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ICPP MULTIPLE FUELS PROCESSING PROGRAM

FY 1977 SUPPLEMENT DOCUMENT

Allied Chemical
IDAHO CHEMICAL PROGRAMS
IDAHO NATIONAL ENGINEERING LABORATORY
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
IDAHO OPERATIONS OFFICE UNDER CONTRACT EY-76-C-07-1540

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FY-1977 SUPPLEMENT DOCUMENT

by

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ALLIED CHEMICAL CORPORATION
IDAHO CHEMICAL PROGRAMS - OPERATIONS OFFICE

Prepared for the
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
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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 FY-1979 Baseline Program involves a total cost of $609 million and recovery of 16,048 kg of U-235 worth $722 million during the study period: FY 1978 through FY 1989. In comparison to a case in which the ICPP would be shut down and expenditures would be at a minimum and assuming a 10% discount rate, the Baseline Program yields an incremental net present cash flow of $232 million. The discounted benefit/cost ratio is 2.3. Thus, the MFPP continues to provide an attractive means of reprocessing at the ICPP a wide variety of irradiated nuclear fuels for which there are no other existing suitable facilities. Completion of this program will require integrating about $300 million worth of new KZ line-item facilities into the existing ICPP facilities.

Production funding required for the Baseline Program for FY 1979, the highlighted year in the report, is higher than for FY 1978 because:

(1) Cost escalation, projected to be 8%, accounts for 34% of the $5.67 million total increase.

(2) An added $2.7 million is required for fuel process and NWCF testing and startups.

(3) Manpower must expand in support of the increased capital expenditures and the increased number of facilities to meet the production schedules, and accounts for about 20% of the increase.

Production costs are compared in the following tabulation:

KZ Program Cost of Production* ($000)	Fiscal Year 1978	Fiscal Year 1979
Operation	22,990	28,690
R&D	1,200	1,170
KZ (except KZ 01-03, 03-04,* and 03-07*)	24,190	29,860
U-235 Purchase (KZ 01-03)	500	800

*KZ 03-04, ERDA Radioactive Waste R&D, and KZ-03-07, Supporting Services--Long-Term, are not covered by this document.

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

Project	FY Funding Date	Approximate Beneficial Use	Total Est. Cost ($$10^6$)	Est Obligations During Study period ($$10^6$)
Calcined Solids Storage Bins				
Fifth set of bins	1978	Apr 1981	12	12
Sixth set of bins	1980	Apr 1983	25	25
Seventh set of bins	1985	Apr 1988	35	35
New Waste Calcining Facility	1976	July 1980	68.3	31.8
Personnel Protection & Support Fac.	1977	FY 1979	10.5	8.7
Fluorinel & Fuel Storage	1977	Oct 1981	98.5	88.5
Safeguards & Security Upgrade	1977	Jan 1980	2.3	1.9
Plant Analytical Chemistry Building	1979	Sept 1981	15.5*	15.5*
Utilities Expansion	1979	Apr 1981	12	12
SNM Measurement System	1980	Apr 1983	4	4
Central Receiving & Warehouse	1980	FY 1982	2	2
Plant Modernization	1981	FY 1985	10	10

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 events of the Baseline Case are:

(1) Start of Rover fuel processing in July 1979

(2) On-stream factor of the present Waste Calcining Facility (projected as 0.42 during period before NWCF startup in FY-80)

(3) Hot operation of the NWCF (July 1980)

(4) Availability of the fifth, sixth, and seventh set of calcine solids storage bins beginning in 1981 with the fifth set

(5) Operation of the Fluorinel process beginning October 1981

(6) Availability of the Plant Analytical Chemistry Building in September 1981

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*The data sheet shows a range of $15.5 to $17.0 million.

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

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

A delay of the NWCF would cause a delay in fuel processing campaigns; no fuel storage problems would occur for any reasonable delay. A delay in the Fluorinel 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 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 ERDA and other programs. Most of these fuels are becoming available in quantities too small to be economically processed in either commercial or other ERDA fuel reprocessing plants. With its demonstrated multifuel-reprocessing capability, ICPP is able, with capital expenditures in some cases, to process these fuels. Likewise, the NWCF will be capable of converting all high-activity liquid waste to retrievable solids suitable for long-term storage. A complete statement of the mission of Allied Chemical - Idaho Chemical Programs (ICP) and of the objectives for ICP in the nuclear fuel cycle is given in Appendix A.

This report updates the ICPP Multiple Fuels Processing Program (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] The purpose of these documents is to assist Allied Chemical and ERDA personnel in:

(1) Overall program planning and budgeting for the ICPP under the direction of ERDA
(2) Guiding associated R&D programs
(3) Managing the storage and recovery of fissile material
(4) Managing radioactive waste
(5) Determining facility requirements and priorities for competing programs and activities
(6) Establishing fuel reprocessing charges.

Justification for estimated capital and operating funds required in FY 1979 is highlighted in this document. A 12-year study period starting with FY 1978 is employed in economic calculations; present values are taken to FY 1978. 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. The overall economic benefit from the program is described by comparisons to a case in which expenditures were reduced to a minimum for site shutdown and surveillance. Additional information on the MFPP is provided by the following appendices:

Appendix A -- Defines mission and objectives of ICP.
Appendix B -- Bases and assumptions used in this MFPP supplement.
Appendix C -- Figure C-1 showing processing schemes for all MFPP fuels.
Appendix D -- Improvements in computerized methods made this year.
Appendix E -- Major accomplishments in FY 1977.
Appendix F -- Logic diagram for the next MFPP supplemental document.

2. HOW TO IDENTIFY FUELS AND PROCESSES

In this report, fuels are identified by numbers and processes either by numbers 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,[10] a classified document issued by the Idaho Operations Office of ERDA.

II. BASELINE PROGRAM

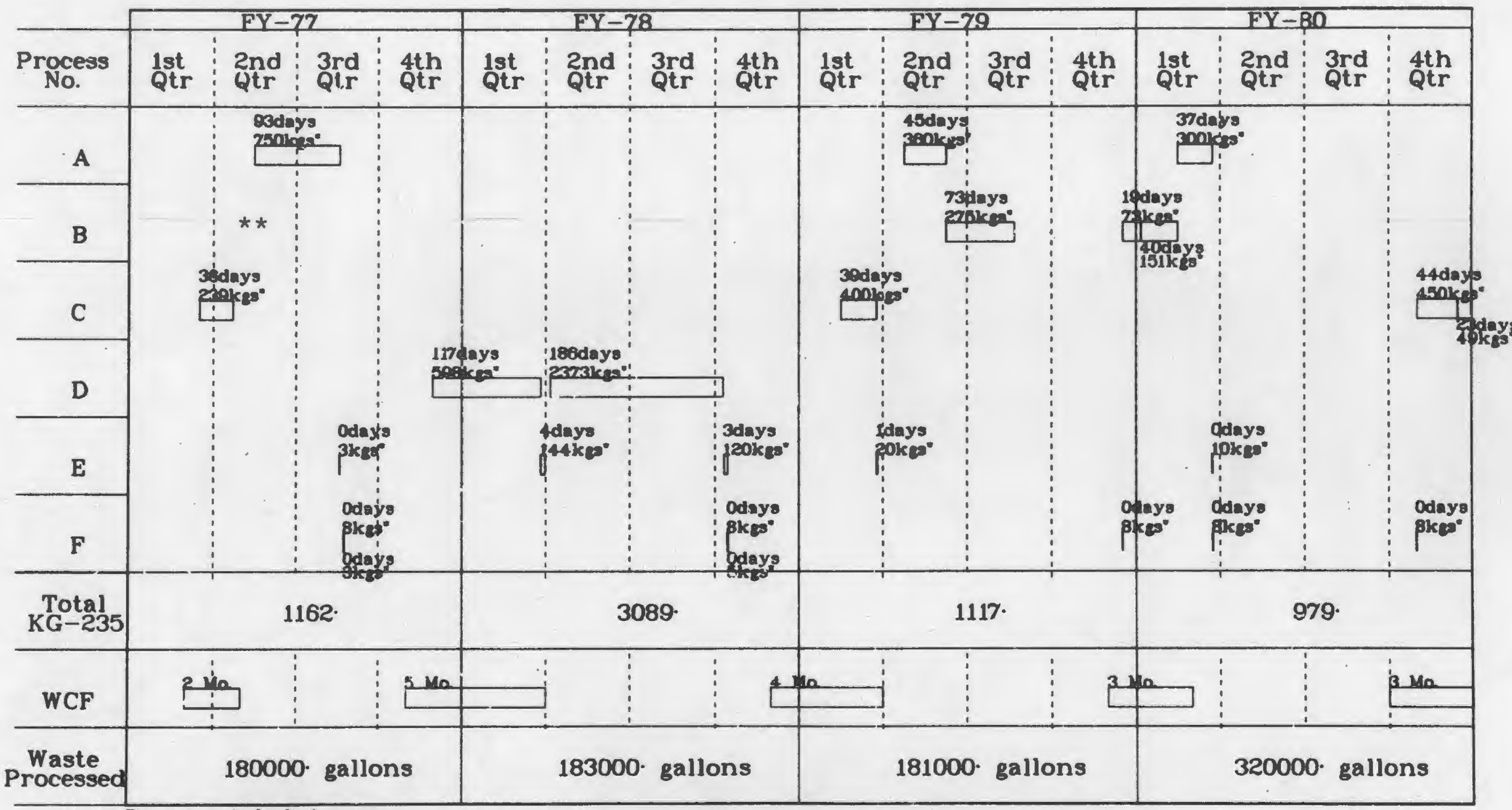
1. NEED FOR REVISION OF THE FIVE-YEAR-PLAN CASE

The INEL Long Range Program Plan[11] for FY 1977 through FY 1983 was based on a processing schedule developed in mid-December 1976. That schedule, which is illustrated by Figure 1* and Table I,* was based on the fuel-receipt information available in early December. This information was little changed from that used in the last MFPP document.[9]

The annual update of fuel receipts issued by ERDA[12] in mid-March projected increases for a few fuels but both large and small decreases for others, for a net decrease of about 1800 kg of U-235 up through FY 1988. (For more detail on changes in receipts, see Appendix B, Item 2, or compare the receipts listed in Table I with those in Table II.) The decreases

*Sixty kilograms of U-235 in Fuel 3 was added to the FY 1977 processing illustrated to obtain the INEL Long-Range Program Plan.

ICPP OPERATING SCHEDULE



Process A=fuels 1
B=fuels 2,3,30
C=fuels 4,5,6,7
D=fuels 9,25
E=fuels 8,19,10
F=fuels 29,33

FIVE-YEAR-PLAN BASE CASE - (FORMER BASELINE)

FIG. 1

CASE RUN ON 12/16/76

*U-235

** 60 kg from process B was added to obtain the schedule for the INEL Long Range Program Plan.

TABLE I ANNUAL SUMMARY OF OPERATIONS--FIVE-YEAR-PLAN CASE (FORMER BASELINE)

BASE CASE

CASE RUN ON 12/17/76

NO.	NAME OF FUEL	RECOVERY PROCESS	STARTUP DATE MO YR	START INVEN	FISCAL 1977 KG REC	KG PROC	KG INV	FISCAL 1978 KG REC	KG PROC	KG INV	FISCAL 1979 KG REC	KG PROC	KG INV	FISCAL 1980 KG REC	KG PROC	KG INV	FISCAL 1981 KG REC	KG PROC	KG INV
1	FUEL NUMBER 1	PROCESS 1	7 73	0	0	749	0	0	0	0	0	359	0	0	299	0	0	307	0
2	FUEL NUMBER 2	PROCESS 2	7 73	444	152	0	47	165	0	212	211	0	159	210	0	150	223	0	148
3	FUEL NUMBER 3	PROCESS 2	7 73	935	203	0	936	125	0	1061	270	274	960	51	150	779	56	671	81
4	FUEL NUMBER 4	PROCESS 3	7 73	239	232	238	231	232	0	463	232	399	295	232	449	77	232	174	135
5	FUEL NUMBER 5	PROCESS 3	7 73	49	0	0	49	0	0	49	0	0	49	0	32	16	0	16	0
6	FUEL NUMBER 6	PROCESS 3	7 73	19	0	0	19	0	0	19	0	0	19	0	0	19	0	18	0
7	FUEL NUMBER 7	PROCESS 3	7 73	57	0	0	57	0	0	57	0	0	57	0	0	57	0	56	0
8	FUEL NUMBER 8	PROCESS 10	1 75	144	120	0	264	0	263	0	0	0	0	0	0	0	0	0	0
9	FUEL NUMBER 9	PROCESS 4	1 78	2971	0	159	2811	0	2811	0	0	0	0	0	0	0	0	0	0
10	FUEL NUMBER 10	PROCESS 9	10 83	97	0	0	97	0	0	97	0	0	97	0	0	97	0	0	97
11	FUEL NUMBER 11	PROCESS 6	10 82	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
12	FUEL NUMBER 12	PROCESS 6	10 82	27	0	0	27	0	0	27	0	0	27	0	0	27	0	0	27
13	FUEL NUMBER 13	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	FUEL NUMBER 14	PROCESS 5	10 82	9	33	0	42	0	0	42	0	0	42	0	0	42	12	0	54
15	FUEL NUMBER 15	PROCESS 6	10 82	51	10	0	60	0	0	60	0	0	60	0	0	60	384	0	444
16	FUEL NUMBER 16	PROCESS 6	10 82	0	0	0	0	9	0	9	0	0	9	45	0	54	3	0	57
17	FUEL NUMBER 17	PROCESS 5	10 82	0	0	0	0	18	0	18	39	0	57	39	0	96	37	0	132
18	FUEL NUMBER 18	PROCESS 5	10 82	0	0	0	0	5	0	4	12	0	16	11	0	27	12	0	39
19	FUEL NUMBER 19	PROCESS 10	1 75	10	10	2	16	10	0	26	10	19	16	10	9	16	10	20	6
20	FUEL NUMBER 20	PROCESS 16	1 -1	60	0	0	60	0	0	60	20	0	79	0	0	79	0	0	79
21	FUEL NUMBER 13	PROCESS 7	10 81	76	0	0	76	0	0	76	0	0	76	131	0	205	54	0	260
22	FUEL NUMBER 22	PROCESS 6	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	58	0	57
23	FUEL NUMBER 23	PROCESS 6	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	FUEL NUMBER 24	PROCESS 5	10 82	0	10	0	9	1	0	10	49	0	59	73	0	132	82	0	214
25	FUEL NUMBER 25	PROCESS 4	1 78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	FUEL NUMBER 26	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	88	0	87	0	0	87
27	FUEL NUMBER 27	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	4	0	3	76	0	79
28	FUEL NUMBER 28	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	185	0	184
29	FUEL NUMBER 29	PROCESS 10	1 75	36	0	7	28	0	7	20	0	7	12	0	7	4	0	3	0
30	FUEL NUMBER 30	PROCESS 2	7 73	73	0	0	73	0	0	73	0	53	19	0	19	0	0	0	0
31	FUEL NUMBER 31	PROCESS 16	1 -1	21	25	0	45	31	0	76	50	0	126	60	0	186	60	0	246
32	FUEL NUMBER 32	PROCESS 16	1 -1	157	58	0	214	66	0	280	44	0	324	41	0	365	32	0	397
33	FUEL NUMBER 33	PROCESS 10	1 75	25	0	2	22	0	4	17	0	0	17	0	7	9	0	8	0
34	FUEL NUMBER 34	PROCESS 15	-1 -1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	FUEL NUMBER 35	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NO.	FISCAL 1982 KG REC	KG PROC	KG INV	FISCAL 1983 KG REC	KG PROC	KG INV	FISCAL 1984 KG REC	KG PROC	KG INV	FISCAL 1985 KG REC	KG PROC	KG INV
1	0	308	0	0	0	0	0	235	0	0	217	0
2	212	0	134	254	0	168	301	0	35	250	0	104
3	0	0	0	49	0	48	0	0	0	94	0	39
4	232	328	38	232	212	57	232	231	58	317	0	374
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	97	0	0	97	0	96	0	0	0	0
11	0	0	0	1	0	1	0	0	1	0	0	1
12	0	0	27	0	0	27	0	0	27	0	26	0
13	57	0	57	95	63	0	148	17	26	204	85	136
14	46	0	99	0	0	99	0	0	99	0	26	73
15	0	0	444	47	0	491	0	0	491	0	491	0
16	50	0	106	50	0	156	50	0	206	50	82	174
17	35	0	167	34	201	0	33	30	2	36	14	24
18	10	0	49	10	59	0	10	9	0	10	4	6
19	10	16	0	10	7	2	10	11	0	10	6	4
20	0	0	79	0	0	79	0	0	79	0	0	79
21	0	260	0	0	0	0	0	0	0	0	0	0
22	0	0	57	0	0	57	60	0	120	0	0	126
23	0	0	0	0	0	0	0	0	0	0	0	0
24	42	0	256	66	0	322	0	205	117	0	117	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	87	928	1015	0	900	661	238	0	238	0
27	0	0	79	0	77	2	0	2	0	0	0	0
28	0	0	184	0	184	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	3	0	1	11	0	12	6	0	4	0	0	0
31	76	0	322	65	0	387	56	0	443	56	0	499
32	25	0	422	16	0	438	22	0	460	22	0	482
33	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	308	0	0	365	0	0	31	0

NO.	FISCAL 1986 KG REC	KG PROC	KG INV	FISCAL 1987 KG REC	KG PROC	KG INV	FISCAL 1988 KG REC	KG PROC	KG INV	TOTALS KG REC	KG PRC
1	0	263	0	0	0	0	0	23	0	0.	2767.
2	312	0	69	211	0	87	219	0	0	2720.	0.
3	38	0	6	0	0	6	0	0	0	886.	1097.
4	0	374	0	0	0	0	0	0	0	2173.	2412.
5	0	0	0	0	0	0	0	0	0	0.	49.
6	0	0	0	0	0	0	0	0	0	0.	19.
7	0	0	0	0	0	0	0	0	0	0.	57.
8	0	0	0	0	0	0	0	0	0	120.	264.
9	0	0	0	0	0	0	0	0	0	0.	2971.
10	0	0	0	0	0	0	0	0	0	0.	97.
11	0	0	1	0	0	1	1	0	2	3.	0.
12	0	0	0	0	0	0	0	0	0	0.	27.
13	411	382	102	995	693	327	90	301	0	2000.	1544.
14	0	73	0	0	0	0	0	0	0	91.	100.
15	0	0	0	0	0	0	0	0	0	441.	492.
16	50	219	4	0	4	0	0	0	0	307.	307.
17	34	49	8	35	31	11	35	46	0	375.	375.
18	11	14	2	10	9	3	10	13	0	111.	111.
19	10	13	0	10	6	4	10	14	0	120.	130.
20	0	0	79	0	0	79	0	0	79	20.	0.
21	0	0	0	0	0	0	0	0	0	185.	261.
22	0	0	126	0	0	126	0	0	126	127.	0.
23	229	0	228	0	219	9	229	35	203	458.	255.
24	21	15	5	0	0	5	0	5	0	344.	344.
25	168	0	168	0	167	0	0	0	0	168.	168.
26	0	0	0	0	0	0	0	0	0	1916.	1916.
27	0	0	0	0	0	0	188	187	0	268.	268.
28	0	0	0	0	0	0	0	0	0	185.	185.
29	0	0	0	0	0	0	0	0	0	0.	36.
30	0	0	0	0	0	0	0	0	0	20.	74.
31	0	0	499	0	0	499	0	0	499	479.	0.
32	0	0	482	0	0	482	0	0	482	326.	0.
33	0	0	0	0	0	0	0	0	0	0.	25.
34	0	0	0	0	0	0	0	0	0	0.	0.
35	0	215	0	0	269	0	0	405	0	0.	1596.

FISCAL YEAR	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	TOTALS
FUELS RECEIVED,KILOGRAMS	853.	662.	938.	995.	1516.	798.	1868.	1837.	1049.	1284.	1261.	782.	13843.
FUELS PROCESSED,KILOGRAMS	1162.	3089.	1117.	979.	1275.	915.	2133.	1868.	1344.	1624.	1403.	1034.	17947.
FUELS INVENTORY,KILOGRAMS	5191.	2764.	2585.	2601.	2838.	2721.	2456.	2425.	2130.	1791.	1648.	1396.	
NON-F WASTE PRODUCED,GALLONS	14580.	0.	25600.	31079.	21137.	21053.	13360.	120807.	41579.	29075.	533.	2971.	321779.
NON-F WASTE PROCESSED,GALLONS	0.	24480.	15600.	31079.	21137.	21053.	13360.	120807.	41579.	29079.	533.	2971.	321679.
NON-F WASTE INVENTORY,GALLONS	296480.	272000.	282000.	282000.	282000.	282000.	282000.	282000.	282000.	282000.	282000.	282000.	
FLUORIDE WASTE PRODUCED,GALLONS	212727.	117012.	379401.	231348.	658407.	174728.	572755.	390771.	521510.	359665.	458189.	297983.	4414515.
FLUORIDE WASTE PROCESSED,GALLONS	135008.	118940.	124765.	217268.	666781.	666827.	671870.	601367.	607579.	375627.	435250.	340660.	4961939.
FLUORIDE WASTE INVENTORY,GALLONS	1224919.	1222991.	1477627.	1491707.	1483333.	991234.	892120.	681524.	595455.	619513.	642452.	599775.	
LOW-HEAT WASTE PRODUCED,GALLONS	55419.	76126.	55767.	54641.	56272.	53395.	70044.	63193.	64472.	83573.	84175.	58402.	775479.
LOW-HEAT WASTE PROCESSED,GALLONS	45002.	39644.	41587.	72422.	222256.	222274.	223957.	200457.	74453.	74134.	92284.	52742.	1361248.
LOW-HEAT WASTE INVENTORY,GALLONS	880968.	917449.	931629.	913848.	747864.	578984.	425071.	287808.	277787.	287227.	279118.	284778.	
TOTAL WASTE PRODUCED,GALLONS	282727.	193138.	460768.	317068.	735817.	249176.	656159.	574771.	627561.	512338.	542898.	359356.	5511770.
TOTAL WASTE PROCESSED,GALLONS	180010.	183064.	181953.	320769.	910175.	910154.	909186.	922631.	723651.	478840.	528067.	396373.	6644868.
TOTAL WASTE INVENTORY,GALLONS	2402365.	2412440.	2691255.	2687554.	2513196.	1852218.	1599191.	1251331.	1155241.	1188739.	1203569.	1166553.	
SOLIDS WASTE PRODUCED, CUBIC FT.	3913.	3842.	3868.	6520.	18484.	18464.	18458.	18312.	14924.	9781.	10912.	8235.	
SOLIDS WASTE INVENTORY, CUBIC FT.	55056.	58898.	62766.	69286.	87770.	106254.	124752.	143064.	157988.	167768.	178680.	186914.	
DAYS OF FUEL PROCESSING	163	281	174	144	260	116	231	240	221	221	225	176	
DAYS OF WASTE CALCINING	122	122	122	142	323	323	322	327	256	169	187	140	

TABLE II ANNUAL SUMMARY OF OPERATIONS--BASELINE PROGRAM

BASELINE PROGRAM

CASE RUN ON 05/09/77

NO.	NAME OF FUEL	RECOVERY PROCESS	STARTUP DATE MO YR	START INVEN	FISCAL 1978 KG REC	FISCAL 1978 KG PROC	FISCAL 1978 KG INV	FISCAL 1979 KG REC	FISCAL 1979 KG PROC	FISCAL 1979 KG INV	FISCAL 1980 KG REC	FISCAL 1980 KG PROC	FISCAL 1980 KG INV	FISCAL 1981 KG REC	FISCAL 1981 KG PROC	FISCAL 1981 KG INV	FISCAL 1982 KG REC	FISCAL 1982 KG PROC	FISCAL 1982 KG INV
1	FUEL NUMBER 1	PROCESS 1	7 73	0	0	0	0	0	299	0	0	0	0	0	349	0	0	161	0
2	FUEL NUMBER 2	PROCESS 2	7 73	10	131	0	140	148	0	69	107	0	176	151	0	71	93	0	46
3	FUEL NUMBER 3	PROCESS 2	7 73	905	219	339	783	208	197	713	107	0	820	57	31	751	3	549	162
4	FUEL NUMBER 4	PROCESS 3	7 73	150	170	199	119	162	0	281	151	0	432	200	0	632	0	632	0
5	FUEL NUMBER 5	PROCESS 3	7 73	49	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0
6	FUEL NUMBER 6	PROCESS 3	7 73	19	0	0	19	0	0	19	0	0	19	48	0	67	0	66	0
7	FUEL NUMBER 7	PROCESS 3	7 73	57	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0
8	FUEL NUMBER 8	PROCESS 10	1 75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	FUEL NUMBER 9	PROCESS 4	1 78	2971	0	0	2971	0	482	2487	0	592	1895	0	1895	0	0	0	0
10	FUEL NUMBER 10	PROCESS 10	1 75	97	0	0	97	0	45	51	0	0	51	0	0	51	12	56	7
11	FUEL NUMBER 11	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	FUEL NUMBER 12	PROCESS 5	10 82	27	0	0	27	0	0	27	0	0	27	0	0	27	0	0	27
13	FUEL NUMBER 13	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	123	0	123	229	0	351
14	FUEL NUMBER 14	PROCESS 5	10 82	42	0	0	42	0	0	42	0	0	42	12	0	54	50	0	103
15	FUEL NUMBER 15	PROCESS 5	10 82	60	0	0	60	0	0	60	0	0	60	0	0	60	384	0	444
16	FUEL NUMBER 16	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	FUEL NUMBER 17	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	FUEL NUMBER 18	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	FUEL NUMBER 19	PROCESS 10	1 75	16	10	9	15	10	9	15	10	9	15	10	9	15	10	20	5
20	FUEL NUMBER 20	PROCESS 16	1 -1	60	0	0	60	20	0	79	0	0	79	0	0	79	0	0	79
21	FUEL NUMBER 13	PROCESS 7	10 81	76	0	0	76	0	0	76	184	0	259	0	0	259	0	259	0
22	FUEL NUMBER 22	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	56	0	55	0	0	55
23	FUEL NUMBER 23	PROCESS 15	-1 -1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	FUEL NUMBER 24	PROCESS 5	10 82	10	30	0	40	49	0	88	64	0	152	70	0	222	30	0	252
25	FUEL NUMBER 25	PROCESS 4	1 78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	FUEL NUMBER 26	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	FUEL NUMBER 27	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	70	0	69
28	FUEL NUMBER 28	PROCESS 5	10 82	0	0	0	0	0	0	0	43	0	42	172	0	214	0	0	214
29	FUEL NUMBER 29	PROCESS 10	1 75	28	0	0	27	0	1	25	0	0	24	0	1	22	0	21	0
30	FUEL NUMBER 30	PROCESS 2	7 73	73	0	0	73	0	0	73	0	0	73	0	0	73	0	0	73
31	FUEL NUMBER 31	PROCESS 16	1 -1	46	16	0	61	28	0	89	43	0	132	49	0	181	64	0	245
32	FUEL NUMBER 32	PROCESS 16	1 -1	215	69	0	284	55	0	338	50	0	388	38	0	426	28	0	454
33	FUEL NUMBER 33	PROCESS 10	1 75	22	0	1	20	0	0	19	0	1	17	0	0	16	0	15	0
34	FUEL NUMBER 34	PROCESS 15	-1 -1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	FUEL NUMBER 35	PROCESS 5	10 82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NO.	FISCAL 1983 KG REC	FISCAL 1983 KG PROC	FISCAL 1983 KG INV	FISCAL 1984 KG REC	FISCAL 1984 KG PROC	FISCAL 1984 KG INV	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	TOTALS KG REC	TOTALS KG PRC
1	0	206	0	0	196	0	0	0	0	0	231	0	0	0	0	0	0	0	0	108	0	0.	1557.
2	161	0	28	191	0	9	180	0	153	143	0	79	110	0	106	87	0	79	102	0	0	1604.	0.
3	21	122	7	41	0	3	53	0	56	25	0	29	0	0	29	0	0	29	0	0	0	744.	1242.
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	683.	833.
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	49.
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48.	67.
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	57.
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	0.
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	2971.
10	12	15	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.	121.
11	0	0	0	3	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	3.	0.
12	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	27.
13	297	637	0	364	240	97	329	412	0	263	263	0	677	570	73	730	418	338	857	1155	0	3889.	3699.
14	0	0	103	0	0	103	0	0	103	0	103	0	0	0	0	0	0	0	0	0	0	62.	104.
15	0	443	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	384.	444.
16	0	0	0	84	0	84	0	0	84	0	93	0	0	0	0	0	0	0	84	83	0	168.	168.
17	0	0	0	23	22	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0	27.	27.
18	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.	2.
19	10	12	3	10	13	0	10	6	3	10	13	0	10	6	3	10	13	0	10	9	0	120.	136.
20	0	0	79	0	0	79	0	0	79	0	0	79	0	0	79	0	0	79	0	0	79	20.	0.
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184.	260.
22	0	0	55	60	0	115	41	0	156	48	58	146	90	131	104	60	80	83	1	35	49	356.	307.
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	0.
24	30	52	230	9	88	150	0	133	17	0	17	0	0	0	0	0	0	0	0	0	0	282.	292.
25	0	0	0	47	0	46	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	47.	47.
26	0	0	0	911	850	60	909	969	0	0	0	0	230	172	57	231	288	0	0	0	0	2281.	2281.
27	0	69	0	43	0	42	44	86	0	0	0	0	0	0	0	0	0	0	0	0	0	157.	157.
28	0	214	0	193	144	48	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	408.	408.
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	28.
30	10	77	3	6	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.	78.
31	57	0	302	55	0	357	56	0	413	0	0	413	0	0	413	0	0	413	0	0	413	368.	0.
32	17	0	471	17	0	488	14	0	502	0	0	502	0	0	502	0	0	502	0	0	502	288.	0.
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	22.
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	0.
35	0	39	0	0	90	0	0	49	0	0	66	0	0	115	0	0	160	0	0	142	0	0.	665.

FISCAL YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTALS
FUELS RECEIVED,KILOGRAMS	645.	680.	759.	986.	973.	615.	2059.	1636.	519.	1117.	1118.	1058.	12165.
FUELS PROCESSED,KILOGRAMS	659.	1040.	605.	2291.	1785.	1921.	1654.	1754.	840.	997.	961.	1540.	16048.
FUELS INVENTORY,KILOGRAMS	4919.	4559.	4713.	3408.	2596.	1291.	1694.	1576.	1255.	1375.	1532.	1050.	
NON-F WASTE PRODUCED,GALLONS	23400.	800.	800.	800.	45623.	19531.	31910.	47276.	7148.	533.	1067.	800.	179689.
NON-F WASTE PROCESSED,GALLONS	0.	0.	0.	74360.	45623.	19531.	31910.	48665.	5760.	533.	1067.	800.	228249.
NON-F WASTE INVENTORY,GALLONS	353960.	354760.	355560.	282000.	282000.	282000.	282000.	280612.	282000.	282000.	282000.	282000.	
FLUORIDE WASTE PRODUCED,GALLONS	290050.	269670.	24745.	198574.	614899.	819483.	510562.	550765.	338267.	431814.	373048.	539426.	4961307.
FLUORIDE WASTE PROCESSED,GALLONS	247513.	168759.	178744.	390166.	486447.	503569.	505232.	481704.	513550.	516980.	530985.	617307.	5140954.
FLUORIDE WASTE INVENTORY,GALLONS	1303185.	1404096.	1250097.	1058505.	1186957.	1502871.	1508207.	1577268.	1401985.	1316819.	1158882.	1081001.	
LOW-HEAT WASTE PRODUCED,GALLONS	50190.	69100.	48654.	65506.	83220.	67056.	61133.	60137.	77031.	88211.	73976.	75170.	819384.
LOW-HEAT WASTE PROCESSED,GALLONS	22501.	56252.	59581.	130054.	162147.	167853.	168409.	160567.	171181.	172324.	157852.	71763.	1500478.
LOW-HEAT WASTE INVENTORY,GALLONS	986649.	999497.	988570.	924023.	845096.	744298.	637022.	536593.	442444.	358332.	274456.	277863.	
TOTAL WASTE PRODUCED,GALLONS	363640.	339570.	74199.	264881.	743742.	906071.	603611.	658179.	422447.	520559.	448091.	615395.	5960379.
TOTAL WASTE PROCESSED,GALLONS	270014.	225011.	238325.	594580.	694216.	690954.	705551.	690935.	690491.	689838.	689904.	689869.	6869683.
TOTAL WASTE INVENTORY,GALLONS	2643793.	2758352.	2594226.	2264527.	2314052.	2529169.	2427229.	2394472.	2126428.	1957150.	1715337.	1640863.	
SOLIDS WASTE PRODUCED, CUBIC FT.	5786.	4891.	5043.	11360.	13693.	13898.	14067.	13594.	14031.	14073.	14118.	14420.	
SOLIDS WASTE INVENTORY, CUBIC FT.	59269.	64161.	69204.	80564.	94256.	108153.	122225.	135814.	149845.	163916.	178034.	192453.	
DAYS OF FUEL PROCESSING	148	183	78	276	282	282	263	229	198	216	174	237	
DAYS OF WASTE CALCINING	183	152	183	270	270	269	275	269	269	269	269	269	

made the former baseline case impractical because considerable fuel scheduled for processing in FY 1978 and subsequent years would not be available. Another important reason for redesign of the baseline case was the long delay in Rover project completion that was found necessary after December.

In comparing the former baseline operating schedule, shown in Figure 1, with the new baseline operating schedule in Figure 2, note that custom-processed fuels and fuels released from ICP research and development programs are shown in Figure 1 but not in Figure 2. Therefore, the annual totals of kilograms of U-235 shown in Figure 2 are less than the annual totals for all fuels processed, shown in Table II.

In comparing Figure 1 with Figure 2, also note that there are changes in the meanings of the process letters C, D, and E; each figure has a small table below it which lists the fuels assigned to each letter.

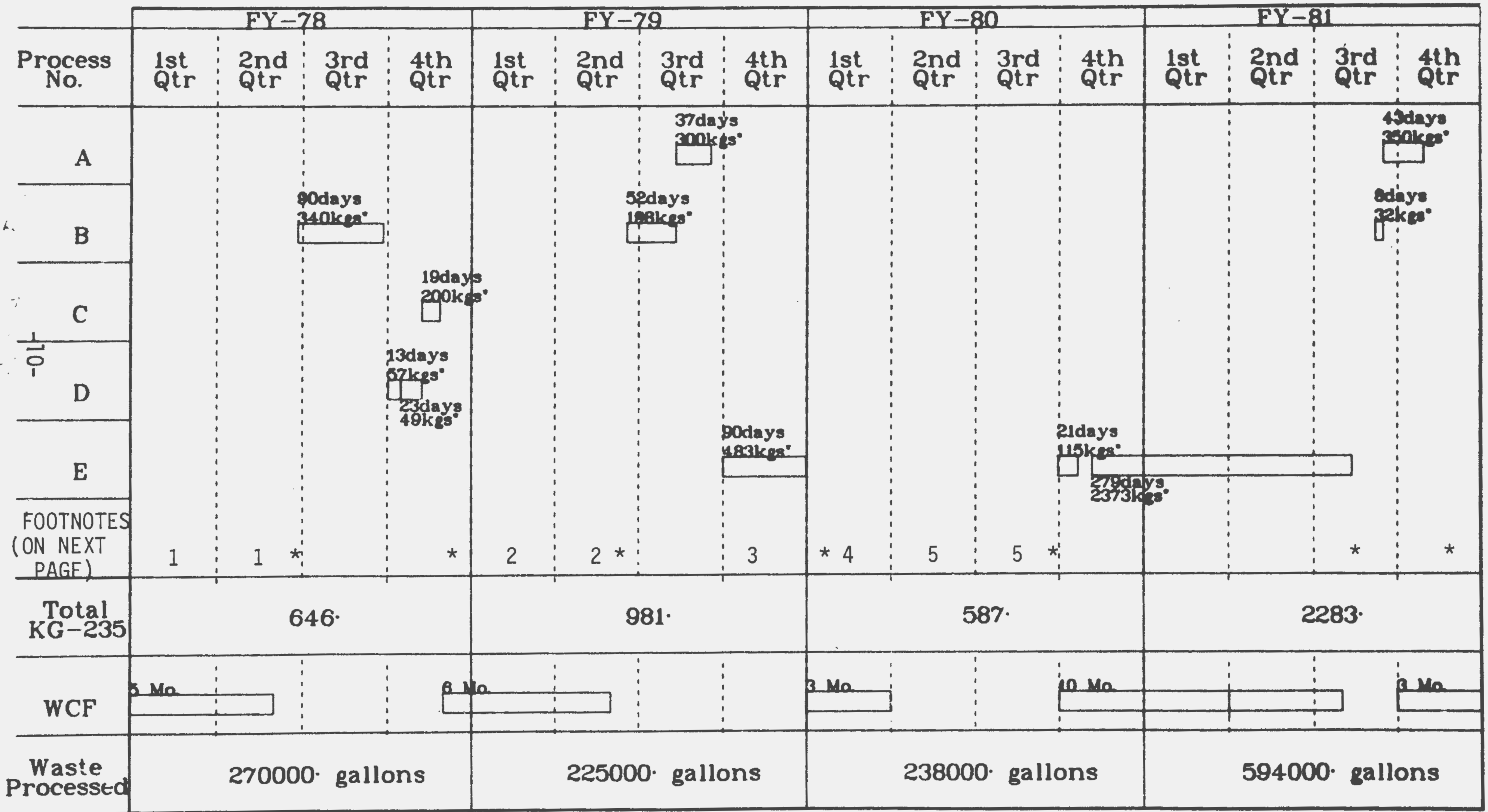
2. OPERATIONS IN THE BASELINE PROGRAM

In the new baseline program, recovery of 16,048 kg of U-235 is projected during the 12-year study period. Fuel processing and other operations are projected to generate about 5.9 million gallons of high-level radioactive liquid wastes. Calcining of 6.9 million gallons of high-level liquid wastes is planned, which will reduce the inventory from 2.6 million to 1.6 million gallons; the 140,000 cubic feet of granular solids produced by the calcining will bring the total calcine inventory to about 190,000 cubic feet.

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

As explained in Footnote 1 of Figure 2, preventive maintenance and repairs in E, H, and J cells are projected for the first six months of FY 1978. The WCF will be started up this September and kept operating as

ICPP OPERATING SCHEDULE



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

BASELINE PROGRAM

FIG. 2

CASE RUN ON 04/15/77

*U-235

FOOTNOTES FOR FIGURE 2

1. During the first and second quarter of FY-78, maintenance turnarounds will be made in E, H, and J cells, and, possibly, in G cell. Leaks will be fixed in E cell with major emphasis on preventive maintenance. The replacement of the product evaporator will be the major job in H cell together with preventive maintenance. The J cell work will be inspection of the nuclear poisoned plates in the tanks.

2. During the first and second quarter of FY-79, another E cell turnaround will be made. The G cell work indicated in Footnote 1, if not done during FY-78, will be done in this period. The headend centrifuges will be tied in and tested; this is part of the line item called Personnel Protection and Support Facility. In addition, repairs, preventive maintenance, and process improvements are scheduled for N, P, Q, U, Y, W, and K cells.

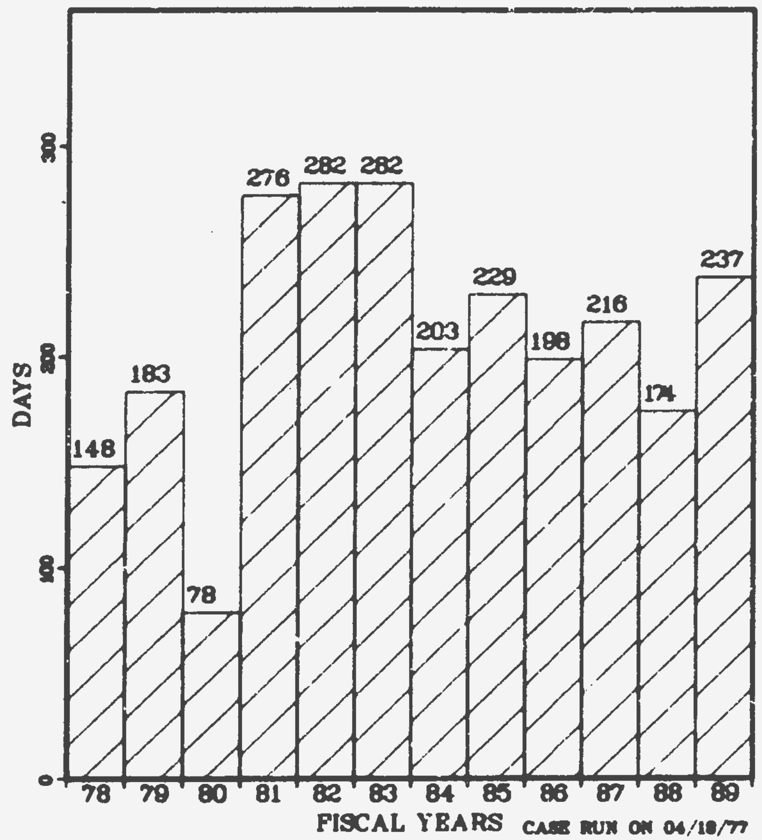
3. Funding adequate for Process E (Fuel 9) completion in time to permit startup as shown is assumed.

4. Fuel 9 processing will continue through the first quarter of FY 1980, if possible.

5. Downtime is scheduled during the second and third quarters of FY 1980 for maintenance, plant modifications, and NWCF cold operation.

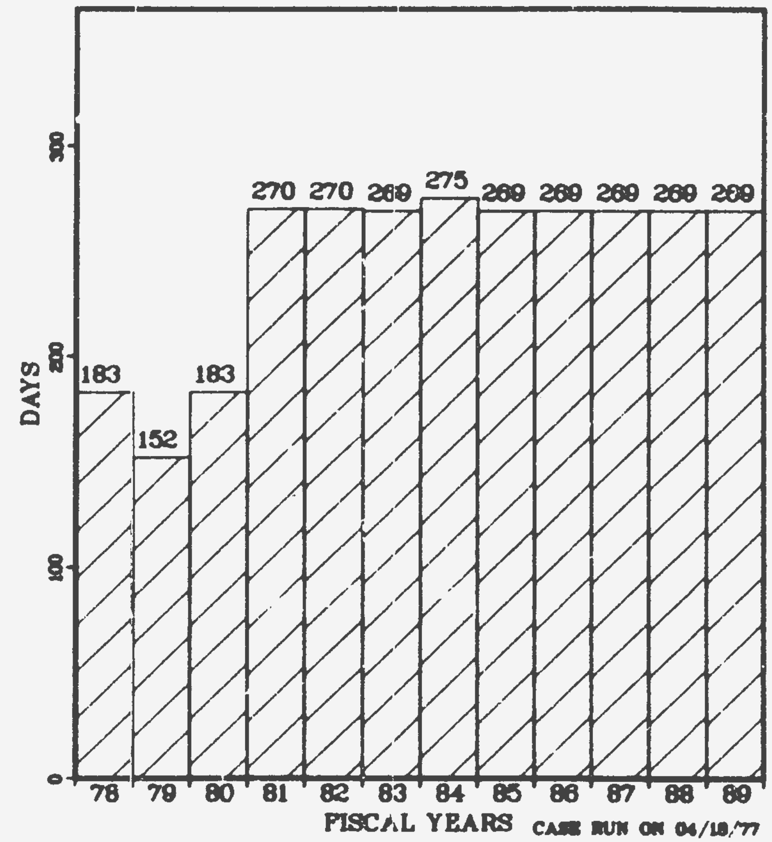
*These symbols show approximate times for physical inventories of nuclear materials.

FUEL PROCESSING DAYS



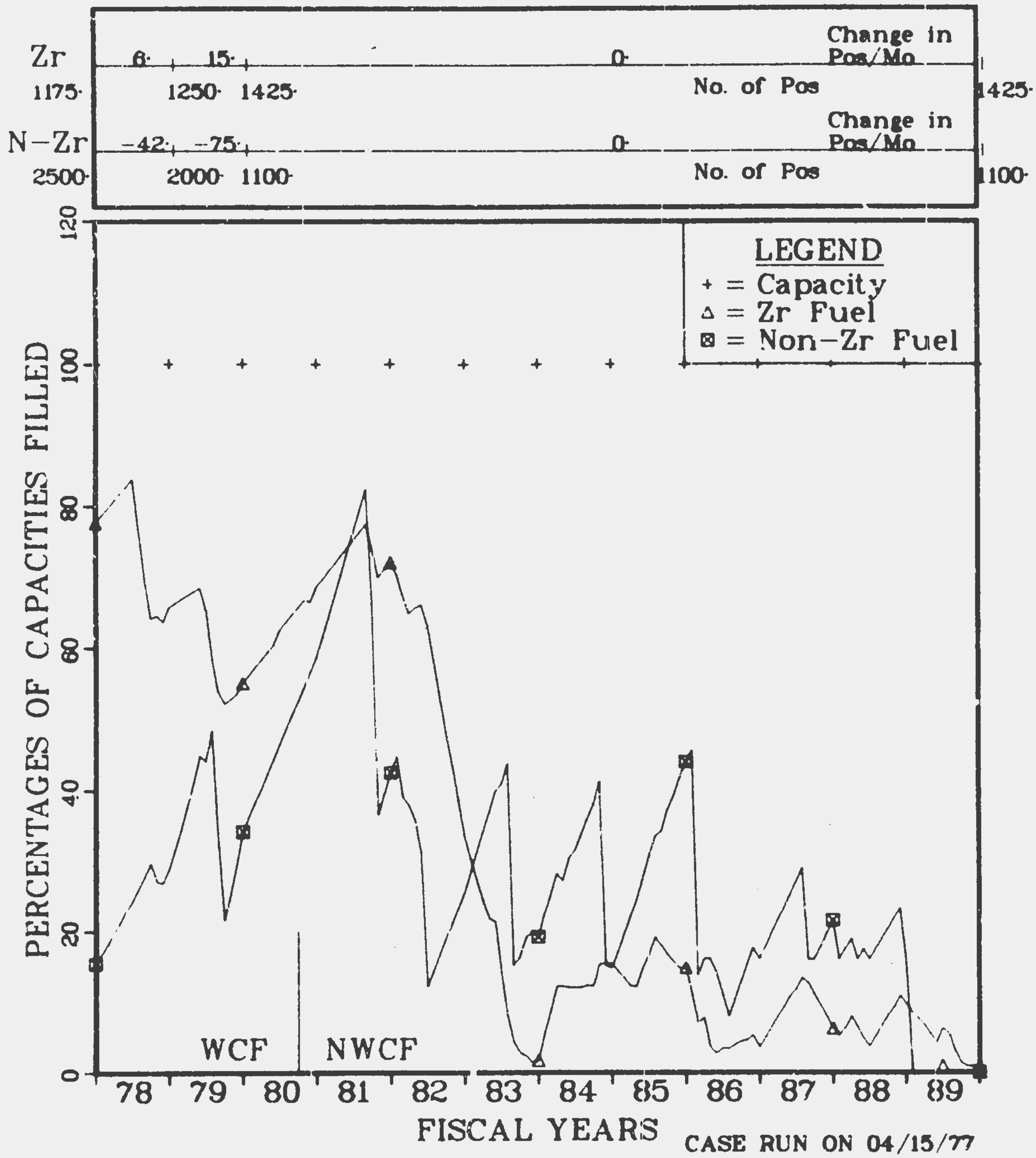
BASELINE PROGRAM
FIG. 3

WASTE CALCINING DAYS



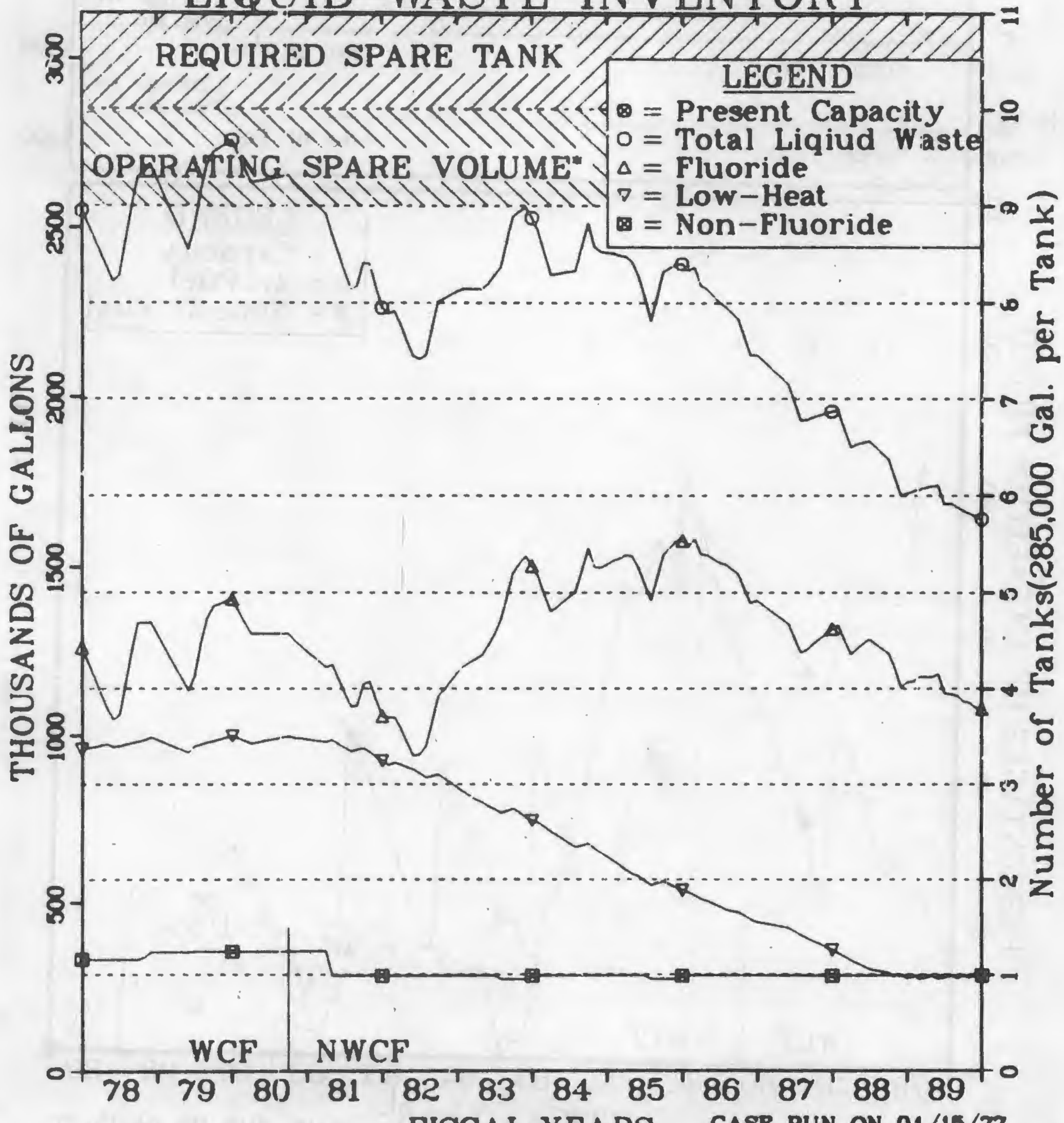
BASELINE PROGRAM
FIG. 4

PROJECTED FUEL BASIN STORAGE REQUIREMENTS (in %)



BASELINE PROGRAM
FIG. 5

PROJECTED RADIOACTIVE LIQUID WASTE INVENTORY

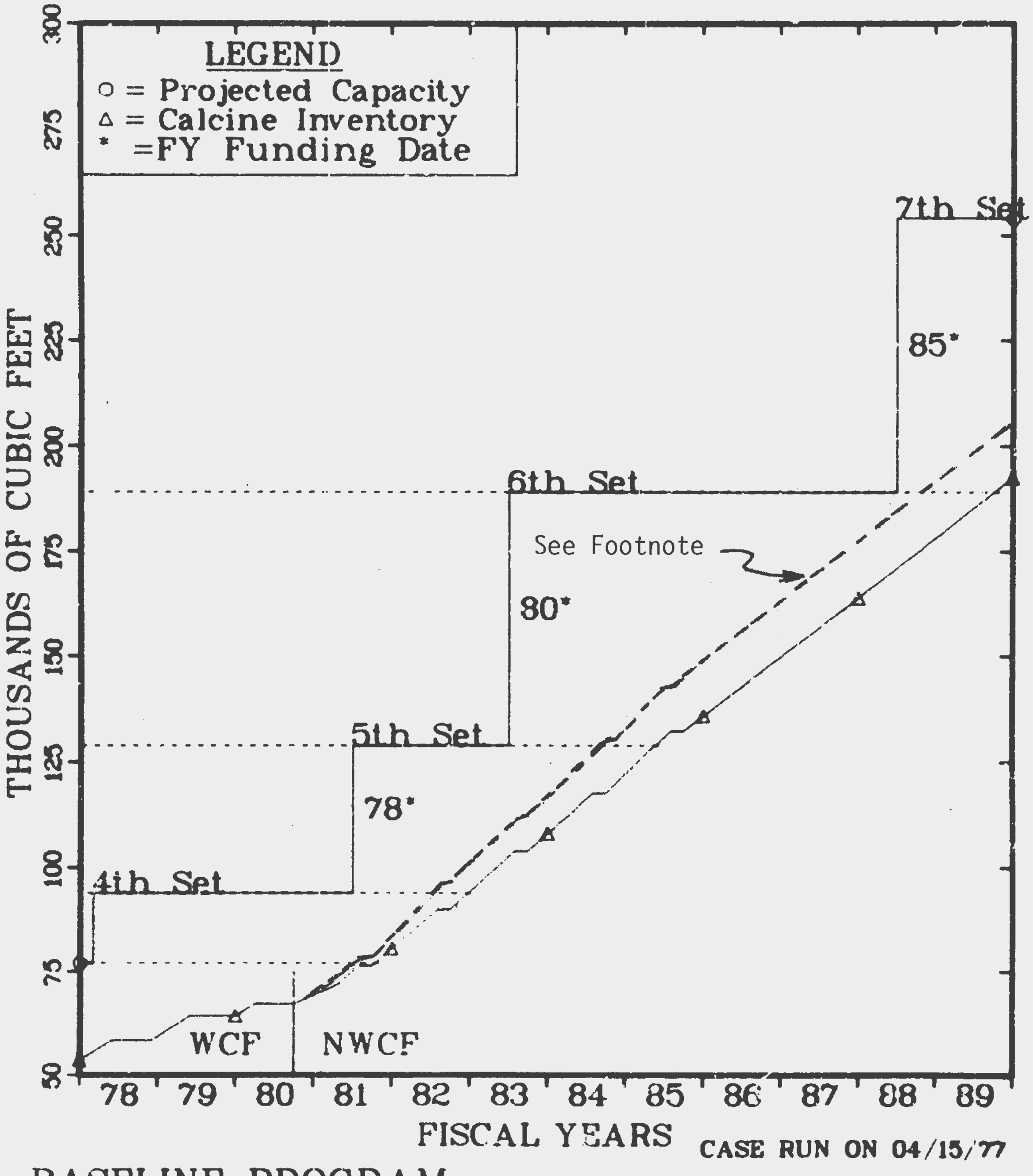


BASELINE PROGRAM

FIG. 6

*NOTE: 70,000 GAL VOLUME AVAILABLE IN SMALL TANKS IS NOT SHOWN.

PROJECTED CALCINE STORAGE REQUIREMENTS



BASELINE PROGRAM

FIG. 7

NOTE: Assumption for indicated line is a 20% increase in NWCF calcining for FY-1981 through FY-1985.

long as practical. Campaigns on Fuels 3, 5, 7, and 4 are projected for the last half of FY 1978. Preventive maintenance, process improvements, and the tie-in and testing of the headend centrifuges have been scheduled for the seven months that follow these campaigns (see Footnote 2).

Earliest completion of Rover Project construction is expected by April 1978; testing and preparations for Rover startup (Process E in Figure 2) will begin thereafter and continue during a campaign on Fuels 3 and 1 (Processes B and A, respectively), scheduled to start in March of 1979 and to fill most of the third quarter of FY 1979. This campaign and the preceding ones in FY 1977 and FY 1978 will have reduced fuel storage basin inventories to the point that fuel can be received and stored for more than two years, FY 1980 and FY 1981, without further processing. This is shown by Figure 5. This figure also shows storage capacities in terms of numbers of positions, the rates at which capacities change, and the periods during which these changes in capacity occur. The following paragraphs explain the changes in basin hardware that cause the storage capacity changes.

Capacities need changing because some zirconium fuels to be received in the future will not physically fit in the north and middle basins. Storage in racks in the south basin will be provided to eliminate fuel-unit diameter or weight as restrictions for future zirconium fuel storage. Because many of the types of currently stored zirconium fuels will continue to be received, storage in the north and middle basins will continue to be utilized.

Current fuel wet storage capacities are 1,175 positions for zirconium fuels on hangers in the north and middle basins and 2,500 positions for aluminum and stainless-steel fuels in aluminum racks in the south basin. Completion of the planned modifications will permit selected zirconium fuel storage in all basins, but will eventually reduce the total number of wet storage positions for all fuels to approximately 2,500. Aluminum fuels will eventually be stored in the north and middle basins, and existing aluminum racks will be phased out of use as new stainless-steel racks are installed in the south basin.

The new stainless-steel, unpoisoned racks contain 15 positions per rack and will be installed in FY 1979 on a batch basis. The capacity changes shown in Figure 5 are based on installation rates of about one rack per month. By FY 1980, a total of 45 racks (675 positions) will have been provided in the south basin for zirconium fuel and 750 yokes in the north and middle basins for zirconium fuel, bringing the total zirconium fuel storage capability to 1,425 positions. A total of 3 racks and 250 yokes will be used for nonzirconium fuel for a total of 1,100 positions. A total of 80 new racks will be available, and more than the 48 assumed installed for Figure 5 could be installed if necessary.

Up through FY 1978, present rack storage will be used for all aluminum fuels. The presence of these racks will not interfere with installation and utilization of the new racks during FY 1978. Beyond FY 1978, the aluminum racks will be phased out as storage is made available for aluminum fuel storage in the north and middle basins and as new racks are installed in the south basin. Fuels received after the new metal clad storage facility becomes available in FY 1981 will be put in the new facility. The inventory in the old basin will fall as the fuel in it is processed over a period of several years.

Referring again to Figure 2, processing of unirradiated Rover fuel has been assumed halted after three months for correction of possible operating problems. If significant problems do not occur, processing of the remaining 115 kg of U-235 in unirradiated Rover fuel and of 500 to 750 kg in irradiated Rover fuel may be completed in the first quarter of FY 1980.

Not less than the second and third quarters of FY 1980 will be required for maintenance, plant modifications, project tie-ins, and NWCF cold operation. The NWCF is projected to start operating with hot wastes in July 1980. Processing of the remainder of the Rover fuel will also begin then. Calcining of Rover waste will be given priority during both WCF and NWCF operation; this will minimize the quantity and time for retention in the unvaulted tanks. The waste would cause precipitation if it were mixed with any of the other ICPP wastes.

Cold operation of the Fluorinel process is projected for completion in October of 1981; hot operation is expected to begin then and would continue for several months, if possible. However, the need for shutdown for a ten-month period has been assumed to follow the first two months of operation. Thereafter, the process was assumed operable an average of about 200 days per year. The "second crew expansion" to permit concurrent operation of headend and tailend processes was assumed to coincide with the beginning of this second Fluorinel hot operating period, which is projected for the start of FY 1983. The crew has been assumed to be retained until the end of FY 1989 and by that time will have reduced the processable fuel inventory to 52 kg of U-235, a very low figure. Unless large receipts should be expected in FY 1990, the second crew would be terminated at the end of FY 1989, or perhaps up to a year earlier.

The WCF is expected to operate the equivalent of about 14 months at normal average rates during the 27-month period starting with FY 1977 and ending at the end of the first quarter of FY 1980, when cold operation of the NWCF is scheduled to begin. Operating the WCF one month at the normal average rate will solidify about 45,000 gallons of fluoride wastes; the remaining total projected WCF calcining is, therefore, about 630,000 gallons. Figure 2 shows the 14 months are divided into three campaigns of 5, 6, and 3 months. However, every reasonable effort will be made to minimize WCF downtime. The WCF will not be shut down when operation at near-normal rate can be safely continued. Therefore, actual operation achieved may differ considerably from that shown in Figure 2; some possibilities in this regard are discussed in Section III, Consequence Analyses.

Liquid waste inventories are shown in Figure 6. Rover wastes are included in the inventories. A significant difference from the last MFPP document is the use of the operating spare volume; last year, this volume was not used in the baseline program. Even with the use of the 285,000 gallons of operating spare volume, processing will be restricted by lack of waste space until after a WCF startup. Note the close approach to five full tanks of fluoride waste at the end of FY 1979. A subsequent three-month WCF campaign, processing of Rover instead of some other fuel, and required downtime (see Footnote 5 to Figure 2) all combined to increase available fluoride waste space to about 120,000 gallons. Interruption of Rover processing to fill this space would be undesirable.

A potential way to obtain added liquid waste space without additional tanks would be to make one of the two 318,000-gallon tanks the required spare by putting the waste now in it into the current required spare, which, like the other nine tanks, holds only 300,000 gallons when completely full. This would permit considerably more than 285,000 gallons, the current maximum, to be stored in each tank, but the transfer would result in some dilution. The potential gain and the feasibility of these actions are being evaluated.

For Figure 6, the assumption was made that calcining a 3 to 1 mix of fluoride and intermediate wastes would be possible beginning in March 1978. Calcining of this mix in the WCF has been tried twice but was discontinued when the chloride concentration in the recycle stream increased. If the trial planned for March 1978 is not successful, fluoride waste will continue to be calcined alone.

Evaluation of alternate methods for solidifying the sodium-containing low-heat waste is in progress under 189 I-8, "ICPP Waste Management Development." A new facility to solidify low-heat waste would be needed by mid-FY-1984 if storage of this waste is limited to five large tanks, and could be built before then.

Approximate annual shipments of uranium and U-235 are listed in four categories in computer-generated Table III. When the uranium quantities are relatively small, they could be either held for later shipment or shipped in the same year with uranium in another category, depending on circumstances.

3. PROGRAMS AND ASSOCIATED COSTS (KZ PROGRAMS)

3.1 Operations-Funded Programs**

Funding required for operations and research and development in FY 1979 is compared to that required for FY 1978 in the following tabulation:

Item	KZ No.	FY 1978 ($000)	FY 1979 ($000)	Differences ($000)
Process fuels	01-02	13,985	16,120	2,135
Process startup	01-05	-0-	1,400	1,400
Conceptual engineering	01-05	1,370	1,310	(60)
Safeguards & Security	01-05	355	675	320
Waste Solidification	03-02	6,630	7,430	800
NWCF startup	03-03	-0-	1,300	1,300
Conceptual engineering	03-03	645	450	(195)
Operations Subtotal		22,985*	28,685*	5,700
Process Development (R&D)	02	1,195*	1,170	(25)
KZ Production Costs**		24,180	29,855*	5,675
U-235 Purchase	01-03	500	800	300
Totals		24,680	30,655	5,975

*Five added to obtain zeroes in computer calculations.

**KZ-03-04, ERDA Radioactive Waste R&D, and KZ 03-07, Supporting Services - Long-Term, are not covered by this document.

Escalation accounts for nearly $2.0 million of the $5.7 million total increase in KZ production costs. The added costs for Rover and NWCF testing and startups, excluding escalation of $0.2 million from the total startup cost of $2.7 million, amounts to about $2.5 million. The remaining $1.2 million of increase results from a variety of increases in the scope of work, principally, as follows:

TABLE III

ANNUAL SHIPMENTS OF PRODUCTS, IN KGS

BASELINE PROGRAM | CASE RUN ON 05/09/77

FISCAL	U235 >50% & U236 >1%			U235 >50%		U235 10 TO 50%		U235 <10%		U233 FROM HTGRS		U235 FROM HTGRS	
YEAR	URAN.	U-235	U-236	URAN.	U-235	URAN.	U-235	URAN.	U-235	URAN.	U-233	URAN.	U-235
1978	519.	397.	71.	37.	34.	0.	0.	0.	0.	0.	0.	0.	0.
1979	629.	498.	69.	602.	445.	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	471.	438.	0.	0.	0.	0.	0.	0.	0.	0.
1981	468.	382.	40.	2582.	2397.	0.	0.	0.	0.	0.	0.	0.	0.
1982	996.	794.	111.	1254.	814.	0.	0.	0.	0.	0.	0.	0.	0.
1983	2231.	1787.	235.	52.	44.	0.	0.	0.	0.	0.	0.	0.	0.
1984	1459.	1231.	92.	307.	273.	72.	17.	0.	0.	0.	0.	0.	0.
1985	1865.	1579.	93.	255.	229.	24.	6.	0.	0.	0.	0.	0.	0.
1986	854.	712.	64.	123.	106.	547.	104.	2274.	133.	0.	0.	0.	0.
1987	592.	501.	41.	173.	145.	0.	0.	3546.	142.	0.	0.	0.	0.
1988	1084.	913.	87.	133.	111.	0.	0.	2015.	81.	0.	0.	0.	0.
1989	1492.	1252.	128.	226.	190.	13.	3.	1223.	84.	0.	0.	0.	0.
	12188.	10047.	1022.	6214.	5227.	656.	130.	9058.	439.	0.	0.	0.	0.

TOTAL KGS OF U-233 AND U-235 RECOVERED BUT NOT SHIPPED: 197.

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

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

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

Further discussion of Operations-funded programs which support baseline operations is in Section VII, Process Development and Support.

Costs for KZ program production activities for every year of the study period are shown in Table IV. Operating costs are in the upper half of the table, and capital costs in the lower half. The capital cost is discussed in Section 3.2, which follows.

TABLE IV

ICPP-WCF COST DATA BEGINNING WITH 1978
(DOLLARS ARE IN THOUSANDS) CASE RUN ON 05/31/77

BASELINE PROGRAM

FISCAL YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	POST	TOT
A. COSTS OF PRODUCTION														
OPERATION	22990	28690	28010	28800	27930	28280	27260	27170	26690	26970	27140	27060	0	326990
R AND D (KZ02)	1200	1170	1740	1800	1830	1830	1720	1600	1500	1400	1300	1300	0	18390
KZ PRODUCTION	24190	29860	29750	30600	29760	30110	28980	28770	28190	28370	28440	28360	0	345380
U-233 PURCHASE (KZ01-03)	500	800	900	900	1200	1000	900	900	0	0	0	0	0	7100
B. CAPITAL COSTS														
CALCINE STORAGE ***	12000	0	25000	0	0	0	0	35000	0	0	0	0	-33140	38860
SECURITY UPGRADE	1090	10	0	0	0	0	0	0	0	0	0	0	0	1100
NEW WCF	20100	11700	0	0	0	0	0	0	0	0	0	0	0	31800
PERS. PROT.,SUP.	5000	3700	0	0	0	0	0	0	0	0	0	0	0	8700
FLUORINEL & FUEL STG	8490	80000	10	0	0	0	0	0	0	0	0	0	-8850	79650
UTILITIES EXPANSION	0	1300	10630	70	0	0	0	0	0	0	0	0	-2400	9600
ANAL. CHEM. BLDG	0	1500	10000	4000	0	0	0	0	0	0	0	0	-3100	12400
SNM MEAS. SYSTEM ***	0	0	1000	2000	1000	0	0	0	0	0	0	0	-1200	2800
RECEIVING & WHSE ***	0	0	500	1000	500	0	0	0	0	0	0	0	-600	1400
PLANT MODERNIZAT.***	0	0	0	2000	5000	3000	0	0	0	0	0	0	-4000	6000
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	2250	3050	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	-19510	15790
CAPITAL EQ.-KZ PROD.	4500	4410	4840	3000	3000	3000	3000	3000	3000	3000	3000	3000	-16690	24060
CAPITAL EQ.-KZ R & D	110	550	170	160	150	150	100	100	100	100	100	100	-610	1280
TOTAL CONSTRUCTION	53540	106220	55150	15230	12650	9150	6100	41100	6100	6100	6100	6100	-90100	233440

TOTAL POST: -90100

THE FUEL PROCESSING HEADEND AND TAILEND OPERATE CONCURRENTLY BETWEEN THESE DATES: 9-30-82 AND 11-89
ALL COSTS ARE IN THOUSANDS. COSTS BEYOND FY 1979 ARE NOT ESCALATED.
POST COLUMN SHOWS CREDITS FOR UNDEPRECIATED VALUES OF NEW EQUIPMENT.
DEPRECIATION IS EXPLAINED IN APPENDIX B, ITEM 13.

3.2 Projects

Funding for capital line-items included in the Idaho KZ Program of the Baseline Program* and the approximate dates when beneficial use is to be achieved are as follows:

Capital Line Items	First FY of Funding	Approximate Beneficial Use	Total Estimated Cost ($\$10^6$)	Estimated Obligation After 1977 ($\$10^6$)
Calcined Solids Storage Bins				
Fifth set of bins	1978	Apr 1981	12	12
Sixth set of bins	1980	Apr 1983	25	25
Seventh set of bins	1985	Apr 1988	35	35
Safeguards & Security Upgrade	1977	Jan 1980	2.3	1.9
New Waste Calcining Facility	1976	Jul 1980	68.3	31.8
Personnel Protection & Supt. Fac.	1977	FY 1979	10.5	8.7
Fluorinel Process & Metal-Clad Fuel Storage Facility	1977	Oct 1981	98.5	88.5
Utilities Expansion	1979	Apr 1981	12	12
Plant Analytical Chemistry Bldg.	1979	Sept 1981	15.5**	15.5**
SNM Measurement System	1980	Apr 1983	4	4
Central Receiving and Warehouse	1980	FY 1982	2	2
Plant Modernization	1981	FY 1985	10	10

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

Table IV shows the funding periods and the amounts of obligations necessary each year of the study period for each line item. Exceptions are the calcined-solids-storage-bin projects, which only show lump-sum amounts collapsed into initial funding years. Portions of costs for five other projects were obligated prior to the study period and thus were excluded from Table IV; these are the NWCF project, for which $38.5 million was obligated prior to FY 1978; the Fluorinel Process and Metal-Clad Fuel Storage Facility,

* Two projects included in the INEL Long-Range Plan,[11] Advanced Waste Treatment and Calcine Retrieval and Packaging, are considered within the scope of this document but are excluded from the list of line-items due to lack of definition at this time.

** The data sheet shows a range of $15.5 to $17.0 million. The cost shown here is used in the economic analysis herein.

where $10.0 million was obligated in FY 1977; the Personnel Protection and Support Facility, where $1.8 million was obligated in FY 1977; and the Safeguards and Security Upgrade, where $0.4 million was obligated in FY 1977.

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

There are two FY-1979 line-item projects shown in Table IV: Utilities Expansion and the Plant Analytical Chemistry Building.

Utilities Expansion

The Utilities Expansion Project provides for the replacement and expansion of existing utility production and distribution systems that have deteriorated. Included in this project are:

(1) An expansion to the service building (CPP 606)

(2) A tunnel system for routing utilities

(3) An additional deepwell and pumphouse

(4) Additional storage vessels for raw water, fuel oil, oxygen, and nitrogen

(5) A centralized propane system

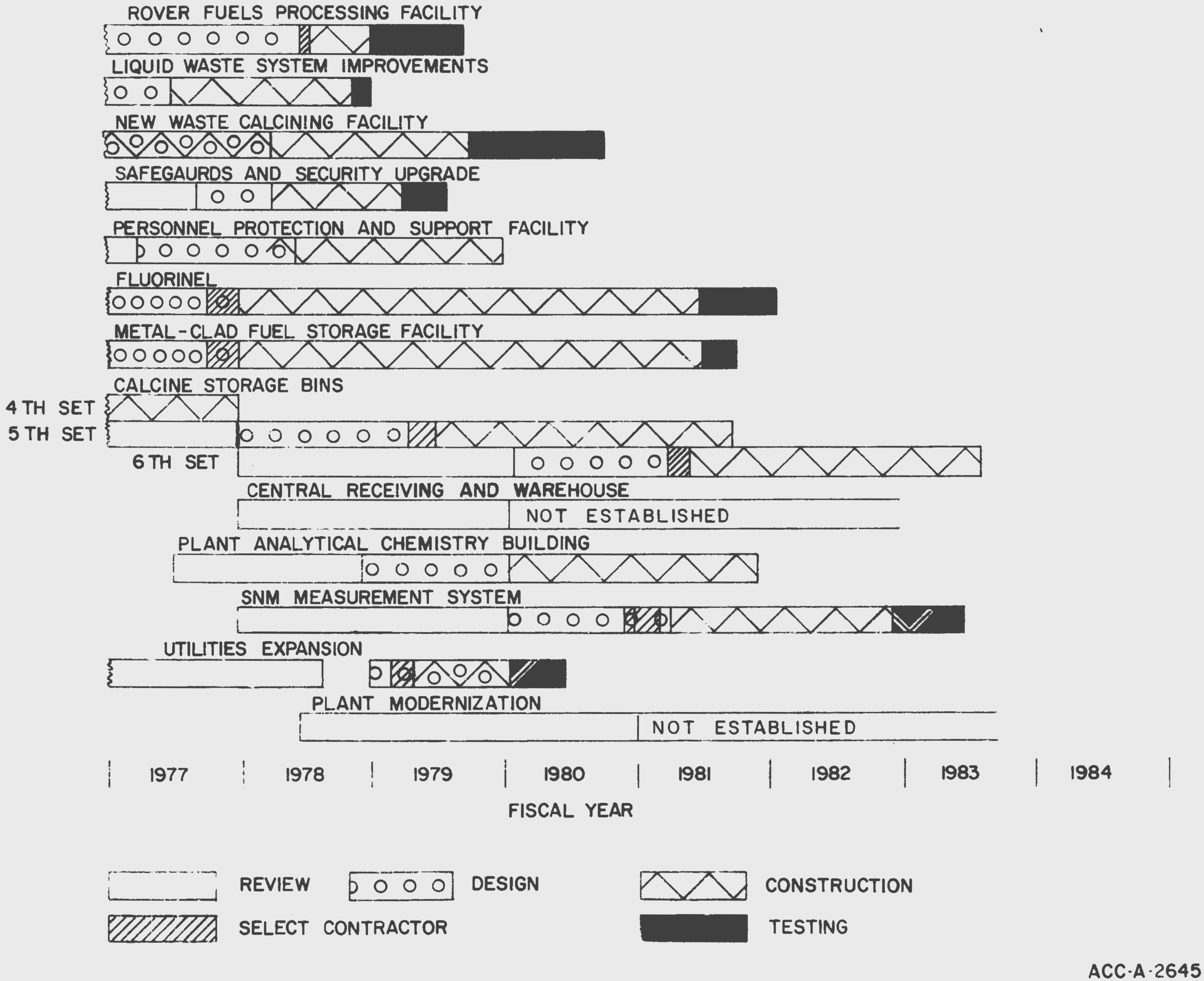
(6) An expanded sanitary sewage treatment plant

(7) An expanded substation transformer area and control house

Utility production and distribution systems will be expanded and modernized. These systems include steam, compressed air, various treated water systems, raw water/firewater, sanitary and service waste, nitrogen, oxygen, normal and emergency power, and communication.

The ICPP was built in 1951 and has undergone a series of expansions and modifications. This project is necessary to replace deteriorated utility systems and to provide reliable, efficient systems to serve this multipurposed plant. When these systems are replaced, added

FIGURE 8-MULTIPLE FUELS PROCESSING PROGRAM CONSTRUCTION SCHEDULE



capacity will be built into each system to provide for normal and specific plant expansion such as Fluorinel and the Metal-Clad Fuel Storage Facility.

The latest energy conservation techniques will be used during the design and construction of this project.

Plant Analytical Chemistry Building

A detailed space analysis of ACC-ICP needs, based on the INEL Long-Range Plan,[11] shows a laboratory space shortfall of approximately 15,000 net usable square feet (NUSF) in FY 1979. If space is not developed, new program and planned program expansion must be curtailed. The present analytical chemistry laboratories in CPP-602 have been in operation for 27 years, and building construction makes precision analyses excessively tedious. Accordingly, analytical chemistry space is most needed and, thus, programs with less stringent requirements can occupy the vacated CPP-602 space.

The Plant Analytical Chemistry Building will have approximately 20,000 NUSF with 11,500 NUSF laboratory space, 3,200 NUSF office space, and with the remaining space for required support areas. Providing the remaining shortfall of 3,500 NUSF laboratory space is to be evaluated later.

III. CONSEQUENCE ANALYSES

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 300,000-gallon storage tanks for high-level radioactive aqueous waste. There are twelve 300,000-gallon tanks in the tank farm and four smaller tanks amounting to 70,000 gallons in concrete vaults at the lowest level of the plant. The large tanks are considered to be full at 285,000 gallons to allow for jet dilution in case transfer is required. One of the 300,000-gallon tanks is used for the waste diversion system. We are committed in accordance to Federal regulations to have one spare 300,000-gallon tank at all times to handle 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 285,000-gallon capacity. The main purpose for maintaining this unfilled space, called operating spare volume, is to provide flexibility in waste storage and to permit processing to continue after a leak. Generally, the sum of this unused volume is equivalent to one large waste tank. However, in the first three years of the simulation period, the operating spare volume will be permitted to be less than one large waste tank in order to increase fuel processing.

If a second leaker developed, the operating spare volume, when maintained, would be available to hold the contents of one full tank. If this emergency situation should ever occur, the deleterious effects of mixing fluoride and intermediate waste would have to be accepted. However, existing solution stability data would be used to minimize to the extent possible such 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 Variation in Operations of the Existing WCF

1.2.1 No WCF Calcining

If the Waste Calcining Facility were not to operate at all before the startup of the NWCF, a significant reduction in fuel processing would be necessary for the period FY 1977 - FY 1981. The reduction would total 468 kg U-235 for that period. The fuel processing schedule is shown in Figure 9. Wastes generated plus miscellaneous wastes from other operations would require use of nearly all of the operating spare volume in that period until NWCF startup. This is shown in Figure 10. The present value of net cash flow (PVNCF), assuming a 10% discount rate, would be about $21 million less than in the Baseline Program. No significant fuel storage problems would occur, as shown in Figure 11.

1.2.2 WCF at 50%

Operation of the WCF at only 50% of its projected throughput would require a reduction in fuel processing prior to NWCF startup--about 217 kg U-235. The fuel processing schedule is illustrated in Figure 12. The PVNCF would be $8 million less than in the Baseline Program, assuming a 10% discount rate.

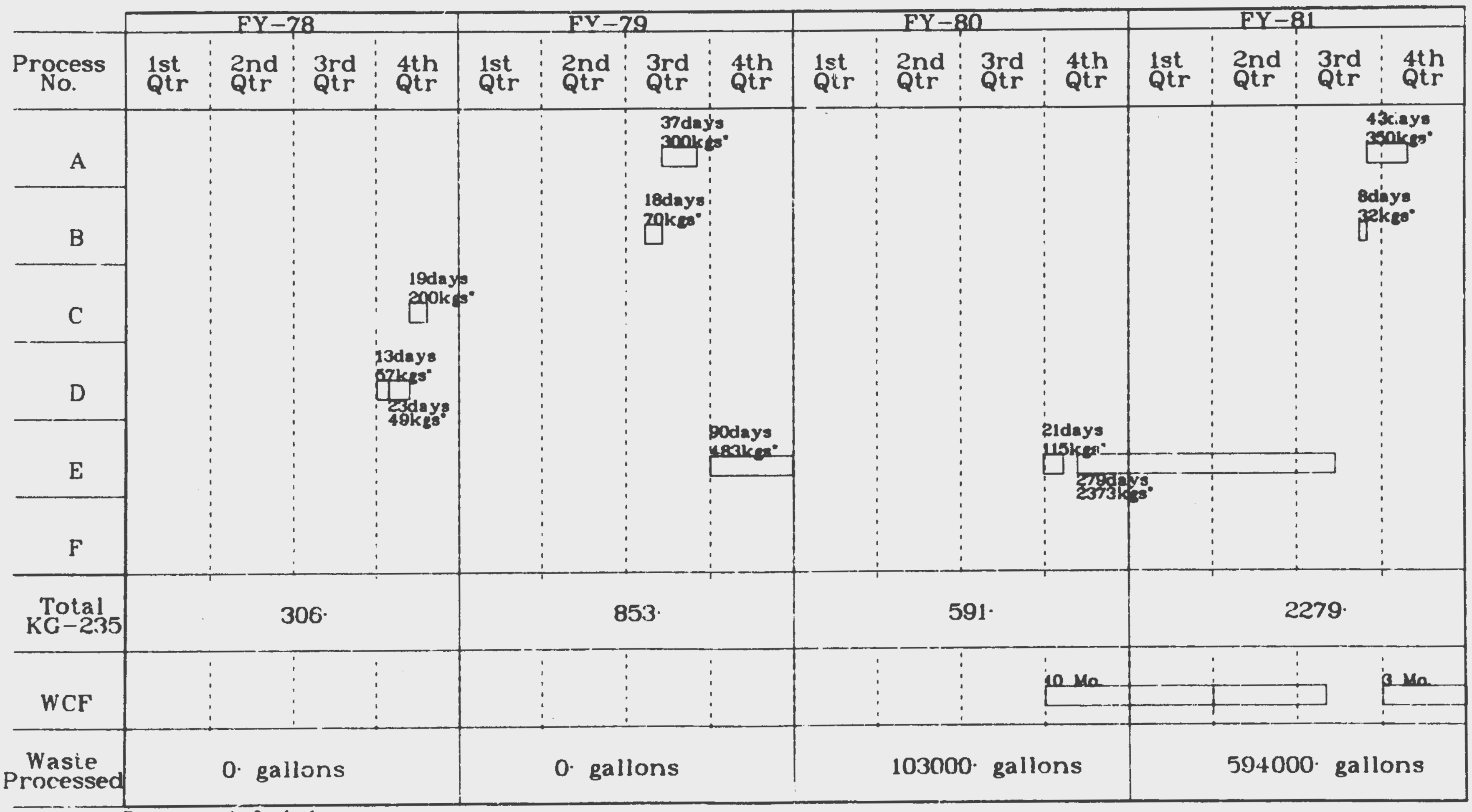
1.3 Variation in NWCF Startup

NWCF startup is critical to fuel processing after FY 1980. Three scenarios were investigated: a three-month delay from planned startup (July 1980), a six-month delay, and a twelve-month delay. Only for the twelve-month delay would it be necessary to alter the fuel processing schedule prior to NWCF startup. However, processing schedules after July 1980 (planned startup) would be affected, and, thus, the net cash flow would be decreased (Figure 13). In the three NWCF delay cases, the operating spare volume was assumed regained as soon as possible after NWCF startup. Continued use of all this space, which would require mixing of Fluoride and low-heat wastes, would reduce the large economic penalty of delayed NWCF startup.

2. CHANGES IN FUEL RECEIPTS

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

ICPP OPERATING SCHEDULE



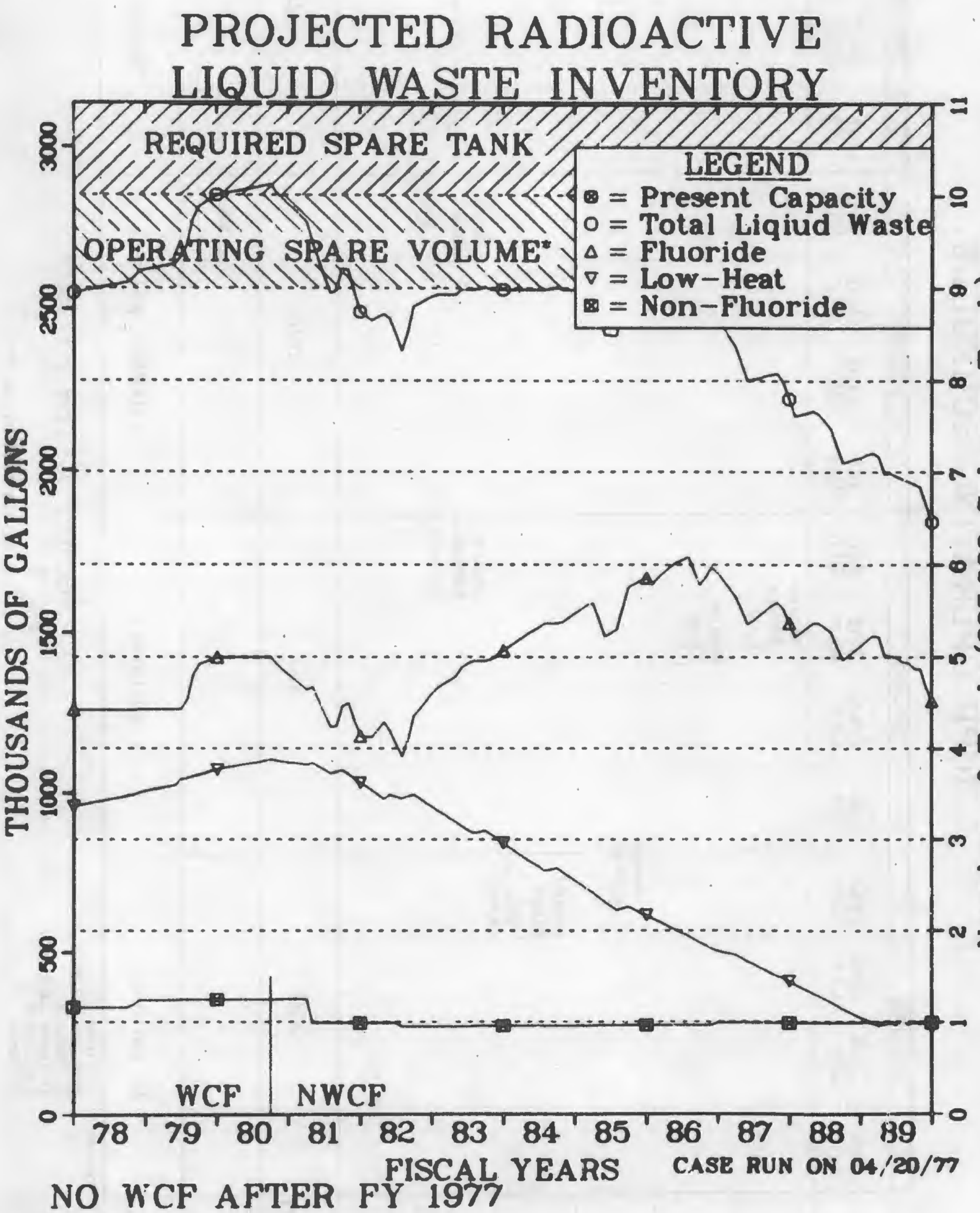
Process A=fuels 1
B=fuels 2,3,30
C=fuels 4
D=fuels 5,6,7
E=fuels 9
F=fuels

NO WCF AFTER FY 1977

FIG. 9

CASE RUN ON 04/20/77

*U-235

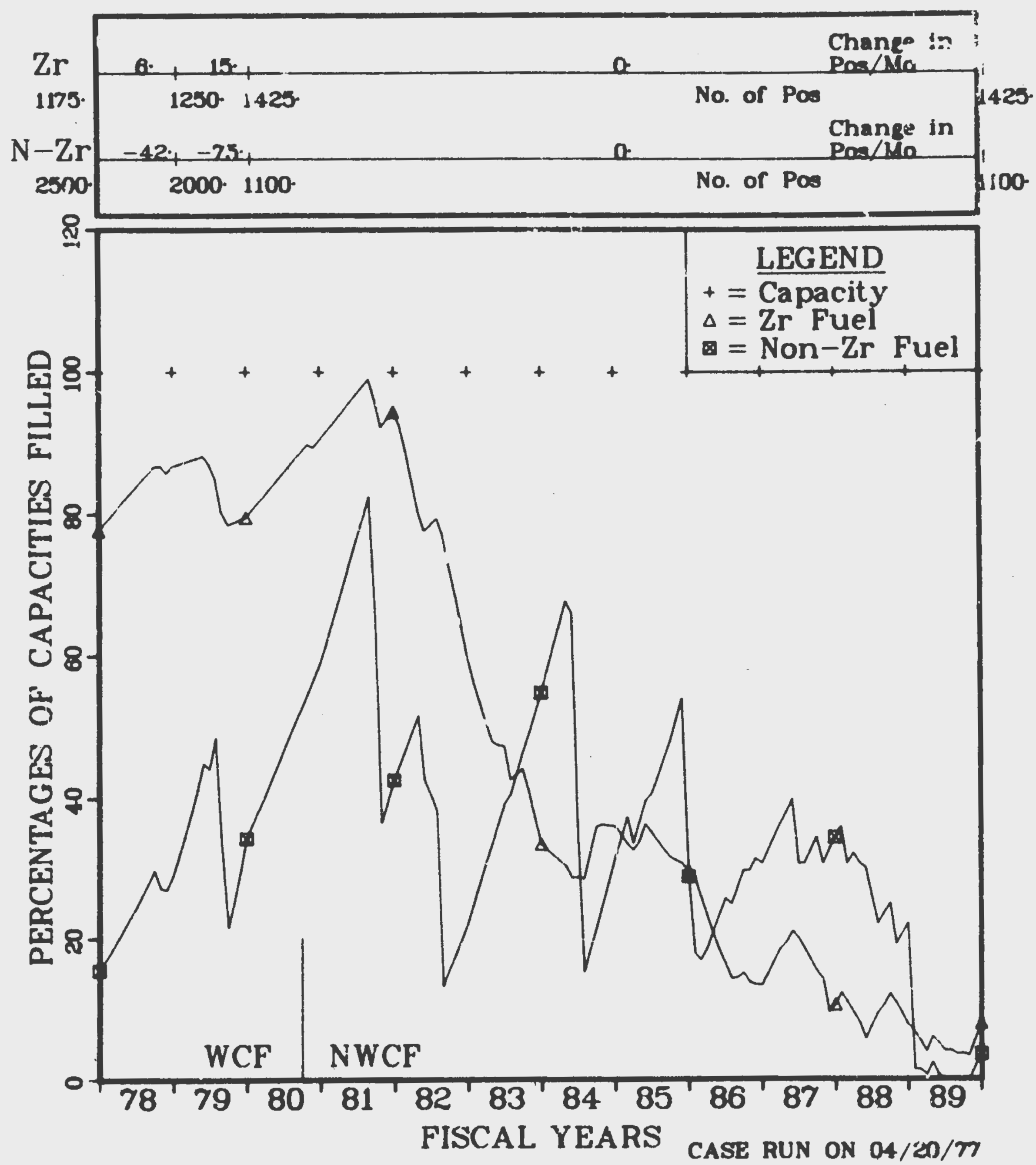


NO WCF AFTER FY 1977

FIG. 10

*NOTE: 70,000 GAL VOLUME AVAILABLE IN SMALL TANKS IS NOT SHOWN.

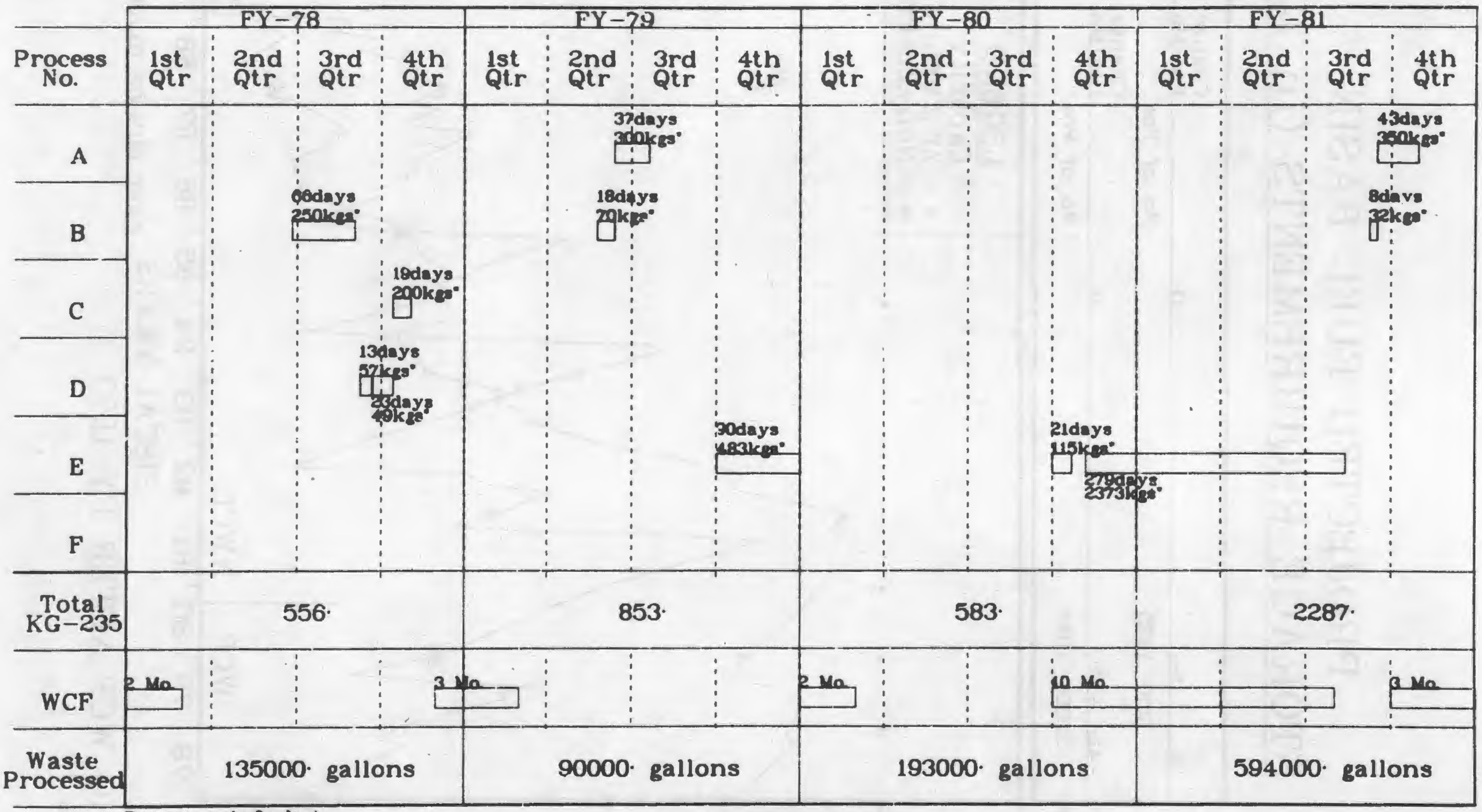
PROJECTED FUEL BASIN STORAGE REQUIREMENTS (in %)



NO WCF AFTER FY 1977

FIG. 11

ICPP OPERATING SCHEDULE



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

50% WCF AFTER FY 1977

FIG. 12

CASE RUN ON 04/20/77

*U-235

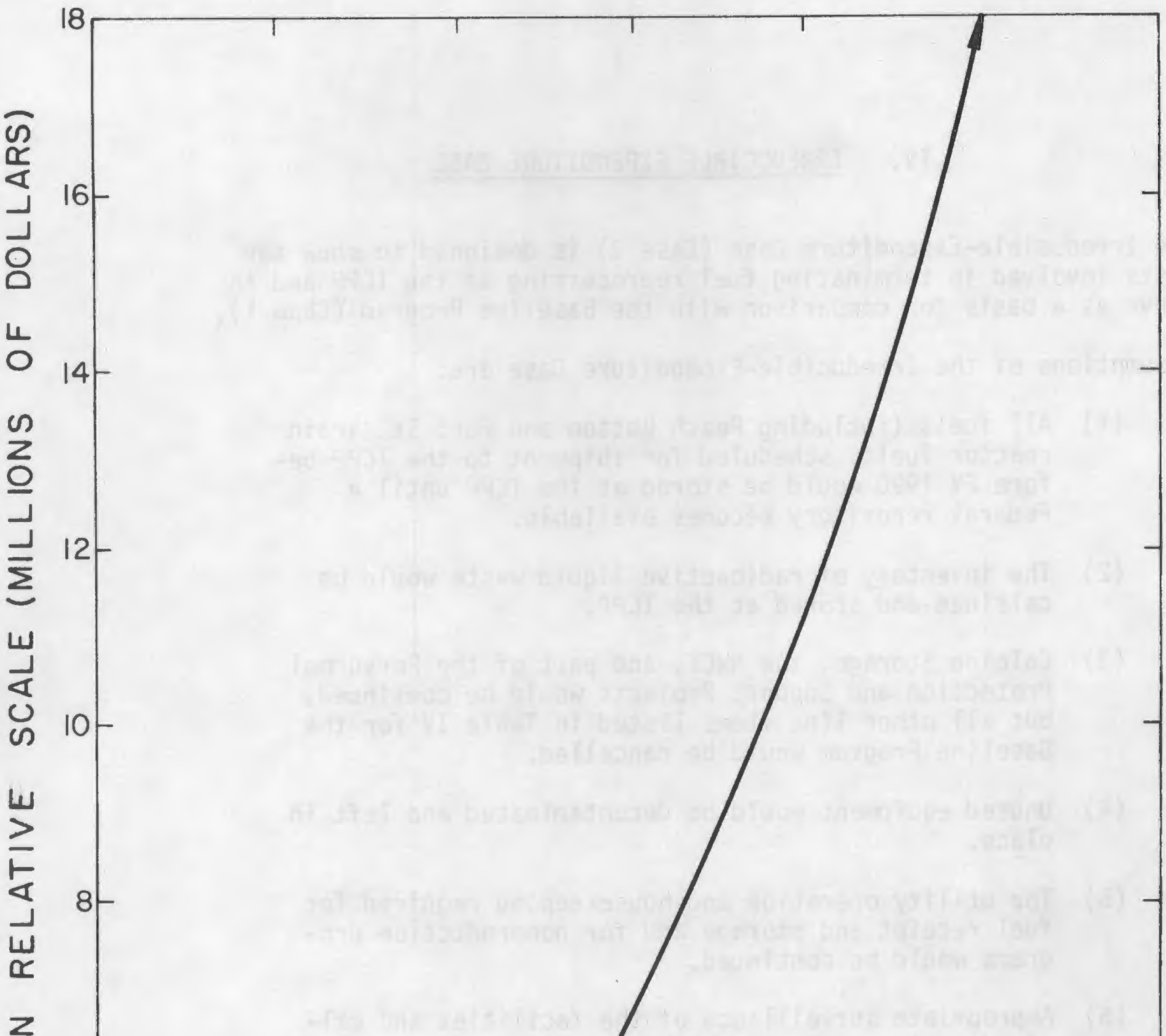


FIGURE 13. Effect of NWCF startup on present value of net cash flow.

IV. IRREDUCIBLE EXPENDITURE CASE

The Irreducible-Expenditure Case (Case 2) is designed to show the costs involved in terminating fuel reprocessing at the ICPP and to serve as a basis for comparison with the Baseline Program (Case 1).

Assumptions of the Irreducible-Expenditure Case are:

(1) All fuels (including Peach Bottom and Fort St. Vrain reactor fuels) scheduled for shipment to the ICPP before FY 1990 would be stored at the ICPP until a Federal repository becomes available.

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

(3) Calcine Storage, the NWCF, and part of the Personnel Protection and Support Projects would be continued, but all other line items listed in Table IV for the Baseline Program would be cancelled.

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

(5) The utility operation and housekeeping required for fuel receipt and storage and for nonproduction programs would be continued.

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

(7) A small crew would handle fuel receipts, record keeping, and associated decontamination and waste treatment. Necessary support facilities would also be provided.

In order to store the scheduled fuel shipments at the ICPP, a new storage facility would be required and would be made large enough to permit the existing fuel storage basin to be removed from service. A total of 4,000 positions for zirconium fuels and about 5,000 positions for nonzirconium fuels would be required. About 10,000 positions would be built to allow for possible increases in receipts. This new fuel storage facility (assumed dry for this case) would have to be operational by the end of FY 1982. The estimated cost of this facility is $110 million; this estimate allows for 8% escalation to the time of expenditure. Special actions would be required to obtain funding for the facility in order to initiate design at an early date consistent with October 1982 operation.

Notification of the projected shutdown was assumed to be received October 1, 1977. Conceptual design of the new storage facility was assumed to start at once and would require six months. Selection of the architect-engineer and completing the design would require about 23 months, ending February 1980. Construction would begin October 1, 1979 and require 30 months, ending April 1, 1982. A six-month period for tests and corrections was assumed. The facility would consist of four main areas: (a) a truck and railcar receiving bay and cask preparation area of about 7200 square feet, (b) a fuel unloading hot cell of about 1600 square feet, (c) a storage area of about 49,000 square feet, and (d) a cell area for support systems (including intake and exhaust filtering systems, special off-gas systems, decontamination solution makeup and collection systems, operating corridors, etc) of about 98,000 square feet. Conceptual design and costing of the facility is based on extrapolation of information from the conceptual design and cost estimate made for a smaller facility by a reputable architect-engineering firm.

The operations schedule for this case is presented in Table V, and the costs are described in Table VI. Processing Fuels 3 and then 1 in the second and third quarters of FY 1978 to recover 536 kg of U-235 would fill the fluoride waste tanks and provide fuel storage space adequate for receipts projected through FY 1982.

Valid comparison of the Irreducible-Expenditure Case to the other cases of fuel processing requires an assumption that the present value of the cost of permanent disposal elsewhere of the fuels that would be stored at the ICPP for an interim period would not be greatly different from the present value cost for permanent disposal of the calcined wastes derived from these fuels in other cases. Any reasonable difference in the present values of these costs could be made small by extending the interim storage periods. Since the interim storage facilities would exist at that time, extension of the interim storage makes good economic sense, at least as long as a catastrophic release of fission products is dismissed as incredible or held to a sufficiently low probability during the interim storage period.

TABLE V

ICPP-WCF PROCESSING SCHEDULE

CASE 2 -- IRREDUCIBLE EXPENDITURES

	FY-78	FY-79	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	Totals
Fuels, kg													
Received	645	680	759	986	973	615	2,059	1,636	519	1,117	1,118	1,058	12,165
Processed	536	0	0	0	0	0	0	0	0	0	0	0	536
Inventory	5,042	5,722	6,481	7,467	8,440	9,055	11,114	12,750	13,269	14,386	15,504	16,562	
Non-Fluoride Waste, gal													
Produced	0	0	0	0	0	0	0	0	0	0	0	0	
Processed	0	0	0	48,560	76,695	205,305	0	0	0	0	0	0	330,560
Inventory	330,650	330,560	330,560	282,000	205,305	0	0	0	0	0	0	0	
Fluoride Waste, gal													
Produced	368,600	0	0	0	0	0	0	0	0	0	0	0	368,600
Processed	247,513	168,755	178,743	407,089	464,738	162,411	0	0	0	0	0	0	1,629,249
Inventory	1,381,735	1,212,980	1,034,237	627,148	162,411	0	0	0	0	0	0	0	
Low Heat Waste, gal													
Produced	47,960	42,600	42,600	42,600	42,600	42,600	42,600	42,600	42,600	42,600	42,600	42,600	516,560
Processed	22,501	56,252	59,581	135,696	154,913	127,817	172,500	172,500	172,500	172,500	172,500	0	1,419,530
Inventory	984,419	970,768	953,787	860,690	748,378	663,161	533,261	403,361	273,461	143,561	13,661	56,261	
Solid Waste, ft^3													
Produced	5,786	4,891	5,043	11,563	13,433	12,712	14,080	14,080	14,080	14,080	14,080	0	123,828
Inventory	59,269	64,161	69,204	80,167	94,200	106,912	120,992	135,072	149,152	163,232	177,312	177,312	
Days of Fuel Processing	122	0	0	0	0	0	0	0	0	0	0	0	122
Days of Calcining	183	152	183	270	270	270	270	270	270	270	270	0	2,678

TABLE VI

ICPP-WCF COST DATA

CASE 2 -- IRREDUCIBLE EXPENDITURES

	FY-78	FY-79	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	Cost	Total
A. Cost of Production														
Operation	21,000	15,000	14,000	13,000	13,000	12,000	12,000	12,000	12,000	12,000	12,000	5,000		153,000
R&D Costs	600	300	300	0	0	0	0	0	0	0	0	0		1,200
KZ Production	21,600	15,300	14,300	13,000	13,000	12,000	12,000	12,000	12,000	12,000	12,000	5,000		154,200
B. Capital Costs														
Calcine Storage	12,500	0	25,000	0	0	0	0	0	0	0	0	0		37,500
NWCF	20,100	11,700	0	0	0	0	0	0	0	0	0	0		31,800
Fuel Stqrage Facility	10,000	40,000	40,000	15,000	5,000	0	0	0	0	0	0	0	-33,000	77,000
Pers. Prot. (Revised)	5,000	0	0	0	0	0	0	0	0	0	0	0		5,000
General Plant Projects	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	500	100	100	100		8,800
Capital Equip. - KZ Prod	2,000	1,000	500	500	500	500	500	500	200	100	100	100		6,500
Capital Equip. - KZ R&D	50	50	0	0	0	0	0	0	0	0	0	0		100
	50,650	53,750	66,500	16,500	6,500	1,500	1,500	1,500	700	200	200	200	-33,000	166,700

V. ECONOMIC ANALYSES

The cash flow analyses for the FY-1978 Baseline Case and the Irreducible-Expenditure Case are on Tables VII and VIII, respectively.

A comparison of the Baseline Case and the Irreducible-Expenditure Case is presented in Table IX. This table summarizes the comparison for the 12-year period: FY 1978 through FY 1989. For an annual comparison, refer to Figure 14. The nondiscounted costs for the Baseline Case and the Irreducible-Expenditure Case are $609 million and $321 million, respectively. The nondiscounted benefits for the Baseline Case and the Irreducible Expenditure Case are $722 million and $21 million; respective quantities of U-235 recovered are projected to be 16,048 and 536 kg. Thus, relative to the Irreducible-Expenditure Case, the Baseline Case will recover 15,512 additional kilograms worth $701 million at a cost of $288 million. The corresponding nondiscounted benefit-to-cost ratio is 2.43. As shown in Table IX and Figure 14, corresponding present values (discounted at 10%) for the incremental benefits, costs, and net cash flows are $417, $185, and $232 million, and the discounted benefit-to-cost ratio is 2.26.

TABLE VII

ICPP-WCF CASH FLOW EVALUATIONS BEGINNING WITH FY 1978
(DOLLARS ARE IN THOUSANDS) CASE RUN ON 05/31/77

BASELINE PROGRAM

FISCAL YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	POST	TOT
A. PRODUCTION														
1. PRODUCT, KG														
U-235	658	1039	605	2290	1784	1920	1655	1753	839	997	961	1539	0	16047
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	658	1039	605	2290	1784	1920	1655	1753	839	997	961	1539	0	16047
2. NON-DISC BENEFIT	26360	44790	27460	103880	80930	87100	75090	79540	38100	45230	43600	69840	0	721920
B. NON-DISCOUNTED COSTS														
PRODUCTION	24190	29860	29750	30600	29760	30110	28980	28770	28190	28370	28440	28360	0	345380
CONSTRUCTION	53540	106220	55150	15230	12650	9150	6100	41100	6100	6100	6100	6100	-90100	233440
WASTE ADJ.	0	0	0	0	0	0	0	0	0	0	0	0	30460	30460
TOTAL	77730	136080	84900	45830	42410	39260	35080	69870	34290	34470	34540	34460	-59640	609280
C. CASH FLOW ANALYSIS														
NON-DISC CASH FLOW	-51380	-91300	-57450	58050	38520	47840	40010	9670	3810	10760	9060	35380	59640	
PRESENT WORTH AT 10.0 %	-51380	-83000	-47480	43620	26310	29710	22590	4960	1780	4560	3500	12400	19010	
CUMULATIVE PRESENT WORTH	-51380	-134380	-181850	-138240	-111930	-82230	-59640	-54690	-52910	-48350	-44860	-32460	-13450	-13450

D. SUMMARY

PERCENT DISCOUNT	TOTAL DISCOUNTED BENEFITS	TOTAL DISCOUNTED COSTS	DISCOUNTED BENEFIT-TO-COST RATIO	TOTAL PRESENT VALUE OF NET CASH FLOW
0.0	721870.	609280.	1.18	112590.
7.50	490870.	483090.	1.02	7770.
10.00	438600.	452040.	0.97	-13440.
12.50	394640.	425020.	0.93	-30380.
15.00	357390.	401390.	0.89	-43990.
20.00	298300.	362270.	0.82	-63970.

TABLE VIII

ICPP-WCF CASH FLOW EVALUATION

CASE 2 -- IRREDUCIBLE EXPENDITURES

	FY-78	FY-79	FY-80	FY-81	FY-82	FY-83	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	Post	Total
A. Production														
1. U-235, kg	536	0	0	0	0	0	0	0	0	0	0	0		536
2. Nondiscounted Benefit	21,430	0	0	0	0	0	0	0	0	0	0	0		21,430
B. Nondiscounted Costs ($000)														
Production	21,600	15,300	14,300	13,000	13,000	12,000	12,000	12,000	12,000	12,000	12,000	5,000		154,200
Construction	50,650	53,750	66,500	16,500	6,500	1,500	1,500	1,500	700	200	200	200	-33,000	166,700
Total	72,250	69,050	80,800	29,500	19,500	13,500	13,500	13,500	12,700	12,200	12,200	5,200	-33,000	320,900
C. Cash Flow Analysis ($000)														
Nondiscount Cash Flow	-50,820	-69,050	-80,800	-29,500	-19,500	-13,500	-13,500	-13,500	-12,700	-12,200	-12,200	-5,200	33,000	-299,470
Present Worth @ 10%	-50,820	-62,773	-66,777	-22,164	-13,319	- 8,382	- 7,620	- 6,928	- 5,925	- 5,174	- 4,704	-1,823	10,515	-245,893

D. Summary

% Discount	Benefits	Costs	Present Value of Net Cash Flow
0	21,430	320,900	-299,470
7.5	21,430	278,933	-257,503
10.0	21,430	267,323	-245,893
12.5	21,430	256,760	-235,330

TABLE IX

ECONOMIC SUMMARY FOR BASELINE PROGRAM:
FY 1978 THROUGH FY 1989

	BASELINE PROGRAM (CASE 1)	IRREDUCIBLE EXPENDITURE (CASE 2)
PRODUCTION, KG		
U-235	16047	536
U-233	0	0
ENDING INVENTORIES		
LIQUID WASTE,1000 GAL	1640.9	56.3
SOLID WASTE,1000CU FT	192.5	177.3
CAPITAL COSTS ($000)		
LINE ITEMS	245600	184300
GPP	35300	8800
RCE	42640	6600
ENDING CAPITAL CREDIT	-90100	-33000
ENDING WASTE COST	30460	0
PRODUCTION COST	345380	154200
TOTAL COST ($000)	609280	320900
PRESENT TOTAL COST	452040	267323
FULL PRODUCT VALUE	721870	21430
PRESENT PRODUCT VALUE	438600	21430
NET CASH FLOW (NCF)	112590	-299470
PRESENT VALUE OF NCF	-13440	-245893
INCREMENTAL TO CASE 2		
PRODUCT VALUE	700440	0
TOTAL COST	288380	0
NET CASH FLOW	412060	0
BENEFIT/COST RATIO	2.429	0.0
INCREMENTAL TO CASE 2 AND PRESENT VALUES AT 10% DISCOUNT RATE		
PRESENT PROD. VALUE	417170	0
PRESENT TOTAL COST	184717	0
PRESENT VALUE OF NCF	232453	0
BENEFIT/COST RATIO	2.258	0.0

INCREMENTAL BENEFITS, COSTS AND NET CASH FLOWS

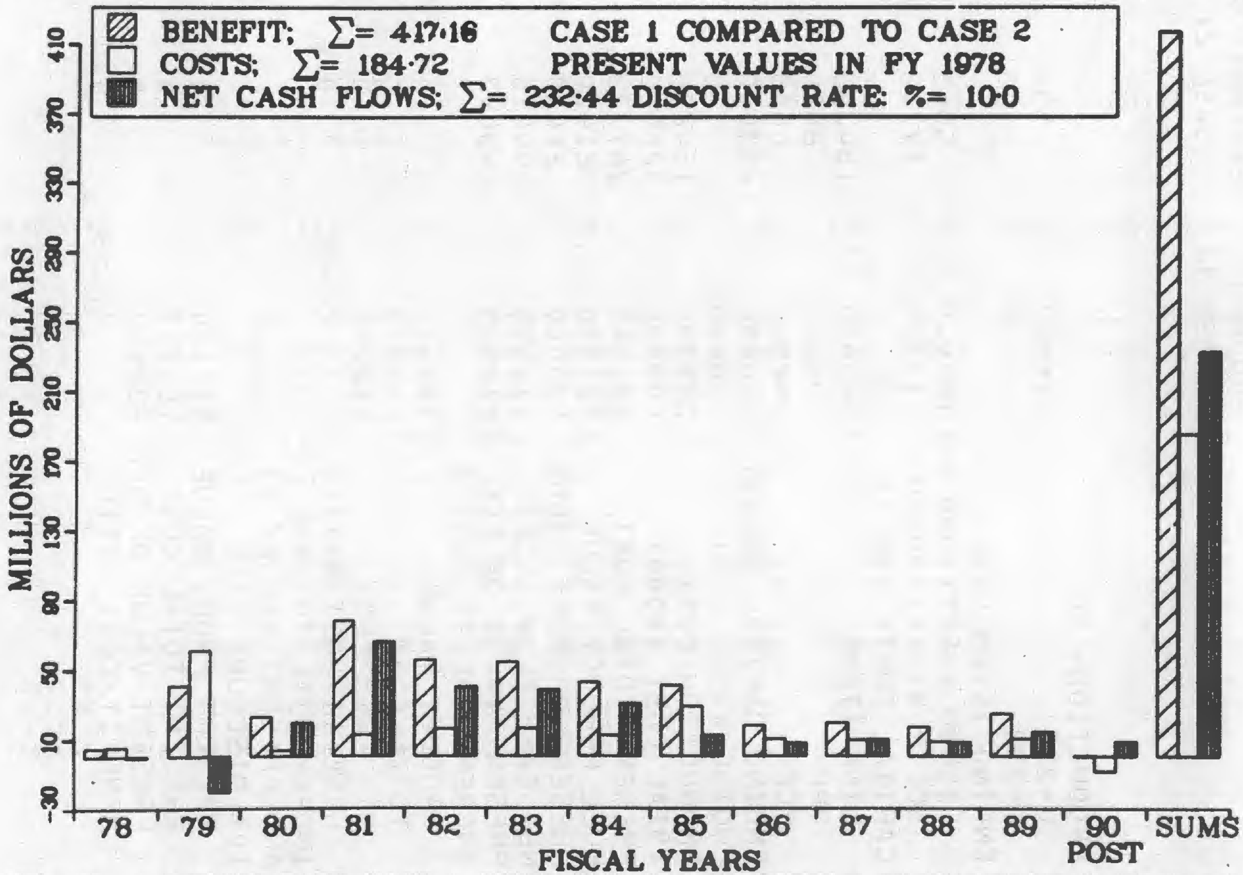


FIG. 14--BASELINE CASE, CASE 1, COMPARED TO IRREDUCIBLE-EXPENDITURE CASE, CASE 2

VI. PROJECTS

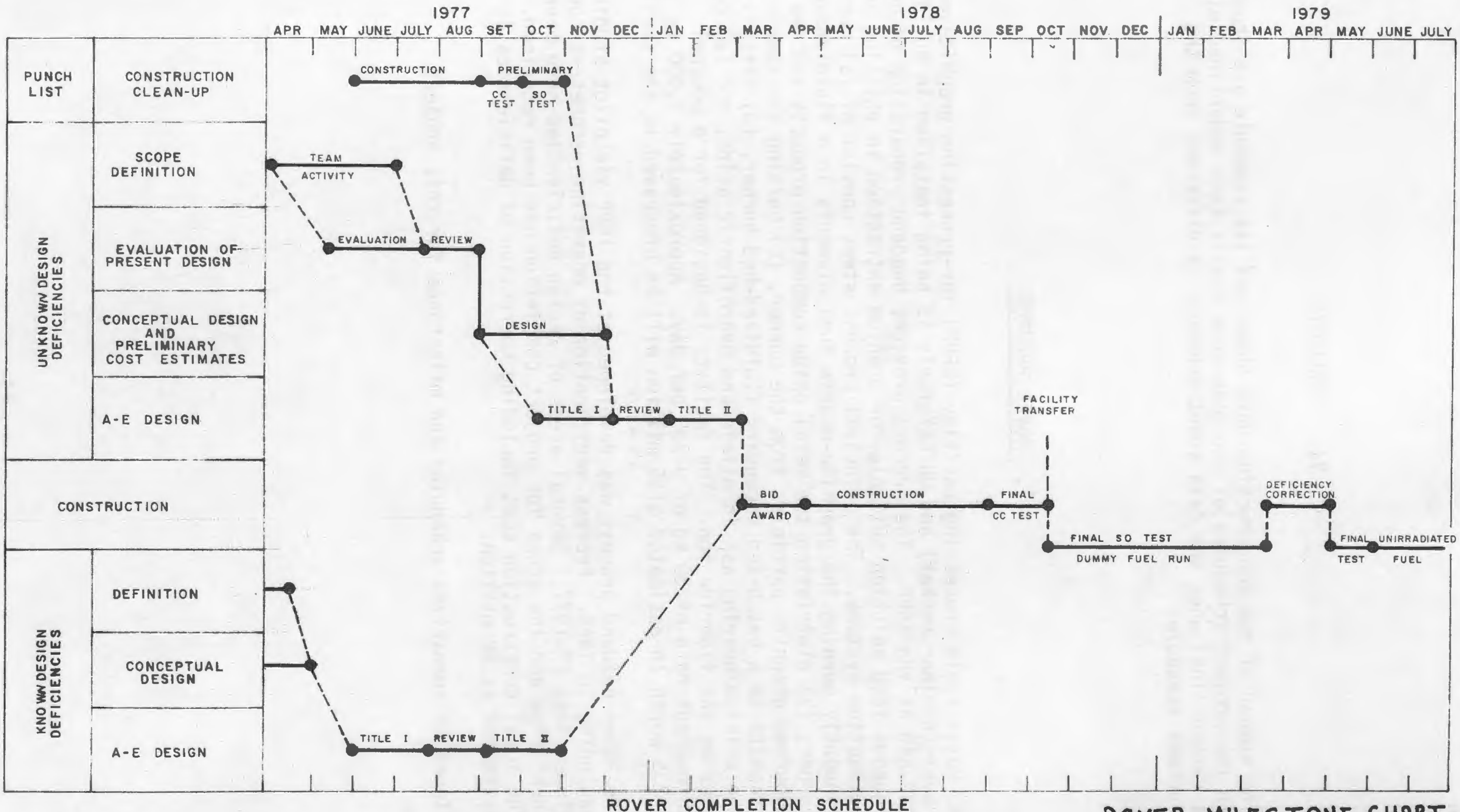
The number of the Construction Data Sheet and its schedule are shown on the project schedules of the milestone charts (and underlined with a dashed line) when the data sheet schedule is different from the current schedule.

1. ROVER PROJECT

A Rover Fuels Processing Facility (RFPF) 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 U-235 per day. Approximately 3,000 kg of U-235 worth an estimated $135 million will be processed in the facility.

The Rover headend process was developed at the ICPP via pilot studies beginning in 1966. Process verification of operating parameters continues into FY-1977. Several areas of design deficiencies have been identified and the scope for project completion has been redefined. The total construction cost including correction of deficiencies is estimated at $8 million.

Figure 15 summarizes schedules and milestones for this project.



ROVER MILESTONE CHART
FIGURE 15
PAGE 44

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 an $68.3 million facility scheduled-for hot operation in July 1980. 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, 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 3,000 gpd will be possible in the new facility.

History

The existing Waste Calcining Facility was built in the early 1960s as a pilot plant unit to demonstrate the solidification (calcination) of highly radioactive liquid waste in a heated, fluidized bed. Since its completion, the WCF has served as a production facility and has been used to convert some 2.9 million gallons of liquid waste into 53,000 cubic feet 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 immobilize contained radioactive isotopes, and thus make space available in existing liquid waste storage tanks for interim storage of fresh waste generated when processing irradiated fuels to recover U-235. The existing WCF was placed on line 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 $68.3 million, based on a Title I cost estimate of $65 million and on an allowance of $3.3 million for utilities services. Of the $65 million, approximately $11 million is for engineering design, $2.7 million for project management and remote mockups, and $42.5 million for construction. The remaining $8.8 million is contingency. The new facility will provide the latest technology in fluid-bed solidification, remote replacement of equipment, and materials of construction. The facility will also provide an extensive decontamination capability in the form of cells, work areas, and equipment.

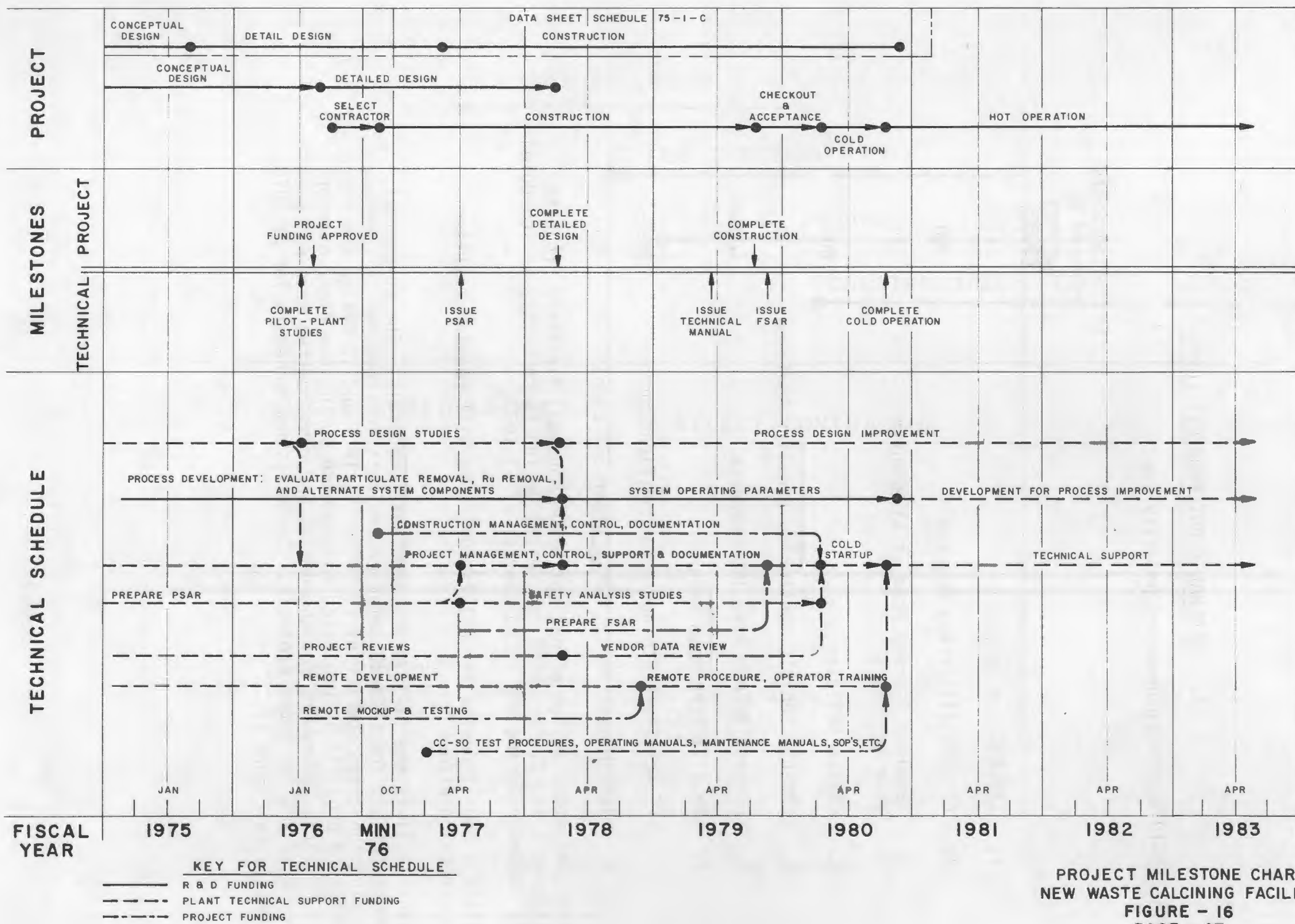
Design Requirements

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

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

Schedule

The major milestones associated with this project are shown in the diagram (Fig. 16) and indicate a design completion date of about January 1978 and a construction and checkout completion date of about January 1980. Checkout will be followed by six months of operation with cold feed. Hot operation is scheduled to begin in July 1980.



PROJECT MILESTONE CHART
NEW WASTE CALCINING FACILITY
FIGURE - 16
PAGE - 47

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3. GENERAL PLANT PROJECTS (GPP)

The FY-1978 GPPs in order of priority are:

		Estimated Costs, Proposed KZ Funding ($000)
1.	CPP-637 Lab Upgrade	515
2.	CPP-602 Filter Box Upgrade	360
3.	Gasoline Storage Area at Blue/White Zone Interface	25
4.	Office Building	600
5.	CPP-653 Vehicle Monitoring Facility Addition	50
6.	Process Makeup Area Improvements	400
7.	FY-1978 ICPP Road Program	50
8.	HF Acid Bulk Storage Area Modification	200
9.	ICPP Miscellaneous GPPs (under $5K each)	50

The conceptual design effort (of $150 thousand) for these projects (except 1 and 2, for which conceptual design is complete) is scheduled to commence during the third quarter of FY 1977.

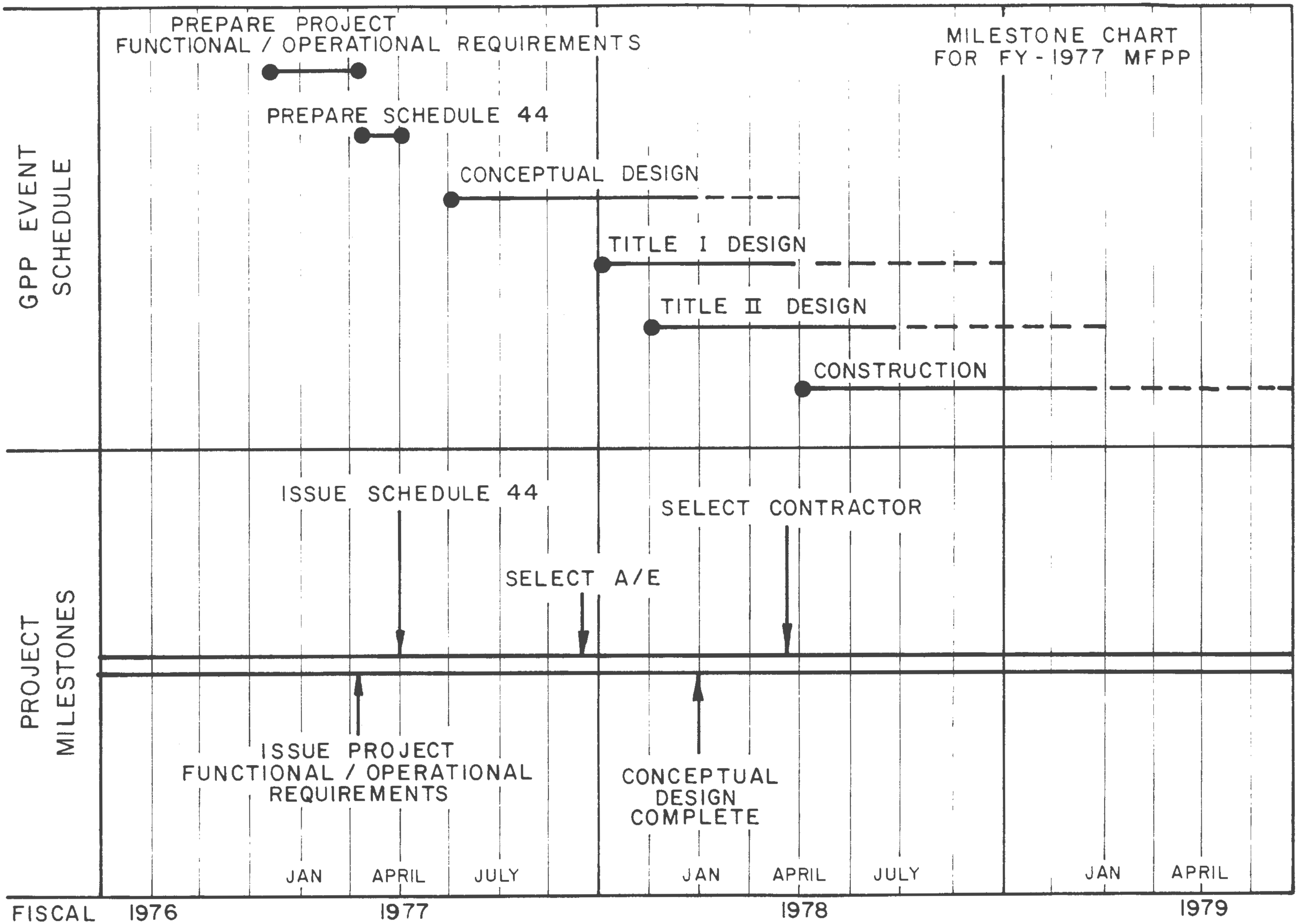
Title I and II design for all FY-1978 GPPs will require architect-engineering effort.

Table X lists the FY-1979 GPP candidate proposals. The conceptual design effort for ERDA-ID selected projects is scheduled to commence during the third quarter of FY 1978. Title I and II design for these selected projects is projected to commence during the first quarter of FY 1979. Schedules for the design and construction have not been prepared yet for these projects. The milestone schedule for FY 1978 GPPs is in Figure 17.

TABLE X

FY-1979 GPP CANDIDATE PROPOSALS

Estimated Priority	Project Title	Estimated Costs ($000)
1	CPP-601 Decontamination System	350
2	CPP-601 Health Physics Office Upgrade	50
3	ICPP Vehicle Storage Building	200
4	ICPP Bus Loading/Unloading Lot and Parking Area	200
5	Underground Fuel Storage Vaults	60
6	ICPP Miscellaneous GPPs (Under $5K Each)	50
7	ICPP Training Simulator	450
8	Hot Waste and Laundry Sorting, Packaging, and Compacting Facility	200
9	CPP-601 West Vent Corridor Improvements	250
10	Tie-Line NWCF to Third Set of Bins	330
11	Modify Waste System for Experimental Facilities	500



FY-1978 GENERAL PLANT PROJECTS

FIGURE-17

ACC-A-2613

4. PLANT ANALYTICAL CHEMISTRY BUILDING

Description

The Plant Analytical Chemistry Building will house approximately 11,500 net usable square feet (NUSF) of laboratories, 3,200 NUSF of office space, 6,000 NUSF of support space, and a mechanical core. The design shall provide for temperature control, humidity control, inlet air filtration, clean rooms, and vibration-isolated balance rooms. The building will not contain any white laboratories.

History

A preliminary conceptual design for the Chemical Services Building was completed during the FY 1976 transition quarter. Conceptual design was started in November of FY 1977 and then placed in suspension on March 31, 1977. The building has been renamed the Plant Analytical Chemistry Building (PACB). Conceptual design of the PACB resumed in April 1977.

Justification

A detailed space analysis of ACC-ICP needs based on the INEL five-year program plan shows a laboratory shortfall of approximately 15,000 NUSF in FY 1979. If space is not developed, new programs and existing program expansion must be curtailed. For example, the KZ-01 program will require an additional 3,000 NUSF of laboratory space by FY 1979. The present analytical chemistry laboratories, CPP-602, have been in operation for 27 years and, although the building construction does not prevent precision analyses, efforts required to maintain any degree of precision are excessive. Accordingly, analytical chemistry space is most needed and programs with less restrictive requirements can occupy the vacated CPP-602 space.

Cost Data

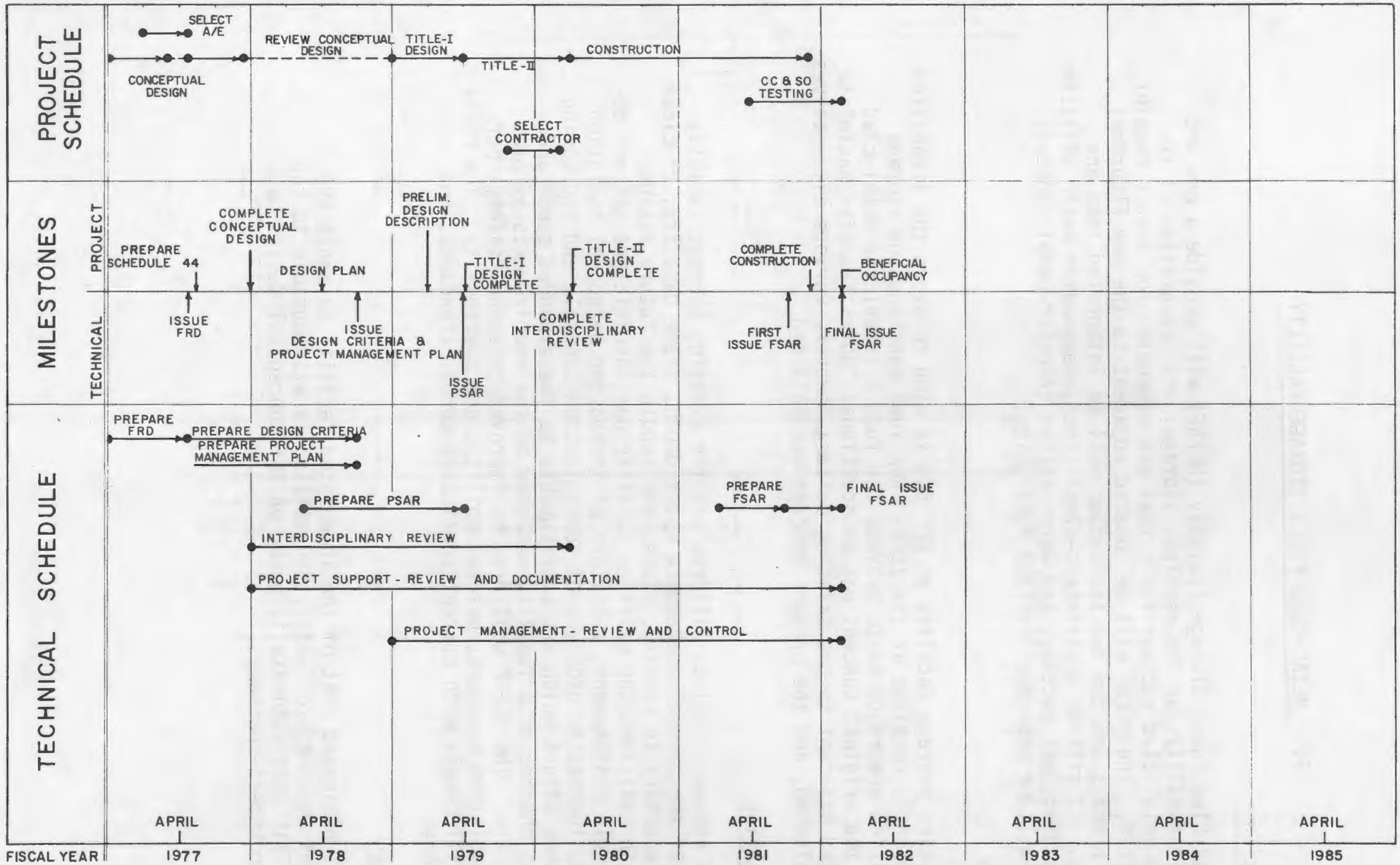
It is estimated that the PACB total cost will be between $15.5 and $17 million. A more accurate number will be generated at the completion of the PACB conceptual design report. A $15.5 million figure is assumed for the economic calculations in this document.

Conceptual Design Requirements

The preliminary conceptual design for FY 1976 transition quarter was $85,000. Conceptual design costs through March 31, 1977, were $45,000. It is estimated that the conceptual design for the PACB during the remainder of FY 1977 will be $150,000.

Schedule

Figure 18 summarizes the milestones and schedule for the Plant Analytical Chemistry Building. Design will be complete in November 1979, and construction will be complete in September 1981.



PROJECT MILESTONE CHART
PLANT ANALYTICAL CHEMISTRY BUILDING
FIGURE 18
PAGE 53

5. METAL-CLAD FUELS STORAGE FACILITY

Description

The Metal-Clad Fuels Storage Facility (MCFSF) will provide a new and versatile facility for the receipt, storage, and preparation of irradiated metal-clad nuclear fuels that are scheduled for future receipt at the ICPP. The MCFSF will be located adjacent to the new Fluorinel headend process and the two facilities will be integrated into one building. It will be a stainless-steel-lined, deep-water basin utilizing wet unloading, wet cutting, and water-filled transfer-canal concepts. Storage will be provided for 1800 fuel units.

History

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

Justification

This new storage facility will replace the existing storage facility because of the present inadequate water depth, crane capacity, or clear height necessary to receive, store, and handle the future assigned fuels. In addition, the existing facility has insufficient seismic design, single confinement, a history of increasing personnel radiation exposure, increasing problems of contamination control, and increasing maintenance effort which are attributable to the expanded scope and operating charter of a facility designed to the requirements of over 25 years ago. The MCFSF will provide improved personnel safety, personnel radiation exposure, maintainability, and operability. The MCFSF design will comply with current applicable codes, standards, and regulations.

Cost Data

The total estimated cost of the integrated facility is about $98.5 million of which approximately $58 million is attributable to the MCFSF. This cost estimate is based on the conceptual design made by the architect-engineer.

Conceptual Design Requirements

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

Schedule

The project and technical milestone chart for design and construction of the MCFSF is shown in Figure 19 along with the project and technical schedules. The design and construction completion dates are October 1979 and April 1981, respectively, as shown in the figure.

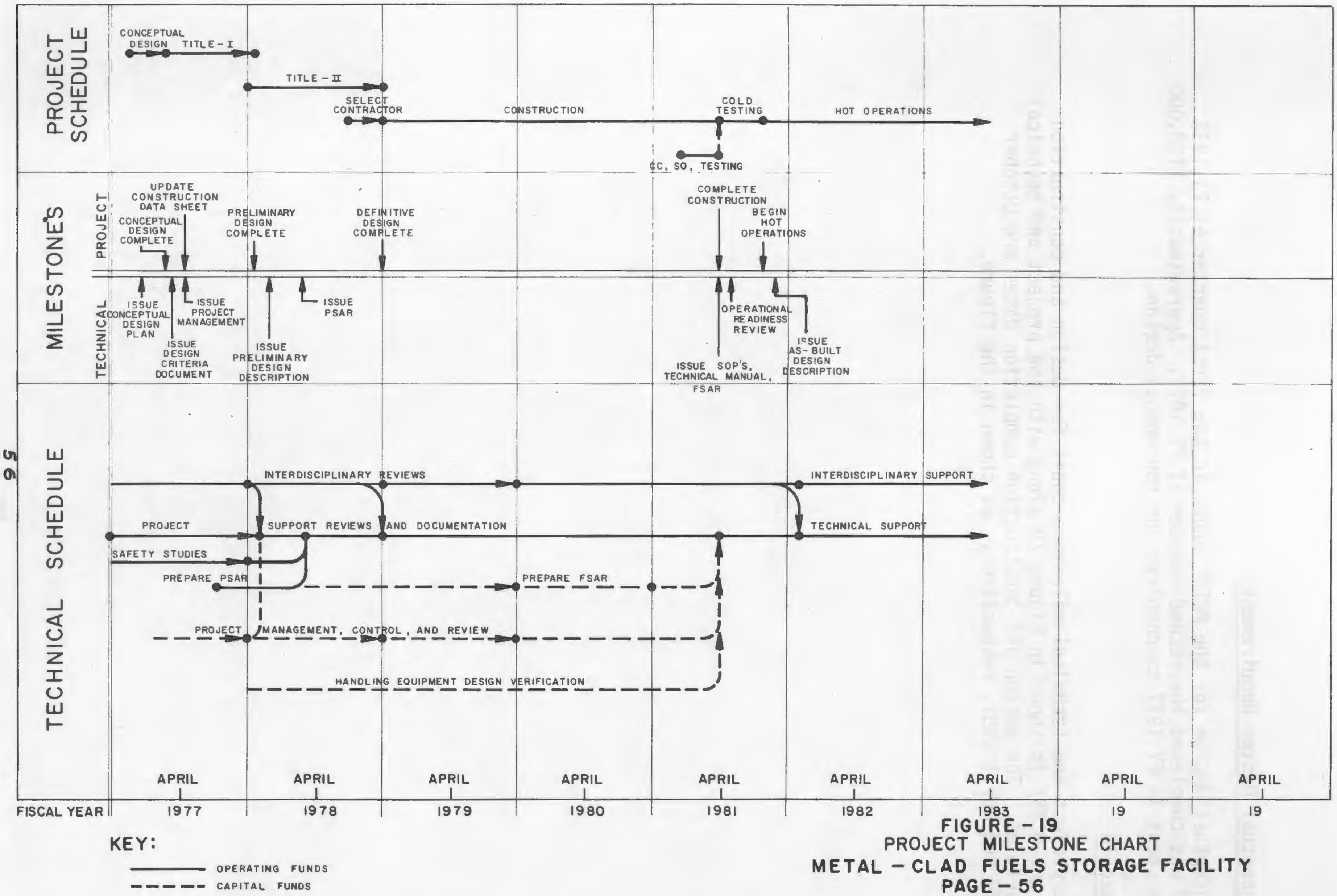


FIGURE - 19
PROJECT MILESTONE CHART
METAL - CLAD FUELS STORAGE FACILITY
PAGE - 56
ACC-A-2644

6. FLUORINEL DISSOLUTION PROCESS

Description

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, complexing tanks, and off-gas condensers and scrubbers. The complexed solution will pass through a solids/liquid separation system and be collected in a surge tank, and then transferred to the present solvent extraction facilities. The shielded cell will be in the same building and close-coupled to the MCFSF. Analytical capability will be added to provide rapid analyses of the process solutions.

History

Pilot plant studies on several fuels have demonstrated the processing concept.

A conceptual design based on equipment installation in CPP 601 was previously prepared. The Ralph M. Parsons Company was selected as the architect-engineer in FY 1976, and Title I design began in May 1976. As a result of problems identified during the design and model construction, a decision was made to locate the process in a new building combined with the storage facility. Conceptual design for the new facility was completed in April 1977. Much of the engineering effort from the previous Title I can be used for the new Title I.

Justification

Large quantitites of fuel will be received at the ICPP during the next ten years for which no process presently exists. 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. Because of problems in trying to fit the required process equipment in CPP 601 cells, it appears best to construct a new cell for this process away from CPP 601.

Cost Data

The total estimated cost of the integrated facility is about $98.5 million. The dissolution-process share of a new facility is estimated at $40.5 million.

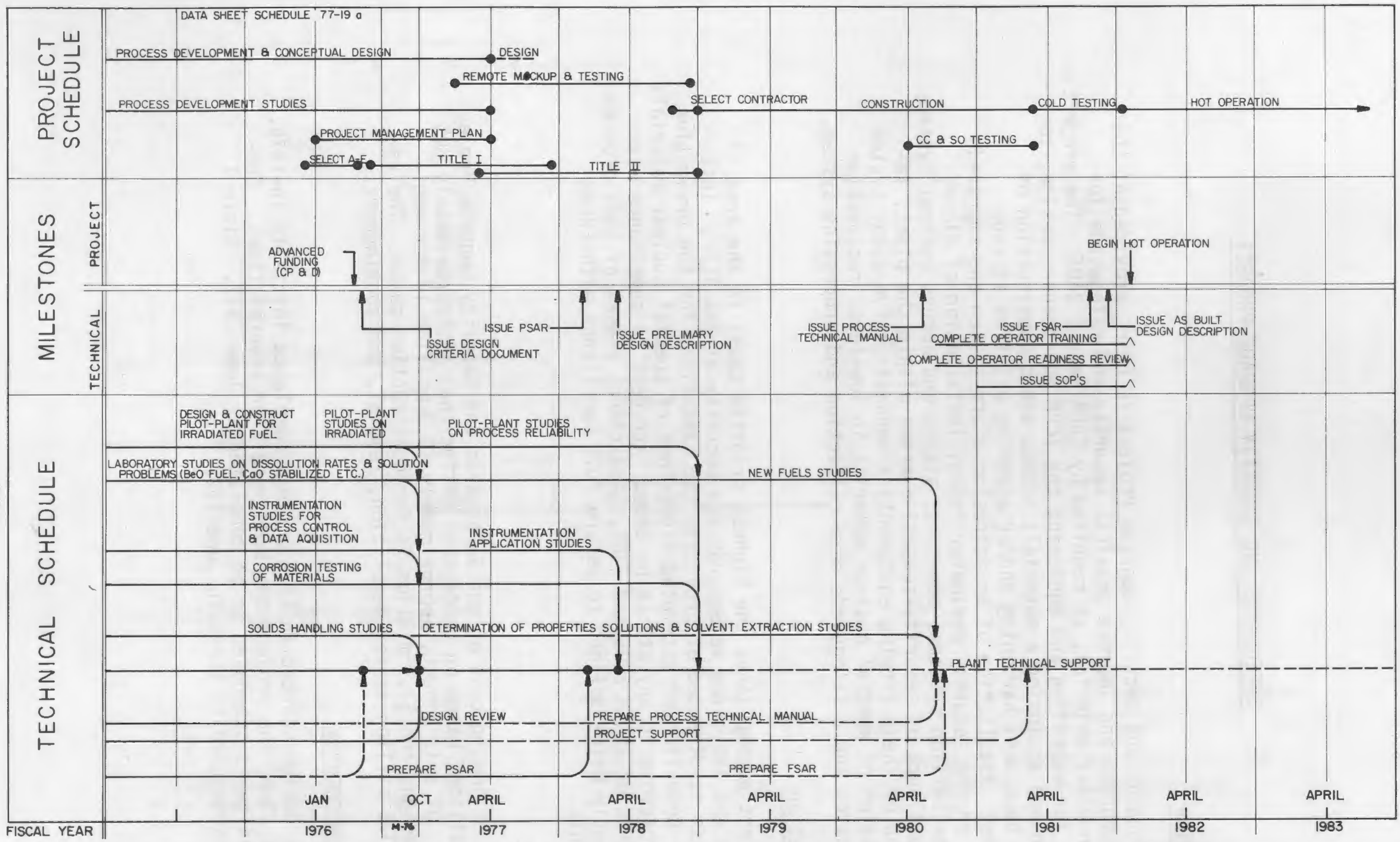
Conceptual Design Requirements

The conceptual design for the process to be located in CPP 601 was completed in June 1975 by Norman Engineering Company. Conceptual design to relocate the process in a new cell was started February 1, 1977 by The Ralph M. Parsons Company and completed April 15, 1977 at an additional design cost of about $50,000.

Schedule

Long-lead procurement will begin in FY 1978. An FY-1979 funding is expected for construction to start October 1978. Completion is expected in March 1981. Hot startup is projected for October 1981.

The project milestone chart for design and construction of the processing system is shown in Figure 20.



KEY ———— PROJECT SUPPORT FUNDING
– – – – – – PROJECT FUNDING

FIGURE 20
PROGRAM MILESTONE CHART
FLUORINEL PROGRAM
PAGE 59

ACC-2353

7. SAFEGUARDS AND SECURITY UPGRADE PROJECT

Description

The Safeguards and Security Upgrade Project is being provided at the ICPP to upgrade and improve physical security and safeguards for special nuclear material, as required by ERDA Manual 2405. The project provides for expanding and equipping the ICPP guardhouse; design, construction and equipping a materials access area; construction of security barriers; hardening and/or alarming existing storage facilities; installation of an intrusion alarm system and improved lighting on the security perimeter fence; installation of closed-circuit television systems, monitors, alarms and access control systems for surveillance of security-sensitive areas within the plant; installation of theft-sensing equipment; a nondestructive assay system for detection of special nuclear material in low-level radioactive solids waste, and a safeguards data collection and processing system.

Justification

This project accomplishes the highest priority tasks in the area of upgrading and improving safeguards and security at the ICPP. This first phase is directed at providing the capability for the prevention or timely detection of attempted diversions of special nuclear materials and the response to any attack by armed intruders in compliance with requirements of ERDAM 2405 and 7401. Additional phases of this program are currently being defined to assure full compliance with ERDAM requirements.

Cost Data

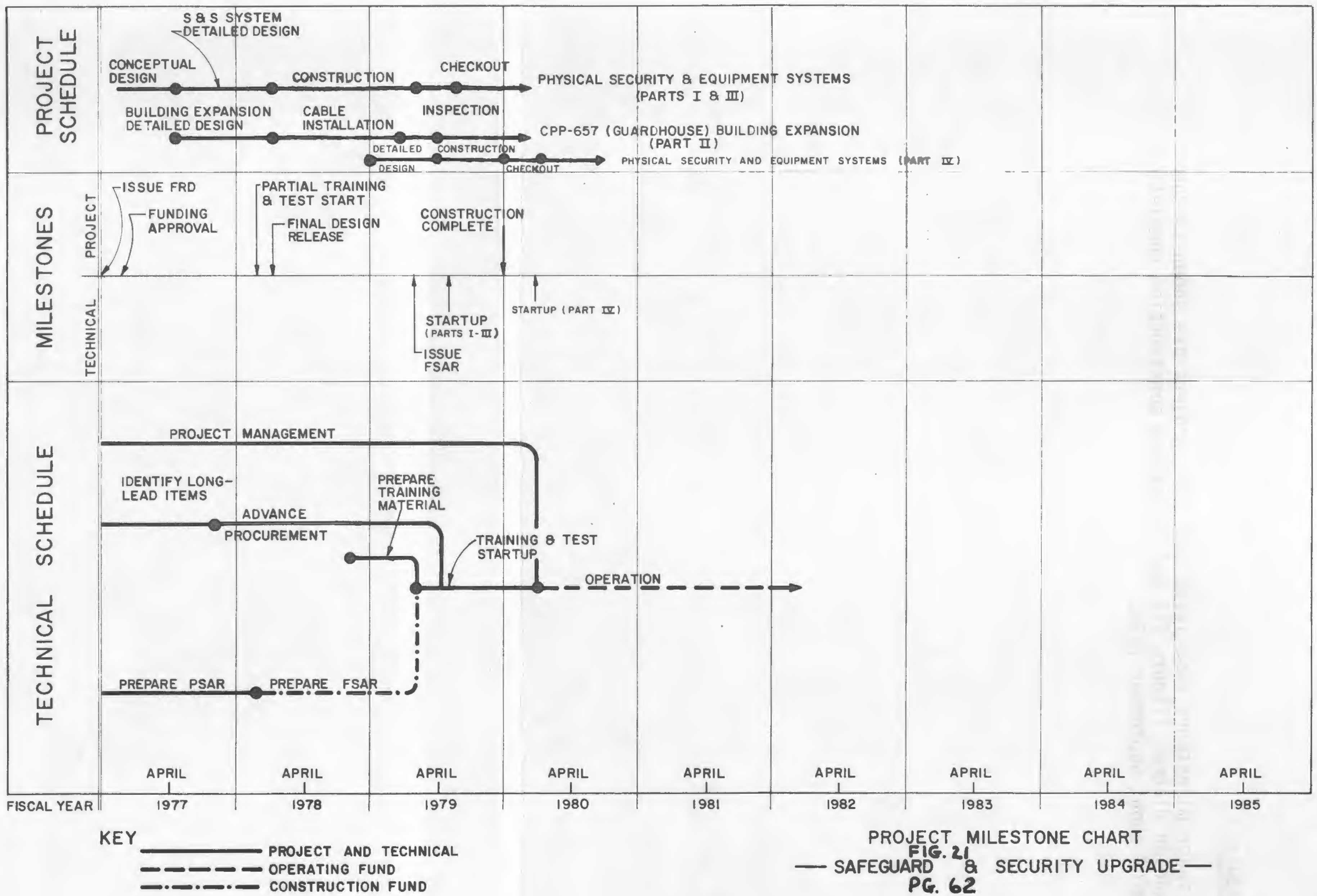
The total estimated cost of the Safeguards and Security Upgrade Project is $2.3 million, based on conceptual design that is approximately 80% complete. Of this amount, approximately $0.3 million is for engineering design, and $1.5 million is for construction costs. The remaining $0.5 million is for demolition, removal, and contingency.

Design Requirements

Conceptual design started in 1974 and was completed initially in 1975. Since that time, the project has been redefined several times. Conceptual design is scheduled to be completed by June 1977. Title I design is scheduled to start in June 1977.

Schedule

The major milestones associated with this project are shown in the companion diagram (Figure 21) and indicate a construction completion date of about September 1979.



PROJECT MILESTONE CHART
FIG. 21
— SAFEGUARD & SECURITY UPGRADE —
PG. 62

8. SNM MEASUREMENT SYSTEM

Description

The purpose of the proposed project is to improve ICPP safeguards of Special Nuclear Material (SNM) inventory and measurement capability to a level consistent with ERDA standards. The project, as presently proposed, will incorporate new tankage in the intercycle and final product storage areas to provide the additional mixing, sampling, monitoring, measurement, and data collection capabilities required for nuclear materials accountability. The solid product loadout equipment will be upgraded to provide automatically printed weight records of the solid product loadout operation. Theft sensing by monitoring storage tanks for unexpected level changes and detecting unauthorized sampler use will also be provided as part of this project.

The tank design for both intercycle and final product storage will be made critically safe by tank dimensions and, if necessary, by the use of nuclear poison and moderator. Each tank will be equipped with a mixing system, using air sparging or pumped recirculation and two independent content-measurement systems. The product loadout equipment will be upgraded to include printing scales to tare the product containers and weigh the solid product and samples.

Justification

The SNM Measurement System is required to provide the uranium measurement capability necessary to implement a safeguards accountability system in compliance with ERDAM 7401 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. Also, SNM diversions will be deterred by the theft sensor systems and the reduced time required for loss detection. Currently, SNM is measured just following dissolution (for entry into the plant) and as final product (for removal from the area). In between, hundreds of kilograms of product are held for several months in unmeasurable intercycle storage and final liquid product storage tankage. This upgrade will allow inventories in the process area to be measured without the long delays in process cleanouts currently required for SNM material balances.

The existing 48-tank intercycle storage system is not equipped for nor is it amenable to mixing, sampling and measurement; thus, a new system of suitably equipped tanks of the same capacity will be provided. The existing nine-tank final liquid product storage must be replaced with a new larger capacity system that will provide improved mixing, sampling, and measurement. The increased capacity is necessary for an increased number of inventories to be made in the downstream equipment.

Cost Data

The total estimated cost of the proposed SNM measurement system project is uncertain at this time, for reasons explained in the following paragraphs. A cost of $4 million has been assumed for the calculations in this report.

Design Requirements

Conceptual design of the SNM measurement system began in November 1976 and continued through April 1977, at which time ERDA-ID decided the project should be reevaluated for FY 1980 funding. All conceptual design effort is suspended temporarily for a review of the project to determine if a change in scope is necessary.

Schedule

The plan is to complete the conceptual design effort by August 15, 1977, and submit a new short form data sheet for the SNM Measurement System Project in April 1978. Figure 22 shows a tentative milestone schedule.

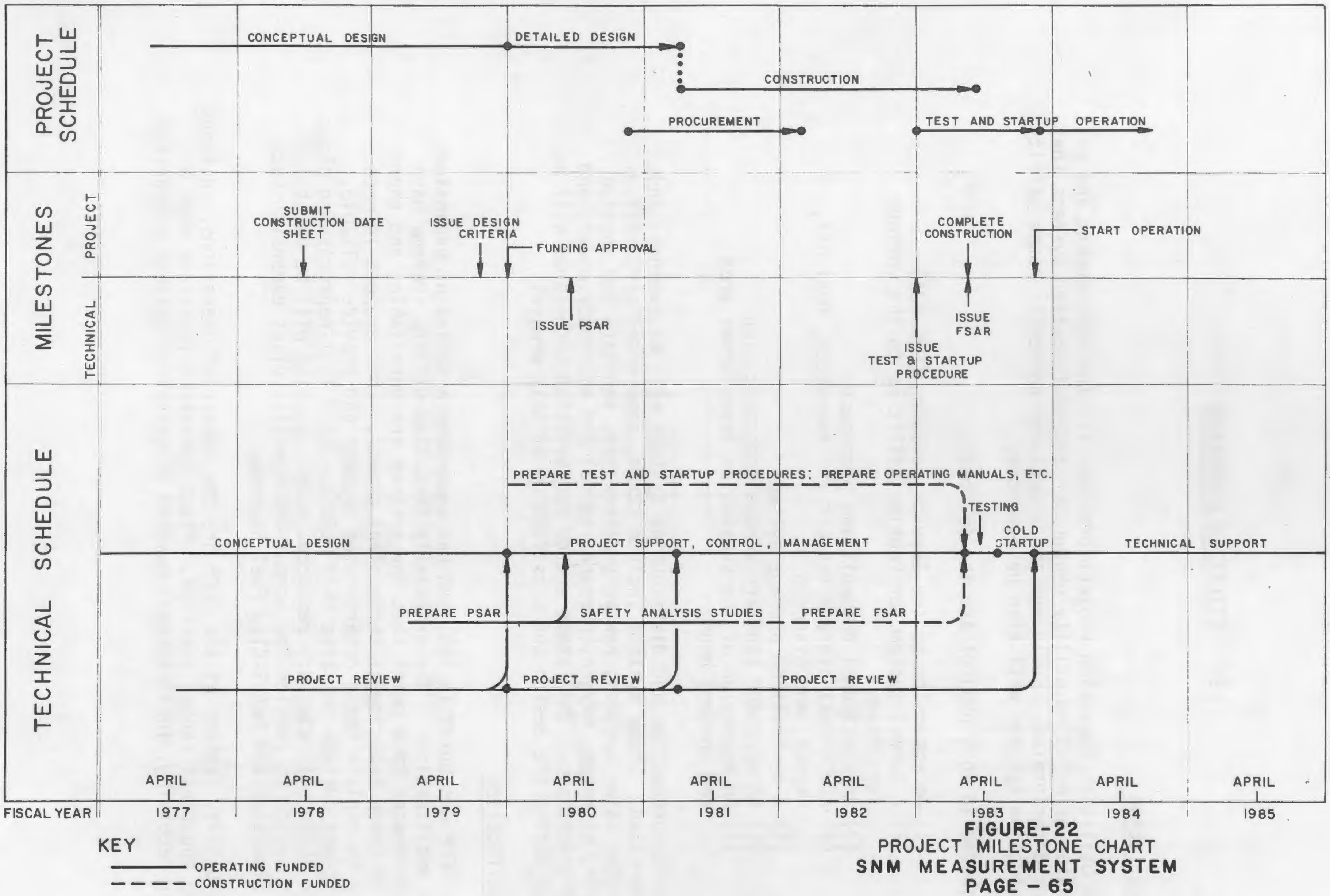


FIGURE-22
PROJECT MILESTONE CHART
SNM MEASUREMENT SYSTEM
PAGE - 65

ACC-C-2655

9. UTILITIES EXPANSION

Description

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

Included in this project are the following:

(1) An expansion to the Service Building (CPP 606)
(2) A tunnel system for routing utilities to the various facilities
(3) An additional deepwell and pumphouse
(4) Additional storage vessels for raw water, fuel oil, oxygen, and nitrogen
(5) A centralized propane system
(6) An expanded sanitary sewage treatment plant
(7) An expansion of the substation transformer area and control house

Utility production and distribution systems will be expanded and modernized. These systems include steam, compressed air, various treated water systems, raw water/firewater, sanitary and service waste, nitrogen, oxygen, propane, normal and emergency power, and communications. The latest energy conservation techniques will be used during the design and construction 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 no spare capacity to serve plant growth. This project is necessary to replace these deteriorated systems and provide reliable, efficient systems to serve this multipurposed fuel reprocessing plant. When these utilities are replaced, added capacity will be built into each system to provide for normal and specific plant expansion such as Fluorinel and Metal-Clad Fuel Storage.

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

Cost Data

The total estimated cost for the Utilities Expansion Project is $12 million, based on conceptual design estimates. Of this amount, approximately $1.2 million is for engineering design, $0.4 million is for project administration, and $8 million is for construction. The remaining $2.4 million is contingency.

Design Requirements

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

Schedule

The major milestones associated with this project are shown in the accompanying diagram (Figure 23). This diagram indicates that construction on this project is scheduled to begin in October of 1979 and will be completed in October of 1981.

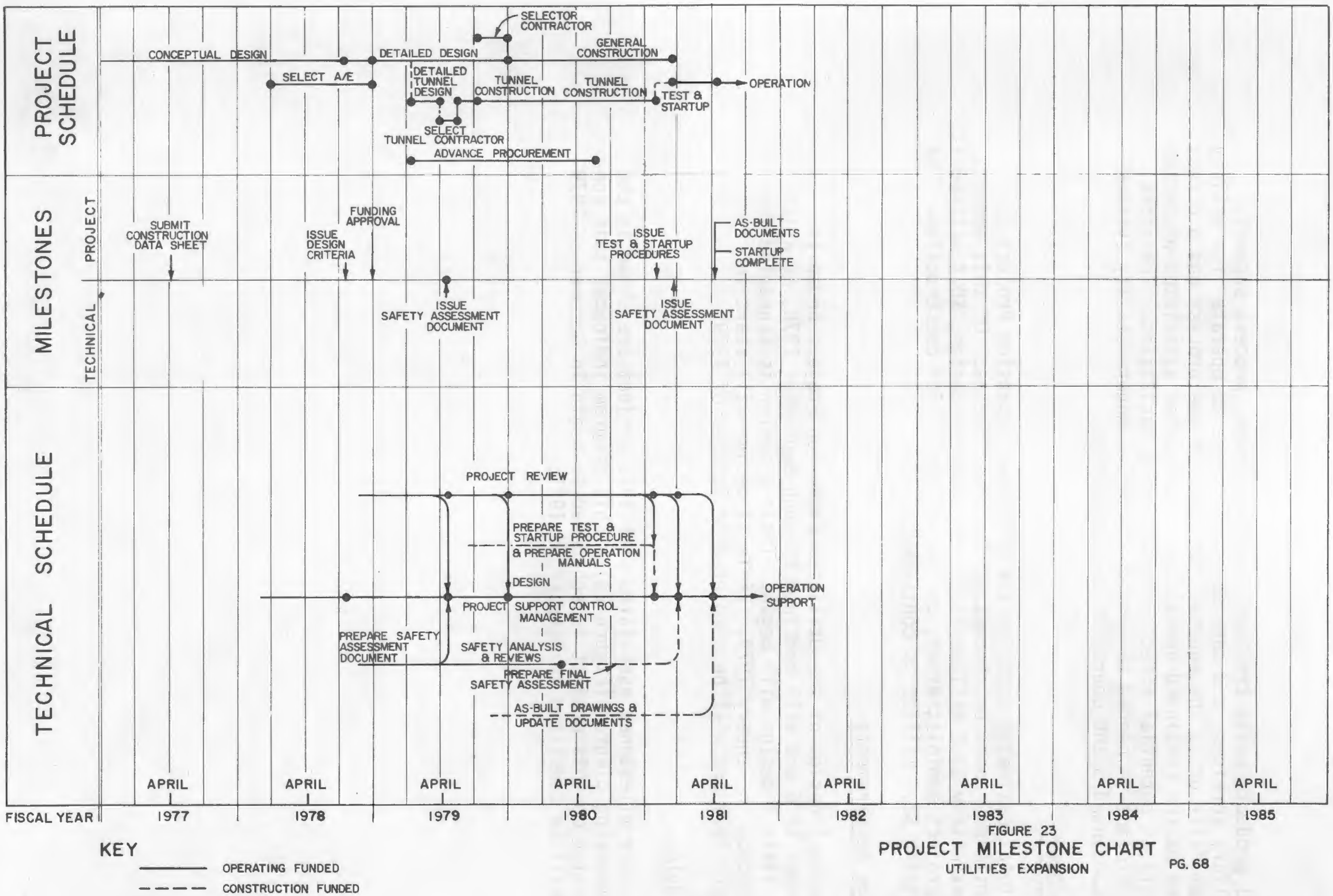


FIGURE 23
PROJECT MILESTONE CHART
UTILITIES EXPANSION

PG. 68

ACC-C-2649

10. 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 modifying the old maintenance building.

The eight plant modifications presently being considered to reduce radiation exposure include: (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 approximately 50,000 square feet of floor space and is sized to house all maintenance functions and related support facilities. The building will contain a maintenance craft area divided into sections for (1) welding, (2) structural fabrication, (3) machining, (4) pipe-fitting, (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, an area for repair and storage of engine-driven maintenance equipment, and a storage area for maintenance supplies.

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

Justification

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

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

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

Cost Data

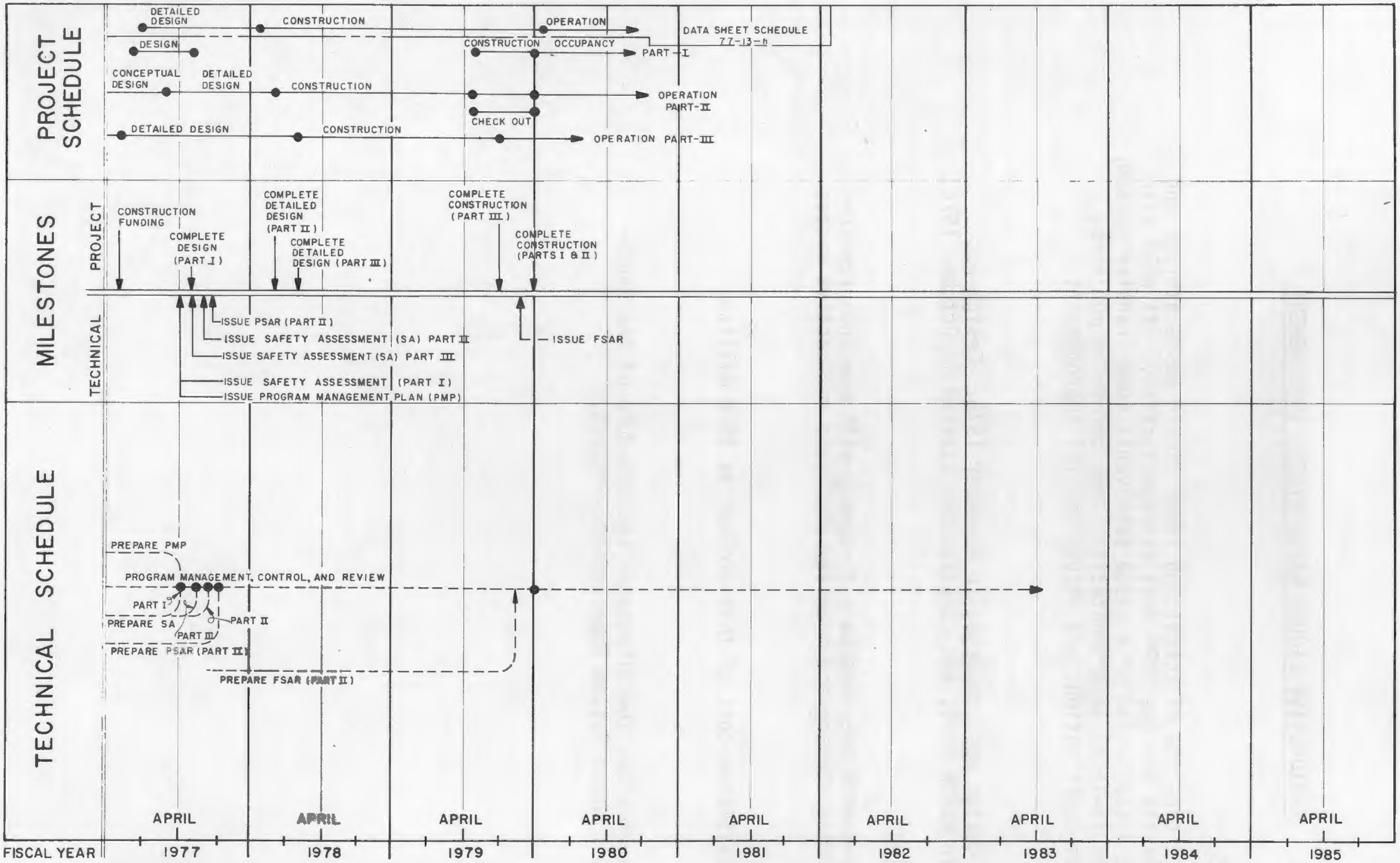
The estimated cost of this project is $10.5 million.

Conceptual Design Requirements

Conceptual design was completed in November 1976.

Schedule

Figure 24 summarizes the milestones and schedule for the Personnel Protection and Support Facility. Design will be complete in February 1978, and all construction will be complete in September 1979.



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

PROJECT MILESTONE CHART
FIGURE - 24
PERSONNEL PROTECTION AND SUPPORT FACILITY
PAGE 71

ACC-S-1085

11. RADIOACTIVE LIQUID WASTE SYSTEM IMPROVEMENT

Description

This project consists of installing added liquid waste storage and pumping capacity for the ICPP fuel storage facility. It will also include the installation of a waste tank vault sump transfer system, improved liquid-level instrumentation, leak detection monitors, valve access modification, and vacuum control improvements.

History

Conceptual design was completed in November 1975. Design was initiated in March 1976, and construction started in October 1976.

Justification

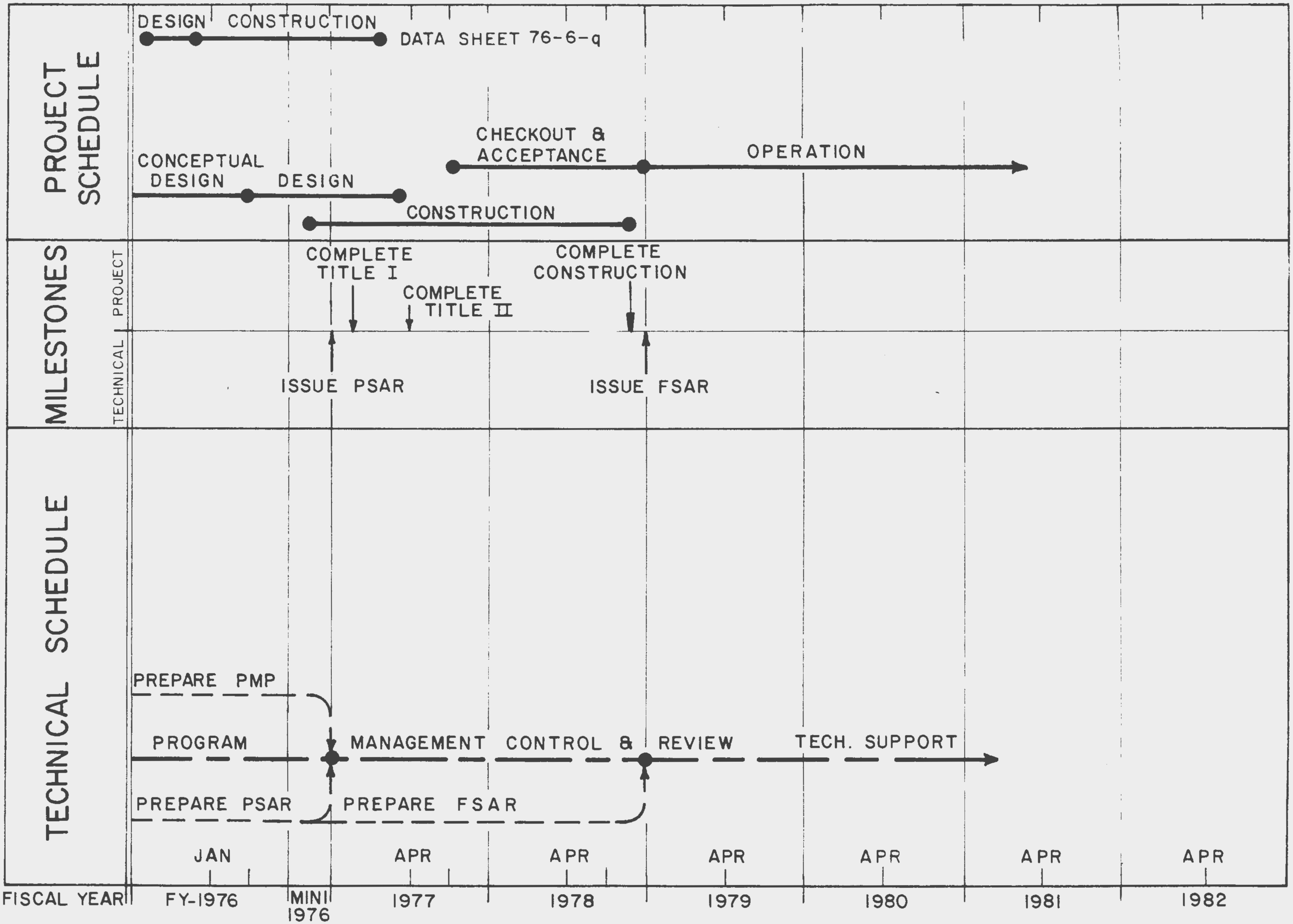
These improvements are necessary to comply with new ERDA requirements regarding storage and transfer of liquid radioactive wastes.

Cost Data

The total estimated cost of this project is $5.8 million.

Schedule

Figure 25 summarizes the milestones and schedule of the Radioactive Liquid Waste System Improvements Project.



ACC-A-2624

RADIOACTIVE LIQUID WASTE SYSTEM IMPROVEMENTS PROJECT

FIG.-25

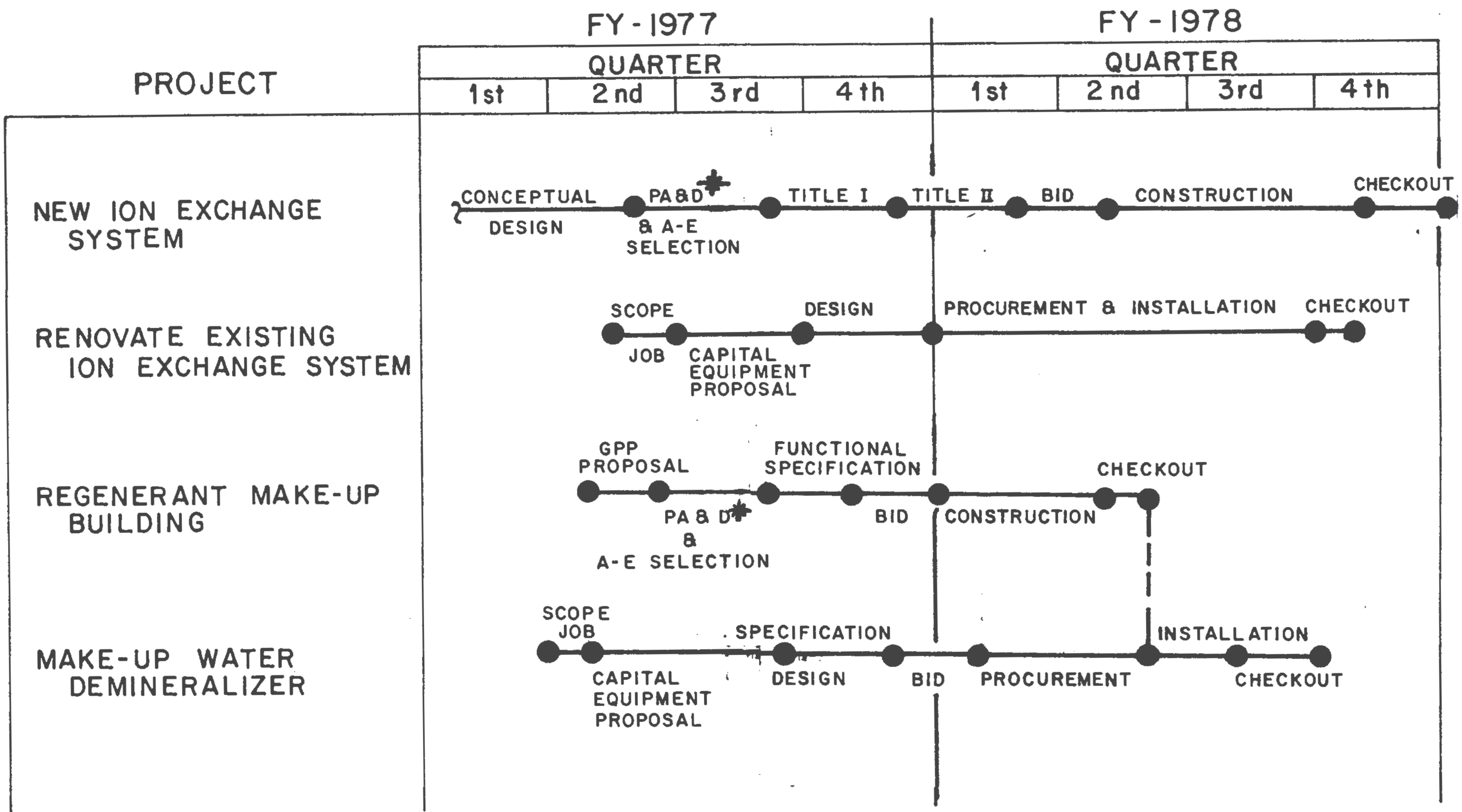
12. CPP 603 BASIN UPGRADE

Because design of a new basin to replace the 25-year-old CPP 603 basin is under way, the CPP-603 Basin Upgrade scope has been reevaluated assuming about a five-year life for the present basin. This reevaluation concluded that the four GPP and capital equipment projects shown in Table XI are essential to satisfactory operation of the facility until the new basin is available. The project schedules are shown in Figure 26. Installation of an ozonation system and a ventilation system is not recommended based on present conditions and improvements in progress. Replacement fuel storage hangers for the North and Middle Basins are on hand and will be installed as needed. Fabrication of 55 additional fuel storage racks for zirconium-type fuel storage in the South Basin is in progress; when the last of these are delivered (about September 1977) a total of 80 racks (1200 positions) will be available for use. Fabrication of about 50 fuel storage buckets is planned using FY 1976 Capital Equipment funds; about 200 additional buckets will be procured in FY 1978. Total conceptual design cost for these projects is $295,000.

TABLE XI

CPP 603 FUEL STORAGE BASIN PROJECTS

Project Name	Funding Source	Funding Amount ($000)	Description
Ion Exchange Upgrade	FY-77 GPP	$600	Provide additional independent ion exchange capacity (~150 gpm) in a new addition to CPP 603
Renovate Existing Ion Exchange System	FY-77 CE	150	Make modifications to the existing system to efficiently use regenerant solution, reduce radiation exposures and increase demineralized water storage capacity for regenerant solution makeup
Regenerant Makeup Building	FY-77 GPP	100	Provide a building to store ion exchange chemicals and permit use of associated chemical handling equipment
Makeup Water Demineralizer	FY-77 CE	100	Provide commercial raw water demineralizer for basin makeup and regenerant solution makeup water.



BASIN UPGRADE SCHEDULE

FIG. 26

* ASSUMES ERDA-ID APPROVAL JUNE 1, 1977; BOTH PROJECTS MAY BE COMBINED.

ACC-A-2647

13. PLANT MODERNIZATION

Description

The Plant Modernization Project consists of replacement of the ICPP stack, improvements to plant process instrumentation and modifications to other functional areas in order to enhance reliability and contamination control measures.

History

Equipment initially installed at the ICPP is now over 25 years old, and the installation allows radioactive solutions to have direct access to areas frequently occupied by personnel. Some instruments have been replaced over the years, and, as a result, the ICPP now has a widely assorted collection of instruments, many of which are outdated. The stack is over 25 years old and has deteriorated.

Justification

The existing ICPP stack is severely corroded and contaminated internally and must be replaced before it becomes a hazard. Plant instrumentation must be improved to reduce radiation exposure by isolating potentially radioactive instrument lines from areas frequented by personnel. The instrumentation systems require modernization to improve quality and reliability of process measurement and monitoring. Instrument improvements may include installation of improved sensing and transmitting equipment. Other contamination control and radiation reduction projects will also be considered for inclusion in the project.

Cost Data

The total estimated cost for Plant Modernization is $10 million. This is an order of magnitude estimate and will require conceptual design to verify.

Conceptual Design Requirements

Conceptual design costs for this project are estimated to be approximately $200,000 in FY 1978 and $500,000 in FY 1979.

Schedule

Tentatively, Title I will start at the beginning of FY 1981.

14. CENTRAL RECEIVING AND WAREHOUSE

Description

The Central Receiving and Warehouse Building will provide space for centralized receipt and transfer of incoming materials, for materials handling and storage, and office space for warehouse personnel. This will be a 25,000 to 35,000-square-foot building of standard warehouse construction, i.e., dock-level flooring throughout, high-bay doors for material transfer, few permanent inner walls, etc. The proposed location of the Central Receiving and Warehouse is on Birch Street, south of the Vehicle Monitoring Facility, to allow easy access from either the white or the blue zone.

Justification

Currently, materials for use at the ICPP are purchased by EG&G and are then delivered to various use points in the CPP area. No one person controls receipt of materials. In some cases, new material must be stored outdoors.

The Central Receiving and Warehouse will allow white delivery trucks to unload materials at one white location and, thus, reduce the risk of contamination spread. All incoming material will pass through one distribution point, which will allow better control and management of material. This facility will prevent weather damage to material that must now be stored outside. In addition, there will be space for storage of sensitive items and controlled storage of material held for future use.

Cost Data

The rough order of magnitude total estimated cost for the Central Receiving and Warehouse Building is $2 million, and will require conceptual design to verify.

Conceptual Design Requirements

Conceptual design costs are estimated to be $160,000 in FY 1978 and $40,000 in FY 1979.

Schedule

Tentatively, Title I design will start at the beginning of FY 1980, October 1979.

15. CALCINED SOLIDS STORAGE BINS PROJECT

Description

These calcined-solids-storage-bin projects provide waste storage bins to safely contain highly radioactive solids from the solidification of high-level liquid wastes. All calcined solids storage bin projects have the same general design and consist of stainless steel storage bins enclosed in a reinforced concrete vault. The stainless steel bins provide the primary containment of the solids and the concrete vault provides secondary containment and radiation shielding. Calcined solids are pneumatically transported to the storage bins and the transport air is returned to the calciner facility. The storage vaults are largely below grade and are anchored to bedrock.

History

At this time, six sets of storage bins have either been completed, are under construction, are being designed, or have a schedule for design. Two sets of bins have been built and are now filled. The third set has been built and is now being filled (~45% full) with calcine from the Waste Calcining Facility. Construction of the fourth set is scheduled to be completed in FY 1977 and will be filled by the NWCF. Advanced conceptual design of the fifth set will be completed in FY 1977, and Title I design will start in FY 1978. Conceptual design for a sixth set will start in FY 1978. Figure 7 indicates a seventh set of bins will be needed in FY 1989 and that funding for this set has been assumed for FY 1985.

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

Bin Set	Approximate Capacity, cu ft	Total Estimated Cost, million $	Scheduled Completion
1,2,3	77,000	-	-
4	17,000	1.8	FY 1977
5	35,000	12.5	FY 1981
6	60,000	25.0	FY 1983
7	65,000	35.0	FY 1988

The estimates for the sixth and seventh sets of bins are rough order of magnitude costs and will require conceptual design to verify.

Justification

All high-level radioactive wastes resulting from fuel reprocessing at the ICPP must be solidified. If fuel processing is to continue at the ICPP, additional calcined solids storage facilities must be provided to satisfy this requirement. As shown by Figure 7, the NWCF will fill the fourth set of bins by the end of FY 1981; thus, the fifth set must be constructed by mid-FY-1982. Then the fifth set will allow the NWCF to continue operating and reducing the liquid waste inventory.

Cost Data

The total estimated cost for the fifth set of bins is $12.5 million for 35,000 cubic feet of storage volume. This cost estimate is based on the conceptual design completed in FY 1976. Advanced conceptual design has continued in the transition quarter and in FY 1977. Due to the higher processing rate of the NWCF, the age of the calcined wastes will be reduced, resulting in higher decay heat generation rates. Because of the maximum allowable temperature limits for stored calcine, the higher decay heat generation rate requires that a modified bin design be used, which increases the cost of the facility.

At this time, the conceptual design of the sixth set of bins has not been started, so an accurate total estimated cost cannot be prepared.

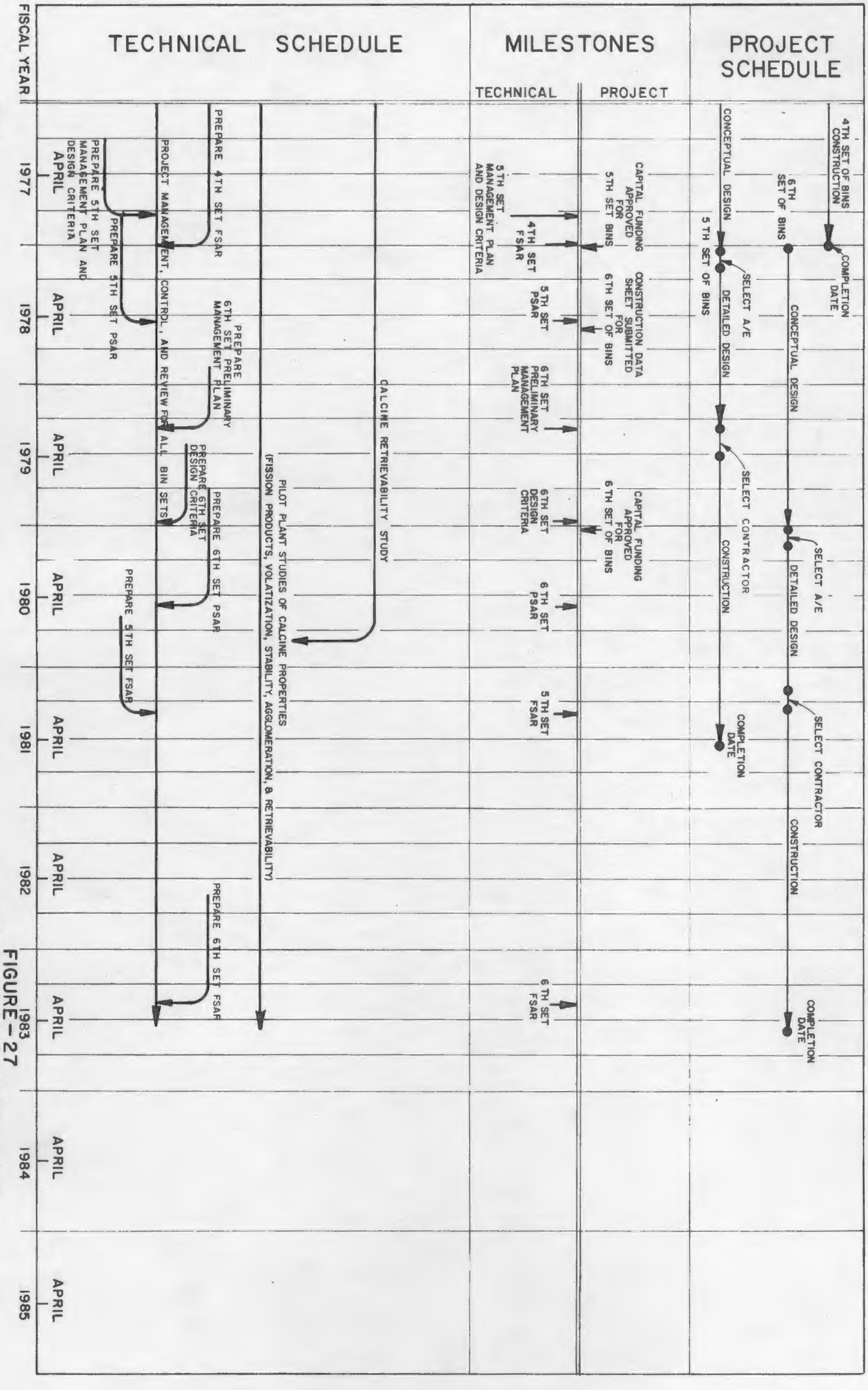
Conceptual Design Requirements

Conceptual design for the fifth set of bins began in FY 1976 and, as of January 1, 1977, $160,000 had been spent. Approximately $113,000 more will be spent in FY 1977 on advanced conceptual design. The advanced conceptual design efforts will better define the government-furnished equipment so that procurement of these items can begin early in the final design.

Conceptual design for the sixth set will begin in FY 1978. Nearly $1.1 million is projected for this two-year conceptual design effort because a new master bin concept is proposed. Remote maintenance may be used for some of the equipment. The sixth set will be designed for higher radioactive decay heat generation rates that will be experienced during the mid-1980s.

Schedule

The project milestone charts for design and construction of the various sets of bins are shown in Figure 27 along with the technical schedule.



KEY:

FIGURE - 27
PROJECT MILESTONE CHART
CALCINED SOLIDS STORAGE BINS
PAGE - 81

ACC-B-2132

VII. PROCESS DEVELOPMENT AND SUPPORT

1. TECHNICAL SUPPORT TO FUEL RECEIPT AND STORAGE

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

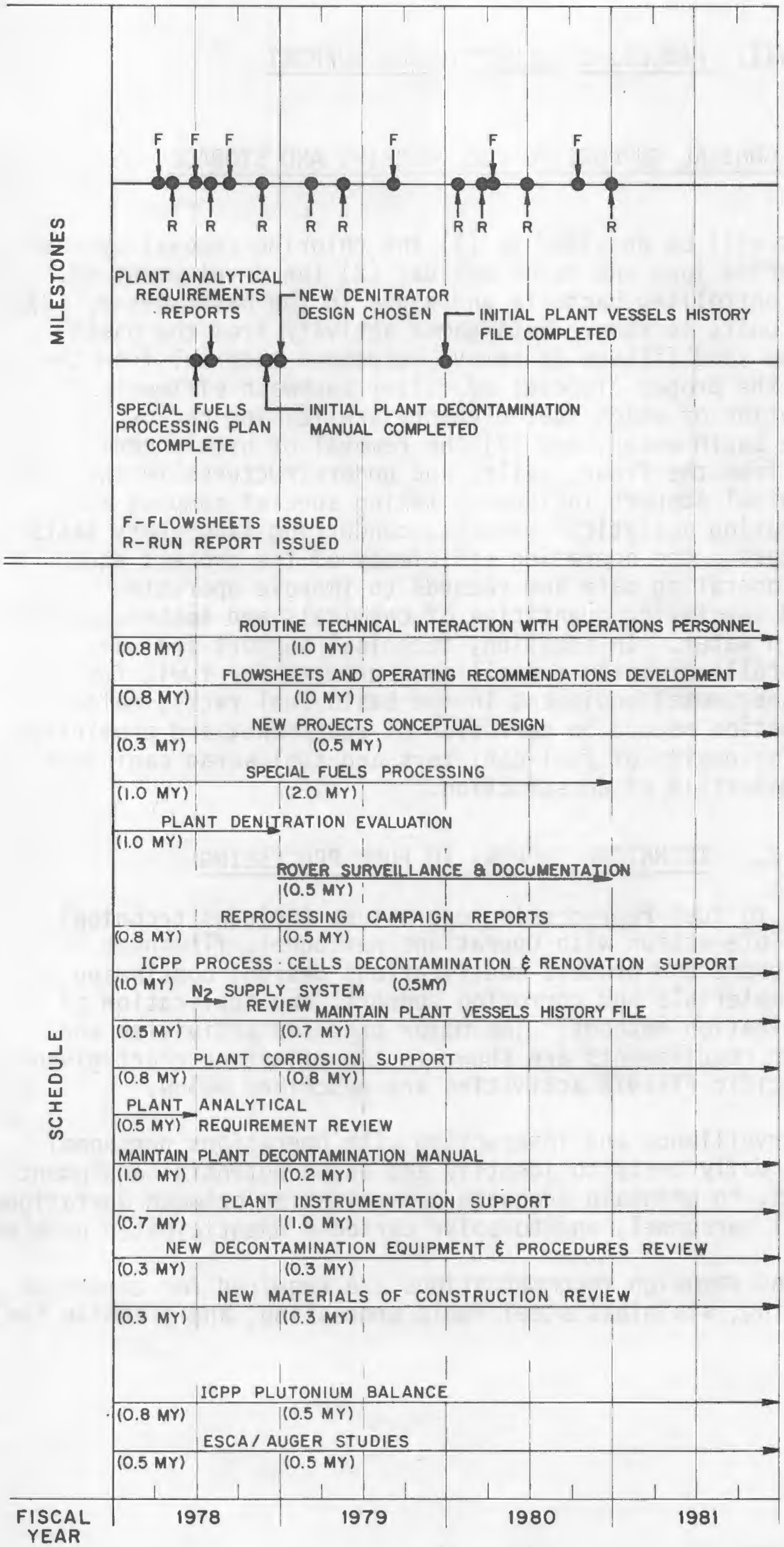
2. TECHNICAL SUPPORT TO FUEL PROCESSING

Technical support to fuel reprocessing operations includes technical surveillance and interaction with Operations personnel, flowsheet development, equipment and process modifications design, continuing safety analyses, materials and corrosion support, and application of improved decontamination methods. The major proposed activities and estimated manpower requirements are shown in the milestone chart given in Figure 28. Specific FY-1978 activities are described below.

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

2. Flowsheets and campaign recommendations are required for zirconium fuel processing, stainless steel fuels processing, and graphite fuels

FIG. 28


MILESTONES
F F F F F F
R R R R R R R R R
PLANT ANALYTICAL REQUIREMENTS REPORTS
NEW DENITRATOR DESIGN CHOSEN
INITIAL PLANT VESSELS HISTORY FILE COMPLETED
SPECIAL FUELS PROCESSING PLAN COMPLETE
INITIAL PLANT DECONTAMINATION MANUAL COMPLETED
F-FLOWSHEETS ISSUED
R-RUN REPORT ISSUED
SCHEDULE
ROUTINE TECHNICAL INTERACTION WITH OPERATIONS PERSONNEL
(0.8 MY) (1.0 MY)
FLOWSHEETS AND OPERATING RECOMMENDATIONS DEVELOPMENT
(0.8 MY) (1.0 MY)
NEW PROJECTS CONCEPTUAL DESIGN
(0.3 MY) (0.5 MY)
SPECIAL FUELS PROCESSING
(1.0 MY) (2.0 MY)
PLANT DENITRATION EVALUATION
(1.0 MY)
ROVER SURVEILLANCE & DOCUMENTATION
(0.5 MY)
REPROCESSING CAMPAIGN REPORTS
(0.8 MY) (0.5 MY)
ICPP PROCESS CELLS DECONTAMINATION & RENOVATION SUPPORT
(1.0 MY) (0.5MY)
N2 SUPPLY SYSTEM REVIEW
MAINTAIN PLANT VESSELS HISTORY FILE
(0.5 MY) (0.7 MY)
PLANT CORROSION SUPPORT
(0.8 MY) (0.8 MY)
PLANT ANALYTICAL REQUIREMENT REVIEW
(0.5 MY)
MAINTAIN PLANT DECONTAMINATION MANUAL
(1.0 MY) (0.2 MY)
PLANT INSTRUMENTATION SUPPORT
(0.7 MY) (1.0 MY)
NEW DECONTAMINATION EQUIPMENT & PROCEDURES REVIEW
(0.3 MY) (0.3 MY)
NEW MATERIALS OF CONSTRUCTION REVIEW
(0.3 MY) (0.3 MY)
ICPP PLUTONIUM BALANCE
(0.8 MY) (0.5 MY)
ESCA/AUGER STUDIES
(0.5 MY) (0.5 MY)
FISCAL YEAR
1978
1979
1980
1981

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

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

4. The Special Fuels Disposal Plan will be finished. This plan will outline all the work required to prepare flowsheets, complete safety analyses, and design equipment modifications for processing or disposal of the fuels at the ICPP. Work described in the plan will be started after completion of the plan and will probably continue through 1980. Fuels located elsewhere in the United States that are compatible with ICPP reprocessing equipment will also be covered under this plan.

5. Scoping studies will be undertaken to provide a basis for developing a new plant denitration system. Designs from other ERDA sites and private companies will be examined to establish the most compatible system for ICPP.

6. Campaign reports for ICPP reprocessing activities from FY 1974 to the present will be published.

7. Several of the ICPP process cells will be decontaminated and renovated in FY 1978. Technical assistance will be provided for decontamination and to design vessel and piping modifications.

8. The ICPP nitrogen gas distribution system will be reviewed and modifications recommended to provide more capacity and a continuous nitrogen gas supply to the necessary systems.

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

10. Routine plant corrosion support will become more substantial beginning in FY 1978 to provide assistance as required.

11. The processing plant analytical requirements will be reviewed to determine areas in which sampling frequencies may be reduced. New operating procedures will be recommended wherever possible.

12. The plant decontamination manual will be revised and expanded to include additional basic technical information, new procedures and plant process systems. Procedures for operating the decontamination facility at the NWCF will be provided.

13. The plant instrumentation support will be increased to provide continuous updating of plant instrumentation. Many areas of the plant are years behind the state-of-the-art in new technology and increasingly stringent regulations for process control are requiring more accurate and dependable instruments.

14. New decontamination equipment and methods are developed each year. An ongoing effort at the ICPP is required to keep abreast of these innovations.

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

16. The plutonium balance study for the ICPP will be continued through FY 1978. Process modeling, hazards analyses, plutonium pathways to operating personnel, and equipment modifications design will be included in this study.

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

Projected Costs and Man-Years

	Fiscal Year			
	1978	1979	1980	1981
M-Y	11.1	10.3	10.3	7.8
$K	1,080	1,200	1,150	1,150

3. TECHNICAL SUPPORT TO THE WCF

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

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

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

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

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

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

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

	Projected Costs and Man-Years						
	Fiscal Year						
	1977	1978	1979	1980	1981	1982	1983
M-Y	3.9	7.1	10.6	11.5	11.5	11.5	11.5
$K	175	370	600	650	650	650	650

Milestone List

Milestones		Dates
1.	Determine corrosion rate due to Cl^-	Sept. 1977
2.	Determine feasibility of ignition below 365° C	Sept. 1977
3.	Issue H-6 Campaign Report	Oct. 1977
4.	Issue H-7 Campaign Report	Oct. 1977
5.	Begin sampling WCF off-gas	Sept. 1977
6.	Update WCF computer program	Sept. 1977
7.	Issue H-8 Campaign Report	Sept. 1978
8.	Issue H-9 Campaign Report	Sept. 1979
9.	Issue H-10 Campaign Report	Sept. 1980
10.	Begin NWCF support	4th Qtr. 1980

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 with milestone dates based on planned funding levels.

1. Plant Contamination Source Identity and Reduction		
	a. In-plant decontamination program, 6-man decontamination crew	FY-77 & -78
	b. CPP 603 cleanup program	FY-77
	c. Survey and recommend outside area cleanup	FY-77
	d. Extend monitoring to all ICPP effluent points	FY-78
2. Personnel Monitoring and Contamination Control		
	a. Personnel self-monitoring	90% complete
	b. Red/White/Blue program implementation to provide close contamination control	80% complete
3. Effluent Monitoring and Reduction		
	a. Monitor major effluent contributors to the stack	FY-78
	b. Install H-3, I-129 samplers and Sb-127 and Kr-85 real-time monitors to stack	FY-77
	c. Add computerized processing of real-time effluent monitoring signals	FY-77 & -78
4. Personnel Radiation Exposure Control and Reduction		
	a. Reduce total plant exposure by improved preplanning and execution of radiation jobs	CY-77

	b. Restrict individual exposures to less than 3 rem	CY-78
	c. Initiate an aggressive ALARA program	CY-77
5.	Personnel External Dosimetry	
	a. Develop and implement improved personnel dosimeter	FY-78
	b. Develop improved portable survey instrumentation	FY-78
	c. In-plant computer processing of personnel dosimetry records	90% complete
6.	Personnel Internal Dosimetry	
	a. Initiate improved in-plant air sampling programs for long-lived beta and alpha emitters	FY-78
	b. Implement bioassay routine program	FY-77
	c. Computerize internal dosimetry documentation	FY-78
7.	Environmental Monitoring	
	a. Establish an outside air sampling array	FY-78
	b. Establish a sampling and analytical program to document environmental levels resulting from ICP operation	FY-78 & -79
8.	Emergency Response	
	a. Upgrade emergency response, supplies, and equipment	FY-78
	b. Improve emergency training exercises	FY-78
9.	Training and Quality Control	
	a. Upgrade HP technician training	FY-78
	b. Upgrade HP professional training	FY-78
	c. Upgrade plant personnel safety training	FY-78

10. Procedures

a. Revise and update current safety procedures FY-77

b. Produce an HP manual FY-77

11. Shipping

a. Improve shipment contamination control 90% complete

b. Improve survey instrumentation FY-78

Safety Review Document

The Safety Review Document (SRD) will be completed during FY 1978 with effort gradually switching to incorporation of existing Safety Analysis Reports into the SRD format. When completed, the SRD will be a complete safety analysis of all ongoing facilities and processes within the ICPP, including old and new projects. A continuing effort to maintain and update the SRD will be provided each year, beginning in FY 1978.

5. KZ RESEARCH AND DEVELOPMENT--FUEL PROCESSING

The manpower and operating costs for the KZ Special Materials Production efforts in the area of processing R&D are given in the following table. These programs provide for improvements in existing ICPP process beyond the scope of direct plant support and for development of new production processes for the ICPP. Processing R&D presently involves three programs: (1) ICPP Process Development, I-7; (2) Advanced Graphite Fuels Reprocessing, I-9; and (3) Waste Transfer Systems, I-208. Design verification and flowsheet optimization for the Fluorinel Process are the major tasks in ICPP Process Development, I-7. The Advanced Graphite Fuels Reprocessing Program (I-9) will be terminated at the end of FY 1977. The remaining design verification and process support work for the Rover process will be handled by the ICPP Process Development Program (I-7). The Waste Transfer System Program (I-208) is directed to the preparation of criteria for buried-pipeline transfer of radioactive liquid wastes. In FY 1979, this program will only involve the long-term monitoring of underground corrosion specimens. The Waste Transfer System Program (I-208) will be terminated, and this work will be continued by the ICPP Process Development Program (I-7).

KZ, Special Materials Production

Project Title		Fiscal Year 1977	1978	1979	1980	1981	1982	1983
ICPP Process Development, (I-7)	(Men)	8	13	12	12	12	12	12
	($K)	375	625	600	600	600	600	600
Advanced Graphite Fuels Processing (I-9)	(Men)	4	*					
	($K)	200						
Waste Transfer Systems (I-208)	(Men)	1.9	2.0	*				
	($K)	100	105					

*Effort will continue under the ICPP Process Development Program (I-7).

6. KZ RESEARCH AND DEVELOPMENT--WASTE MANAGEMENT

ICPP Waste Management Development (I-8)

The major tasks for the I-8 program during the period FY 1977 through FY -1983 are: (1) calcination flowsheet development for Rover, sodium-bearing, electrolytic, Fluorinel, and, possibly other wastes; (2) calcination equipment and process improvement studies; and (3) development of an alternate method for solidifying high-sodium wastes.

	Fiscal Year						
	1977	1978	1979	1980	1981	1982	1983
Men	9	10	11	11	11	12	12
$K	415	470	570	610	670	700	700

VIII. CONCLUSIONS

1. Satisfactory progress of the Multiple Fuels Processing Program in FY 1978 requires funding of $24.18 million for production, $53.5 million of obligational authority for capital facilities and equipment, and $0.5 million for reactor product purchase.

2. Funding will be needed for the MFPP in FY 1979 as follows:

Production	$29.86 million
Capital	$106.2 million
Reactor Product Purchase	$0.8 million

3. The Utilities Expansion requires funding in FY 1979. The total estimated cost is $12 million. Expansion of capacities and replacement of some deteriorated systems are imperative.

   Also, initial funding will be needed for the Plant Analytical Chemistry Building in FY 1979, which has a total estimated cost of $15.5 to $17 million. Any delay in funding would be highly undesirable due to the critical need for laboratory space at the ICPP.

4. Recovery of the fissile products in the scheduled reactor fuels will be highly profitable for the government. Relative to the Irreducible-Expenditure Case, the profitability of operation as projected in the Baseline Case would be as follows:

	Millions of Dollars From FY 1978 - FY 1989, Inclusive	
	Not Discounted	Present Value in FY-78 (discounted @ 10%)
Value of Incremental Product	700.4	417.2
Incremental Processing Cost	288.4	184.7
Incremental Net Cash Flow	412.0	232.5

5. Performance of the WCF is expected to control fuel processing until the NWCF is started up. Any delay from the planned July 1980 NWCF hot startup date would reduce the present value of products and the present value of net cash flow.

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12. Letter, J. P. Hamric to F. H. Anderson, "Fuel Receipt Forecasts, FY 1978 - FY 1989," March 17, 1977.

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APPENDIX A

MISSION AND OBJECTIVES

Mission of ICP

General: To produce results satisfying the needs of ERDA'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 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 ERDA channels.

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

7. To use overall ERDA 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 continue 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 ERDA action.

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

13. To make maximum use of reprocessing technology developed at all ERDA 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 1979 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 1978 through FY 1989. Last year the period was FY 1977 through FY 1988.

2. Fuel receipts are as specified by ERDA.[12] The fuel numbers and process numbers are identified in the Materials Management Plan, a classified document.[10] Total receipts projected for the FY-1978-89 study period are about 14% (1800 kg U-235) below those projected last year for the FY 1977-88 period. Large increases in Fuels 13, 26, 27, and 28 (2365 kg U-235) are more than offset by large decreases in Fuels 2 and 4 and smaller decreases in Fuels 3, 8, 16, 17, 18, 22, and 23. Fuels 31 and 32 are excluded from this analysis; they were not shown last year and they are scheduled for receipt and storage only.

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 3, 9, 13, 15, and 21 and in waste rates for Fuels 1, 3, and 4. The processing rates are expressed in kg U-235 per flowsheet day. The conversion between flowsheet days and calendar days shown in Figures 1, 2, 3, and 4, and Tables I and II 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 U-235 in aluminum fuel to 1 kg of U-235 in zirconium fuel. Fluorinel coprocessing, which was not assumed last year, employs a ratio of 2.5 to 1.0.

5. Processing of Rover fuel will begin on July 1, 1979. This is a 22-month delay from the prediction made last year.

6. Of the 12 large (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 285,000 gallons, allowing 15,000 gallons (5%) for dilution during emergency transfer to the safety spare tank. In

TABLE B-1

FUEL PROCESSING RATES AND WASTE GENERATING RATES

Fuel No.	Special Applica-bility Dates	Kg U-235 per Flow-sheet Day* Before 2nd Crew Expansion	After 2nd Crew Expansion	Waste, gal/kg U-235 Non-Fluoride	Fluoride	Low Heat
1	None	9.4	13.0		270	10
2	None	13.0	20.0	145		10
3	None	4.4	5.1		850	10
4	None	12.0	20.0	60		15
5	None	2.5		100		10
6	None	15.0		90		10
7	None	5.0		100		10
8	None	37.0	37.0			20
9	<9-80	6.3			40	10
9	>9-80	10.0			40	10
10	None	37.0	37.0	350		10
11	None	1.1	1.4		1800	60
12	None	5.0	5.5		225	10
13	None	7.0	9.0		350	10
14	None	1.8	2.4		670	35
15	None	5.7	7.0		575	10
16	None	2.7	3.2		400	100
17	None	7.3	11.0		145	35
18	None	24.0	37.0		45	10
19	None	30.0	30.0	80		10
20	None	Not Applicable	Not Applicable		Not Applicable	
21	None	7.0	9.0		350	10
22	None	0.96	1.44		1100	280
23	None	2.03	3.04		530	130
24	None	4.0	4.5	350		10
25	None	13.0	20.0		180	10
26	None	7.8	10.0		350	10
27	None	7.0	9.0	350	350	10
28	None	7.6	10.0		350	10
29	None	37.0	37.0		350	10
30	None	4.4	5.1		850	10
31	None	Not Applicable	Not Applicable		Not Applicable	
32	None	Not Applicable	Not Applicable		Not Applicable	
33	None	37.0	37.0		350	10
34	None	37.0	37.0	80		10
35	None	8.0	10.5		230	10

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

addition, 300,000 gallons of space in the remaining waste tanks is usually maintained to permit continued fuel processing after a leak has occurred. This "operating spare volume" will be used in order to increase product recovery. The planned use of the operating spare volume is a change from last year's policy.

7. Mixed calcining of fluoride and low-heat wastes at a 3:1 ratio will start February 1, 1978. Last year, this mixed calcining was to start July 1, 1976.

8. Projected radioactive liquid fluoride waste inventories, as shown in Figure 6 and Table II, include the waste from first-cycle extraction of Rover fuel. This low-activity waste will actually be stored in Tanks WM-103 to -106, which are not normally used for radioactive waste storage. The Rover waste will be calcined in a 1:1 ratio with other fluoride waste as soon as possible after generation so as to minimize the storage period. Last year, Rover waste was assumed to be treated like other fluoride wastes.

9. Miscellaneous wastes are assumed to total 3,550 gallons per month (42,600 gallons per year). Last year, 25,000 gallons per year was assumed. Miscellaneous wastes are mixed with the low-heat wastes from third-cycle extractions.

10. The first calcining of stainless steel wastes will be done in FY 1981. Nonfluoride waste is nearly all composed of stainless steel wastes.

11. Liquid-to-solid ratios assumed for calcining of the wastes are as follows: nonfluoride - 13.4:1, fluoride - 6.3:1, fluoride-low-heat, 3 to 1 mix - 6.6:1. In the Irreducible Expenditure Case, some of the low-heat waste must be calcined alone; addition of chemicals is assumed required; this reduces the liquid-to-solid ratio by a factor of 4, to 1.65. In calcining of the typical ending waste inventory assumed in calculating the waste adjustment costs (see Assumption 17), some low-heat waste is assumed calcined at this low ratio. All these ratios include allowance for the dolomite used in calciner startups. Last year, the nonfluoride ratio was 8.3; reevaluation of stainless steel waste composition indicated the increase to 13.4.

12. Line-item capital costs are consistent with those reported in long-range budget projections with certain exceptions: The Advanced Waste Treatment and the Calcine Retrieval and Packaging Projects are excluded, and several project costs were revised.

13. Capital expenditures are depreciated as follows:

a. Line items (other than calcine storage) at 10% per year after the last year of funding. An exception was made for the Fluorinel and Fuel Storage Facility Project, which will be officially funded last in FY 1979. Because cold testing of the facility will not start until FY 1981, $10,000 was shifted from FY 1978 to FY 1980 so that depreciation would start in FY 1981 instead of FY 1980.

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

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

d. Calcine storage -- only for space used.

14. Discounting will begin in FY 1979, i.e., all present valuing will be to FY 1978. Last year, discounting began in FY 1978.

15. Hot operation of the NWCF will begin on July 1, 1980.

16. Hot operation of the Fluorinel process will begin October 1, 1981; this is a delay of one month from last year.

17. A waste adjustment charge is added in post-FY-1989 in each cash flow analysis to reflect and to normalize unequal waste inventories which unavoidably occur at the end of FY 1989 for the various processing schedules. This cost or normalizing factor is necessary since a premise of this study requires that all liquid waste must be converted to solid calcine for long-term storage. The waste adjustment costs amount to $19.00 per gallon of fluoride wastes, $13.50 per gallon of nonfluoride wastes, and $22.00 per gallon of low-heat (second- and third-cycle and miscellaneous) wastes; these costs include both calcining and solid storage costs for the wastes. All costs in the post-FY-1989 column were assumed to occur in FY 1990 for discounting purposes. The waste adjustment charge was assumed to be zero in the Irreducible-Expenditure Case. Respective waste adjustment costs last year were $14.68, $13.84, and $13.54. The increase results from estimated increases in operating costs and in capital costs for calcine storage bins.

18. The unit values of U-235 are as follows.[13]

Fiscal Year	U-235 Value ($/g) This Year	U-235 Value ($/g) Last Year
1977	37.95	31.37
1978	39.99	32.38
1979	43.06	33.40
1980 and there-after	45.35	34.41

19. In the simulations, additional personnel that would allow concurrent operation of the headend and tailend parts of the fuel processing were added with timing optimized for maximum present value of net cash flow. The cost of these personnel is estimated to be $2,000,000 per year ($166,667 per month). 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.

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

21. Several factors or characteristics that influence the planning for an ICPP operating schedule are:

    (a) Waste inventory limits
    (b) Fuel storage limits
    (c) Fuel processing and waste calcining rates
    (d) Fuel and process availabilities
    (e) Waste generation rates
    (f) Economic and product delivery objectives, benefits, costs, budgets
    (g) Radiation exposure considerations
    (h) Uncertainties in predicting the exact nature and timing of future events; e.g., the date of Rover process availability or the volume of waste to be generated in processing one unit of new fuel or the quantities of fuels that will require storage.

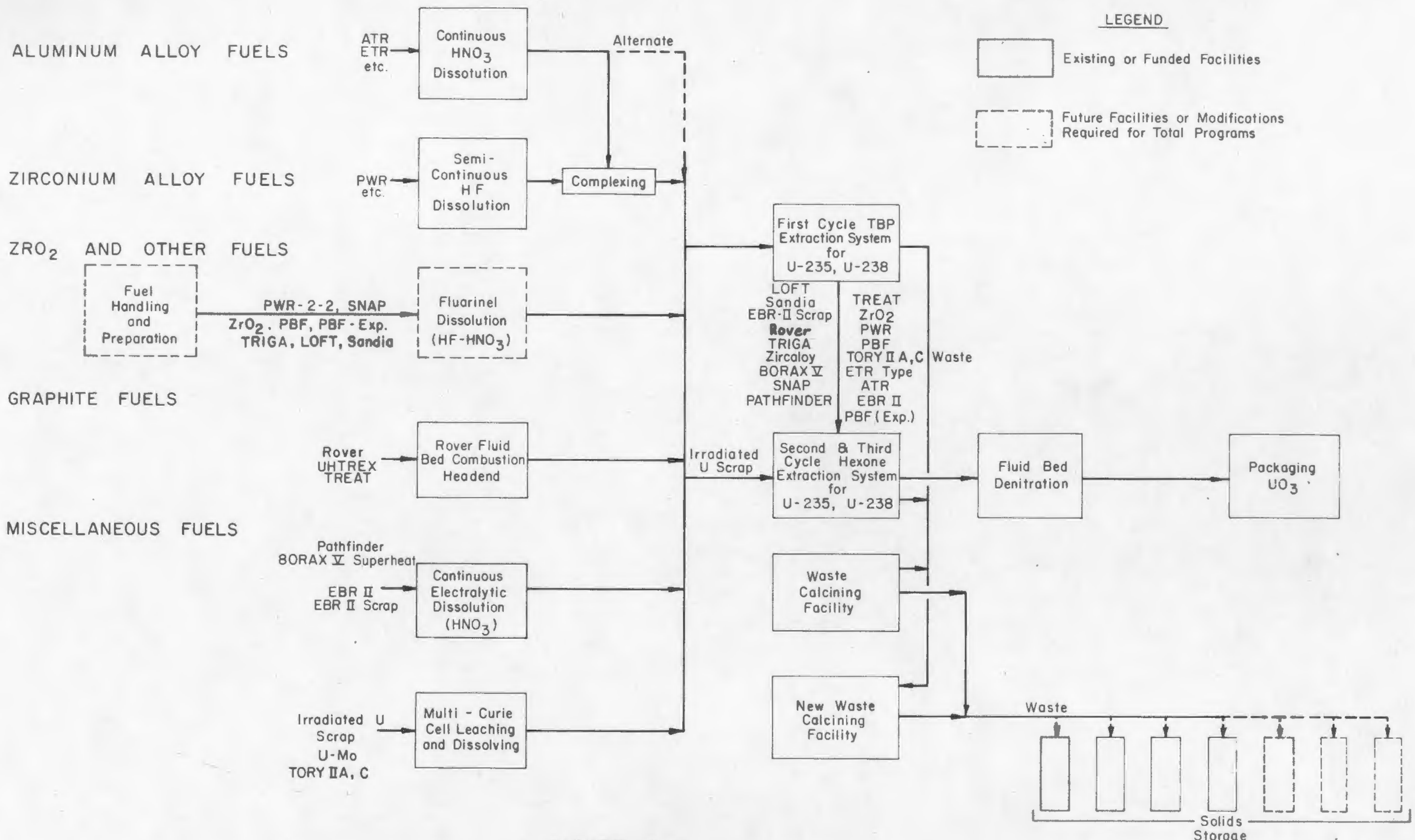


FIGURE C-1

PROCESSING SCHEMES FOR FUELS INVOLVED IN THE MULTIPLE FUELS PROCESSING PROGRAM

APPENDIX C

APPENDIX D

IMPROVEMENTS IN COMPUTER SOFTWARE FOR MFPP SIMULATION AND ANALYSIS

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

(1) The capacity of program was increased from 30 to 50 fuels in order to delineate more fuels.

(2) Minimum campaign lengths were set for each production process after the production dictation period has ended.

(3) The number of fuels that can be coprocessed was increased from one to three.

(4) Software was revised to allow CPPSIM to operate on the CDC 7600 Computer.

APPENDIX E

MAJOR FY 1977 ACCOMPLISHMENTS

The purpose of this appendix is to compare actual results for the first six months of FY 1977 with the plans for FY 1977 presented in the FY 1976 Supplement Document for the MFPP.

Plant operation and major KZ-funded programs are examined. The following tabulation summarizes fuel processing and waste calcining.

	Planned for FY-77 in FY-78 Budget Case	Actual through 5/26/77	Revised Estimate
Fuel processing, kg U-235	1387	700	1247
Net liquid waste calcining, gal	217,000	65,000	110,000

The revised fuel processing estimate has been reduced for the following reasons:

(1) 142 kg of Rover fuel was projected; no Rover fuel will be processed until at least FY 1979.

(2) A reduction of Fuel 4 from 290 to 242 kg because of reduced shipments from Argonne National Laboratory - West.

(3) An increase in custom fuel is planned to partially offset the reductions in the aforementioned fuels.

The waste calcining projection is much lower because of many problems with the calciner. Seven months of decontamination and maintenance is needed to prepare the calciner for startup in September in 1977. The operating problems that have caused the reduced calcining projection are:

(1) Plugging of the transport air-line system

(2) Transport air-line erosion and subsequent spilling of solid calcine

(3) Bypass slide valve corrosion

(4) Excessive vibration of the APS process off-gas blower

(5) Plugging of some feed nozzles

(6) Reduced net throughput rate

All goals for the Metal-Clad Fuel Storage Facility--issue conceptual design plan, complete conceptual design, issue design criteria document, and issue project management plan--were completed on schedule.

The Fluorinel Process goal of completing Title I design review was rescheduled to December 1977 due to a change in the program.

Both goals for the New Waste Calcining Facility--start Title II review and start construction--were accomplished on schedule.

The goal of completing construction of Part I of the Liquid Waste System Improvement Project by the end of the fiscal year is on schedule.

Status of goals for the Waste Management Program is:

(1) Verify proposed Rover waste calcining flowsheet.
COMPLETED ON SCHEDULE

(2) Verify backup Rover waste calcining flowsheet and determine operating parameters.
ON SCHEDULE

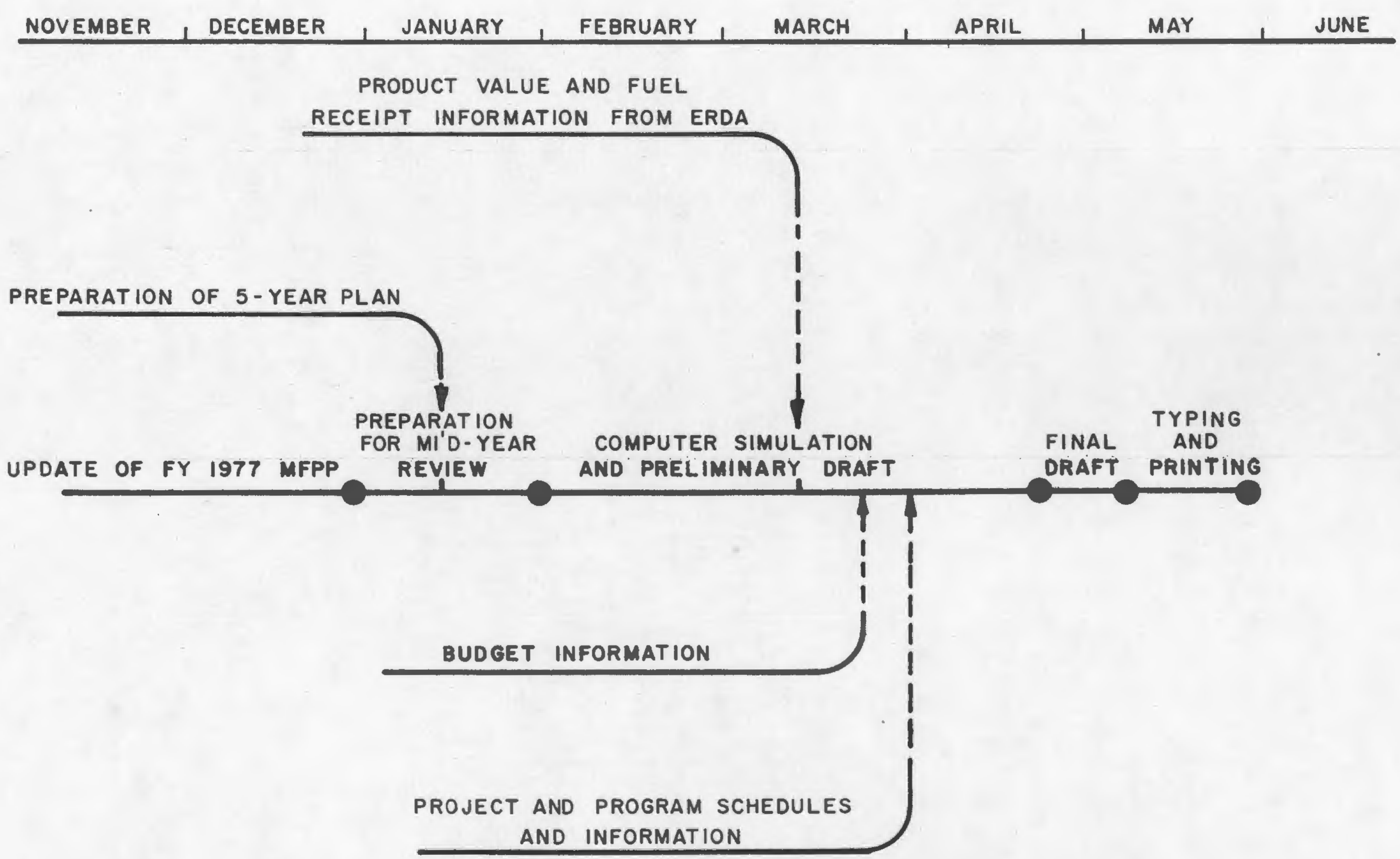
(3) Complete small-scale testing of proposed waste calcining flowsheet for nonfluoride waste.
ON SCHEDULE

(4) Complete survey and evaluation and determine most promising method for management of ICPP sodium-bearing wastes.
ON SCHEDULE

Facility construction for the Rover Project was not completed. Major design deficiencies have been identified. Therefore, construction completion has been rescheduled to October 1978, and startup with unirradiated fuel, to July 1979. The only two goals for FY 1977 are to begin Title I design in June 1977 and to begin Phase I (punchlist items from the original design) construction in June 1977. Both of these goals are on schedule.

APPENDIX F

PLAN FOR PREPARATION OF FY 1978 MFPP



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