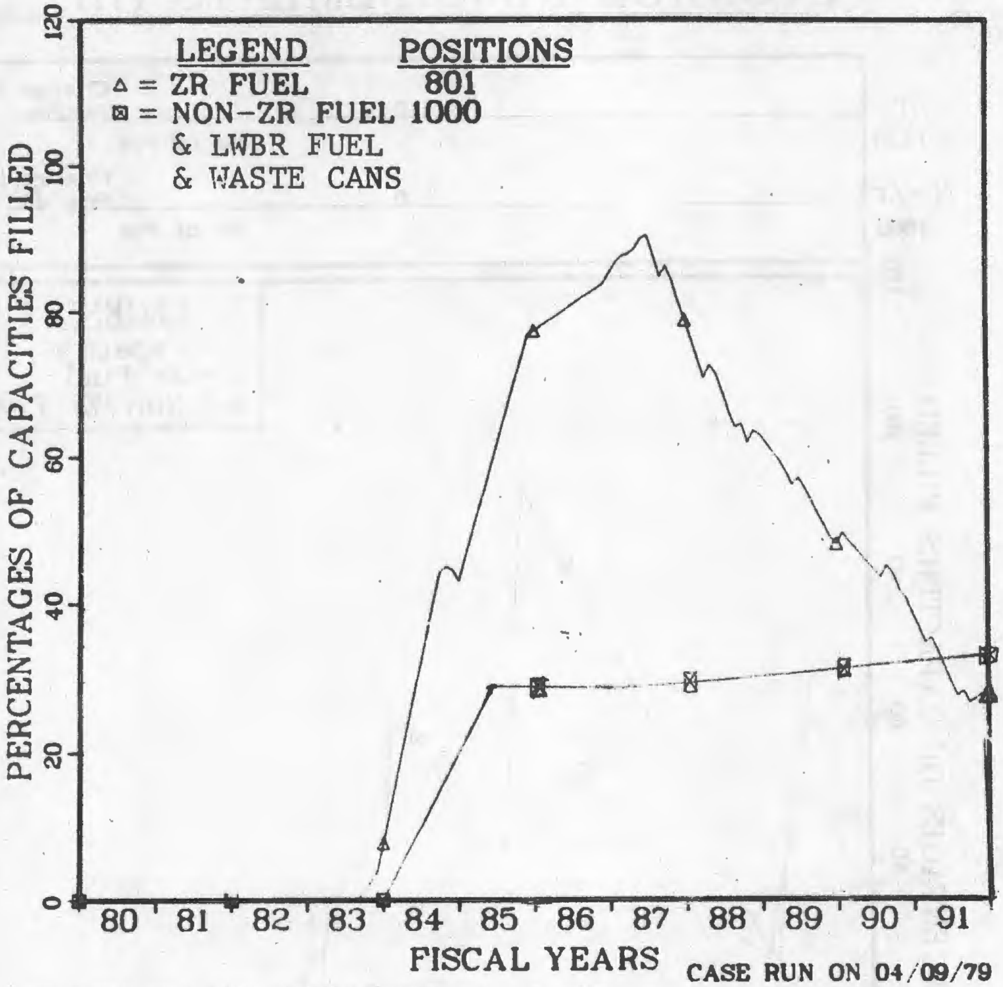
PROJECTED FUEL BASIN STORAGE REQUIREMENTS (in %)



BASE CASE REVISED 4-9-79
FIG. 4

PLOT 1 19.15.31 MON 09 APR. 1979 JOB-H657 CP. ISSCO. DISSPLA VER 4.11

PROJECTED FAST FUEL BASIN STORAGE REQUIREMENTS (in %)

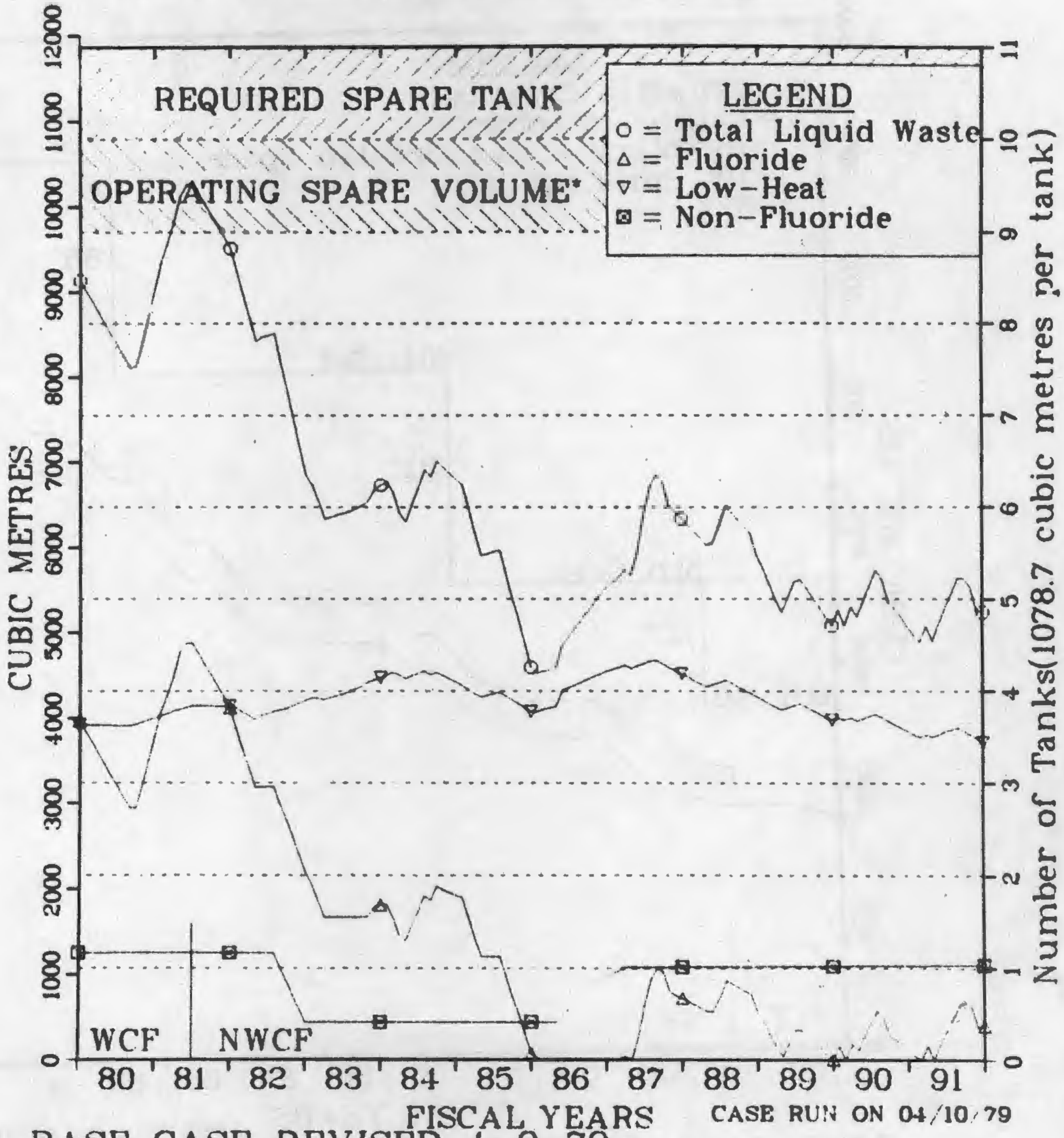


BASE CASE REVISED 4-9-79

FIG. 5

PLOT 2 19.16.06 MON 09 APR. 1979 JOB=MG57 CP. ISSCO. DISSPLA VER 4.11

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY

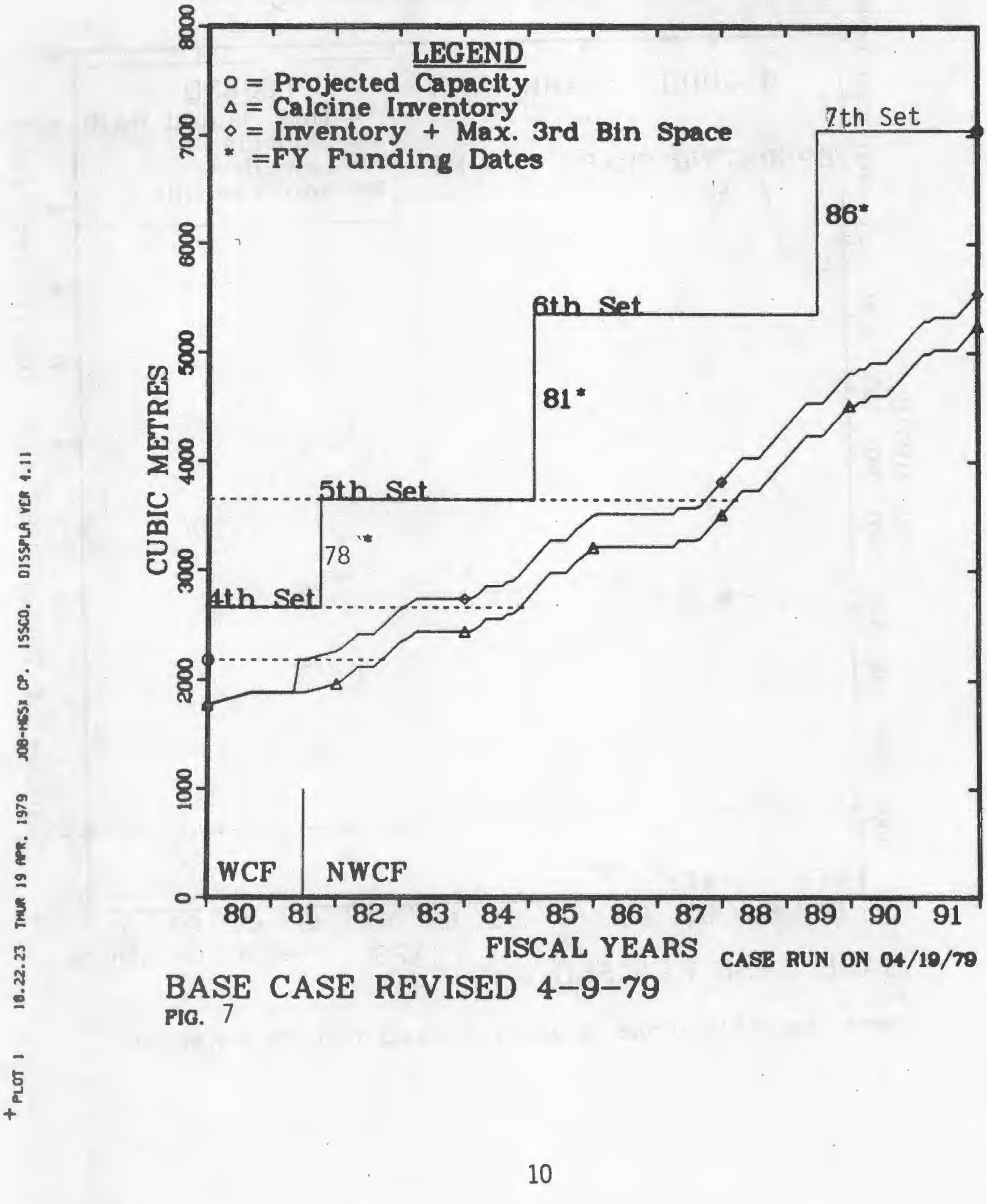


BASE CASE REVISED 4-9-79

FIG. 6

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

PROJECTED CALCINE STORAGE REQUIREMENTS



BASE CASE REVISED 4-9-79

FIG. 7

BASE CASE REVISED 4-9-79

TABLE I - ANNUAL SUMMARY OF OPERATIONS

CASE RUN ON 04/23/79

NO.	NAME OF FUEL	RECOVERY PROCESS	STARTUP DATE MO YR	START INVEN	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	329	0	0	0	0	0	0	0	0	0	0
2	FUEL NUMBER 2	PROCESS 2		135	102	0	237	107	0	102	160	0	262	122	0	384	118	0	38
3	FUEL NUMBER 3	PROCESS 2		498	89	265	321	60	234	58	99	0	157	0	0	157	53	0	210
4	FUEL NUMBER 4	PROCESS 3		406	151	0	556	151	0	707	151	0	858	151	0	1009	151	0	1160
5	FUEL NUMBER 5	PROCESS 3		49	0	0	49	0	0	49	0	0	49	0	0	49	0	0	49
6	FUEL NUMBER 6	PROCESS 3		27	3	0	30	30	0	60	0	0	60	2	0	61	2	0	63
7	FUEL NUMBER 7	PROCESS 3		57	0	0	57	0	0	57	0	0	57	0	0	57	0	0	57
8	FUEL NUMBER 8	PROCESS 3		5	5	0	9	5	0	14	5	0	19	5	0	24	5	0	29
9	FUEL NUMBER 9	PROCESS 4	9 81	2969	0	0	2969	0	17	2951	0	961	1989	0	1579	410	0	410	0
10	FUEL NUMBER 10	PROCESS 10		100	0	0	100	2	0	101	12	19	93	12	24	80	0	0	80
11	FUEL NUMBER 11	PROCESS 3		0	10	0	9	5	0	14	4	0	18	4	0	22	4	0	26
12	FUEL NUMBER 12	PROCESS 5	7 83	19	0	0	19	0	0	19	0	0	19	0	0	19	0	0	19
13	FUEL NUMBER 13	PROCESS 5	7 83	0	116	0	115	119	0	234	114	0	348	535	0	883	564	599	662
14	FUEL NUMBER 14	PROCESS 5	7 83	23	0	0	23	2	0	24	11	0	35	2	0	37	0	0	37
15	FUEL NUMBER 15	PROCESS 5	7 83	61	0	0	61	0	0	61	0	0	61	0	0	61	370	0	430
16	FUEL NUMBER 16	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
17	FUEL NUMBER 17	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	1	0	0	5	0	5
18	FUEL NUMBER 18	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
19	FUEL NUMBER 19	PROCESS 10		20	10	1	27	10	1	35	10	0	45	25	0	70	10	19	60
20	FUEL NUMBER 20	PROCESS 16		60	0	0	60	0	0	60	0	0	60	0	0	60	0	0	60
21	FUEL NUMBER 21	PROCESS 7	7 83	113	0	0	113	0	0	113	0	0	113	0	112	0	0	0	0
22	FUEL NUMBER 22	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	0	0	0	116	0	115
23	FUEL NUMBER 23	PROCESS 5	7 83	12	0	0	12	0	0	12	0	0	12	0	0	12	0	0	12
24	FUEL NUMBER 24	PROCESS 16		0	0	0	0	0	0	0	0	0	0	0	0	0	414	0	414
25	FUEL NUMBER 25	PROCESS 4	9 81	0	2	0	1	5	0	6	5	0	11	2	0	13	2	0	15
26	FUEL NUMBER 26	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	0	0	0	910	271	638
27	FUEL NUMBER 27	PROCESS 5	7 83	2	0	0	2	0	0	2	2	0	3	0	0	3	67	0	70
28	FUEL NUMBER 28	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	134	0	133	0	0	133
29	FUEL NUMBER 29	PROCESS 9		5	0	0	4	0	0	3	0	0	2	0	0	1	0	0	0
30	FUEL NUMBER 30	PROCESS 2		24	0	0	24	0	0	24	0	0	24	0	0	24	0	0	24
31	FUEL NUMBER 31	PROCESS 16		46	21	0	67	35	0	101	47	0	148	51	0	199	66	0	265
32	FUEL NUMBER 32	PROCESS 16		224	63	0	287	47	0	333	41	0	374	32	0	406	24	0	430
33	FUEL NUMBER 33	PROCESS 9		7	0	1	5	0	1	3	0	0	2	0	0	1	0	0	0
34	FUEL NUMBER 34	PROCESS 5	7 83	370	18	0	388	0	0	388	0	0	388	0	0	388	0	0	388
35	FUEL NUMBER 35	PROCESS 5	7 83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	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	FISCAL 1991 KG REC	FISCAL 1991 KG PROC	FISCAL 1991 KG INV	TOTALS KG REC	TOTALS KG PRC
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	330.
2	96	0	134	81	0	215	109	0	9	113	0	18	103	0	34	118	0	9	105	0	17	1334.	0.
3	19	0	229	0	0	229	30	0	259	21	0	280	0	0	280	7	0	287	0	136	150	378.	637.
4	151	0	1311	151	1424	38	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	1057.	1463.
5	0	0	49	0	0	49	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	49.
6	2	0	65	2	66	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	41.	68.
7	0	0	57	0	0	57	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	57.
8	5	0	34	5	0	39	5	41	3	5	0	8	5	0	13	5	0	18	5	0	23	60.	41.
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	2969.
10	30	0	110	0	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56.	156.
11	4	0	30	4	32	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	35.	35.
12	0	0	19	0	0	19	0	0	19	0	0	19	0	0	19	0	0	19	0	0	19	0.	0.
13	240	0	902	303	0	1205	443	0	1522	573	0	2053	454	904	1568	517	946	1082	336	932	446	4314.	3383.
14	2	0	39	0	0	39	2	0	41	0	0	41	2	0	43	0	0	43	2	0	45	23.	0.
15	0	0	430	0	0	430	0	0	430	0	0	430	0	430	0	0	0	0	0	0	0	370.	431.
16	0	0	3	0	0	3	0	0	3	0	0	3	2	0	4	0	0	4	0	0	4	5.	0.
17	0	0	5	0	0	5	1	6	0	0	0	0	0	0	0	0	0	0	1	0	0	8.	8.
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.	1.
19	25	0	85	10	90	5	20	24	1	20	21	0	20	13	6	20	23	3	20	21	1	200.	218.
20	0	0	60	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	0	0	0.	113.
22	0	0	115	58	0	173	0	0	173	58	0	231	57	0	288	0	0	288	0	0	288	289.	0.
23	0	0	12	0	0	12	0	0	12	0	0	12	0	0	12	0	0	12	0	0	12	0.	0.
24	89	0	502	0	0	502	0	0	502	0	0	502	0	0	502	0	0	502	0	0	502	503.	0.
25	2	0	17	2	0	19	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	20.	20.
26	910	168	1379	0	0	1379	230	620	989	229	1180	38	0	38	0	0	0	0	0	0	0	2279.	2279.
27	82	0	152	0	0	152	0	0	152	0	0	152	0	0	152	0	0	152	0	0	152	151.	0.
28	150	0	283	0	0	283	0	0	283	0	279	4	0	4	0	299	274	24	0	24	0	583.	583.
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	5.
30	0	0	24	0	0	24	0	0	24	0	0	24	0	0	24	0	0	24	0	23	0	0.	24.
31	58	0	323	56	0	379	57	0	436	0	0	436	0	0	436	0	0	436	0	0	436	391.	0.
32	15	0	445	17	0	462	16	0	478	0	0	478	0	0	478	0	0	478	0	0	478	255.	0.
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	7.
34	0	0	388	0	0	388	0	387	0	0	0	0	0	0	0	0	0	0	0	0	0	18.	388.
35	0	0	0	0	0	0	0	441	0	0	144	0	0	122	0	0	199	0	0	136	0	0.	1694.

FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTALS
FUELS RECEIVED,KILOGRAMS U-235	590.	578.	661.	1078.	2885.	1880.	689.	913.	1019.	643.	966.	469.	12371.
FUELS PROCESSED,KILOGRAMS U-235	270.	587.	984.	1719.	1954.	168.	1725.	1691.	1627.	1514.	1443.	1276.	14959.
FUELS INVENTORY,KILOGRAMS U-235	5551.	5543.	5220.	4578.	5509.	7221.	6185.	5407.	4799.	3928.	3451.	2644.	
TOTAL WASTE PRODUCED, CU. METRES	1104.	1351.	452.	718.	2028.	450.	1024.	2365.	2209.	1823.	1961.	2093.	17578.
TOTAL WASTE CALCINED, CU. METRES	1191.	883.	2977.	855.	2091.	2650.	90.	1553.	2650.	2641.	1968.	1926.	21476.
TOTAL WASTE INVENTORY, CU. METRES	9053.	9521.	6996.	6858.	6795.	4595.	5529.	6341.	5900.	5082.	5075.	5242.	
SOLIDS WASTE PRODUCED, CU. METRES	111.	80.	384.	94.	318.	454.	13.	293.	500.	498.	371.	357.	3473.
SOLIDS WASTE INVENTORY, CU. METRES	1881.	1962.	2345.	2439.	2757.	3211.	3224.	3517.	4017.	4515.	4886.	5243.	
DAYS OF FUEL PROCESSING	90	142	201	210	321	30	161	251	229	251	229	229	
DAYS OF WASTE CALCINING	243	182	273	88	215	273	9	160	273	272	203	198	

CUBIC METRES OF RADIOACTIVE LIQUID WASTES

FISCAL YEAR:	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTALS
ZR FLUORIDE													
PRODUCED	853.	1084.	2.	2.	2.	0.	0.	0.	0.	0.	0.	514.	2458.
CALCINED	1022.	757.	1921.	524.	833.	780.	70.	0.	0.	0.	0.	113.	6019.
INVENTORY	3794.	4121.	2202.	1681.	850.	70.	0.	0.	0.	0.	0.	401.	
FLUORINEL													
PRODUCED	0.	0.	0.	136.	1631.	202.	0.	1935.	1883.	1505.	1644.	1272.	10207.
CALCINED	0.	0.	0.	0.	687.	1281.	0.	1208.	2061.	2054.	1530.	1385.	10207.
INVENTORY	0.	0.	0.	136.	1080.	0.	0.	727.	549.	0.	114.	0.	
LOW-HEAT													
PRODUCED	251.	263.	306.	343.	327.	248.	484.	319.	320.	314.	310.	301.	3786.
CALCINED	170.	126.	238.	77.	380.	589.	20.	345.	589.	587.	437.	428.	3986.
INVENTORY	4003.	4140.	4208.	4474.	4420.	4080.	4544.	4518.	4249.	3976.	3849.	3721.	
NON-FLUORIDE													
PRODUCED	1.	1.	0.	0.	6.	0.	540.	111.	6.	4.	7.	6.	682.
CALCINED	0.	0.	818.	0.	0.	0.	0.	0.	0.	0.	0.	0.	818.
INVENTORY	1257.	1257.	439.	439.	445.	445.	985.	1096.	1102.	1106.	1113.	1120.	
ROVER													
PRODUCED	0.	3.	144.	237.	62.	0.	0.	0.	0.	0.	0.	0.	445.
CALCINED	0.	0.	0.	255.	190.	0.	0.	0.	0.	0.	0.	0.	445.
INVENTORY	0.	3.	147.	129.	0.	0.	0.	0.	0.	0.	0.	0.	

^{233}U) at the end of FY 1985 to 2644 six years later. These quantities include 1331 and 1477 kg, respectively, not scheduled for processing.

Adequacy of these plans in terms of fuel storage capability is shown by Figures 4 and 5. For Figure 4, 100% of capacity is based on installation of 70 of 80 available racks. Racks will, however, not be installed before they are needed. The new metal-clad fuel storage basin to be provided by the FAST project is scheduled to become available for use in July 1983. Thereafter, all zirconium-clad fuel received will be put in it; other fuels will continue to be put into currently existing facilities. The 1000 positions for non-zirconium and LWBR fuels and for waste cans indicated in the legend for Figure 5 would require purchase of additional fuel storage racks not now authorized. The LWBR fuel which until recently was scheduled for dry storage [13], will require 25 to 30% of the space formerly reserved for 1000 positions of non-zirconium fuels. Use of 28% of non-zirconium capacity by LWBR fuel was assumed for Figure 5. Solid waste from the Fluorinel dissolution process will also be stored in the FAST basin until some other disposition for the waste is made available.[14, 15] One of the two following locations will be selected for storage in the FAST basin: (1) the cutting pool or (2) a fuel storage pool formerly reserved for non-zirconium fuels. Storage in the cutting pool would have no effect on fuel storage capacity but would not be feasible if direct receipt of fuels and fuel cutting were to be added to the FAST programmatic effort. Storage of the cans in the fuel storage pool, which was assumed for Figure 5, would require, by the end of the study period, about 5% of the capacity formerly reserved for non-zirconium fuels. Racks suitable for non-zirconium fuels will be purchased to hold the waste cans, and thus will be available for fuel storage following disposition of the waste.

The waste calcining campaign to begin this June is expected to continue for much of FY 1980, and to increase empty tank space enough to permit the planned fuel processing campaign, which will produce nearly 2000 cubic metres of waste. As shown in Figure 6, a reduction in calcining of up to half of one large tank would raise the inventory to the limit and thus could occur before reduction of fuel processing would be forced. This would be a reduction of about 4.2 months of WCF operation.

Operation of the WCF will be extended to the end of FY 1980, if feasible, but not into FY 1981 because intensified operator training and cold operation of the NWCF are scheduled then, preparatory to hot startup of the new facility the following April 1981.

The NWCF was assumed to perform at about 50% of design capacity for the first six months of hot operation, and thereafter to be available about nine months per year at the design rate. However, suitable and sufficiently cooled waste is not always available. For example, calcination in FY 1983 and part of FY 1984 was held up because the remaining 1.6 tanks of zirconium fluoride waste, if calcined as a blend with either Rover or low heat waste, would produce a calcine generating as high as 120 watts per cubic metre, well above the safe limit of 104 for the fourth set of bins. This calculated heat generation may later be found overly conservative, or some other course of action, not explored for this document, could probably avoid the holdup. Since the fluoride waste inventory was low and complete exhaustion of it was forseen within three years, waiting for the waste to cool was the action assumed and simulated.

An alternative to waiting for the waste to cool would be to purchase aluminum nitrate, blend it with low-heat waste in about a 2.5:1 mole ratio of aluminum to sodium, and calcine it. Compared to calcining as a blend with zirconium fluoride waste, this would be a very expensive way to dispose of the low-heat waste. The prinicipal incremental expense would be for additional calcine bin space; the effective liquid-to-solid ratio would be about 2.2:1, compared to 7:1 for the blend with zirconium fluoride waste. Efforts to reduce the sodium content of this waste, and also its rate of generation, are underway. Note from Table I data that the inventory at the end of FY 1980 would not be all calcined before 1992, so reduced sodium levels do not appear at the calciner under the first-in-first-out assumption employed.

In Figure 7, the line labeled "inventory plus max. 3rd bin space" implies that the WCF will not be operated after NWCF startup and that the third bin set will not be filled; these are conservative assumptions for the simulation—designed to show the earliest date that this case would show need for new bins. However, continued operation of the WCF to fill the third bin set is planned, during periods when the NWCF is in a shutdown. Depending on the type of waste calcined, from 12 to 20 added months of WCF operation will be required to fill the third set.

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 1980 and exclude 88 kg of ^{235}U recovered in the latter part of FY 1991.

TABLE II

PROJECTED PRODUCT SHIPMENTS IN THE BASE PROGRAM

Fiscal Year	To Y-12 U_T	To Y-12 U-235	To Y-12 U-236	To Portsmouth U_T	To Portsmouth U-235
1980	0	0	0	0	0
1981	1,073	830	130	0	0
1982	0	0	0	539	491
1983	0	0	0	2,172	2,007
1984	1,408	1,171	147	703	657
1985	602	518	56	0	0
1986	1,768	1,036	19	398	301
1987	2,143	1,608	136	184	142
1988	2,072	1,773	203	0	0
1989	1,746	1,397	225	0	0
1990	1,692	1,395	208	0	0
1991	1,780	1,462	220	80	71

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, for the KN 03 Program at the ICPP (Supporting Activities), and for those parts of the JM 05 Program (Defense Waste Management) directly applicable to calcination and storage of radioactive wastes at the ICPP. These costs are listed and discussed in following sections 2.1 and 2.2.

2.1 Operating Costs in FY 1980 and FY 1981

Funding needed for ICPP operations covered in this document in FY 1980 and FY 1981 is compared in the following tabulation:

		Dollars in Thousands		
B & RC No.	Brief Titles	FY 1980	FY 1981	Differences
JM 03 01 221	Separations	20,440	25,410	4,970
JM 03 01 311	Startup	1,100	1,340	240
JM 03 01 361	Conceptual Engineering	950	3,030	2,080
KN 03 70 000	Energy Management	150	510	360
	Subtotal(JM 03,KN 03)	22,640	30,290	7,650
JM 05 01 031	Waste Solidification	14,055	12,000	(2,055)
JM 05 01 032	Startup	2,050	4,550	2,500
JM 05 01 033	Conceptual Engineering	350	700	350
	Subtotal(JM 05)	16,455	17,250	795
Total for ICPP Production		39,095	47,540	8,445

These costs were taken from the FY-1981 budget submission; the FY-1981 costs are the minimum of the three alternatives submitted.

Escalation accounts for about $3.5 million of the $8.4 million increase in production costs. Increased costs for startups, principally for the NWCF and the Rover headend, and a $2 million increase for extensive conceptual engineering studies of alternatives for plant upgrade, discussed in section VI-12, account for most of the remaining $4.9 million. There was also some realignment of effort between separations and waste solidification.

Further discussion of Operations-funded programs that support the Baseline Program is in Section VII, Process 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. Operating costs represent budget outlays; capital costs represent budget authorizations. The capital cost is discussed in Section 2.2, which follows.

TABLE III

ICPP-WCF COST DATA BEGINNING WITH 1980
(DOLLARS ARE IN THOUSANDS)   CASE RUN ON 04/23/79

BASE CASE REVISED 4-9-79

FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	POST	TOT
A. COSTS OF PRODUCTION														
OPERATION(JM03+KN03)	22640	30290	38520	39200	35980	33370	34070	33310	33280	33280	33150	33110		0400200
WASTE(JM0501031,32,33)	16460	17250	15160	15650	15670	16120	15200	14900	15190	15180	15010	15000		0186790
PRODUCTION	39100	47540	53680	54850	51650	49490	49270	48210	48470	48460	48160	48110		0586990
PROCUREM'T OF REACTOR PROD.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. CAPITAL COSTS														
CALCINE STORAGE	500	5000	10000	0	0	0	10000	20000	0	0	0	0	-31050	14450
FLUORINEL & FUEL STG	53400	33990	10	0	0	0	0	0	0	0	0	0	-8740	78660
UTILITY REPL & EXPAN	3200	2300	0	0	0	0	0	0	0	0	0	0	0	5500
STEAM GENERATION	10000	13490	10	0	0	0	0	0	0	0	0	0	-2350	21150
PLANT ANAL CHEM BLDG	1000	15000	9000	0	0	0	0	0	0	0	0	0	-2500	22500
RENOV. OF CELLS ***	0	7000	9000**	0	18000	29000	22000	0	0	0	0	0	-42500	42500
RAF UPGRADE & EXPAN	0	7000	4000	0	0	0	0	0	0	0	0	0	-1100	9900
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
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	3270	4780	5000	5000	5000	5000	4500	4000	4000	4000	4000	4000	-27780	24770
EQUIP.(OPERATIONS)	5000	5150	7610	6220	5180	5160	4500	4000	4000	4000	4000	4000	-23880	34940
EQUIP.(WASTE SOLID.)	600	1290	890	500	500	500	500	500	500	500	500	500	-2790	4490
TOTAL CAPITAL	76970	95000	45520	11720	28680	39660	41500	28500	8500	8500	8500	8500	******	258860

TOTAL POST: -142690

THE FUEL PROCESSING HEADEND AND TAILEND OPERATE CONCURRENTLY BETWEEN THESE DATES: 1-30-86 AND 11-91
ALL COSTS ARE IN THOUSANDS. COSTS BEYOND FY 1981 ARE NOT ESCALATED.
POST COLUMN SHOWS CREDITS FOR UNDEPRECIATED VALUES OF NEW EQUIPMENT.
DEPRECIATION IS EXPLAINED IN APPENDIX B, ITEM 11.
***ORDER OF MAGNITUDE ONLY

**CHANGED TO 12000 TOO LATE TO REDO CALCULATIONS.

2.2 Projects

Funding for capital line-items included in the Baseline Program and also having or projected to have budget authorizations within the study period is as follows:

Capital Line Items	First FY of Funding	Approximate Beneficial Use	Total Estimated Cost ($\$10^6$)	Estimated Obligation After FY 1979 ($\$10^6$)
Calcined Solids Storage				
Sixth set of bins	1981[(a)]	Nov 1984	16	15.5
Seventh set of bins	1986	Apr 1989	30[(c)]	30
Fluorinel Dissolution Process & Fuel Receiving Improvements	1977	Jul 1983	150	87.4
Utility Replacement and Expansion	1979	Aug 1981	10.5	5.5
Steam Generation	1980[(b)]	Sep 1983	24	23.5
Plant Analytical Chemistry Building	1981	Apr 1984	25	25
Renovation of Process Cells	1981	Mar 1986	85[(c)]	85
RAF Upgrade and Expansion	1981	Dec 1983	11	11

(a) PE&D funds of $500,000 in FY 1979 and $500,000 in FY 1980 are included in the $16 million total estimated cost.

(b) The $24 million includes $500,000 PE&D funds in FY 1979.

(c) These are order-of-magnitude estimates.

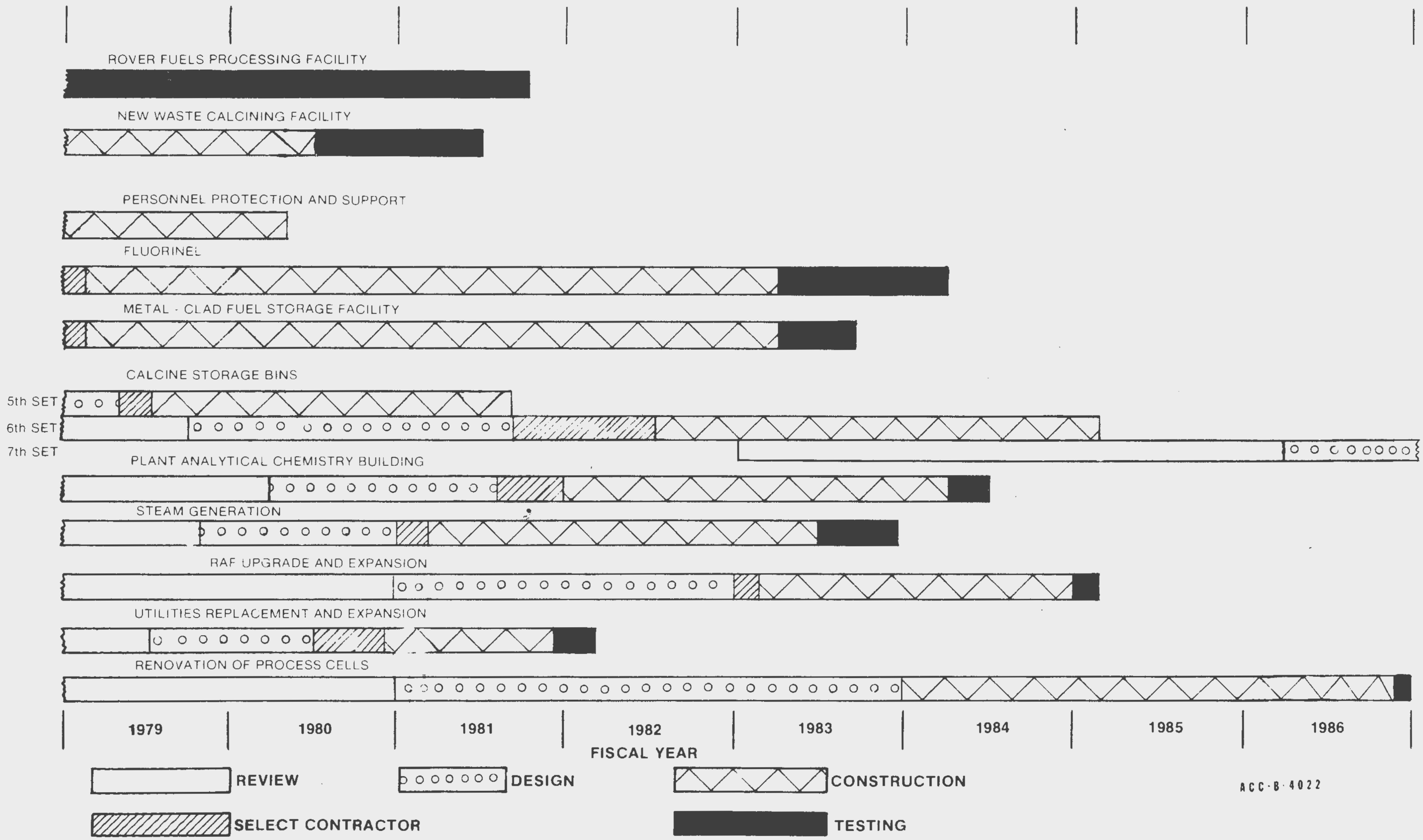
These line-item projects must receive funding as indicated in order to complete the Multiple Fuels Processing Program as presented in this document.

Table III shows the funding periods and the amounts of obligations necessary each year of the study period for each line item. Costs 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 VI details the project schedule, the technical schedule, and the milestones, and gives a brief description of each line-item project. Section VI also lists General Plant Projects for FY 1980 and FY 1981.

There are three FY-1981 line-item projects shown in Table III: Plant Analytical Chemistry Building, Renovation of Process Cells, and Remote Analytical Facility (RAF) Upgrade and Expansion.

Figure 8. – MULTIPLE FUELS PROCESSING PROGRAM MAJOR CONSTRUCTION SCHEDULE



2.2.1 Plant Analytical Chemistry Building (PACB)

Projections of laboratory space requirements at ICPP based on the INEL Institutional Plan[16] 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 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.

The PACB will be a one-story structure with a gross area of approxiamtely 6180 square metres (66,500 sq. ft). The facility will house 1765 NUSM of laboratories and 1347 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 Renovation of Process Cells

This project consists of replacement of the ICPP stack, improvements to plant process instrumentation, modifications to decrease personnel radiation exposure, 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 variety 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; there is no intermediate measurement capability.

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 control 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; emergency repairs have just been completed to keep it from being a hazard until replacement is possible. 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 a long fuel processing downtime. The detailed planning to determine the length of this period has not been completed, but about 16 months has been assumed in the Baseline Program. Further studies may show a longer period to be necessary.

2.2.3 Remote Analytical Facility Upgrade and Expansion

This project will be constructed in an existing building and will improve the existing Remote Analytical Facility (RAF), construct a new Waste Handling and Analytical Cell (WHAC), expand the existing shift laboratory, and add a decontamination laboratory.

The primary justification for this project is to reduce the radiation exposure received by ICPP personnel and to properly support operation of the Fluorinel process.

The RAF contains two parallel lines of shielded boxes which are used for performing chemical analyses on radioactive samples. The RAF contains manipulators which were designed over 25 years ago and which are far less versatile than modern manipulators. Other features of the RAF also require modification to enable optimal operation. The alterations to the RAF will reduce personnel exposure to radiation by replacing some of the existing manipulators with improved manipulators. This will enable certain analyses to be done remotely that presently can only be done directly, and will permit more remote repair and replacement of analytical instruments within the RAF boxes than can be done presently.

The existing shift laboratory will not accommodate the increases in manning that will be required for increased chemical analyses. The WHAC and the shift laboratory portions of the project will reduce overcrowding and radiation exposure of personnel so that chemical analyses needed for the optimal operation of the Fluorinel process can be provided, and so that more highly radioactive chemical analysis wastes can be remotely prepared for disposal. The decontamination laboratory is required for development of improved decontamination techniques and solutions.

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

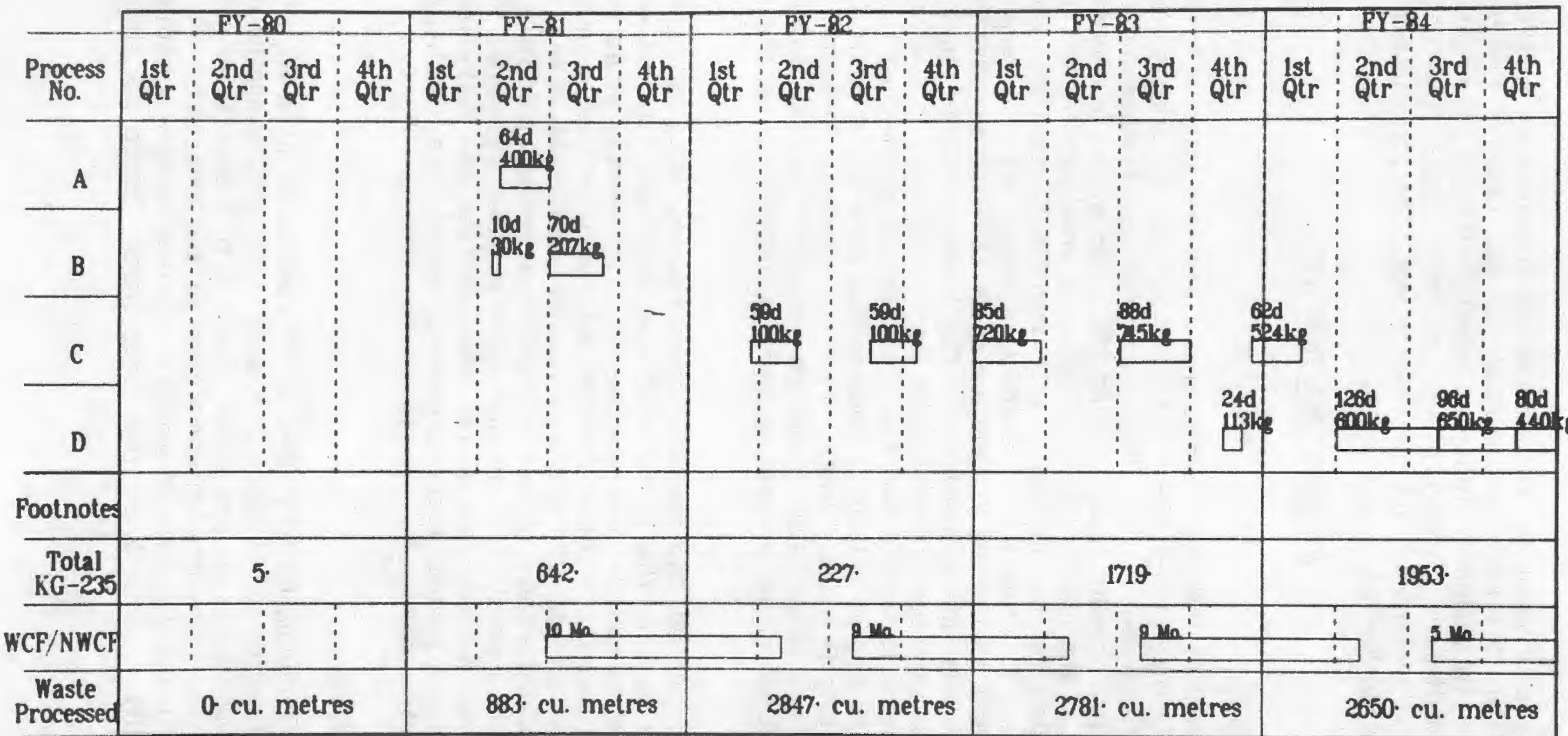
In the first item of this risk examination, a leak was assumed to develop in one (or more) of the 1135-cubic-metre (300,000-gallon) storage tanks for high-level radioactive aqueous waste. There are twelve 1135-cubic-metre tanks in the tank farm and four smaller tanks totaling 265 cubic metres in concrete vaults at the lowest level of the plant. The large tanks are considered to be full at 1080 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 1135-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 1080-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 start of the fuel reprocessing campaign in FY 1980 would be postponed about 3.5 months, as shown by comparing Figure 9 to Figure 1, so that NWCF calcining would permit uninterrupted completion of the campaign. The relative quantities of fuels 1 and 3 processed would be revised to take advantage of an increased availability of fuel 2 at this later time. Figure 10 shows waste

ICPP OPERATING SCHEDULE



Process A=fuels 1
B=fuels 2,3,30
C=fuels 9,25
D=fuels 12,13,14,15,16,17,18,21,22,23,26,27,28,34,35

NO WCF OPERATION

FIG. 9

CASE RUN ON 04/19/79

Fuels not included--4,5,11,6,7,8,10,19,29,33.

inventories. Effects on fuel storage requirements are minor and are not illustrated.

Startup of the Rover process would be delayed one quarter. This delay would not permit all Rover fuel to be recovered before scheduled hot startup of the Fluorinel Process. Startup and operation of Fluorinel and the renovation of cells were given higher priority than Rover completion, so the remainder of Rover processing was postponed until 1987.

1.3 Delay in NWCF Startup

If the fuel processing campaign to start in FY 1980 were not made smaller, a delay in startup of the NWCF of more than a few months would require some low-heat waste to be mixed with fluoride waste. The other effect of a delay would be higher waste inventories until the lost operating time could be regained. There would be more than enough available unused NWCF operating time to permit recovery from a year's delay before the end of FY 1986. The unused time in the base case is evident in Figure 3.

1.4 No WCF; NWCF and FAST Delayed One Year

Consequences of a combination of no WCF operation, 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 11, 12, 13 and 14.

As shown by comparison of Figure 11 to Figure 1, the processing of fuels 1 and 3 would be postponed until after NWCF startup and the quantity of fuel 1 would be increased. Rover operation would begin and continue as in the Base Case for about seven months, but would then be deferred until after the campaign on fuels 1 and 3. All Rover processing could be completed before the cold startup of Fluorinel. This operating schedule would require mixing of low-heat and fluoride wastes (Figure 12) but would hold the fuel basin storage requirements below 90% of capacity.

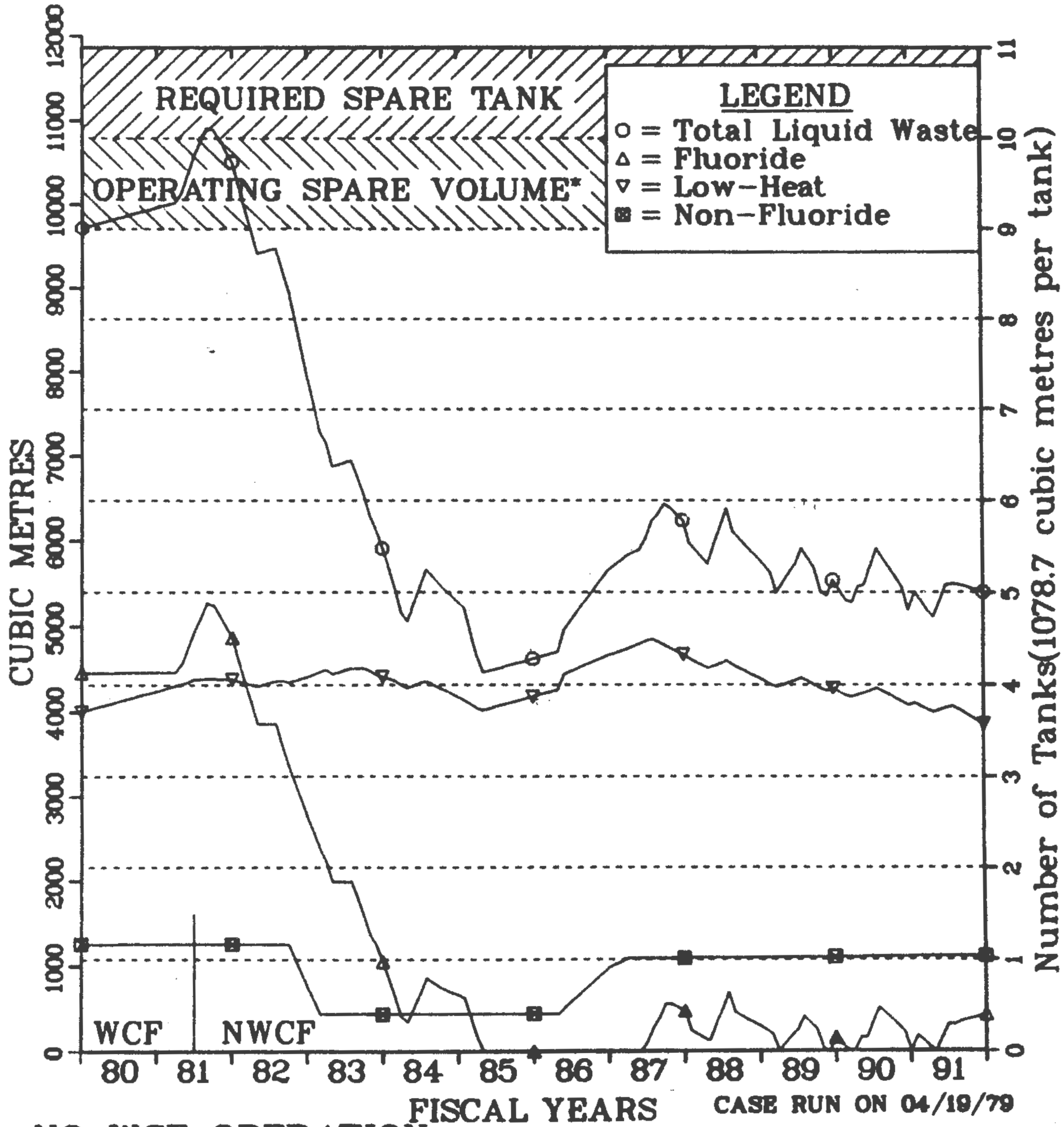
2. CHANGES IN FUEL RECEIPTS

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.

3. FUEL STORAGE BASIN FAILURE

The existing fuel storage basin has walls and floors of reinforced concrete. There is no metal liner. Structures at INEL are now designed to withstand earthquakes causing 0.24 g horizontal acceleration of the bedrock, but the existing basin would probably fail in such a severe quake.[17] At worst, the walls could topple in. While such an earthquake is very unlikely at the ICPP, plans for action in such an

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY

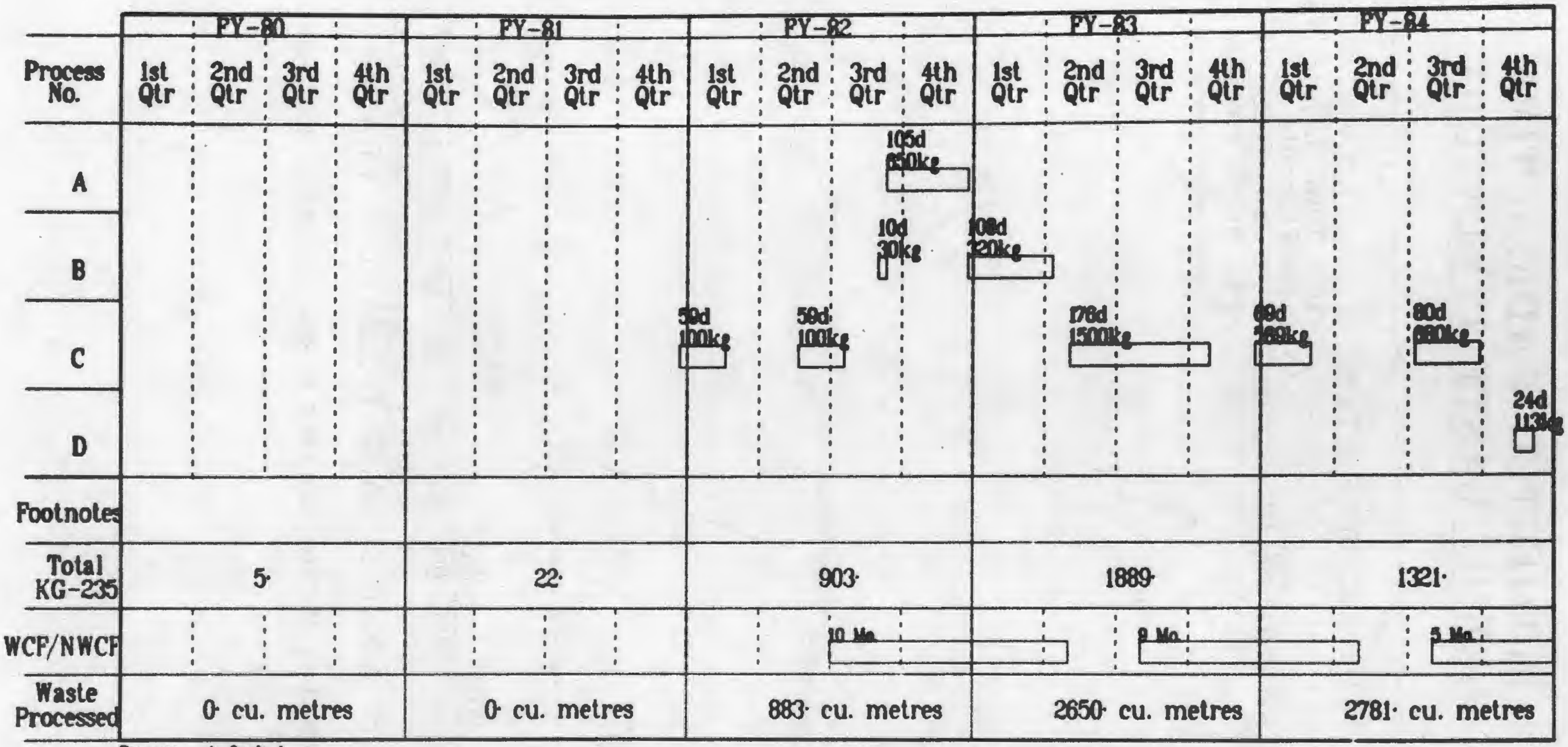


NO WCF OPERATION

FIG. 10

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

ICPP OPERATING SCHEDULE



Process
A=fuels 1
B=fuels 2,3,30
C=fuels 9,25
D=fuels 12,13,14,15,16,17,18,21,22,23,26,27,28,34,35

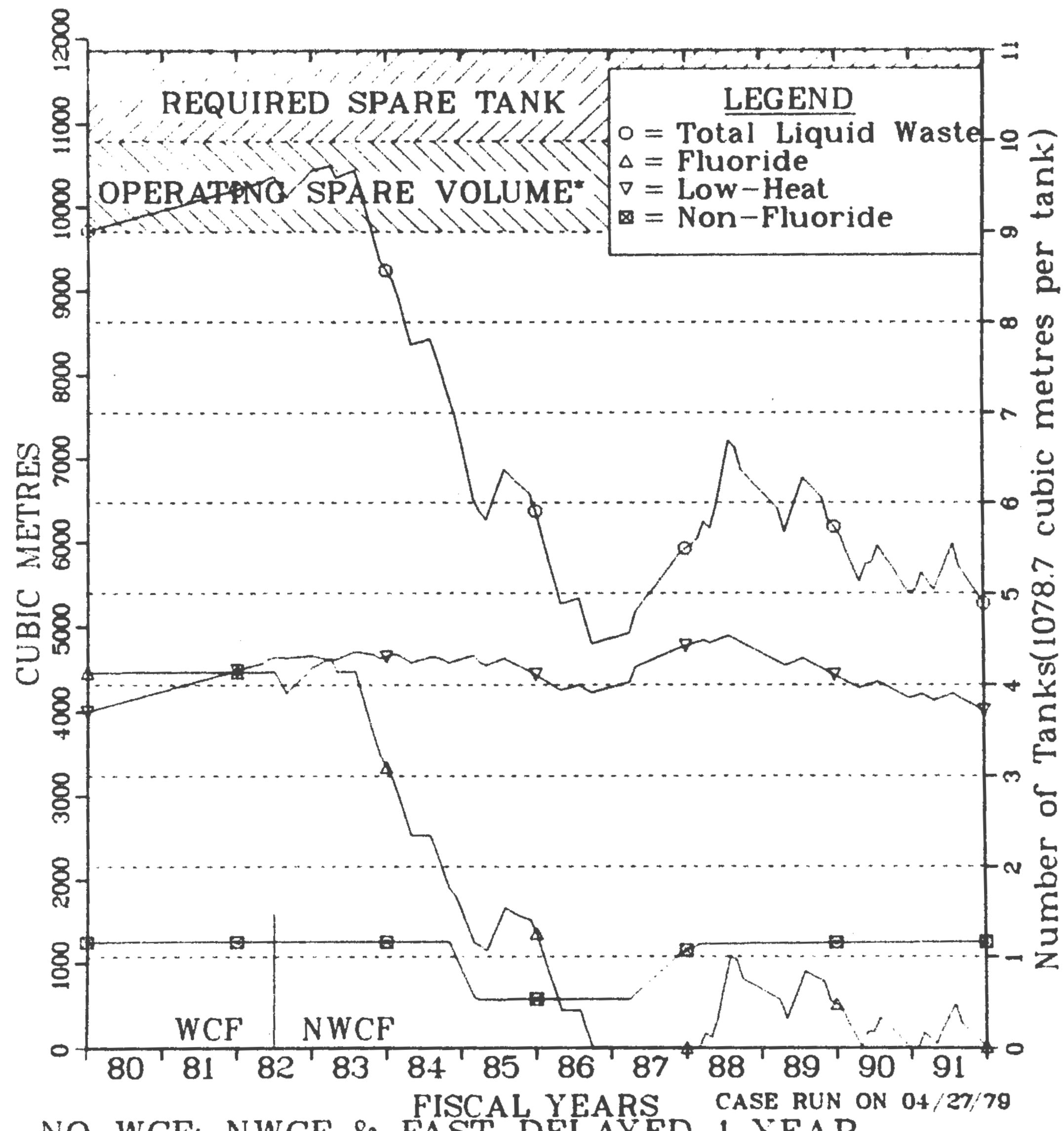
NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 11

CASE RUN ON 04/27/79

Fuels not included--4,5,11,6,7,8,10,19,29,33.

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY

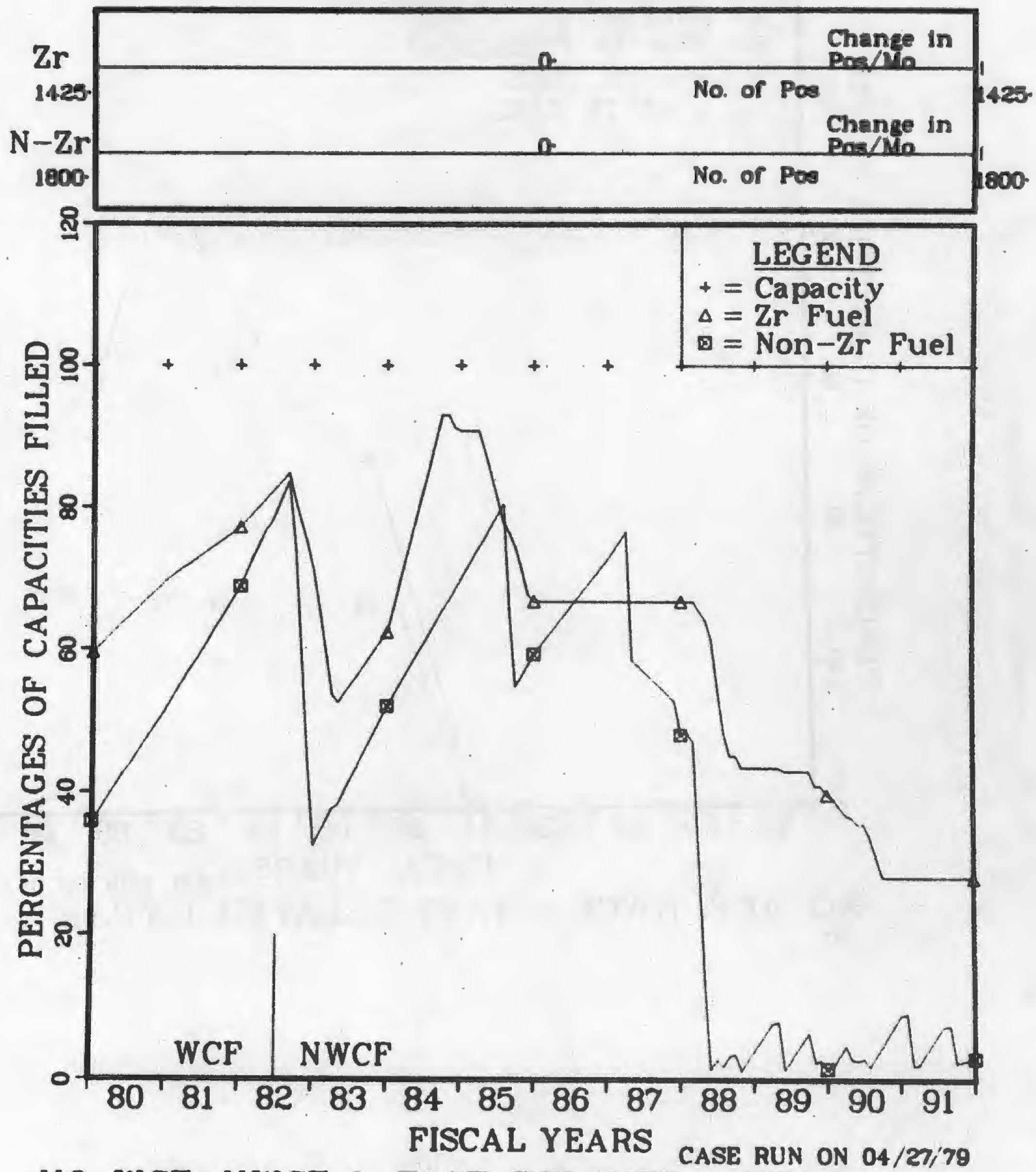


NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 12

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

PROJECTED FUEL BASIN STORAGE REQUIREMENTS (in %)

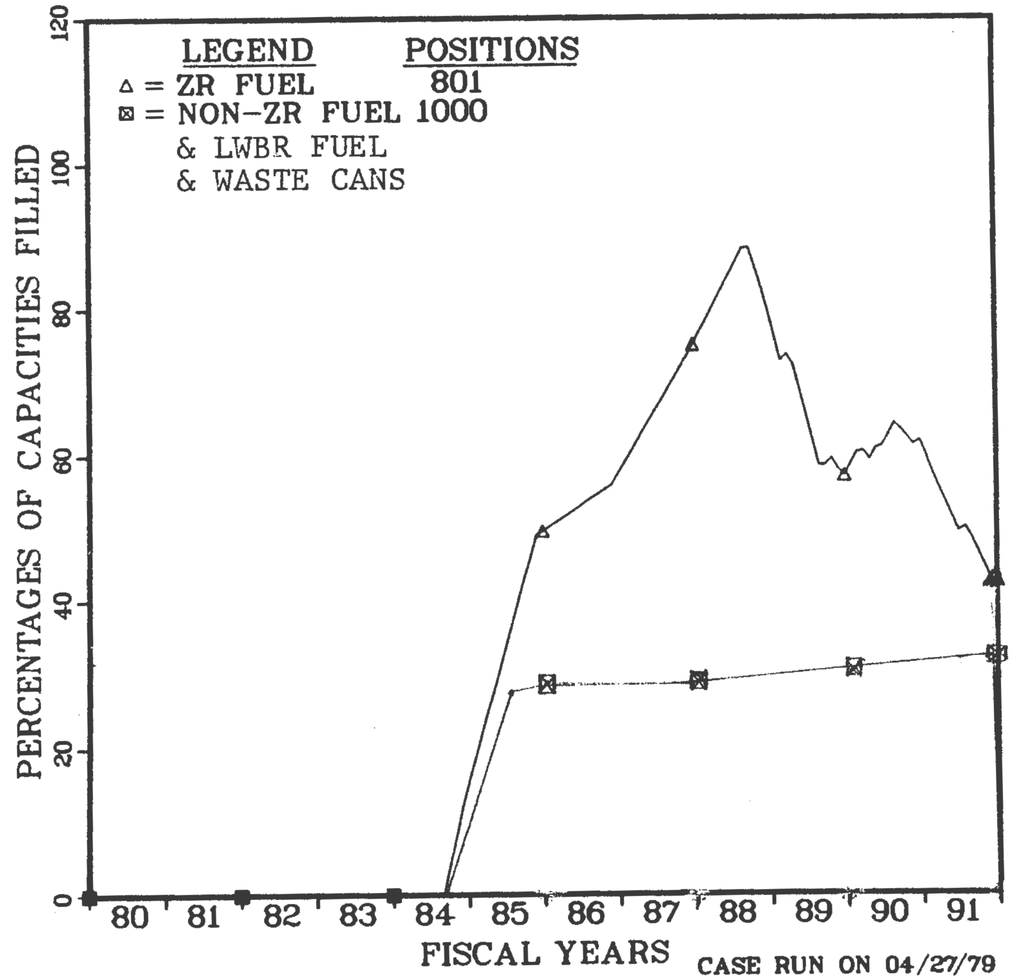


NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 13

+PLOT 2 14.48.56 FRI 27 APR. 1979 JOB-HG52 CP. ISSCO, DISSPLA VER 4.11

PROJECTED FAST FUEL BASIN
STORAGE REQUIREMENTS (in %)



NO WCF; NWCF & FAST DELAYED 1 YEAR

FIG. 14

event have been made.

The water depth in the 1.5 million gallon fuel storage basin is maintained at about 19 feet. If an earthquake leads to water losses, alarms on the water level will sound before the water drops three feet. Emergency supply and firewater pumps, driven by diesel or emergency electric power, can supply at least 4000 gallons per minute to the basin as soon as enough fire hoses are connected. Depending on the severity of the leaks, a temporary seal or blockage of the cracks may be feasible in time to prevent high radiation from nearly uncovered fuel. A sonic detector is available to help locate water leaks from the basin. Also, a store of bentonite clay is kept available to add to basin water in case other leak stopping measures are not effective.

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 Base Case or 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. Most of the 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 $10 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 begin early in FY 1980 and the new casks would be available by FY 1982. Special funding authorizations would be needed to meet this schedule.

(4) Freight was estimated to cost $0.07 per tonne km ($0.10 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 Replacement

and Expansion, Steam Generation, Plant Analytical Chemistry Building, Renovation of Process Cells, and RAF Upgrade and Expansion. The Sixth Set of Calcine Bins would be reduced in capacity from 1699 to 1000 cubic metres; the revised cost was roughly estimated to be $13 million, down from $16 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

FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTALS
FUELS RECEIVED, KILOGRAMS U-235	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FUELS PROCESSED, KILOGRAMS U-235	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FUELS INVENTORY, KILOGRAMS U-235	(Being shipped out during these years)							0.	0.	0.	0.	0.	0.
TOTAL WASTE PRODUCED, CU. METRES	180.	180.	180.	180.	180.	60.	60.	60.	0.	0.	0.	0.	1080.
TOTAL WASTE CALCINED, CU. METRES	1191.	1014.	3152.	1443.	1070.	1070.	1070.	209.	0.	0.	0.	0.	10220.
TOTAL WASTE INVENTORY, CU. METRES	8129.	7295.	4322.	3060.	2169.	1159.	149.	0.	0.	0.	0.	0.	
SOLIDS WASTE PRODUCED, CU. METRES	111.	67.	410.	461.	487.	487.	487.	95.	0.	0.	0.	0.	2604.
SOLIDS WASTE INVENTORY, CU. METRES	1881.	1949.	2358.	2820.	3306.	3793.	4279.	4374.	4374.	4374.	4374.	4374.	
DAYS OF FUEL PROCESSING	0	0	0	0	0	0	0	0	0	0	0	0	
DAYS OF WASTE CALCINING	243	182	273	273	273	273	273	53	0	0	0	0	

CUBIC METRES OF RADIOACTIVE LIQUID WASTES

FISCAL YEAR:	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTALS
ZR FLUORIDE													
PRODUCED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCINED	1022.	645.	1810.	486.	0.	0.	0.	0.	0.	0.	0.	0.	3962.
INVENTORY	2940.	2296.	486.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
FLUORINEL													
PRODUCED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCINED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVENTORY	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
LOW-HEAT													
PRODUCED	180.	180.	180.	180.	180.	60.	60.	60.	0.	0.	0.	0.	1080.
CALCINED	170.	369.	87.	957.	1070.	1070.	1070.	209.	0.	0.	0.	0.	5002.
INVENTORY	3932.	3743.	3837.	3060.	2169.	1159.	149.	0.	0.	0.	0.	0.	
NON-FLUORIDE													
PRODUCED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCINED	0.	0.	1256.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1256.
INVENTORY	1256.	1256.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
ROVER													
PRODUCED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CALCINED	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVENTORY	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	

TABLE V

ICPP-WCF COST DATA

CASE 2 -- MINIMUM-COST SCENARIO

	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	FY-90	FY-91	Totals
A. Cost of Production													
Operation (JM03-KN03)	20,000	12,000	8,000	8,000	8,000	8,000	6,000	5,000	2,000	2,000	2,000	2,000	83,000
Waste (JM0501 031, 32, 33)	16,460	17,200	15,300	15,500	15,600	15,600	15,600	10,000	2,000	2,000	2,000	2,000	129,260
Freight	300	700	1,500	1,800	1,800	1,800	800	0	0	0	0	0	8,700
Production	36,760	29,900	24,800	25,300	25,400	25,400	22,400	15,000	4,000	4,000	4,000	4,000	220,960
B. Capital Costs													
Calcine Storage	500	5,000	7,000										12,500
Casks and Handling Equip.	6,000	4,000											10,000
General Plant Projects	1,700	2,100	1,500	1,500	1,500	1,000	100	100	100	100	100	100	9,900
Capital Equipment	1,600	2,000	1,000	600	600	600	100	100	100	100	100	100	7,000
	9,800	13,100	9,500	2,100	2,100	1,600	200	200	200	200	200	200	39,400

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 benefits 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 1980 through FY 1991. For an annual comparison at a 10% discount rate, refer to Figure 15.

The nondiscounted costs for the Baseline Case and the Minimum-Cost Scenario are \$884 million and \$260 million, respectively. The nondiscounted benefits for the Base Case and the Minimum-Cost Scenario are \$678 million and zero, respectively; 14,958 kg of ^{235}U will be recovered in the Base Case. Thus, relative to the Minimum-Cost Scenario, the Base Case will recover 14,958 additional kilograms worth \$678 million for an additional cost at ICPP of \$624 million. The corresponding nondiscounted benefit-to-cost ratio is 1.09. Total incremental cost of the recovered uranium to the Government would be less than \$624 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 15, corresponding present values (discounted at 10%) for the incremental ICPP benefits, costs, and net cash flows are \$390, \$440, and -\$50 million.

TABLE VI

ICPP-WCF CASH FLOW EVALUATIONS BEGINNING WITH FY 1980
(DOLLARS ARE IN THOUSANDS) CASE RUN ON 04/23/79

BASE CASE REVISED 4-9-79

FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	POST	TOT
A. PRODUCTION														
1. PRODUCT, KG														
U-235	270	586	983	1719	1954	168	1725	1690	1627	1513	1443	1276	0	14958
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	270	586	983	1719	1954	168	1725	1690	1627	1513	1443	1276	0	14958
2. NON-DISC BENEFIT	12270	26620	44630	77980	88640	7620	78240	76680	73790	68650	65450	57890	0	678460
B. NON-DISCOUNTED COSTS														
PRODUCTION	39100	47540	53680	54850	51650	49490	49270	48210	48470	48460	48160	48110	0	586990
CONSTRUCTION	76970	95000	45520	11720	28680	39660	41500	28500	8500	8500	8500	8500	-142690	258860
WASTE ADJ.	0	0	0	0	0	0	0	0	0	0	0	0	38290	38290
TOTAL	116070	142540	99200	66570	80330	89150	90770	76710	56970	56960	56660	56610	-104400	884140
C. CASH FLOW ANALYSIS														
NON-DISC CASH FLOW	-103810	-115930	-54580	11410	8310	-81530	-12540	-40	16820	11690	8790	1280	104400	
PRESENT WORTH AT 10.0 %	-103810	-105390	-45110	8570	5670	-50630	-7080	-20	7850	4960	3390	450	33270	
CUMULATIVE PRESENT WORTH	-103810	-209200	-254300	-245740	-240070	-290690	-297770	-297790	-289940	-284980	-281600	-281150	-247880	-247880

D. SUMMARY

PERCENT DISCOUNT	TOTAL DISCOUNTED BENEFITS	TOTAL DISCOUNTED COSTS	DISCOUNTED BENEFIT-TO-COST RATIO	TOTAL PRESENT VALUE OF NET CASH FLOW
0.0	678400.	884140.	0.77	-205730.
7.50	442040.	686250.	0.64	-244200.
10.00	389750.	637620.	0.61	-247870.
12.50	346250.	595410.	0.58	-249150.
15.00	309790.	558600.	0.55	-248810.
20.00	252790.	497990.	0.51	-245190.

TABLE VII

ICPP-WCF CASH FLOW EVALUATIONS

CASE 2 -- MINIMUM-COST SCENARIO

	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	FY-90	FY-91	Totals
A. Production													
1. U-235, kg	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Nondiscounted Benefit	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Nondiscounted Costs ($000)													
Production	36,760	29,900	24,800	25,300	25,400	25,400	22,400	15,000	4,000	4,000	4,000	4,000	220,960
Construction	9,800	13,100	9,500	2,100	2,100	1,600	200	200	200	200	200	200	39,400
Total	46,560	43,000	34,300	27,400	27,500	27,000	22,600	15,200	4,200	4,200	4,200	4,200	260,360
C. Cash Flow Analysis ($000)													
Nondiscount Cash Flow	-46,560	-43,000	-34,300	-27,400	-27,500	-27,000	-22,600	-15,200	-4,200	-4,200	-4,200	-4,200	-260,360
Present Worth @ 10%	-46,560	-39,091	-28,347	-20,586	-18,783	-16,765	-12,757	- 7,800	-1,959	-1,781	-1,619	-1,472	-197,521

D. SUMMARY

% Discount	Benefits	Costs	Present Value of Net Cash Flow
0.0	0	260,360	-260,360
7.5	0	209,981	-209,981
10.0	0	197,521	-197,521
12.5	0	186,626	-186,626

TABLE VIII

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

FY 1980 THROUGH FY 1991

	BASELINE PROGRAM (CASE 1)	MINIMUM ICPP COST SCENARIO (CASE 2)
RECEIPTS, FISSILE KG	12371	0
PRODUCTION, KG		
U-235	14958	0
U-233	0	0
ENDING INVENTORIES		
FISSILE KG	2643	0
LIQUID WASTE,CU.METRE	5242	0
SOLID WASTE, CU.METRE	5243	4374
CAPITAL COSTS ($000)		
LINE ITEMS	282900	22500
GPP	52550	9900
PCE	66100	7000
ENDING CAPITAL CREDIT	-142690	0
ENDING WASTE COST	38290	0
PRODUCTION COST	586990	220960
TOTAL ICPP COST($000)	884140	260360(A)
PRESENT ICPP COST	637620	197521
FULL PRODUCT VALUE	678400	0
PRESENT PRODUCT VALUE	389750	0
ICPP CASH FLOW (ICF)	-205740	-260360
PRESENT VALUE OF ICF	-247870	-197521
INCREMENTAL TO SCEN. 2		
PRODUCT VALUE	678400	0
ICPP COST	623780	0
ICPP CASH FLOW	54620	0
ICPP BEN./ICPP COST	1.088	0.0
INCREMENTAL TO SCEN. 2 AND PRESENT VALUES AT 10% DISCOUNT RATE		
PRESENT PROD. VALUE	389750	0
PRESENT ICPP COST	440099	0
PRESENT VALUE OF ICF	-50349	0
ICPP BEN./ICPP COST	0.886	0.0

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

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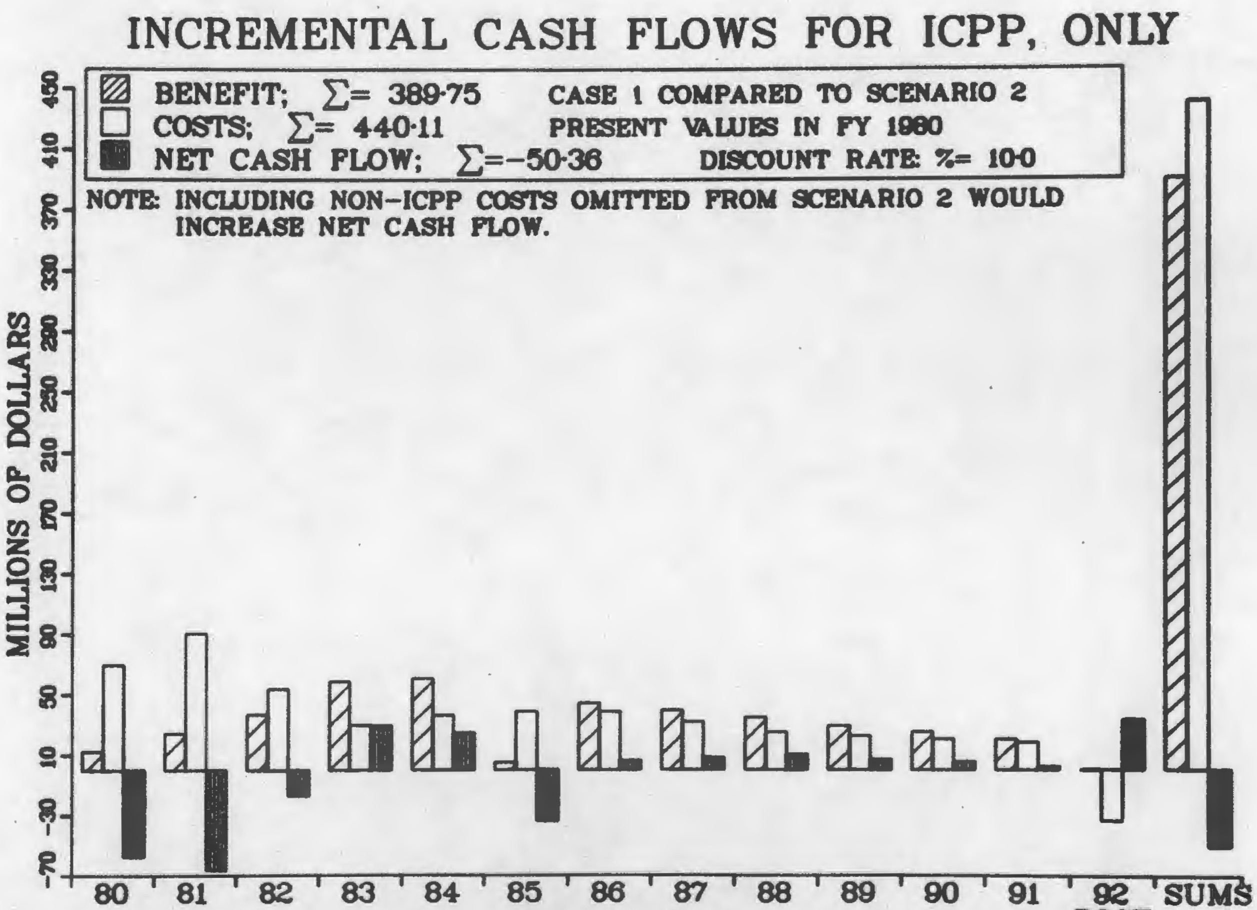


FIG. 15 --BASELINE CASE, CASE 1, COMPARED TO MINIMUM-COST SCENARIO, CASE 2

VI. PROJECTS

1. ROVER PROJECT

A Rover Fuels Processing Facility for processing graphite-matrix Rover (nuclear rocket) and UHTREX 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 ^{235}U per day. Approximately 3,000 kg of ^{235}U, 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. Construction was completed in fiscal year 1978 at a total cost of $7.875 million. System operation and cold tests are continuing with completion expected in fiscal year 1980.

Figure 16 summarizes schedules and milestones for this project.

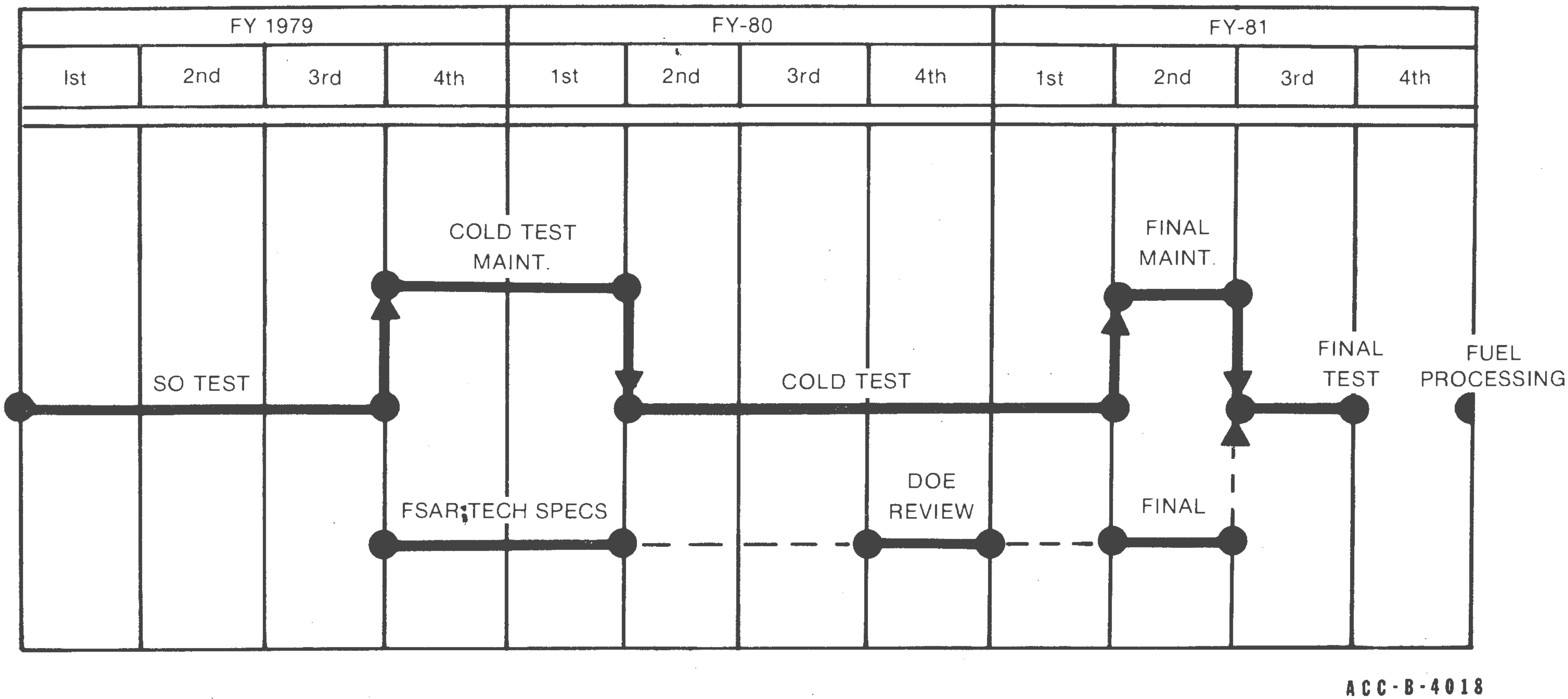


Figure 16. ROVER STARTUP SCHEDULE

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 (3000 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 13,000 m^3 of liquid waste into 1800 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 is $81 million. Of the $81 million, approximately $12.5 million is for engineering design, $1.6 million for project management and remote mockups, $64.7 million for construction, and $2.2 million for fee, subcontractor claims and contingency.

Schedule

The major milestones associated with this project are shown in Figure 17 and indicate 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.

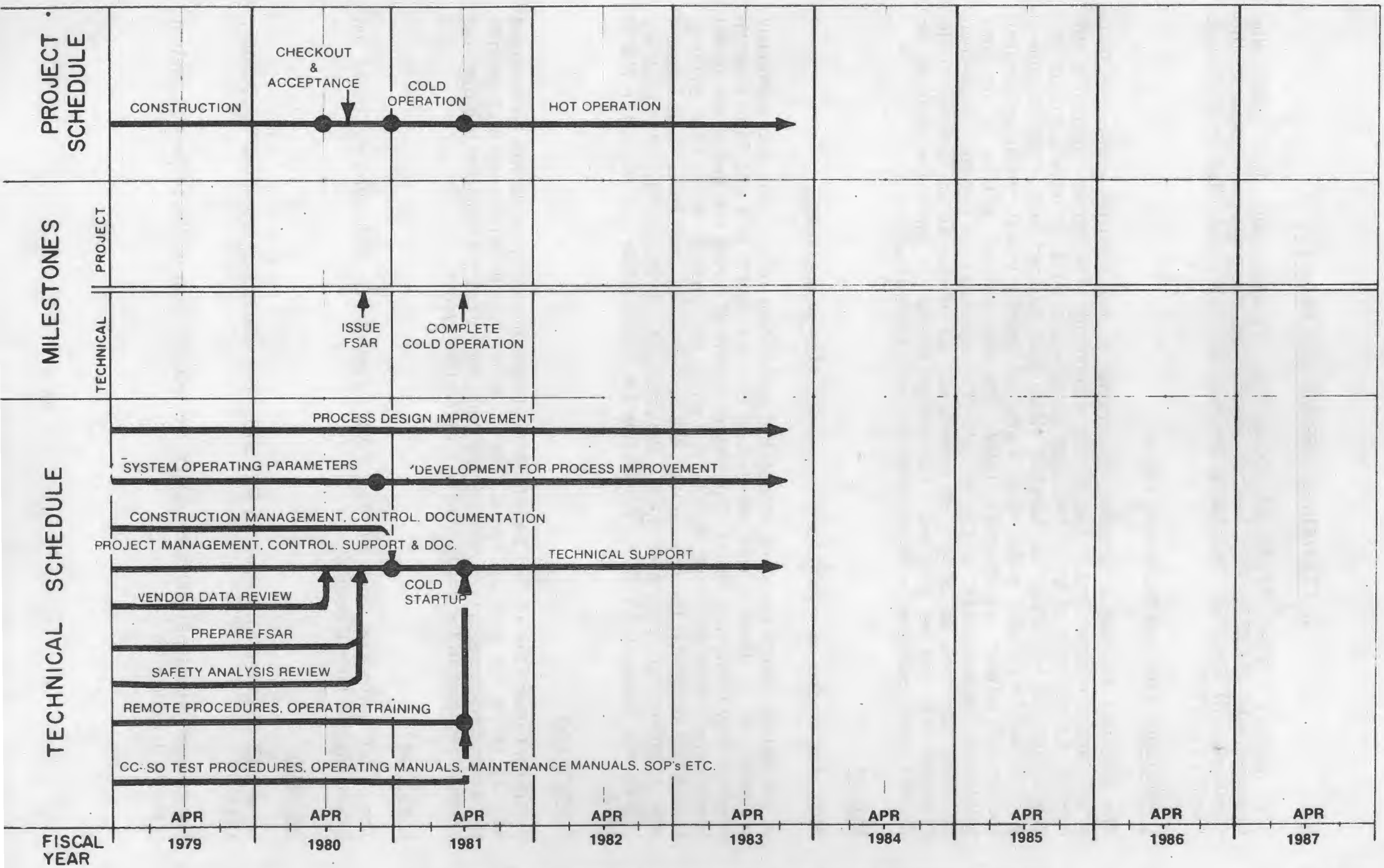


Figure 17. PROJECT MILESTONE CHART: NEW WASTE CALCINING FACILITY

ACC-B-4020

3. FLUORINEL DISSOLUTION PROCESS

The project called "Fluorinel Dissolution Process and Fuel Receiving Improvements" (FAST Facility) has been divided into two parts for purposes of this document: (1) Fluorinel Dissolution Process and (2) Metal Clad Fuel Storage Facility (MCFSF).

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. 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 contruction, 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. Excavation for construction was started in March 1979.

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.

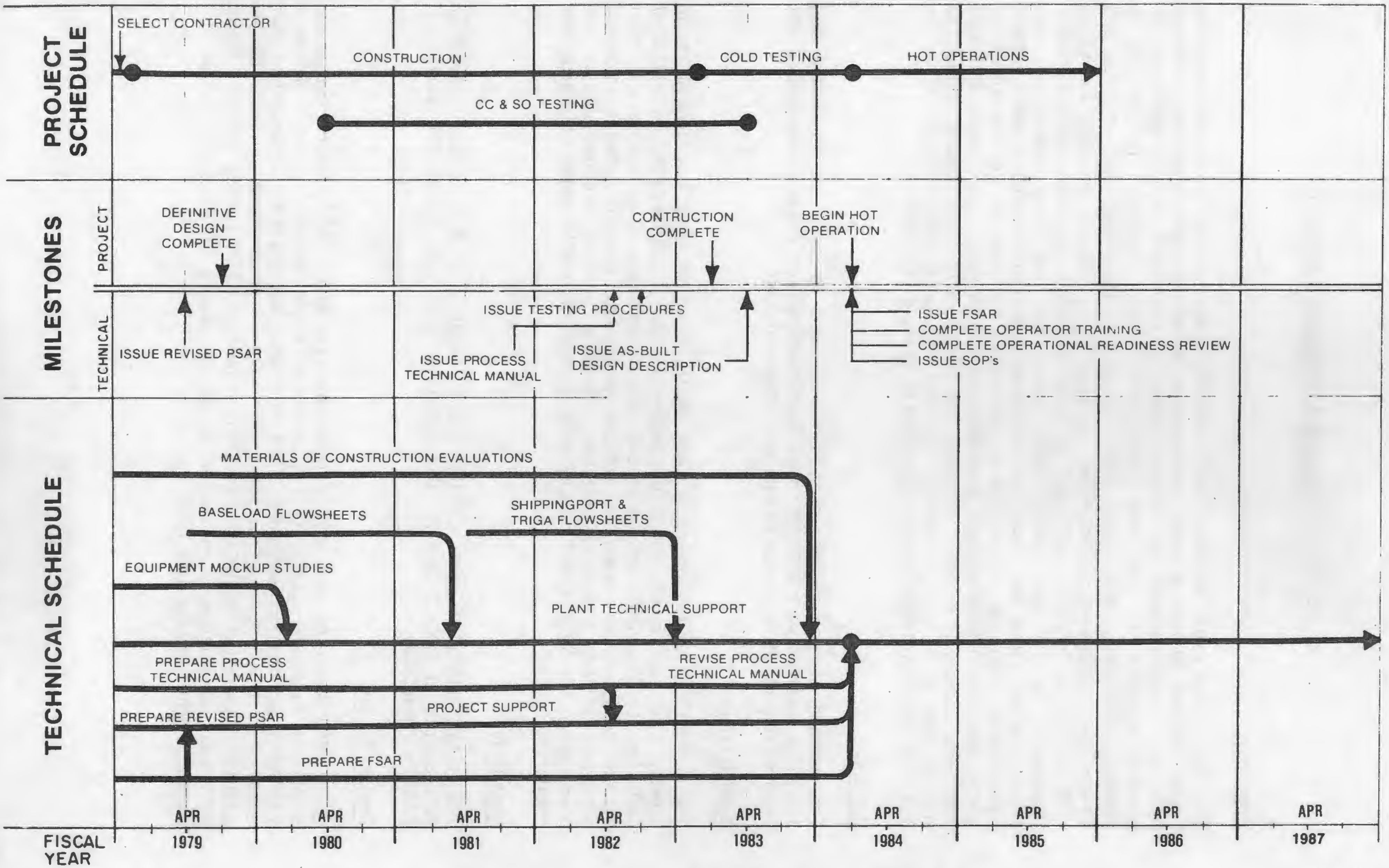
Cost Data

The total estimated cost of the FAST Facility is $150 million, based on 90%-complete Title II design.

Schedule

Long-lead procurement began in FY 1978. Hot startup is projected for January 1984.

The project milestone chart for design and construction of the processing system is shown in Figure 18.



ACC-B-4014

Figure 18. PROJECT MILESTONE CHART: FLUORINEL PROGRAM

4. 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 Headend Process. It will be a stainless-steel-lined, deep-water basin using wet unloading, wet cutting, and water-filled transfer-canal concepts. Storage areas will be provided for about 1800 fuel units; however, purchase of racks for 1000 of these units, formerly planned to be for the non-zirconium fuels, has not been authorized. An assumption was made that these fuels would be stored in the existing basin. Space equivalent to about 280 of the 1000 non-zirconium units will be used for storage of LWBR fuel, which formerly was scheduled for dry storage. Also, waste canisters containing solid wastes from Fluorinel dissolutions will be stored in either the cutting pool or in a pool formerly planned for non-zirconium fuels. If in the latter, about 50 positions would be required by the end of FY 1991.

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.

Justification

The MCFSF will provide adequate water depth, crane capacity, and clear height to receive, store, and handle the future assigned fuels. Facilities for preparation of fuels for the Fluorinel dissolution cell will be provided. The facility will meet current design requirements for natural phenomena and will provide improved personnel safety, personnel radiation exposure control, maintainability, and operability. The MCFSF will comply with current applicable codes, standards, and regulations.

Cost Data

The total estimated cost of the FAST facility is $150 million based on 90%-completed Title II design. The estimated cost for the MCFSF portion of FAST is $90 million.

Project Status

Conceptual design for the MCFSF was completed in FY 1977. Title I design was completed in January 1978 for the combined FAST facility. Title II design is scheduled to end in September 1979 and will incorporate the deepened pool conceptual design finished in July 1978 which was required by DOE-HQ for additional operating flexibility. Excavation for the FAST facility began in March 1979 and construction is scheduled to be completed in December 1982. Hot startup is scheduled for July 1983.

Schedule

The project and technical milestone chart for design and construction of the MCFSF is shown in Figure 19 along with the project and technical schedules.

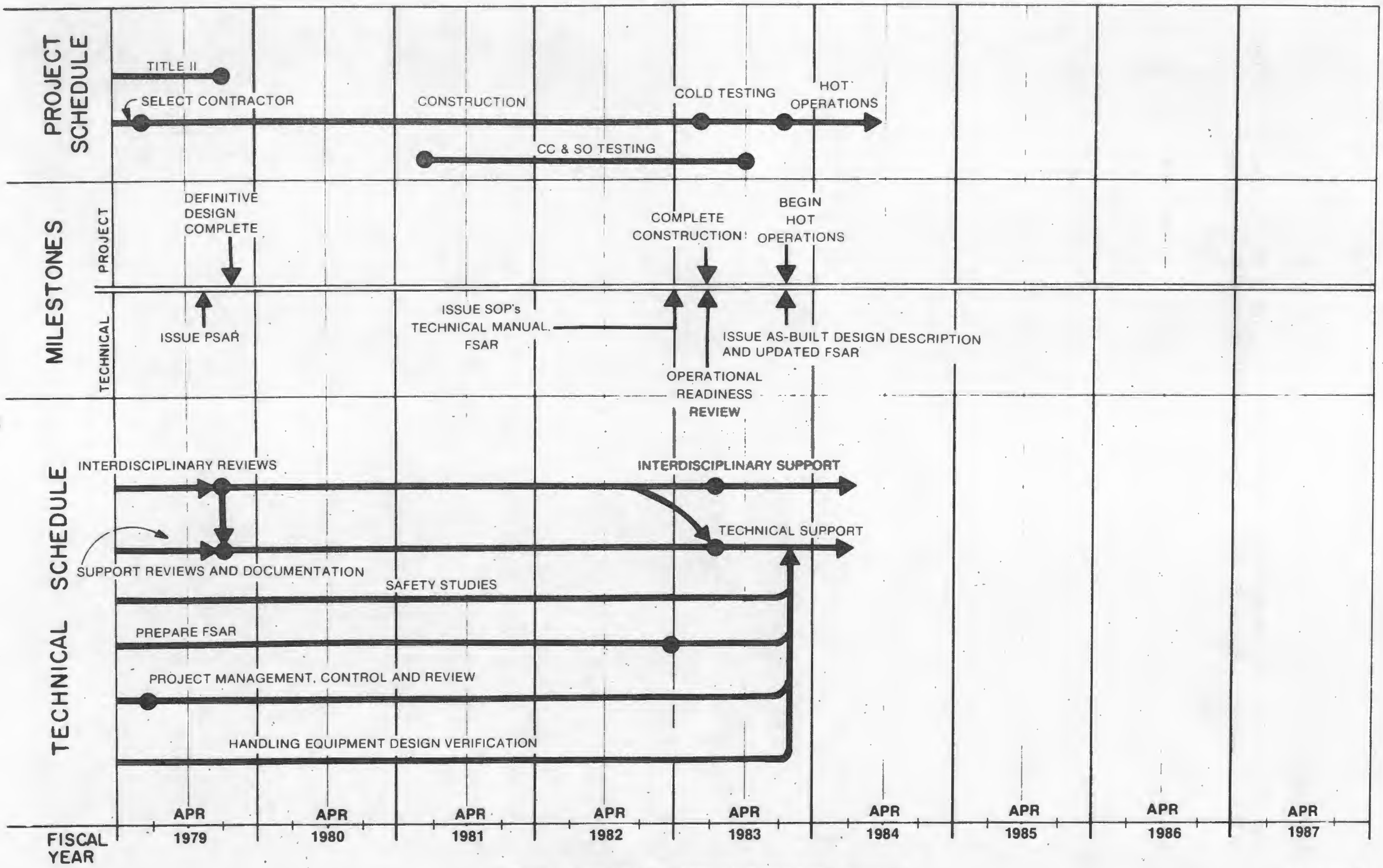


Figure 19. METAL-CLAD FUELS STORAGE FACILITY

ACC-B-4013

5. PERSONNEL PROTECTION AND SUPPORT FACILITY

Description

This project provides for a reduction in personnel radiation exposure and 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 repairing the ICPP main stack.

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 process-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 m^2 (59,000 ft^2) 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 was the emergency repair of the ICPP stack. A reinforced concrete shell has been poured around the existing stack over it's entire length to stabilize the stack against wind and earthquake.

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.

A 1978 inspection of the ICPP main stack indicated severe deterioration of the concrete support shell had taken place. High winds or seismic activity would likely have caused collapse if repairs were not made.

Cost Data

The estimated cost of this project is $10.5 million.

Schedule

Figure 20 summarizes the milestones and schedule for the Personnel Protection and Support Facility. Design was completed in March 3, 1978, and all construction will be complete by March 1980.

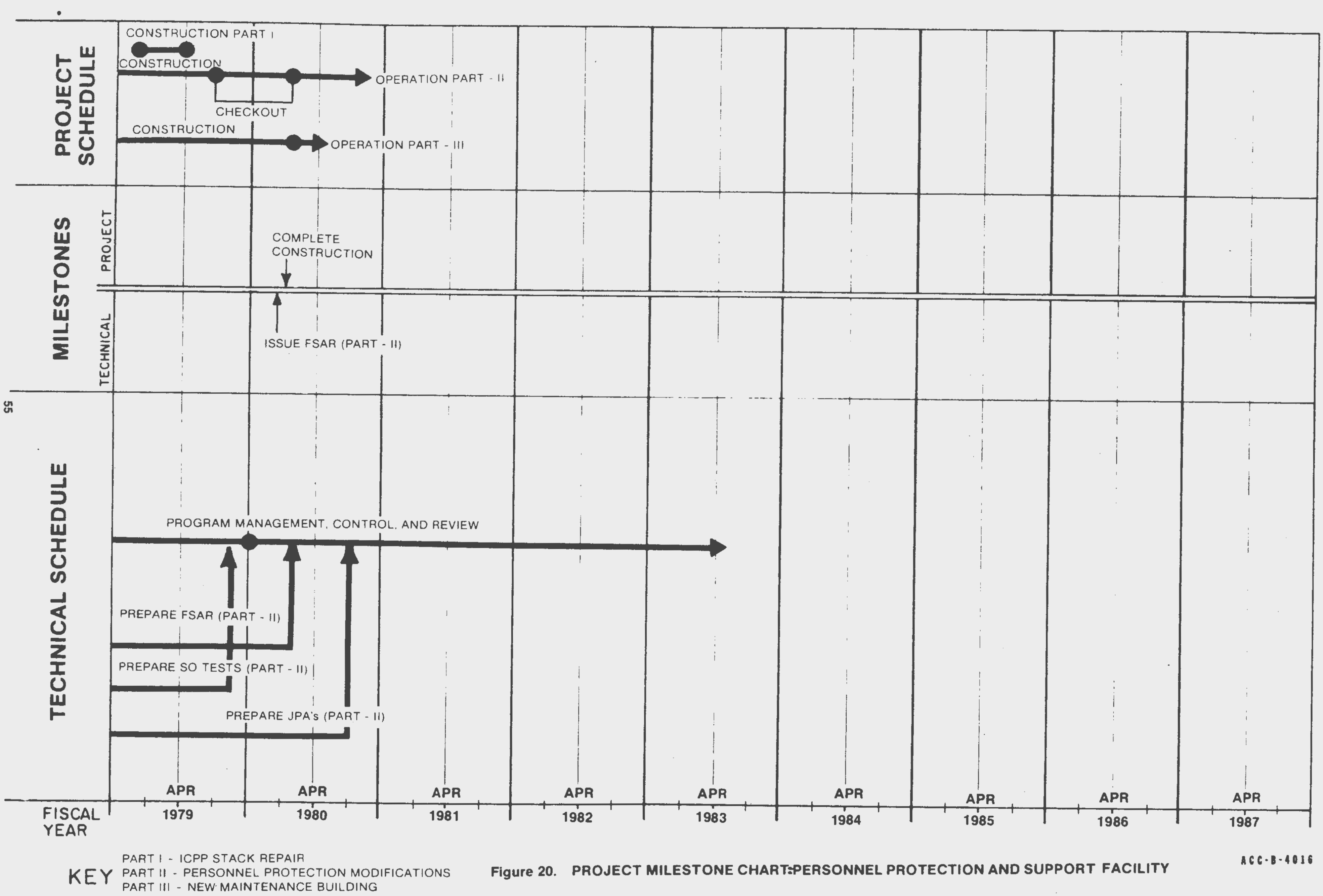


Figure 20. PROJECT MILESTONE CHART-PERSONNEL PROTECTION AND SUPPORT FACILITY

6. UTILITIES REPLACEMENT AND EXPANSION

Description

The Utilities Replacement and Expansion Project (UREP) 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, oxygen, and nitrogen.
(4) An expanded sanitary sewage treatment plant.
(5) A new electrical substation.

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, 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 space 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 UREP is $10.5 million, based on conceptual design estimates. Of this amount, approximately $1.0 million is for engineering design, $0.5 million is for project administration, and $6.3 million is for construction. The remaining $2.7 million is contingency.

Design Requirements

Conceptual design of the UREP began in November 1976, and continued through September 1978. Title I design began in February 1979 and is scheduled for completion in July 1979. Title II design will start in August 1979 and will be completed in July 1980.

Schedule

The major milestones associated with this project are shown in Figure 21. This figure shows that construction on this project is scheduled to begin in 1980 and is to be completed in August 1981.

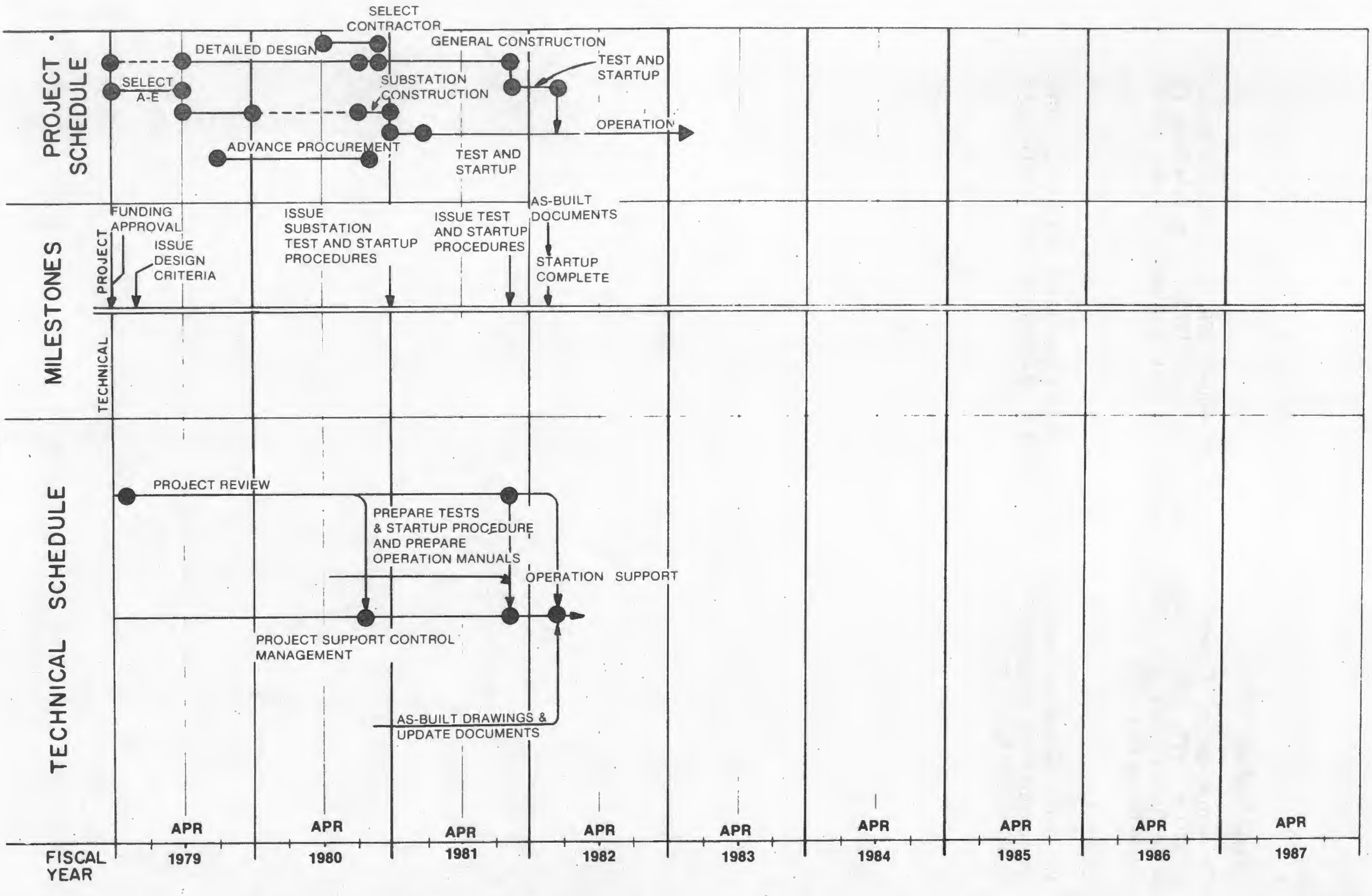


Figure 21. PROJECT MILESTONE CHART: UTILITIES REPLACEMENT AND EXPANSION

7. 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/h) boilers. In addition to the steam generation equipment, the proposed project will include a boiler and service building, coal receiving, storage and handling facilities, liquid and solid waste treatment and disposal, air pollution control, ash handling and storage facilities, and other auxiliaries necessary to provide steam to the ICPP.

Justification

Steam for ICPP is presently being supplied by oil-fired boilers. New production facilities currently being designed and built will cause maximum steam requirements to exceed existing capacity by 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 22.

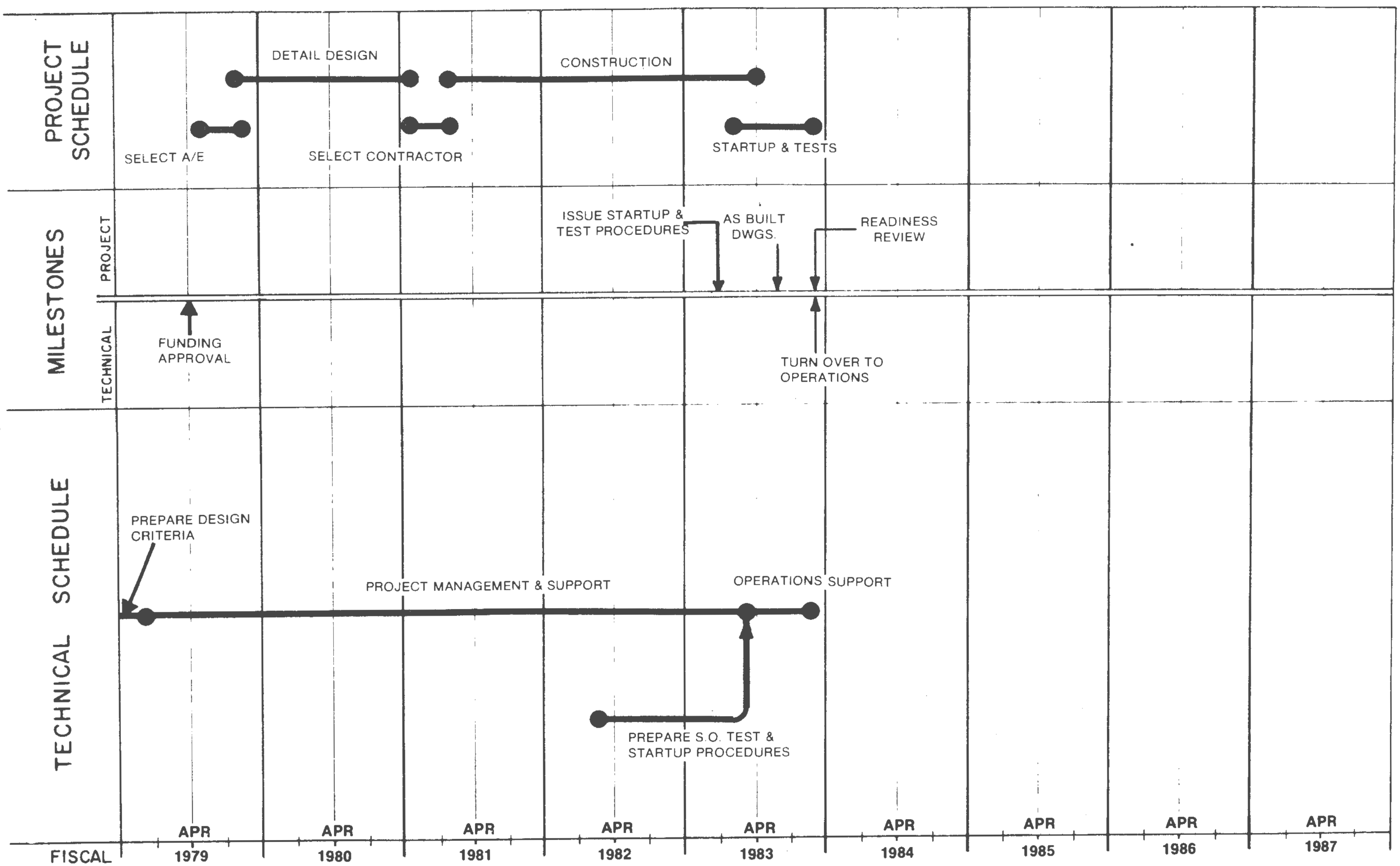


Figure 22. PROJECT MILESTONE CHART:COAL – FIRED STEAM GENERATION

ACC-B-4019

8. PLANT ANALYTICAL CHEMISTRY BUILDING

Description

The Plant Analytical Chemistry building (PACB) will be a one-story structure with a gross area of approximately 6180 m^2 (66,500 ft^2). The facility will house 1765 net usable square metres (NUSM) of laboratories and 1347 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 1976 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 1977. Conceptual design was completed in September 1978. Advanced conceptual design is to be completed by July 1979.

Justification

Projections of laboratory space requirements at ICPP based on the INEL Institutional Plan[16] show a shortage of greater than 1860 NUSM (20,000 ft^2) 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.

Cost Data

The total estimated cost of this project is $25 million.

Conceptual Design Requirements

Conceptual design was completed in July 1978. 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 23 shows the schedule and milestones for this project.

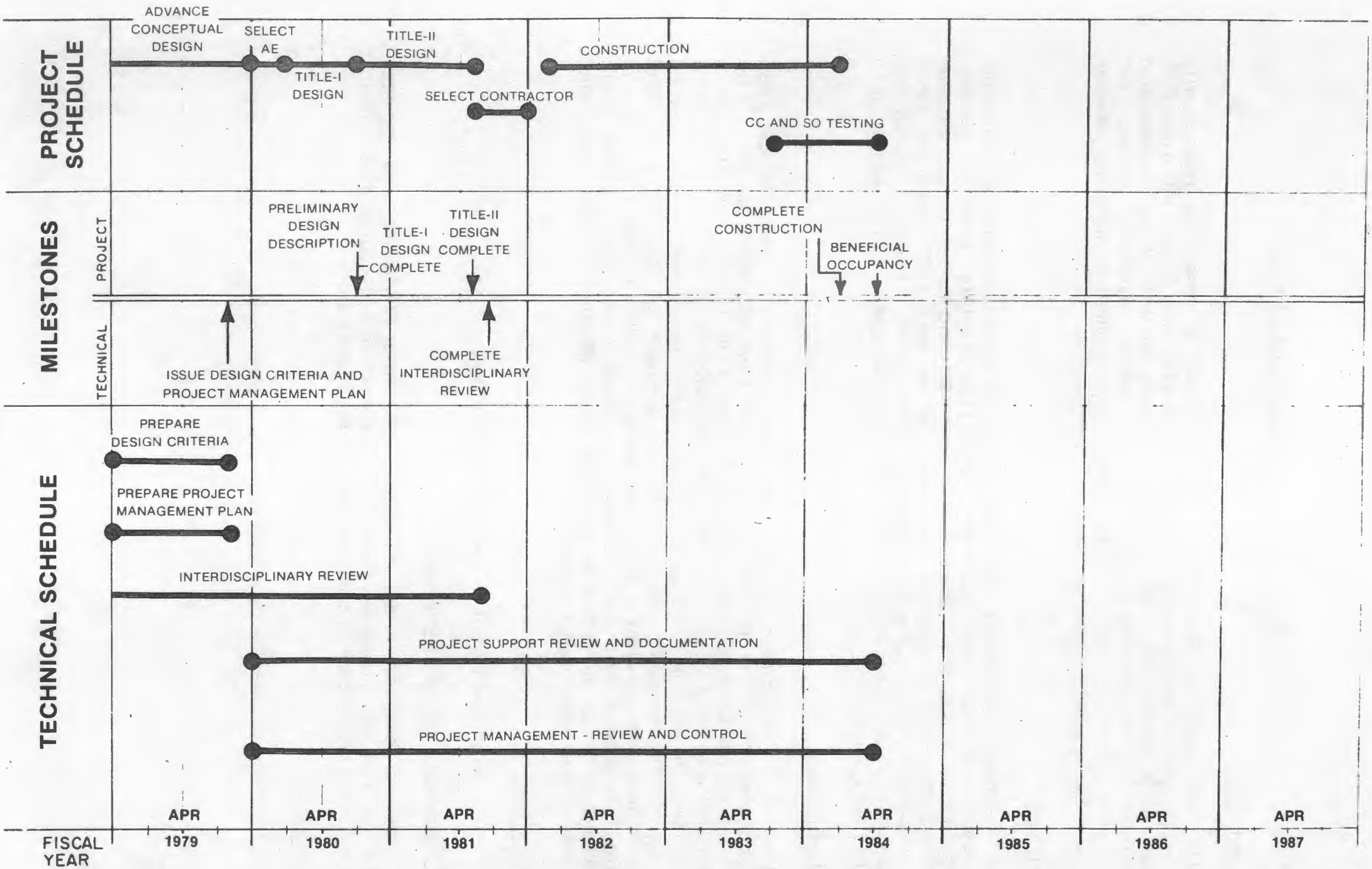


Figure 23. PROJECT MILESTONE CHART:PLANT ANALYTICAL CHEMISTRY BUILDING

ACC-B-4015

9. RENOVATION OF PROCESS CELLS

Description

This project consists of replacement of the ICPP stack, improvements to plant process instrumentation, modifications to decrease personnel radiation exposure, 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 variety 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 with no intermediate measurement capability.

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 control and monitoring. Instrument improvements may include installation of improved sensing and transmitting equipment and control consoles. The existing ICPP stack is severly corroded and contaminated internally and must be replaced; the stack was temporarily repaired to stabilize it until replacement can be made. 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 the Renovation of Process Cells project is $85 million. This is an order of magnitude estimate and will be verified during conceptual design. A data sheet requesting $16 million for Title I design, Title II design, and advance procurement been submitted.[a] A data sheet covering the remainder of the project will be submitted in FY 1982.

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[a] Changed to $19 million too late for correction.

Conceptual Design Requirements

Remaining conceptual design costs for this project are estimated to be approximately $454,000 in FY 1979, and $460,000 in FY 1980. An additional $478,000 was spent in FY 1978.

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 24.

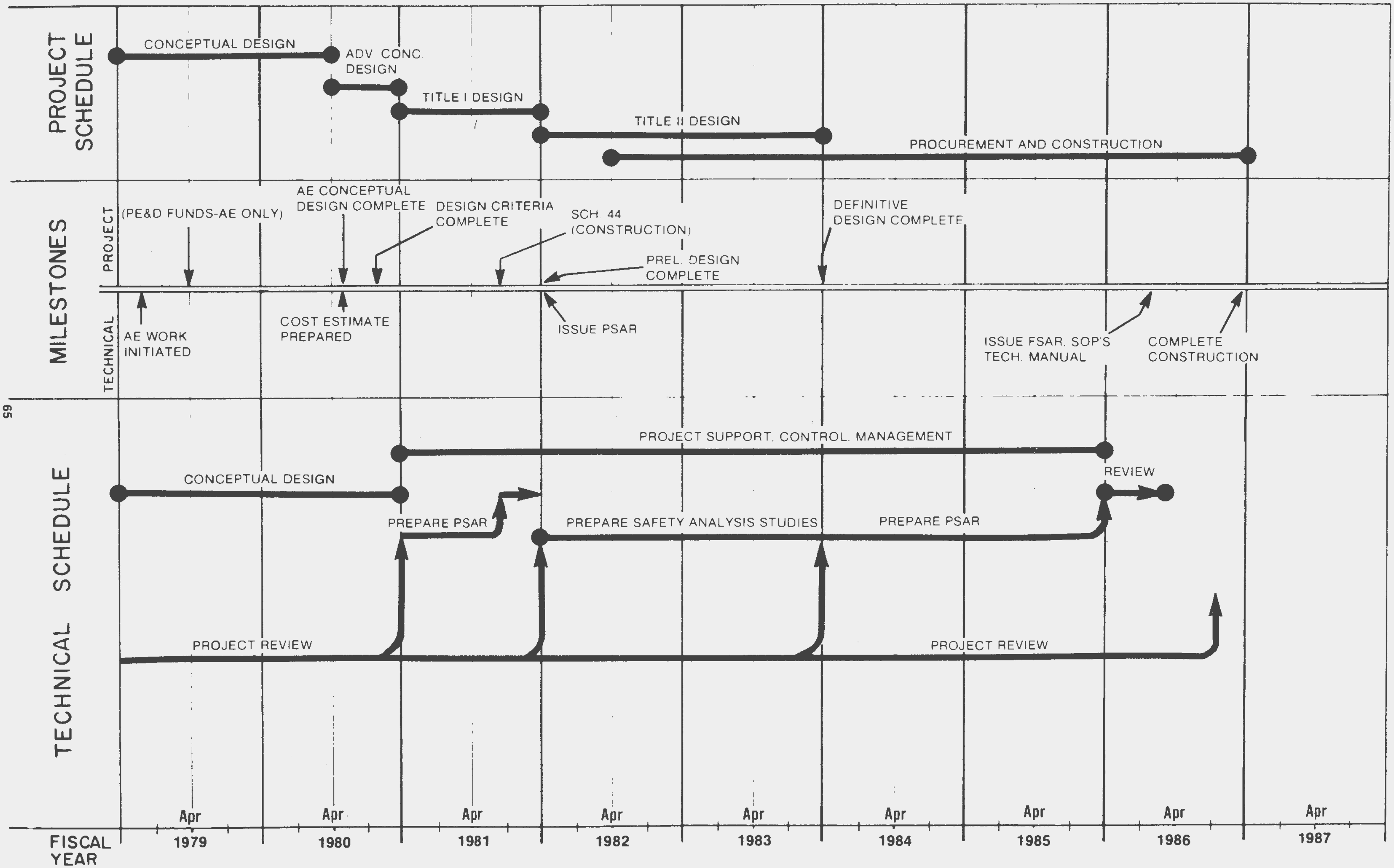

Figure 24. — PROJECT MILESTONE CHART:RENOVATION OF PROCESS CELLS

ACC-B-3957

10. RAF UPGRADE AND EXPANSION

Description

This project will be constructed in an existing building and will require:
(1) Improving the existing Remote Analytical Facility (RAF),

(2) Construction of a new hot cell facility known as the Waste Handling and Analytical Cell (WHAC), and

(3) Expansion of the existing shift laboratory and the addition of a decontamination laboratory.

History

The Remote Analytical Facility is 74 ft long by 27 ft wide and contains two parallel lines of shielded boxes which are used for performing chemical analyses on radioactive samples. The RAF contains manipulators which were designed over 25 years ago and which are far less versatile than modern manipulators. Other features of the RAF also require modification to enable optimal operation. The existing shift laboratory will not accommodate the increases in manning that will be required for increased chemical analyses.

Justification

The primary justification for this project is to reduce the radiation exposure received by ICPP personnel and to properly support operation of the Fluorinel process.

The alterations to the RAF will reduce personnel exposure to radiation by replacing some of the existing manipulators, which are installed in the RAF boxes, with improved manipulators which: (1) will enable certain analyses to be done remotely which presently can only be done directly, and (2) will permit more remote repair and replacement of analytical instruments within the RAF boxes than can be done presently.

The Waste Handling and Analytical Cell and the shift laboratory portions of the project will reduce overcrowding and radiation exposure of personnel so that chemical analyses needed for the optimal operation of the Fluorinal process can be provided, and so that more highly radioactive chemical analysis wastes can be can be remotely prepared for disposal. The decontamination laboratory is required for development of improved decontamination techniques and solutions.

Cost Data

The total estimated cost for this project is $11 million and is based upon a partially-completed (estimated at 65 percent) conceptual design.

Conceptual Design Requirements

The remaining conceptual design costs are estimated to be approximately $100,000.

Schedule

The Waste Handling and Analytical Cell and the shift laboratory portion of the project must become operational prior to the first quarter of FY 1984 so that chemical analyses needed for the optimal operation of the Fluorinel process can be provided. The schedule and milestones for this project are shown on Figure 25.

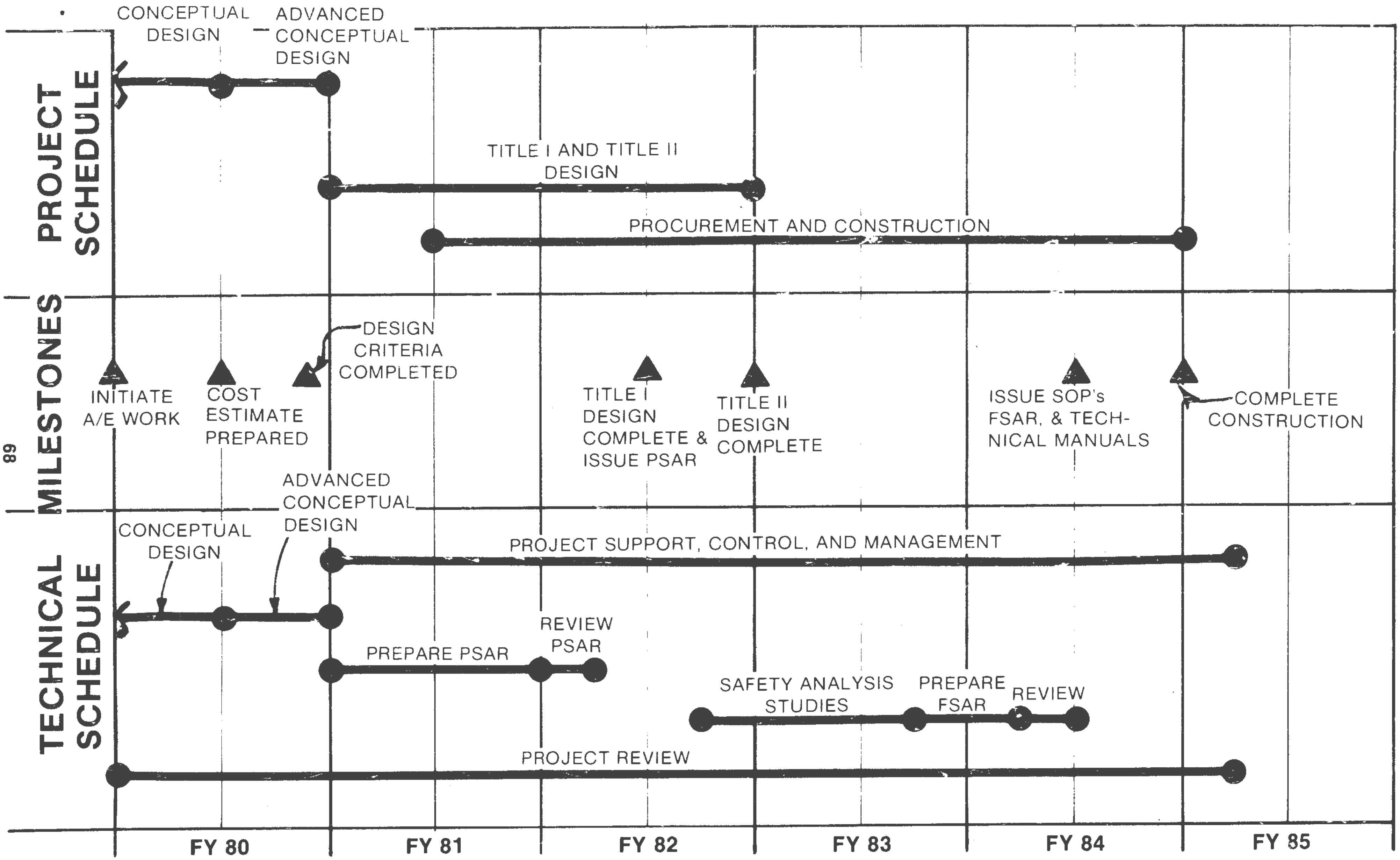

Figure 25. PROJECT MILESTONE CHART:RAF UPGRADE AND EXPANSION

ACC-A-4007

11. CALCINED SOLIDS STORAGE BINS PROJECTS

Description

The calcined solids storage bins projects provides for safe and economical containment of radioactive solids produced by calcining high-level radioactive liquid waste. Four bin sets have been constructed, construction on the 5th Set is due to begin in the 3rd Quarter of FY 1979, and the 6th Set is in advanced conceptual design. The first two bin sets have been filled and the third is being filled from the WCF. The 4th and future bin sets will be filled from the NWCF.

All bin set projects use the same general design, i.e., each consists of stainless steel storage bins enclosed in a reinforced concrete vault. The stainless steel bins provide the primary containment of the calcined solids and the concrete vault provides the secondary containment and radiation shielding. Decay heat is removed by natural convection flow through the vault. The calcined solids are pneumatically transported from the calciner to a solids separator (which is in the storage vault), separated from the transport air and distributed to the bins. Transport air is returned to the calciner.

Capacities and Costs

Capacities and total estimated costs for the sets are as follows:

Bin Set	Approximate Capacity		Total Estimated Cost, Millions $	Estimated Completion
	ft3	M3		
1st, 2nd				
3rd, 4th	94,000	2662		
5th	35,000	991	8.75	June 1981
6th	60,000	1699	16.0	November 1984
7th	60,000	1699	30.0	April 1989

The total estimated cost for the 5th Bin Set based on the Title II design 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 6th Bin Set based on advanced conceptual design is $16.0 million.

Conceptual Design Requirements

Conceptual design for the 5th Bin Set was completed in FY 1977 at a cost of $253,000.

Conceptual design of the 6th and 7th Bin Sets and Transfer Station was $425,000 in FY 1978, and through February 1979, $132,000 has been spent. The Transfer Station has been eliminated from this project.

Justification

If fuel reprocessing is to continue at the ICPP, construction of either additional high-level radioactive liquid waste storage tanks or additional calcined solids storage facilities is required. Additional liquid waste storage is not viable because of economic, safety, and environmental factors. Cost of construction of liquid waste tanks is estimated to be over twice that of equivalent solids storage bins. Conversion of high-level radioactive liquid waste to solids and subsequent storage provides (1) improved safety, (2) greater assurance of isolation for man's environment, (3) minimal reliance on continued maintenance and surveillance, (4) lower overall costs for waste management, (5) reduced volume storage requirement (reduction in volume of about 7:1), and (6) production of a feed material for candidate waste form conversion processes.

Schedule

The project milestone chart for design and construction of the 5th, 6th, and 7th bin sets is shown in Figure 26. The bin construction schedule is based on an optimistic calcining schedule having no shutdown for the Renovation of Process Cells Project and continued operation of FAST after startup.

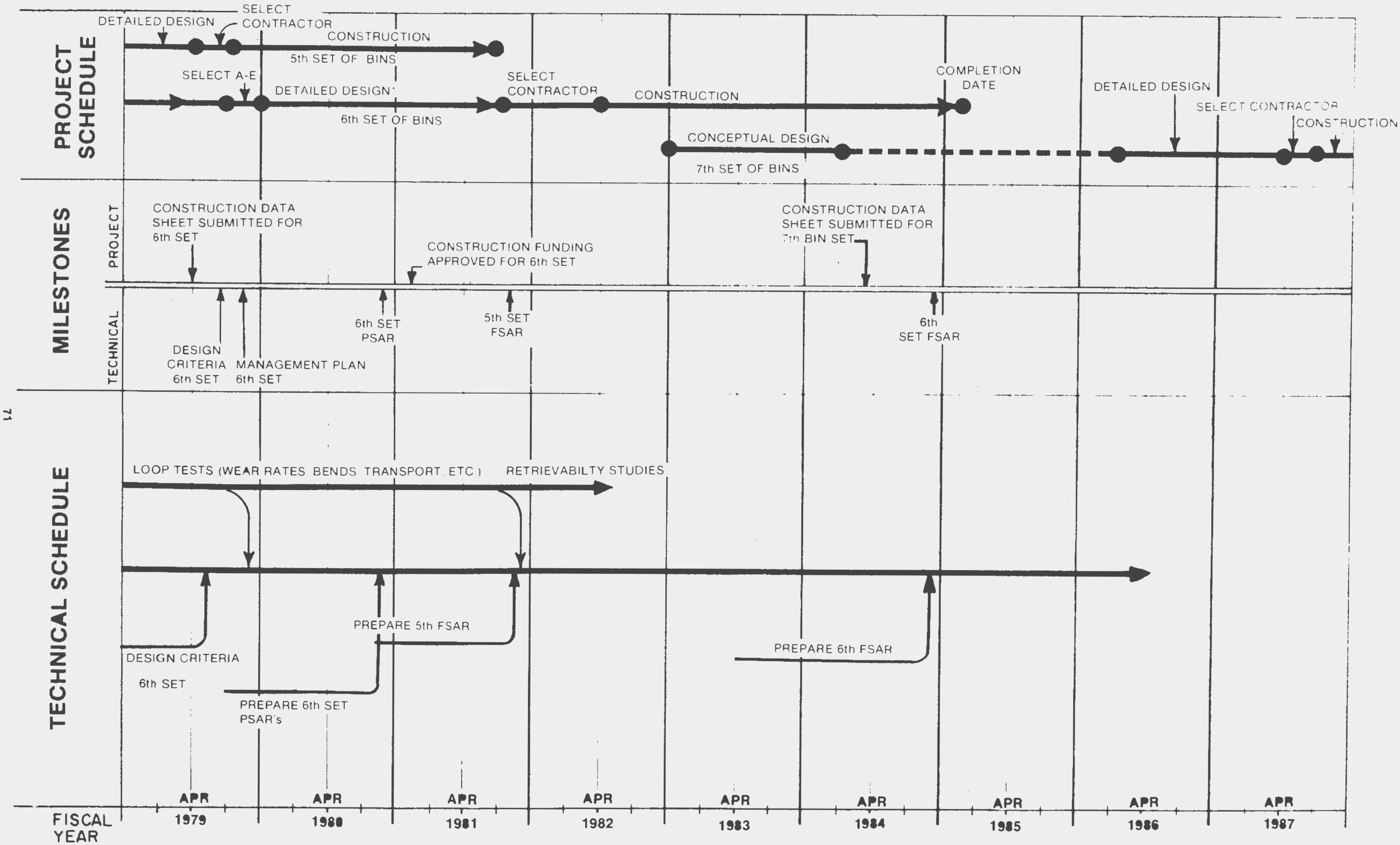

Figure 26. PROJECT MILESTONE CHART: CALCINED SOLIDS STORAGE BINS

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

12. PLANT UPGRADE

Although the Fluorinel process, when completed, will be used to dissolve the fuels now processed in E cell, aluminum fuels will continue to be dissolved in equipment originally installed in G cell, and much other original equipment in E, F, G, and H cells will continue in use. The aluminum dissolvers must operate a total of about 120 days during the last five years of the study period. Of this old equipment, perhaps most important to reliable operation is that for first-cycle extraction, which processes the highly radioactive solutions from all dissolvers. First-cycle extraction was assumed operable for about 235 days each year starting with February 1986, about 50% more than in prior years. There is some question whether this increase in operating time can be obtained with an economic increase in operating and maintenance manpower, and particularly, with a tolerable increase in integrated personnel radiation exposure. All maintenance on these old systems must be done by direct contact.

The Renovation of Process Cells Project, if authorized, will deal with some of the potential problems with these systems but may not do enough. The problems have been under study[18] and study is to continue. Alternatives under consideration include:

(1) Building a new headend and first-cycle extraction system, utilizing remote removal and replacement of key components, within existing CPP-601 processing cells.

(2) Build a new remotely maintained facility to replace processes presently located in CPP-601.

(3) Utilize cells A, B, C, D and L in existing CPP-601 to build redundant direct maintenance headend dissolution and first-cycle extraction systems.

Costs herein include $2.0 million in FY 1981 and $1.0 million in FY 1982 for conceptual design leading to a line item proposal. Project costs would vary widely, depending on the alternative chosen. The need for such a project and the certainty that one will be finally proposed is considered too tentative at this time to justify inclusion of a project cost estimate in this document.

13. GENERAL PLANT PROJECTS (GPP)

The FY 1980 GPPs are:

In Separations Budget

Priority	Project	Estimated Costs ($000)
1	CPP-601 G-Cell Charging Cave Modifications	$ 230
2	CPP-637 Roof Replacement	55
3	ICPP Dispensary Expansion	100
4	ICPP Document Control Building	580
5	ICPP FY-1980 Road Program	150
6	Miscellaneous GPP's	50
7	CPP-637 Low Bay Laboratory Modifications	500
8	Custom Processing Staging Facility	120
9	CFA-649 Laboratory Rehabilitation	60
	Total	1845

In Waste Management Budget

Priority	Project	Estimated Costs ($000)
1	CPP-627 Filter and Exhaust Modifications	$ 520
2	Hatch to PEW Evaporator Pump Pit	130
3	CPP-601 to CPP-604 High-Level Waste Line Replacement	450
4	CPP-734 Waste Monitoring Station Ventilation Modifications	20
5	ICPP Utility Line Replacement	300
	Total	$1,420

The conceptual design efforts ($200,000) for these FY 1980 projects are scheduled to commence during the second quarter of FY 1979. Title I & II design for all of these GPPs will require some architect-engineering effort starting the first quarter of FY 1980. The start of construction is dependent upon the level of design effort necessary. The milestone schedule for FY 1980 GPPs is shown in Figure 27.

Table IX lists the FY 1981 candidate GPPs within the scope of this document. The conceptual design effort for DOE-ID approved projects is scheduled to commence during the second quarter of FY 1980. Title I and II design for these selected projects is projected to start during the first quarter of FY 1981. Schedules for design and construction have not yet been prepared for these projects.

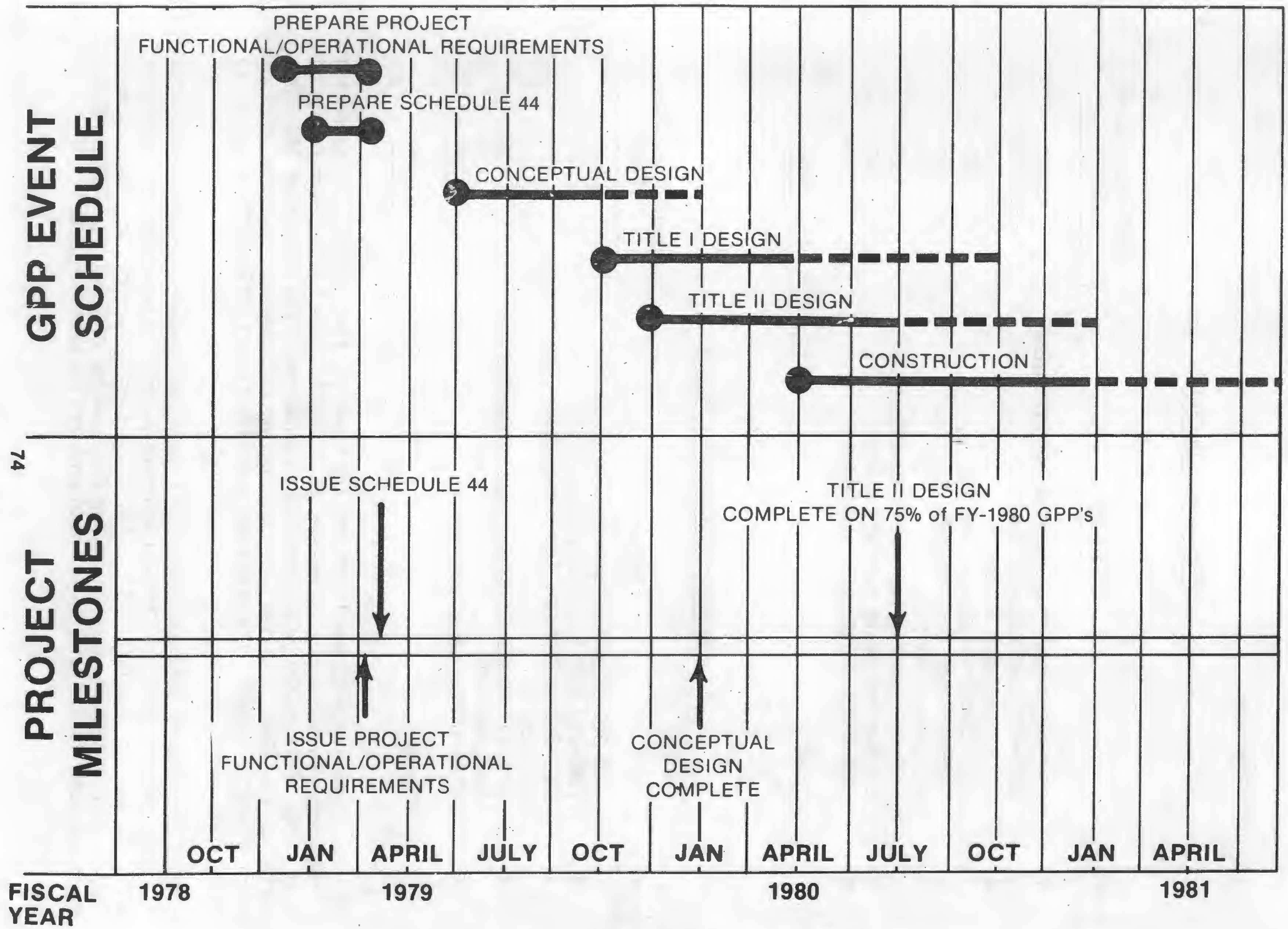

Figure 27. FY-1980 GENERAL PLANT PROJECTS

ACC-A-4006

TABLE IX

FY-1981 GPP CANDIDATE PROPOSALS

In Separation Budget

Project Title	Rough Order of Magnitude Cost ($000)
1. Health Physics Field Office Relocation	200
2. CPP-603 Heating and Ventilation System	500
3. ICPP Miscellaneous Utility Line Replacement	300
4. CPP-601 Operating Corridor Contamination Control	375
5. CPP-606 Heating and Ventilation System Upgrade	500
6. ICPP Road Program	175
7. ICPP Miscellaneous GPPs	50
Total	2100

In Waste Management Budget

Project Title	Rough Order of Magnitude Cost ($000)
1. CPP-602 Ventilation Duct Replacement	100
2. Additional ICPP Cathodic Protection	300
3. ICPP Low-Level Solid Radioactive Waste Handling Facility	450
4. CPP-604 Heating and Ventilation System Upgrade	400
5. Contaminated Equipment Storage Area	175
Total	1425

In the In-house Energy Management Budget

Project Title	Rough Order of Magnitude Cost ($000)
1. Recover Waste Heat from Exhaust Air	405
2. Return Condensate to Boilers	430
3. Energy Savings in Miscellaneous Projects	55
4. Projects Identified from Energy Audits	360
Total	1250

VII. PROCESS SUPPORT

1. PROCESS SAFETY UPGRADING

Technical Support activities in FY 1980 will be dominated by vigorous efforts to systematically upgrade the safety of CPP processes. As a first step in implementation of the safety related goals, the safety analysis function was integrated into the Technical Support Division in December of 1978. With a major goal of routine operation of fuel reprocessing in July 1980, the principal efforts in the first three quarters of FY 1980 will be on preparation of Technical Specifications, updating of the Safety Review Document, design and placement of plant protective systems with appropriate supporting documentation, and supporting experimental work related to newly emphasized process safety questions.

2. DIRECT TECHNICAL SUPPORT ACTIVITIES

The traditional technical support tasks are summarized in the following paragraphs by process function. Because of the substantial resources to be devoted to the safety studies described above, there will be severe limitations on the resources available for these technical support tasks.

2.1 Fuel Receipt and Storage

Following is a list of direct technical support tasks in this category:

(1) Prepare safety analyses, procedures, etc., as needed to receive fuels not covered by existing approved procedures.

(2) Provide technical support for testing fuel handling procedures, etc.

(3) Sample and analyze water as needed to maintain water quality.

(4) Provide surveillance for water treatment systems.

(5) Conduct leak tests of fuel and basin.

(6) Monitor basin equipment and fuel for corrosion.

(7) Review new systems for corrosion potential and recommend suitable materials.

(8) Conduct special corrosion tests as necessary.

(9) Conduct Fluorinel basin review in materials area.

2.2 Fuel Processing

Following is a list of direct technical support tasks in this category:

(1) Provide routine surveillance and support.

(2) Develop flowsheets and operating recommendations as needed.

(3) Do custom fuel processing.

(4) Issue campaign run reports.

(5) Identify, evaluate, and resolve plant system problems.

(6) Review process cells and propose improvements for maintenance turnarounds.

(7) Prepare preliminary design criteria for plant modifications and new systems.

(8) Review engineering designs of new systems.

(9) Contribute to planning and testing of new or modified equipment.

(10) Evaluate plant systems to identify equipment in need of upgrade.

(11) Continue plant equipment reliability program.

(12) Conduct pilot plant tests or laboratory studies as necessary to evaluate design problems.

(13) Provide routine corrosion surveillance.

(14) Perform failure analysis as needed and replacement recommendations.

(15) Evaluate new materials proposed for plant use.

(16) Review new systems for materials compatibility.

(17) Provide corrosion inspection during plant cell turnaround.

2.3 Decontamination Support

Following is a list of direct technical support tasks in this category:

(1) Provide decon recommendations, surveillance, and assistance for decon efforts as requested.

(2) Update Decon Manual as necessary.

(3) Develop decon procedures for NWCF Decon Area as necessary.

(4) Develp decon plan and Decon Manual section for NWCF.

(5) Continue studies of metal surface films.

(6) Test potential decon reagents for relative effectiveness.

(7) Demonstrate in-situ electropolishing of a plant vessel or other equipment.

(8) Evaluate high-intensity ultrasonic agitation as an in-situ decon technique.

(9) Adapt high-pressure (10,000 psi) water blaster for additional solids removal tasks in plant cells.

(10) Implement better methods of monitoring decon progress using newer radiation detectors or dosimeter rabbit sytems.

(11) Demonstrate decon process on selected plant equipment, involving continuous radionuclide transfer from in-cell system to external ion exchange column via dilute reagent recirculation.

(12) Implement use of modular cavities which can be reversibly filled with lead shot for shielding problem hot spots in cells during decon work.

(13) Develop conceptual designs for plant modifications to allow better access to plant equipment for internal decontamination.

(14) Perform design reviews for plant upgrade projects to improve plant decontaminability.

2.4 Waste Storage and Calcination

Following is a list of direct technical support tasks in this category:

(1) WCF technical surveillance.

(2) Technical liaison.

(3) CO-CO_2 analysis.

(4) Off-gas monitoring.

(5) Waste Management Plan for ICPP Liquid Wastes.

(6) Help establish maintenance needs and priorities.

(7) Routine corrosion inspections.

(8) Decontamination assistance.

3. PROCESS IMPROVEMENT ACTIVITIES

These activities improve existing or soon-to-exist processes at the ICPP. The majority of this work consists of the planning, conducting, interpreting and reporting of laboratory and pilot plant tests, including the acquisition, study, and integration of related information from non-ICPP sources and from ICPP plant experience. The activities are summarized in relation to two principal categories in the ICPP budget: (1) Separations and (2) Waste Concentration and Solidification.

3.1 Improvements for Separations Processes

The major tasks in this category are as follows:

(1) Fluorinel process design and flowsheet verification.

(2) Improvement of existing fuels dissolution and separations processes, including the Rover and Fluorinel processes, after startup.

(3) Improving product denitrator design and operations, including development of a mathematical model for its operation. This work will be started in FY 1981.

(4) Procurement of equipment for remote application and related modification, fabrication and testing of remote mockups, and making failure studies of this equipment.

(5) Completion of a comprehensive, detailed study of instrumentation for the plant processes, including identifying existing deficiencies and desirable improvements, determining requirements and criteria for instrumentation to obtain the improvements, and either locating suitable state-of-the-art instrumentation for the improvements or developing the needed but commercially unavailable instrumentation.

3.2 Improvements for Waste Storage, Concentration and Solidification

The major tasks in this category are as follows:

(1) Complete the development and pilot plant testing of fluidized-bed calcination flowsheets for fluorinel waste, sodium-bearing waste blended with fluorinel waste, sodium-bearing waste blended with non-radioactive additives, and wastes in tanks WM-188 and WM-189.

(2) Complete module fabrication for and construction of the new 30-cm diam pilot plant calciner, including an automatic data acquisition system.

(3) Complete nozzle-cap material studies.

(4) Complete sintered-metal filter testing.

(5) Develop methods to control calcine particle size and to reduce the percentage of fine particles.

(6) Test calcine pneumatic transport systems.

(7) Determine flowpaths of volatile species during calcination.

4. 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. Continue decontamination of plant occupied areas—specifically old contamination spill sites.

   b. Continue decontamination of "hot spots" in areas outside plant buildings.

   c. Continue personnel training and discipline.

   d. Expand plant effluent source monitoring.

2. Personnel monitoring and contamination control:

   a. Continue emphasis and upgrading of personnel self-surveys.

   b. Improve radiological housekeeping.

   c. Install additional upgraded portal monitors throughout plant.

   d. Continue plant decontamination.

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. Install samplers on all currently unmonitored effluent points.

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

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

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

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

4. Personnel radiation exposure control and reduction:

   a. Maintain agressive ALARA planning design and job control.

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

   c. Maintain individual exposures at an ALARA level.

5. Personnel external dosimetry:

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

   b. Evaluate and apply the new 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 improved freed survey techniques to reduce exposure estimate uncertainties.

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.

7. Environmental monitoring:

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

   b. Analyze soil samples taken near the ICPP.

   c. Upgrade the documentation of the impact of the ICPP on the surrounding environment.

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

8. Instrumentation:

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

   b. Complete stack monitor upgrade.

c. Install additional effluent point samplers.

9. Emergency response:

   a. Install new emergency staging areas.

   b. Continue emergency training exercises.

   c. Upgrade Emergency Director training manual.

   d. Outfit and maintain new emergency response vehicle.

10. Procedures and training:

   a. Revise and update current safety procedures.

   b. Develop new safety manual.

11. Shipping:

   a. Continue training and follow-up in shipping form completion and control.

   b. Improve contamination survey techniques on vehicles and shipments.

   c. Improve survey techniques of personnel associated with the shipments.

12. Decontamination:

   a. Improve emergency personnel decontamination techniques and procedures.

   b. Implement improved facilities and associated techniques and procedures at NWCF.

   c. Develop decontamination technician training program and procedures manual.

13. Radioactive solid waste management:

   a. Clarify low-level solid waste management program at ICPP.

   b. Improve "hot" equipment storage facilities.

   c. Improve personnel training and discipline in waste segregation and volume reduction.

   d. Provide incineration and/or other volume reduction facilities at ICPP.

VIII. CONCLUSIONS

1. Satisfactory progress of the Multiple Fuels Processing Program in FY 1980 requires funding of $39 million for production, and $77 million of obligational authority for capital facilities and equipment.

2. Funding will be needed for the MFPP in FY 1981 as follows:

Production	$47.5 million
Capital	$95.0 million

3. Capital line-items requiring initial funding in FY 1981 and their total estimated costs are as follows:

Plant Analytical Chemistry Building	$25 million
Renovation of Process Cells	$85 million
Remote Analytical Facility Upgrade and Expansion	$11 million

   Delay in funding these projects would be highly undesirable.

4. The Baseline Program will recover product valued at $678 million for an incremental cost at the ICPP of $624 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 the ICPP. Total incremental cost to the government would be less than $624 million because costs at other sites were not taken into account by the Scenario. Present values for these ICPP increments when a 10% discount rate is applied are $390 million for the incremental product value and $440 million for incremental ICPP cost.

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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 1981 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 1980 through FY 1991. Last year the period was FY 1979 through FY 1990.

2. Fuel receipts are as specified by DOE.[19] The fuel numbers and process numbers are identified in the Materials Management Plan, a classified document.[12] Total receipts projected for the FY-1980-91 study period for fuels to be reprocessed at the ICPP are about 1.9% (225 kg ^{235}U) above those projected last year for the FY 1979-90 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 1, 2, 3, 4, 6, 10, 11 and 25. Waste rates for Fuels 13, 17, 26, 27, 28, 29, and 33 were revised. The processing rates are expressed in kg ^{235}U 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. The coprocessing process uses aluminum and zirconium fuel at an average ratio of 2.725 kg ^{235}U in aluminum fuel to 1 kg of ^{235}U in zirconium fuel. Last year, this ratio was shifted to 2.5:1.0 in 1983. Fluorinel coprocessing employs a ratio of 2.5:1.0.

5. Processing of Rover fuel will begin in September 1981. This is a 21-month delay from the prediction made last year.

6. Of the 12 large (1135 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 1079 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 except for the first three tanks to be calcined, for which a 1:6 ratio is used. Last year the 1:3.5 ratio was used for all fluoride waste. Non-fluoride wastes are assumed blended with fluoride wastes in a 1:2 volume ratio for calcining after a 60% boildown. The tank depletion ratio is

TABLE B-1

FUEL PROCESSING RATES AND WASTE GENERATING RATES

		Kg ^{235}U per Flowsheet Day*		Waste, litres/kg ^{235}U		
Fuel No.	Special Applicability Dates	Before 2nd Crew Expansion	After 2nd Crew Expansion	Non-Fluoride	Fluoride	Low Heat
1	None	7.3	10.0		1000	40
2	None	10.0	16.0	550		40
3	None	3.5	4.0		3200	40
4	None	6.6	10.0	340		60
5	None	2.5		380		40
6	None	10.0	16.0	340		40
7	None	5.0		380		40
8	None	1.7	2.0	1200		40
9	<7/82	2.0			150	40
9	>7/82	10.0	15.0		150	40
10	None	30.0	30.0			1360
11	None	10.0	16.0	150		40
12	None	5.0	5.5		850	40
13	None	5.6	6.7		1200	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		800	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		1200	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	10.0	15.0		600	40
26	None	6.5	8.1		1200	50
27	None	5.6	6.7		1200	50
28	None	6.5	8.1		1200	50
29	None	37.0	37.0		1200	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		1200	50
34	None	7.6	10.0		2000	50
35	None	8.0	10.5		900	40

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

therefore 1:1.2. Rover waste is assumed blended with fluoride waste in a 1:1 ratio. Last year, Rover waste was treated the same as other fluoride wastes.

8. Projected radioactive liquid fluoride waste inventories, as shown in Figure 6, exclude the waste from first-cycle extraction of Rover fuel. This low-activity waste will 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 to minimize the storage period.

9. Miscellaneous wastes are assumed to total 240 cubic metres (63,408 gallons) per years. 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 dilute fluoride - 10.7:1 in WCF and 11:1 in NWCF; fluoride and Rover - 11.5:1; low-heat blend with fluoride from Fluorinel process - 5.3:1. This last ratio was 6.8:1 last year. In the Miniumum-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 estimated 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. This year, a small amount of funding was moved from FY 1981 to FY 1982 for two projects, FAST and Steam Generation, to improve agreement with the start of physical depreciation.

    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 1981, i.e., all present valuing will be to FY 1980. Last year, discounting began in FY 1980.

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

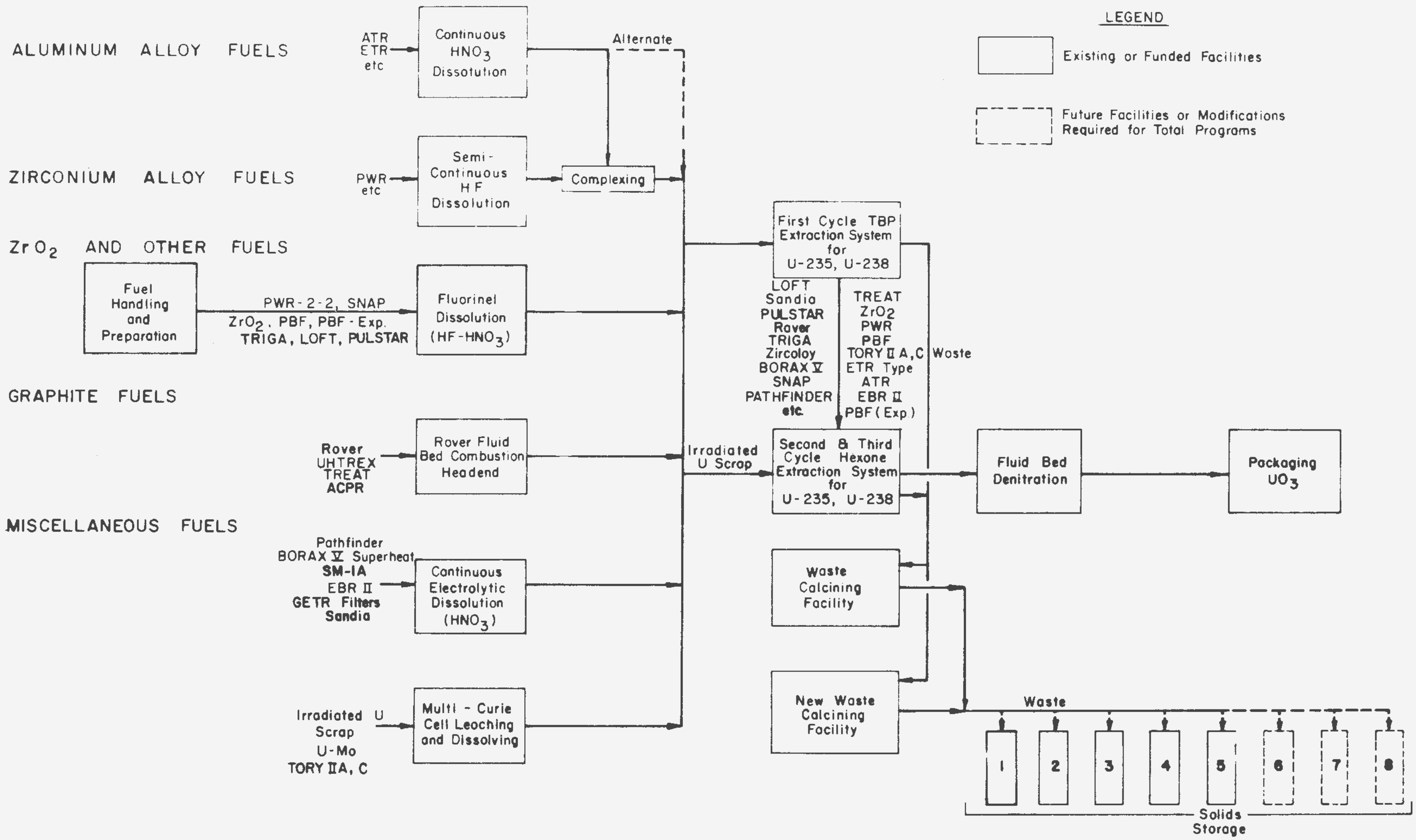
14. Operation of the Fluorinel process will begin with cold fuel in July 1983, and with irradiated fuel in January 1984. The new metal-clad fuel storage facility will become available for use in July 1983. Starting then, all zirconium fuels received will be stored in the new facility. Last year, non-zirconium fuel was also assumed stored there.

15. A waste adjustment charge is added in post-FY-1991 in each cash flow analysis to reflect and to normalize unequal waste inventories which unavoidably occur at the end of FY 1991 for the various processing schedules. This cost or normalizing factor is necessary since all liquid waste must eventually be converted to solid calcine for intermediate-term storage. The waste adjustment costs amount to \$6800 per cubic metre of zirconium fluoride waste, \$7600 per cubic metre of low-heat and Fluorinel waste and \$6500 per cubic metre of nonfluoride waste. Last year, waste adjustment charges were \$5200 per cubic metre for Fluorinel and zirconium fluoride and \$10,000 per cubic metre for low-heat wastes. The reduction for low-heat waste is based on eventual calcine of all low-heat waste in a 1:3.5 blend with Fluorinel waste, as operation of the plant continues through the 1990s. Last year, some of the low heat waste was assumed calcined with aluminum nitrate. These costs include both calcining and solid storage costs for the wastes. All costs in the post-FY-1991 column were assumed to occur in FY 1992 for discounting purposes.

16. The unit value of ^{235}U is \$45.35 per gram.[20]

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 \$2,200,000 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 ^{235}U 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-2656

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 ICPP production activities (CPPSIM). A list of changes and additions to CPPSIM follows:

(1) The number of waste types covered was increased from three to five, and control of calcine heat generation was added. The seven most significant isotopes in each waste produced are calculated. An inventory record is maintained for these, and for waste volume, in each of five pseudo tanks for zirconium fluoride waste and five pseudo tanks for Fluorinel waste. The heat generation per unit volume of liquid is calculated for each of the ten tanks and for the other three types of wastes. Control of simulated calcining was revised and restricted so that calcine heat generation rates will remain below limits established for each set of calcine bins, and so that all types of waste blends can be easily obtained.

(2) Separate controls were established for the starting date for storage of each fuel type (zirconium and non-zirconium) in the FAST basin. Last year, both types were controlled by the same date.

APPENDIX E

MAJOR FY 1979 ACCOMPLISHMENTS

The purpose of this appendix is to compare actual results for the first eight months of FY 1979 with the plans for FY 1979 presented in the FY 1978 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.

	Originally Planned for FY-1979	Actual through 5/31/79	Revised Estimate
Fuel processing, kg ^{235}U	455	0	0
Net liquid waste calcining, cubic metres (allows for WCF decontaminating solutions)	1050	0	600

The very successful WCF campaign H-8, which was started on September 13, 1977, continued until a shutdown on September 29, 1978, that was scheduled for tie-ins of the Priority Utilities Project. The campaign emptied sufficient liquid waste space to permit extension into FY 1979 of the fuel processing that was started July 11, 1978. However, the fuel processing campaign had to be stopped on October 17, 1978, because of a criticality in a scrub column. The necessity for study of the criticality, for related revisions to procedures and equipment, for recovery of the uranium in the process, and for proper interfacing with previously scheduled project work has required deletion of the fuel processing scheduled for FY 1979 that was shown in the 1978 MFPP document.

Recovery from the criticality and removal of all uranium from the system (Sweepdown) required an in-depth reevaluation of all safety related documentation for fuel dissolution, solvent extraction (all cycles), and product denitration. In addition, all system and equipment drawings, flowsheets, and operating procedures were revised as necessary, expanded operator training was conducted, and a readiness review was performed prior to startup of the Sweepdown. The Sweepdown was completed successfully on schedule; about 400 kg of ^{235}U was processed.

A reexamination of possible plant protection systems (PPS) was initiated. Initial efforts are being directed towards reviewing existing criteria for the ICPP and determining if revisions to it are necessary. In addition, all process systems are being reviewed to identify potential PPS's for further evaluation.

At the start of the WCF outage at the end of September 1978, resumption of WCF operation was planned for December after a much shorter outage than had been projected in the 1978 MFPP. However, inspection of the main stack showed a potential for its failure in a high wind; shutdown and evacuation of the WCF would have been required whenever such a wind was likely. Therefore a major maintenance turnaround was scheduled for the WCF, while temporary repairs were scheduled for the stack. Startup of the WCF is projected for June. Major work accomplished in the WCF turnaround included installing new quench pumps, off-gas superheater, venturi scrubber, deentrainment separator and demister, cell explosimeter; relocation of feed control valves; modifying and repairing bubble caps and the distributor plate drain in the calciner vessel; and performing an extensive instrument calibration program.

Because the shutdown of the plant due to a failure of the stack was unacceptable, an interim repair was made. This interim fix included pouring a reinforced concrete sheath around the existing stack and installing a new stainless steel cap on top. This fix will be adequate until a new stack is constructed as a part of the Renovation of Process Cells Project.

Review of the criticality has led to a redirection and a greater emphasis in several areas, including configuration and document control, as-built drawings, preventative maintenance and quality assurance. To provide both better control and visibility of these efforts, organizational changes were made. Activities in these areas were in effect for both the Sweepdown and the WCF turnaround, and continue to be emphasized.

A continuing effort is being made in changeover of the Production Division procedures. Xyzyx Corporation is again under subcontract to assist in changing many existing procedures over to the JPA (Job Performance Aids) format. Priority was given to those JPAs required for Sweepdown and the WCF operations.

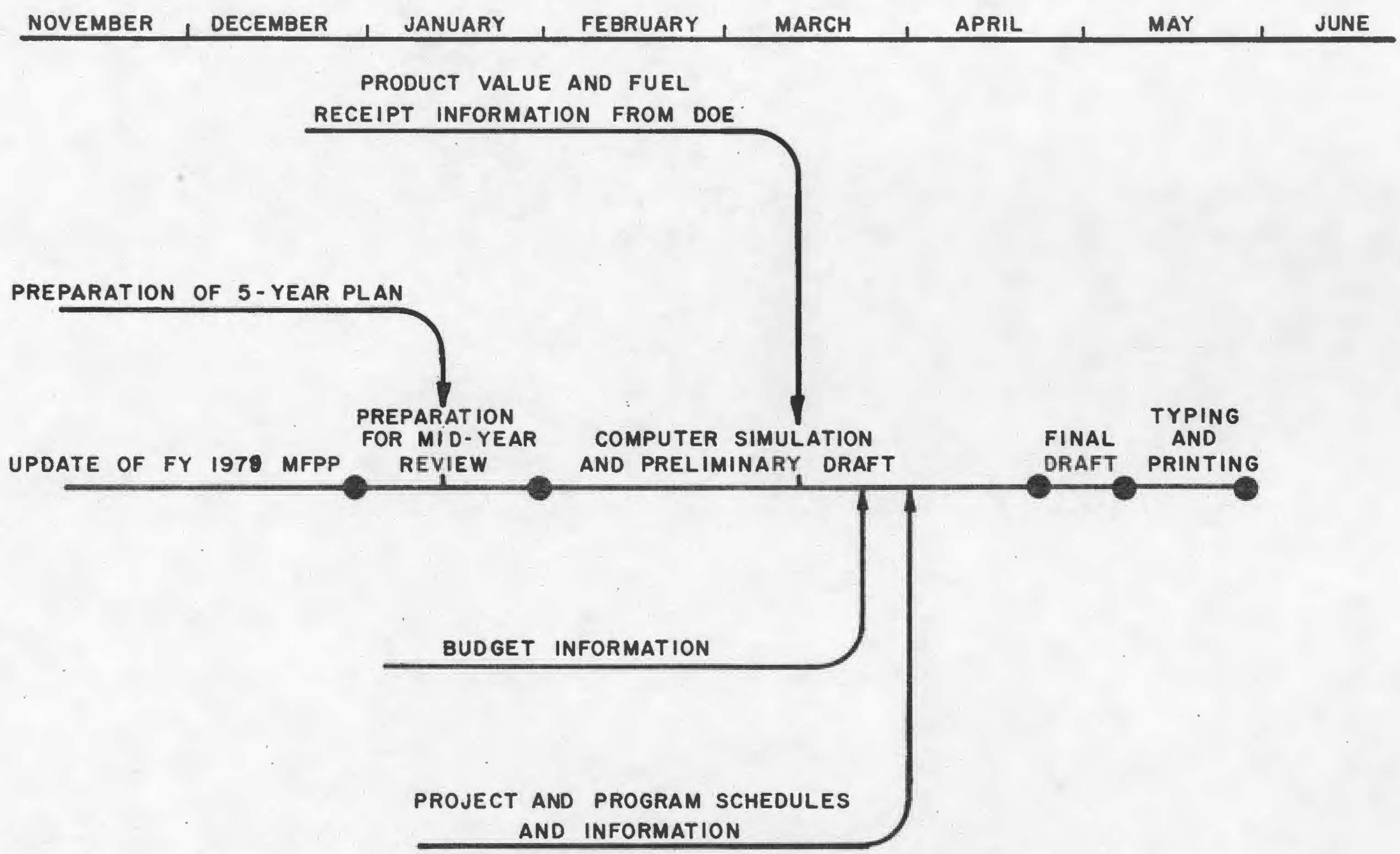
Following is a list of other major goals in the Baseline Program for FY 1979 and the status of the work to accomplish them:

Complete Priority Utilities Project:	About 10% behind schedule.
Complete design of Fluorinel Dissolution Process and Metal Clad Fuel Storage Facility	About 5% behind schedule.
27omplete Safeguards and Security Upgrade Project	On Schedule.
Issue design criteria for the Plant Analytical Chemistry Building	Completed
Complete design of the Fifth Set of Calcine Storage Bins	Completed
Complete a study of the plutonium hazard in reprocessing EBR-II fuels	Completed

Reduce basin water total activity to less than 0.003 $\mu Ci/m\ell$ (a 1975 goal for the end of 1979)	Completed
Install Analytical Service Branch Computer System and 12 of 18 total planned terminals; complete necessary software.	Computer and 10 terminals installed; software completed.

APPENDIX F

PLAN FOR PREPARATION OF FY 1980 MFPP



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