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FY-1985 ISSUE ENVIRONMENTAL, SAFETY AND HEALTH PLAN

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ENVIRONMENTAL, SAFETY AND HEALTH PLAN

FEED MATERIALS PRODUCTION CENTER

NLO, Inc.

FY-1985 ISSUE

ENVIRONMENTAL, SAFETY AND HEALTH PLAN

for the

U. S. Department of Energy
Feed Materials Production Center
Fernald, Ohio

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October 1, 1984

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1.0 EXECUTIVE SUMMARY

The FMPC employs a wide variety of chemical and metallurgical process steps to produce uranium metal used in DOE programs at the reactor sites and elsewhere. NLO, Inc. is the contract operator of the site and is administratively responsible to the Oak Ridge Operations Office of the DOE. Interruption of any of the complex operations because of environment, safety or health reasons could result in serious cost-and-demand consequences for the various programs supported by the FMPC.

This initial Environmental, Safety and Health Plan addresses the improvements needed at the FMPC from FY-1986 through FY-1990. It was compiled from submissions by the Engineering, Health and Safety, Production and Technical Divisions. Specific projects in the areas of:

- Water Pollution Control
- Waste Management
- Atmospheric and Other Environmental Discharges
- Health and Safety
- Emergency Preparedness
- Research and Development

comprise the Five-Year Improvement Plan presented in Section 5. These projects were identified by applying the regulations, standards and DOE-guidance stated in Section 4 to the existing conditions of Section 3. General site information is presented in Section 2. Also, the planning addresses the need to make disposition of the current inventory of thorium materials - either for shipment offsite or conversion to usable products. Projects that will be needed beyond FY-1990, are listed to give visibility to extended long-range work to be done. Regulatory and attitudinal changes could advance certain projects into the five-year planning period.

A summary of capital requirements for planned environmental, safety and health projects is presented in Table 1-1. Projects totaling nearly $151 million are required. Of this amount, $85 million will be needed during the five-year period. Capital funding requirements fluctuate - reaching nearly $30 million in FY-1988, and falling below $5.0 million in FY-1990. In order to levelize funding and engineering support, some projects may require shifting into FY-1987 and/or FY-1990. Operating costs are summarized in Table 1-2, and will increase from the $6.0 million level in FY-1986, to more than $17 million/year by the end of the five-year period.

Water pollution control projects amount to $5.6 million during the period, and will be directed toward the containment of uranium-bearing streams within the production complex. Following completion of the Water Pollution Control Project No. 83-D-146, improvements will be made in the quality and volume of liquid effluents. Annual operating costs of $900,000 are required for the new water pollution control system.

TABLE 1-1
SUMMARY OF CAPITAL REQUIREMENTS
(In $1,000's)

Projects	Type of Funds	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Water Pollution Control	LI	3,500	0	0	0	0	3,500	0
	GPP	2,000	1,000	200	250	250	300	0
	CE	100	100	0	0	0	0	0
Total Capital		5,600	1,100	200	250	250	3,800	0
Waste Management, Current Generation	LI	18,000	17,000	1,000	0	0	0	0
	GPP	675	0	600	25	25	25	0
	CE	60	0	60	0	0	0	0
Total Capital		18,735	17,000	1,660	25	25	25	0
Waste Management, Accumulated Wastes	LI	66,000	0	0	0	0	0	66,000
	GPP	350	350	0	0	0	0	0
	CE	10	10	0	0	0	0	0
Total Capital		66,360	360	0	0	0	0	66,000
Waste Management, Hazardous & Conventional	GPP	246	71	175	0	0	0	0
Reducing Atmospheric & Environmental Discharges	GPP	620	0	620	0	0	0	0
	CE	9,135	335	5,600	3,200	0	0	0
Total Capital		9,755	335	6,220	3,200	0	0	0
Health & Safety	LI	45,500	0	0	25,500	20,000	0	0
	GPP	4,173	1,548	500	875	500	750	0
	CE	290	245	5	40	0	0	0
Total Capital		49,963	1,793	505	26,415	20,500	750	0
Emergency Preparedness	GPP	180	30	100	50	0	0	0
	CE	150	150	0	0	0	0	0
Total Capital		330	180	100	50	0	0	0
GRAND TOTAL		150,989	20,839	8,860	29,940	20,775	4,575	66,000

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TABLE 1-2
SUMMARY OF OPERATING COSTS
(In $1,000's)

Projects	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990
Water Pollution Control	4,950	650	1,100	1,300	1,000	900
Waste Management, Current Generation	16,940	2,800	3,010	3,510	3,710	3,910
Waste Management, Accumulated Wastes	213,780	650	840	935	1,045	9,810
Waste Management, Hazardous & Conventional	80	0	20	20	20	20
Reducing Atmospheric and Environmental Discharges	267	62	30	125	50	0
Health & Safety	11,800	1,750	1,800	1,900	1,750	2,750
TOTAL	247,807	5,912	6,800	7,790	7,575	17,390

Waste management projects are subdivided into three categories: current generation radioactive wastes, accumulated wastes and hazardous/conventional waste materials. Funding of $17 million for the LLWPS System will be required in FY-1986, for the conversion of current generation low-level radioactive wastes to a dry form suitable for shipment offsite. The principal accumulated waste project will be the removal of tailings from Silos 1, 2 and 3 for shipment offsite, costing $26.5 million in operating costs beginning with $200,000 annually during the five-year plan period. Operating costs will increase significantly beyond FY-1990. Pit mining will require $66 million in capital beyond FY-1990.

Capital requirements for hazardous/conventional waste disposal facilities will be $246,000 during the plan period. Minor operating expenses will be incurred.

The major project planned for reducing atmospheric and other environmental discharges is the installation of HEPA filters at fourteen discharge points, requiring $8.8 million. The remainder of fifty-six filters will be provided through the Productivity Retention Project, Packages III and IV. Two projects for reducing uranium in offsite wells and at the edge of the production area will cost $620,000 in capital funds in FY-1987. Funds of $275,000 will be required in FY-1986, for reducing NO_x discharges to the atmosphere.

Several projects are required to meet the ALARA objective for reducing radioactive exposures to personnel. The modernization of building exteriors and interiors will cost $25.5 million in FY-1988. Another $20 million will be needed in FY-1989, for improving materials handling in all plants. Nearly $5.0 million will be required for General Plant Projects for safety upgrades of facilities. Operating costs of $11.8 million will be needed for the removal of surplus facilities and asbestos from pipe.

Capital funds of $330,000 will be required for emergency preparedness projects for responding to environmental and safety incidents. These projects are for upgrading the Emergency Operations Center and obtaining an atmospheric dispersion modeling system.

The goals and objectives of nine specific research and development projects for overcoming environmental and safety concerns are outlined in Section 5-6.

Plans for processing thorium materials are covered in Section 5.7. About half the present inventory of 1087.3 metric tons thorium will be drummed for offsite disposal. Most of the remaining inventory will be processed to a usable form for sale to private industry, and will require $500,000 for facilities. Operating funds of $500,000 will be required for either drumming for offsite disposal or processing to a usable form.

It should be recognized that a successful planning document is not an end in itself; but is a management tool for implementing needed improvements. This initial plan represents a good start for identifying the long-range environmental, safety and health needs of the FMPC. It may take several years of evolution to fully define and prioritize our needs in these areas.

2.0 INTRODUCTION

2.1 Site History

The Feed Materials Production Center (FMPC) began in the late 1940's when the United States Atomic Energy Commission (AEC) initiated a long-term plan to establish an in-house integrated production complex for processing uranium and its compounds from natural uranium ore concentrates. In 1951, NLO, Inc. (formerly National Lead Company of Ohio), a subsidiary of NL Industries (formerly the National Lead Company), New York, entered into contract with the AEC to operate the FMPC, located at Fernald, Ohio. Fernald is approximately twenty miles northwest of downtown Cincinnati near the communities of Miamitown and Ross, Ohio as shown in Figure 2-1. Construction activities began early in 1951, and the entire site was operational by the end of 1954. Operations are administered through the Oak Ridge Operations (ORO) Office of the United States Department of Energy (DOE).

2.2 Regional Overview

The population centers, distances, and directions from the boundaries of the FMPC are given in Table 2-1. More than one million people live within a twenty mile radius of the site.

The total area of the site is 1050 acres of which 850 are in Hamilton County and 200 in Butler County, Ohio. Figure 2-2 shows the current land use at the FMPC, including, production facilities; waste pit storage areas; utilities plants; and supporting buildings. The production area covers 136 acres, and the area under roof is about 19 acres. There are approximately four miles of railroad track and paved road on the site. The paved storage areas total approximately one million square feet.

The elevation of the FMPC is approximately 580 feet. The Great Miami River, to which the site ultimately drains, has a water level elevation of 555 feet at maximum flood stage in the Ross area. Even the worst recorded flood in 1913, would not have affected the area now occupied by the FMPC. Wind directions and speeds are observed at the Greater Cincinnati Airport as indicated in Figure 2-3. Prevailing winds are out of the southwest approximately 34 percent of the time, mostly during the warm-weather months. During the winter months, the prevailing winds are northerly. Weather data are now being observed and collected by the new meteorological tower.

2.3 Employment

NLO, Inc. is managed by an Administrative Group and seven divisions: Accounting; Engineering; Health and Safety; Personnel and Industrial Relations; Procurement; Production; and Technical. Their functions are to provide production and supporting services necessary to fulfill the DOE missions assigned to the FMPC.

Table 2-2 provides a listing of the number of employees for each NLO division as of October 1, 1984. Employment trends since operations began are shown in Figure 2-4. Full-time employment will continue at the 1100-1150 level through the end of the decade.

FIGURE 2-1

LOCATION OF THE FMPC

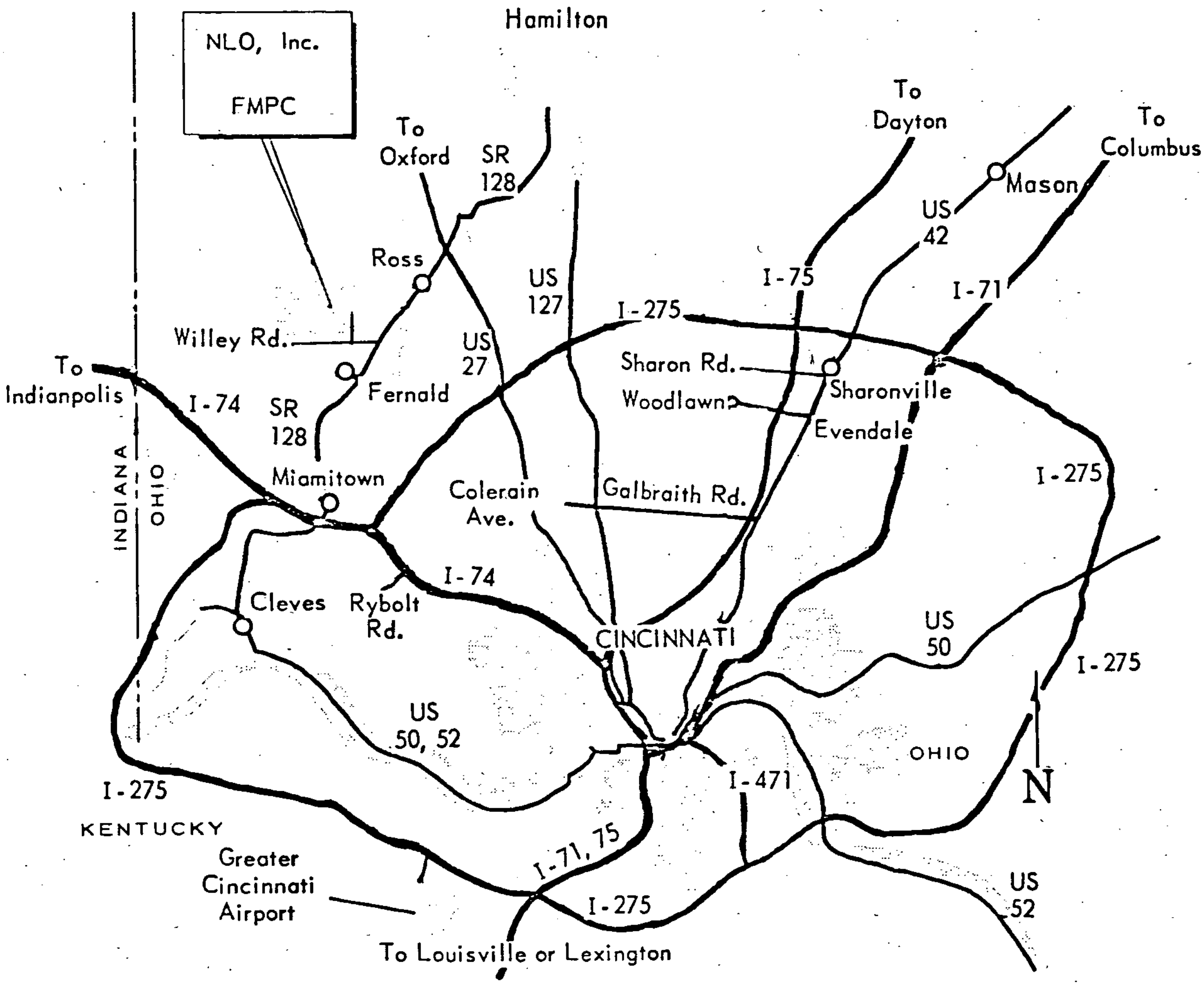

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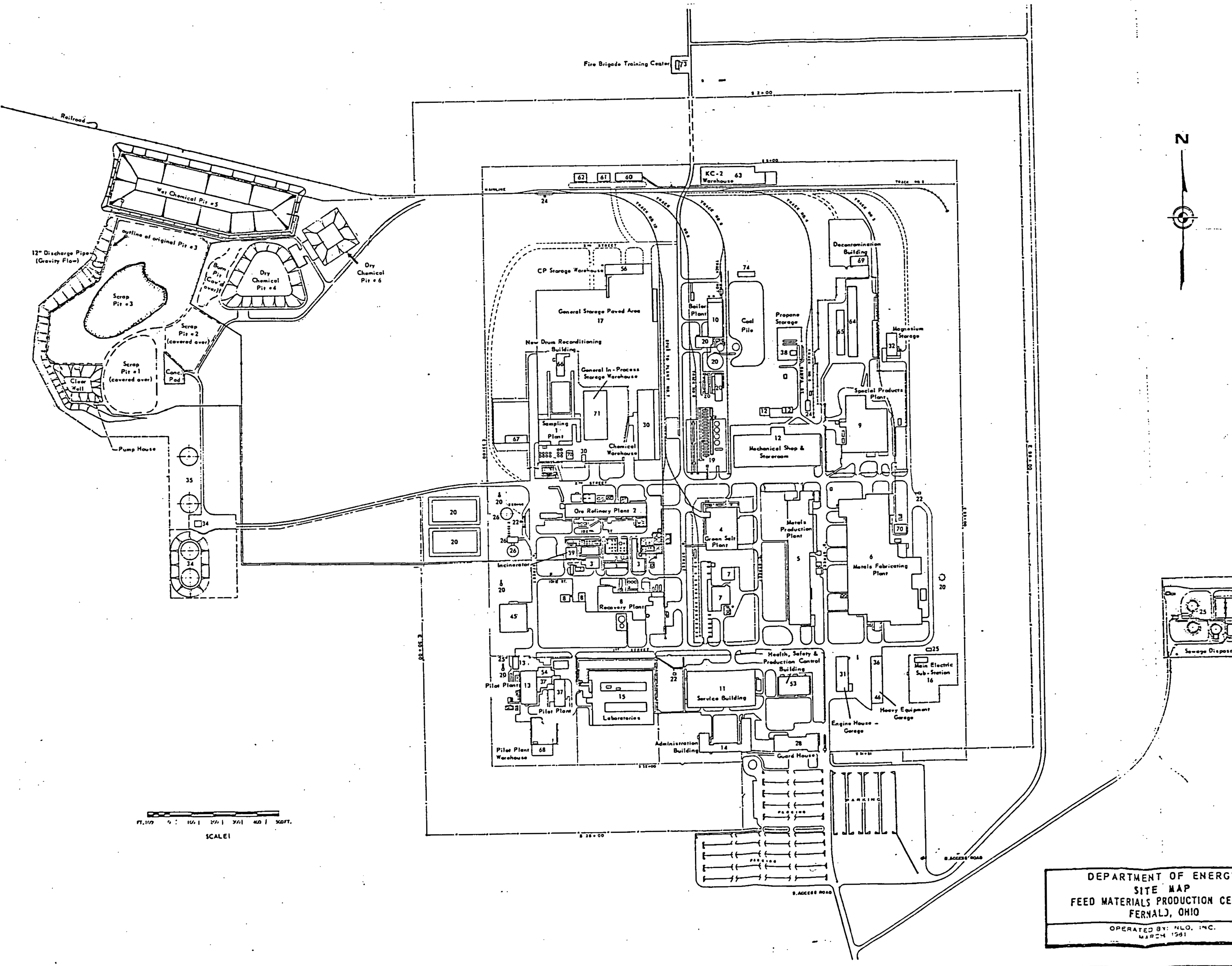
TABLE 2-1
POPULATION CENTERS WITHIN A
TWENTY-MILE RADIUS

Selected Communities Within 20-mile Radius of the FMPC	Distance (Miles)	Direction	*Population
Cincinnati (H) - City	19	SE	385,457
- Metropolitan			873,176
Hamilton (B)	9	NE	63,189
Fairfield (B)	7	ENE	30,777
Ross (B)	3	ENE	5,626
Shandon (B)	3	NW	<1,000
New Haven (H)	3	SW	<1,000
Fernald (H)	1	S	<1,000
New Baltimore (H)	2	SSE	<1,000
Harrison (H)	6	WSW	5,855
Dunlap (H)	3	E	<1,000
Miamitown (H)	7	SSW	<1,000
Millville (B)	7	NNE	<1,000

(H) Hamilton County - 873,176

(B) Butler County - 258,787

*Population figures from US Census Bureau, 9/30/82.



Building Code No.	Title
1	Sampling Plant
	Silo Storage (South of Sampling Plant)
2	Ore Refinery Plant
3	Nitric Acid Recovery Plant
4	Green Salt Plant
5	Metals Production Plant
6	Metals Fabricating Plant
7	Hex Reduction Plant
8	Recovery Plant
9	Special Products Plant
10	Boiler Plant
11	Service Building
12	Mechanical Shop & Storeroom
13	Pilot Plant
14	Administration Building
15	Laboratories
16	Main Electric Sub-Station
17	General Storage Paved Area
18	Water Separation & Disposal Unit
	Chemical Feed Building
	General Sump
19	Metal Tank Farm
20	Water Supply System & Chemical Feed & Filtration Bldg.
	Cooling Tower
	Cooling Tower Pump House
	Elevated Storage Tank
	Treated Water Storage Tank
	Chlorine Building (For Water Treatment Area)
	Water Wells
	Reactivator
21	General Site Preparation & Land Improvement
22	Interplant Service & Product Lines
	Gas Meter House
	Lift Station
	Pipe Trestle
	Truck Scale
23	Communication & Alarm System
24	Railroad System
25	Sanitary Sewer System
	Sewage Disposal
	Imhoff Tanks
	Sludge Beds
26	Fire Protection System
	Elevated Water Tower
28	Security System - Guard House
30	Chemical Warehouse
31	Engine House - Garage
32	Magnesium Storage
34	K-65 Storage Area - K-65 Building
35	Metal Oxide Storage Area
36	Electric Truck Garage Equipment
37	Pilot Plant
38	Propane Storage
39	Incinerator Plant
45	Laboratory Machine Shop
46	Heavy Equipment Garage
53	Health, Safety & Production Control Building
54	Semi-Work Reduction Unit (Pilot Plant)
55	Slag Recycling Plant
56	CP Storage Warehouse
60	Quonset No. 1
61	Quonset No. 2
62	Quonset No. 3
63	KC-2 Warehouse
64	Plant 9 Warehouse
65	Plant 5 Warehouse
66	New Drum Reconditioning Building
67	Plant 1 Storage Building (No. 1 & No. 2)
68	Pilot Plant Warehouse
69	Decontamination Building
70	Scrap Melting Building
71	General In-Process Storage Warehouse
72	Drum Storage Building
73	Fire Brigade Training Center
74	Pad

FIGURE 2-2

DEPARTMENT OF ENERGY
SITE MAP
FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

OPERATED BY: NLO, INC.
MARCH 1981

FIGURE 2-3

WIND DIRECTION

AND

SPEED OCCURRENCES

BASED ON HOURLY SURFACE WIND OBSERVATIONS TAKEN AT GREATER CINCINNATI AIRPORT.

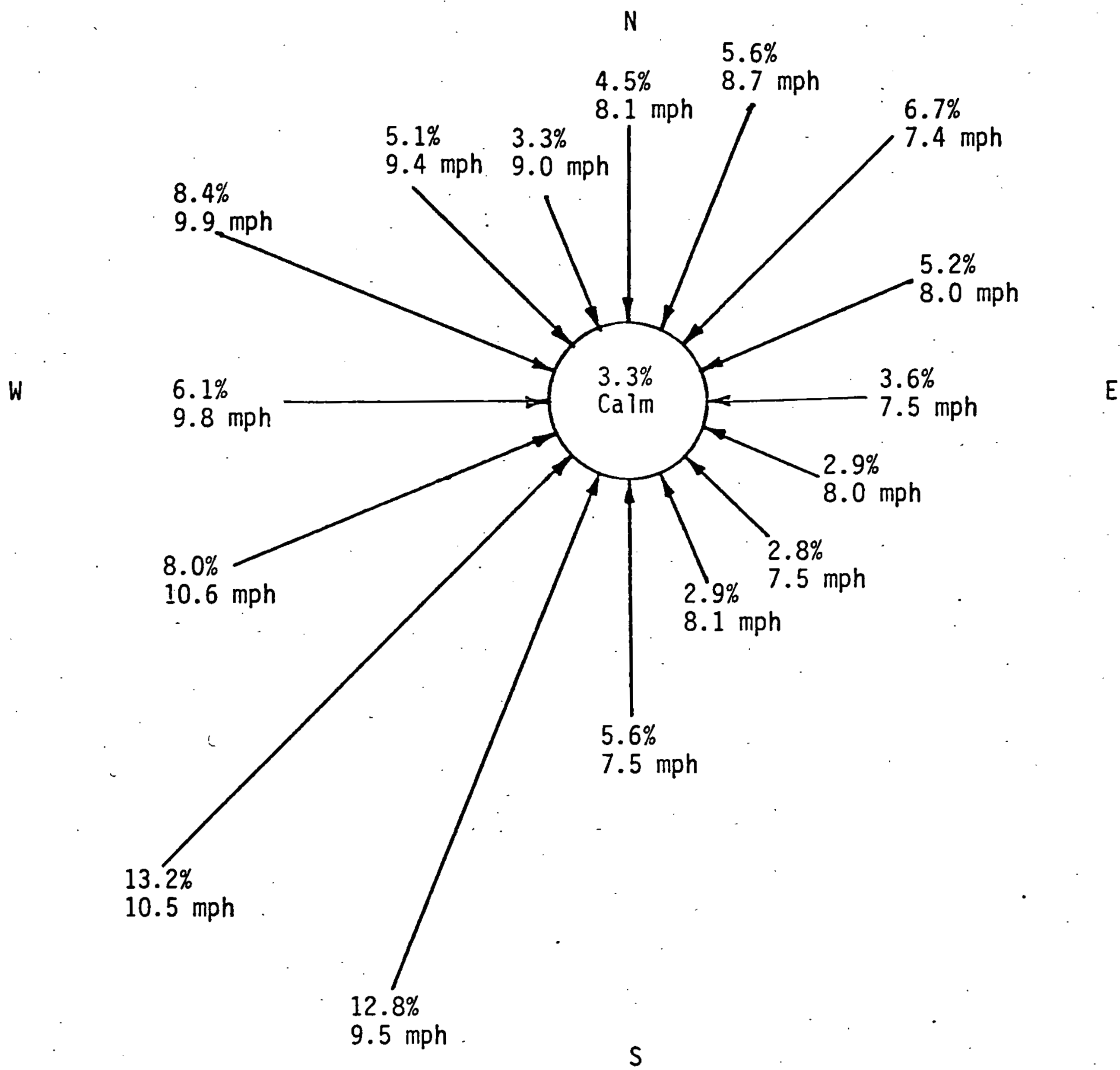
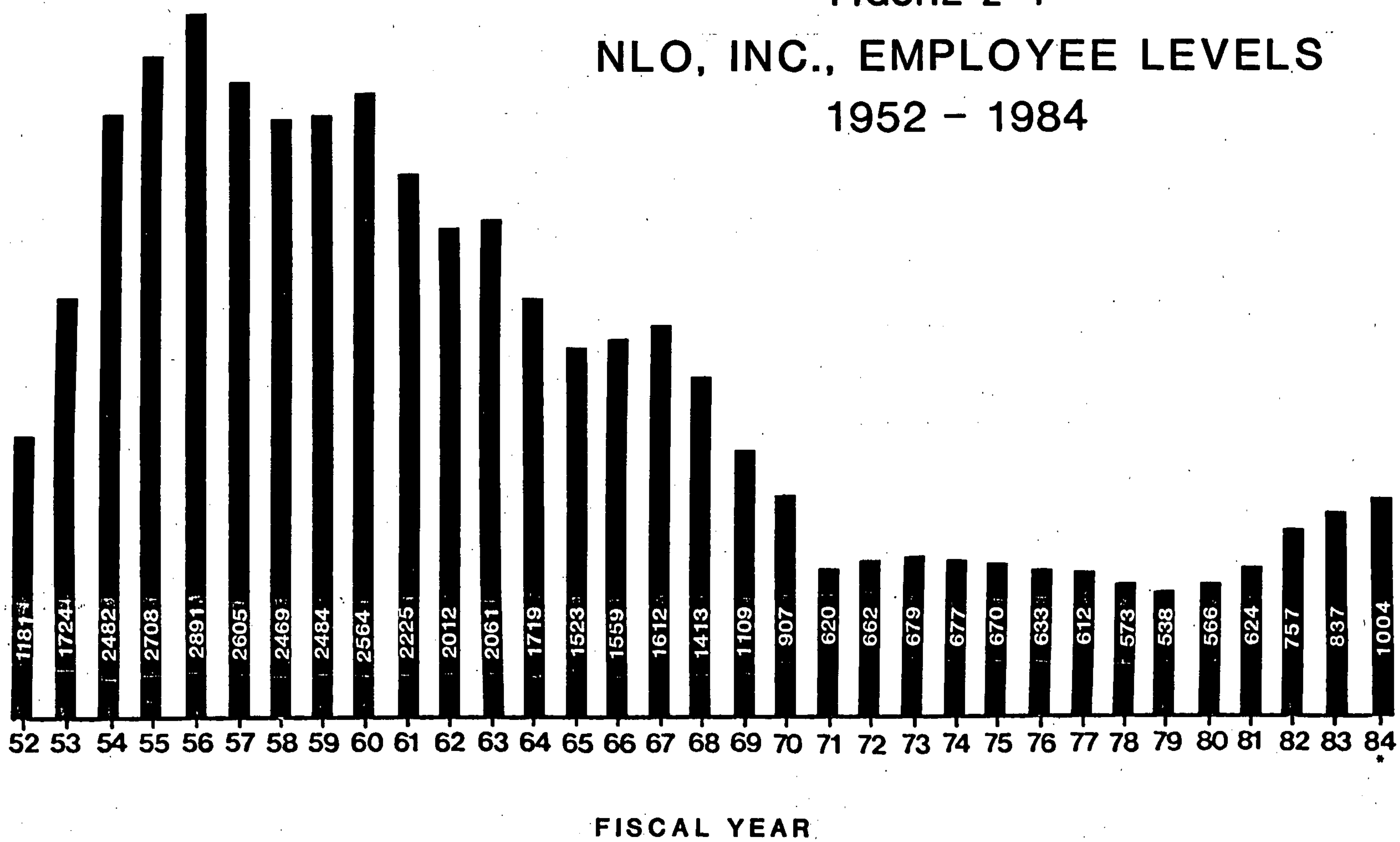


TABLE 2-2
EMPLOYMENT STATUS
Beginning FY-1985

Division	Number of Employees Salary	Wage	Total
Administrative Group	14	0	14
Accounting	67	0	67
Engineering	96	163	259
Health & Safety	37	0	37
Personnel and Industrial Relations	33	32	65
Procurement	25	104	129
Production	71	246	317
Technical	100	25	125
TOTAL	443	570	1013

FEED MATERIALS PRODUCTION CENTER, FERNALD, OHIO
NLO, INC. - CONTRACT OPERATOR

FIGURE 2-4
NLO, INC., EMPLOYEE LEVELS
1952 - 1984



* AS OF SEPTEMBER 1, 1984

2.4 Current Mission and Program Projections

A wide variety of chemical and metallurgical process steps are utilized to support the primary mission of supplying metallic fuel cores for the production reactors located at Richland, Washington and Savannah River, South Carolina. Some metal is shipped directly to DOE facilities at Oak Ridge, Tennessee and Rocky Flats, Colorado. These operations are illustrated in Figure 2-5.

Planning is based on continued production of Mark 31 target elements for Savannah River through FY-1990. Annual deliveries of metal for the N-Reactor at Richland, Y-12 and Rocky Flats are expected to continue through FY-1990. Projections of major product deliveries are:

- Savannah River will be at a nominal rate of 2500 MTU/year target element cores throughout the period.
- Ingot production for the Richland N-Reactor will remain at approximately 1000 MTU/year.
- Depleted uranium derbies for the Oak Ridge Y-12 Plant will be 1500 MTU/year.
- Depleted uranium metal in derby and billet forms for the Rocky Flats site will be continued at variable production levels.

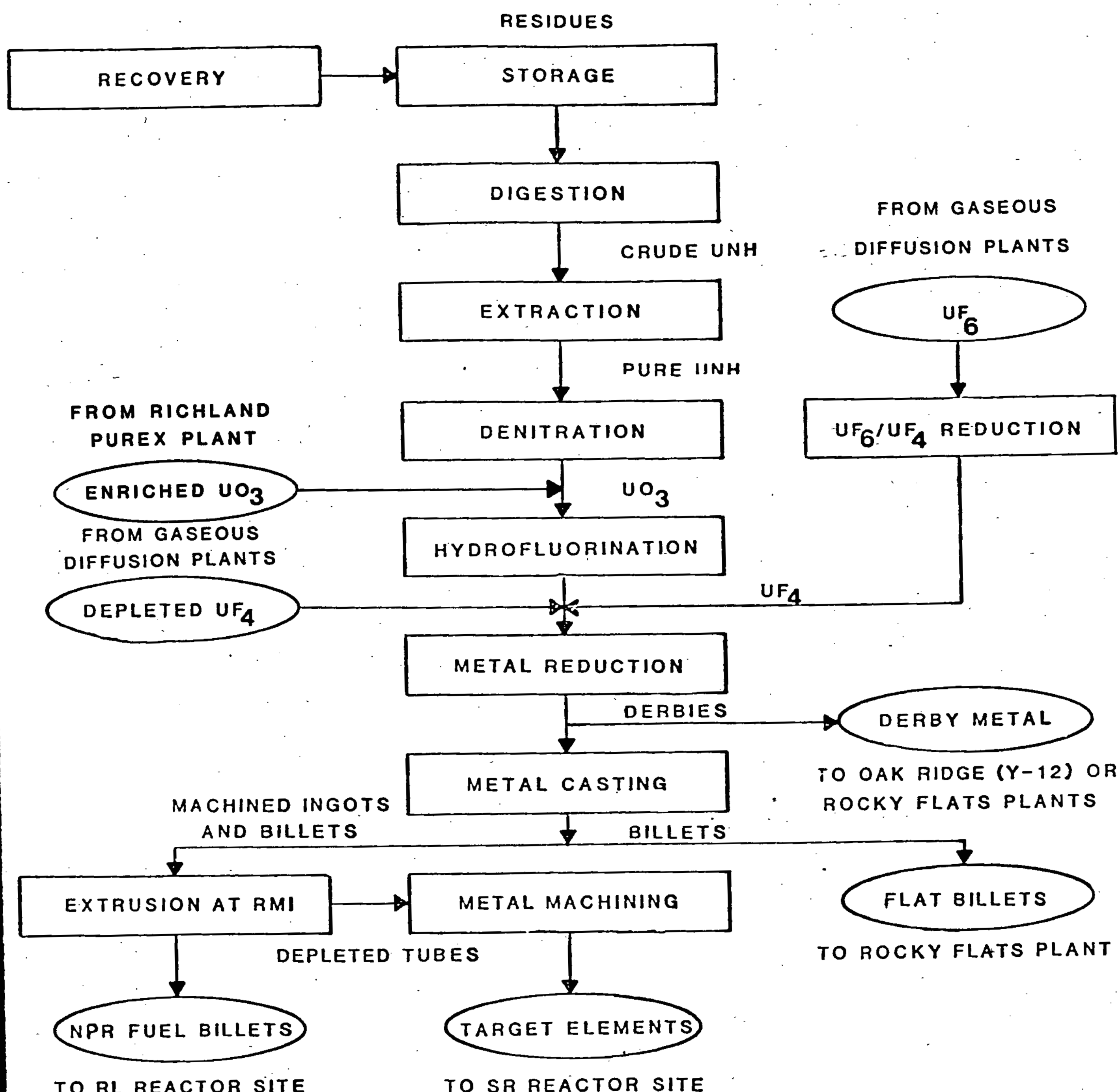
The Richland N-Reactor stream is supported by processing enriched scrap residues generated during the metal production steps plus Purex UO_3 recycled from Richland. Enriched UF_6 sweetener is required to replenish U-235 values consumed in the N-Reactor. All three material types are converted to UF_4, which is the starting point for metal production operations. Production for the Savannah River Mark 31 stream, Y-12 and Rocky Flats begins with depleted UF_4 from inventories.

Most of the metal produced from UF_4 is cast into ingots for extrusion into tubes or billets at the RMI Company, Ashtabula, Ohio. Depleted uranium extrusions are returned to the FMPC, where tube blanks undergo heat treating and fabrication into target element cores for production reactors at Savannah River. Enriched material is further processed into coextrusion billets via an upset forge operation at RMI Company for shipment to United Nuclear (UNC) at Richland.

The FMPC is the only facility within the DOE nuclear production complex capable of producing these uranium metal products for the various programs that they support. Interruptions of any of them because of environmental or safety reasons could result in serious cost-and-demand consequences at the reactor sites, and elsewhere.

FIGURE 2-5

SCHEMATIC DIAGRAM OF THE FMPC PROCESS



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2.5 Operational Capabilities and Facilities Use

Production operations are handled in Plants 1 through 9 and the Pilot Plant. Each plant has specified functions and integrated production relationships for satisfying the overall mission. Principal capabilities of each plant are outlined below:

Sampling Plant (Plant 1)

- Ship, receive, sample and store large amounts of depleted, normal and enriched uranium materials in open and covered storage areas.
- Dry crush, mill and classify feed materials for subsequent processing.
- Digest enriched feeds assaying up to 20% U-235 in geometrically safe equipment.
- Open unirradiated fuel pins, containing enriched uranium dioxide pellets.
- Recondition steel drums for reuse onsite and bale deteriorated drums for salvage.

Refinery UO_3 Plant (Plants 2/3)

- Digest residue materials in nitric acid using stainless-steel tanks and conveying equipment.
- Perform liquid-liquid countercurrent solvent extraction in stainless-steel, perforated-plate pulse columns for purification.
- Concentrate purified uranium solution in stainless-steel, thermo-syphon and tank evaporators.
- Calcine the concentrated purified uranium solution to uranium trioxide in denitration pots.

Green Salt Plant (Plant 4)

- Convert UO_3 to UO_2 for hydrofluorination to uranium tetrafluoride (UF_4), or green salt, in continuous-flow reactor banks designed and staged for gas-solids reactions.
- Blend and package depleted green salt for the metal reduction.
- Operate the Tank Farm to supply all production plants with bulk quantities of required chemical raw materials.

Metals Production Plant (Plant 5)

- Produce tonnage levels of high purity depleted and enriched uranium derby metal in electrical-resistance furnaces.
- Remelt derby and recycle metals for casting into ingot or billet shapes in vacuum induction furnaces.
- Crop and saw ingots into billets and saw sharpening.
- Machine graphite into almost any shape using saws, lathes, milling machines, routers and grinders.
- Mill magnesium fluoride (MgF_2) slag byproduct for reuse in lining reduction pots.

Metals Fabrication Plant (Plant 6)

- Salt-water heat treat enriched and depleted machined ingots and billets.
- Cut depleted extruded tubes received from RMI Company into core blanks.
- Salt-oil heat treat core blanks.
- Final machine heat-treated depleted target element cores.
- Metal pickling and chip briquetting.
- Final inspection for production quality assurance and control.
- Standby capability for rolling as-cast ingots into rod having close dimensional tolerances.

Scrap Recovery Plant (Plant 8)

- Furnace various residue recycle materials from onsite generation and offsite receipt to remove moisture, oils, graphite and metallic impurities.
- Crush, mill and screen recycle materials.
- Filter large volumes using rotary vacuum, precoat filters.
- Wash used drums for reconditioning operations.

Special Products Plant (Plant 9)

- Cast enriched derby and high-grade recycle metals into large diameter ingots.
- Machine as-cast ingots and billets for extrusion at RMI Company.
- Declad unirradiated fuel elements for remelt by chemical treatment.
- Clean depleted derby metal using molten carbonate salt and acid pickling.

Pilot Plant

- Convert uranium hexafluoride (UF_6) to uranium tetrafluoride (UF_4), assaying up to 2.5% U-235.
- Purify and convert thorium nitrate solution to various thorium compounds.
- Furnace 1.25-20% U-235 residue recycle materials.
- Declad aluminum jackets from unirradiated fuel cores by caustic treatment.
- Shot blast uranium derby metal and plasma spray coat casting crucibles.

2.6 Sources of Environmental Discharges

Operations from each of the eight production plants contribute liquid, solid and gaseous discharges to the environment. The principal sources of liquid production wastes are illustrated in Figure 2-6, where process wastes treated in sump facilities located in Plants 2/3, 5, 6, 9 and the Pilot Plant are collected in the General Sump for further treatment. Wastes from Plants 1 and 4 and the Laboratory are usually low enough in uranium concentration to permit final treatment in the General Sump. The Refinery also generates extraction raffinate and slag leach filter cake slurry.

The major source of solid waste material is magnesium fluoride byproduct slag from metal reduction operations in Plant 5. Enriched slag is processed for uranium recovery in the Refinery; depleted slag is stored in pits.

Gaseous airborne emissions arise primarily from nitric acid recovery in the Refinery and pickling operations in Plants 6 and 9. Particulate emissions occur from inadvertent dust releases and from properly operating dust collectors, scrubbers and incinerators throughout the production complex.

FIGURE 2-6

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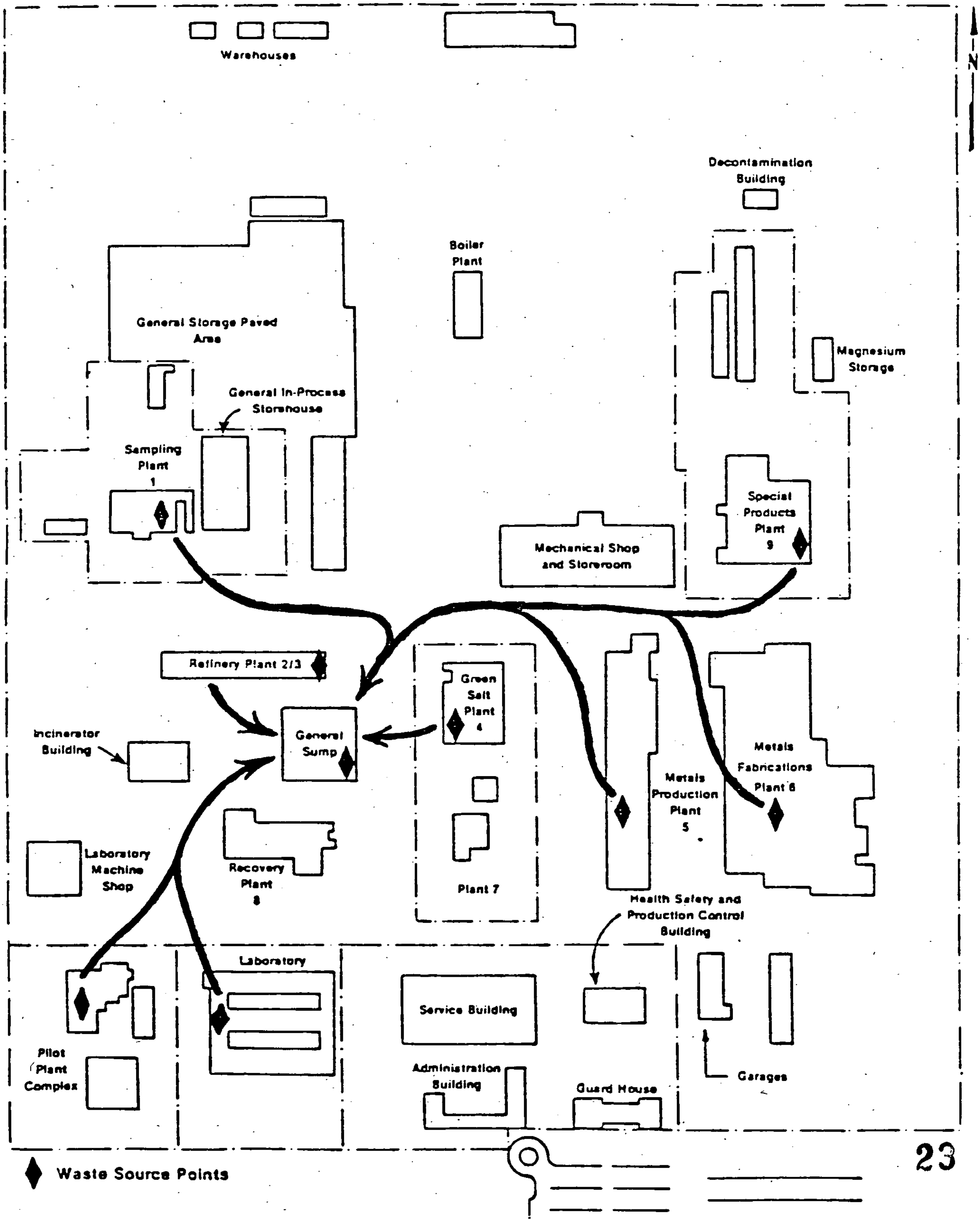
Sources of Production Wastes

COLLECTED & TREATED IN THE GENERAL SUMP



Waste Source Points

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3.0 EXISTING CONDITIONS (FY-1985)

3.1 Water Pollution Control Facilities

Liquid wastes are generated to some degree in every operation at the FMPC. The three branches of the liquid waste stream are: process waste, sanitary waste water and storm water. The system to control the discharge of low-level radioactive waste to the environment through any of the branches is shown in Figure 3-1. Each waste stream and its method of treatment prior to discharge to Manhole-175 are discussed in the following subsections.

3.1.1 Process Waste

Most of the production plants have sump equipment for the collection and initial treatment of process waste. Almost all uranium contained is removed in these facilities. Effluents from the plant sumps are collected at the General Sump for additional treatment. After sedimentation, the treated wastes are then sent to Plant 8 for filtration. Clear effluents from the General Sump and Plant 8 filtration are combined with the treated sewage and storm water streams and discharged to the Great Miami River via Manhole-175.

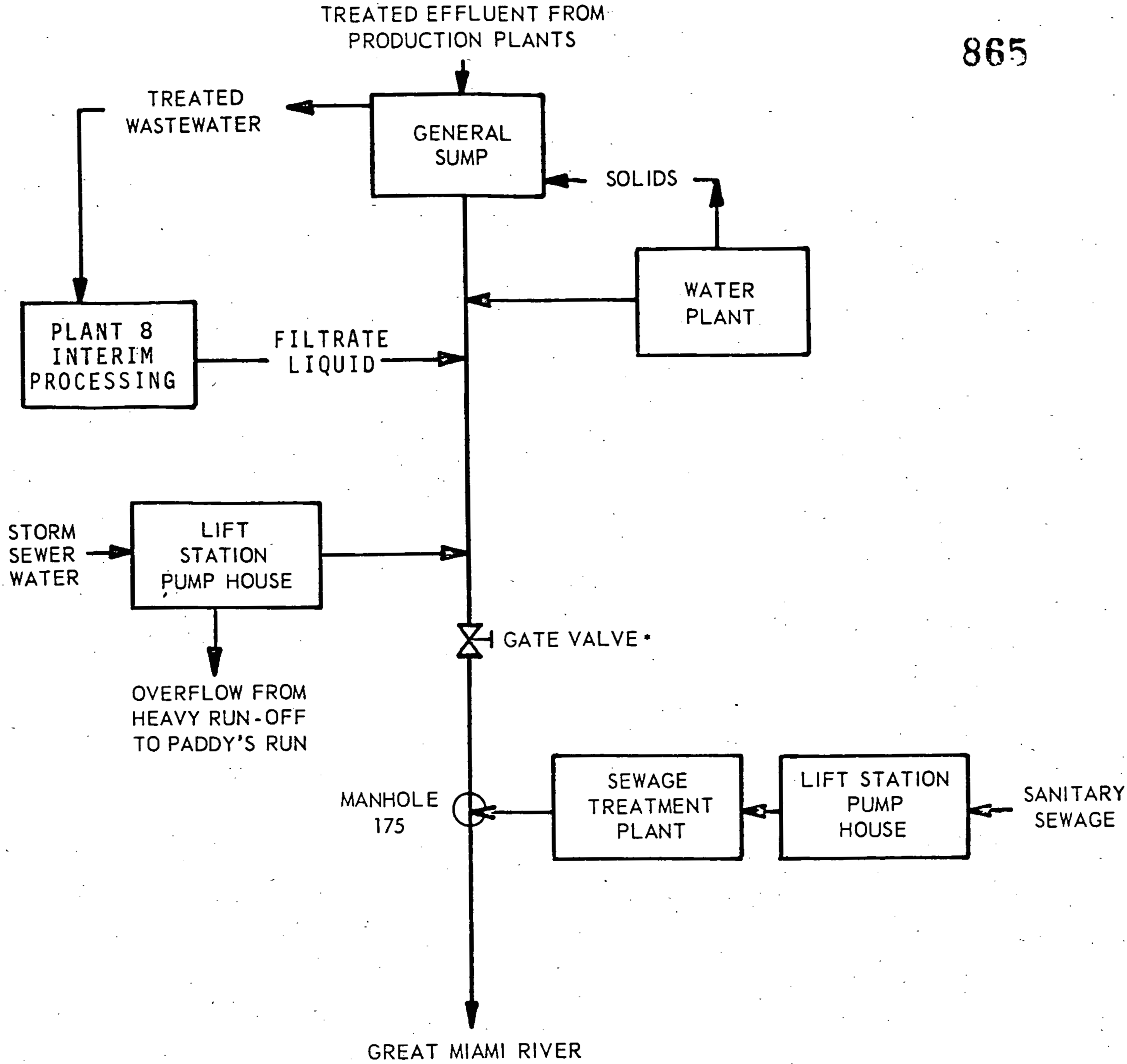
Interim waste processing in Plant 8 is described in Section 3.2.3, and will be conducted until the new Low-Level Waste Processing and Shipping (LLWPS) System becomes operational in FY-1988.

3.1.2 Sanitary Waste Water

Sanitary wastes do not contain significant amounts of uranium. Some uranium contamination does occur through the plant laundry and showers. Treatment of the sewage in the Sewage Treatment Plant removes much of the uranium which is captured in the sewage sludge. The sludge is incinerated in the Scrap Recovery Plant.

3.1.3 Storm Water

The Storm Water System is designed to be uranium-free. However, it is possible for uranium to enter the system through accidental spills and rainwater washing of some uncontrolled pad areas. Although no treatment facility is provided for the storm water, control and recovery of any inadvertent uranium washed or spilled into the Storm Water System is achieved through diversion facilities. Water can be diverted to the General Sump by closing the gate valve. The system remains on recycle until the source of contamination has been determined and corrective action taken.



*Storm sewer water can be diverted to the General Sump by first halting pumping and then closing the gate valve.

FIGURE 3-1 LIQUID WASTE STREAMS

3.2 Waste Management Systems

The safe storage of low-level radioactive waste materials has been an integral part of FMPC activities since the beginning of production operations in 1952. The types of liquid and solid wastes that were generated and the means of handling for disposal are illustrated in Figure 3-2.

3.2.1 Pit Storage of Low-Level Radioactive Waste Materials

Contaminated solids and slurries having concentrations too low to permit economic recovery of uranium or thorium were placed either in dry storage or wet sedimentation pits. Dry waste silos were also used in early operations for storing tailings from processing Refinery extraction raffinate for nitrate recovery. Raffinate is the aqueous waste liquid stream from the primary extraction operation and contains all the metallic impurities and is barren in uranium. Table 3-1 summarizes the capacities and contents of the pits and silos, and Figure 3-3 depicts the layout of these facilities. The inventory of stored waste materials is presented in Table 3-2.

Scrap Pits 1, 2 and 3 are covered and not in service. Pit 4 is a dry waste storage pit that is full and being retired. Pit 5, a hypalon-lined pit, is the only wet chemical storage facility and is filled to its operational capacity. Pit 6 is also a lined pit and is used primarily for dry residue waste storage. Pit 6 is approximately 35 percent full.

Silos 1 and 2 contain radium-bearing residues, which were formerly the property of Afrimet-Indussa, Inc, or its predecessor, the African Metals Corporation. These materials became the property of the DOE from a negotiated settlement effective July 1, 1983. The stabilization of the earthen embankment around these two tanks was completed during FY-1983. Silo 3 contains cold metal oxides from the processing of ore concentrates, and Silo 4 is empty.

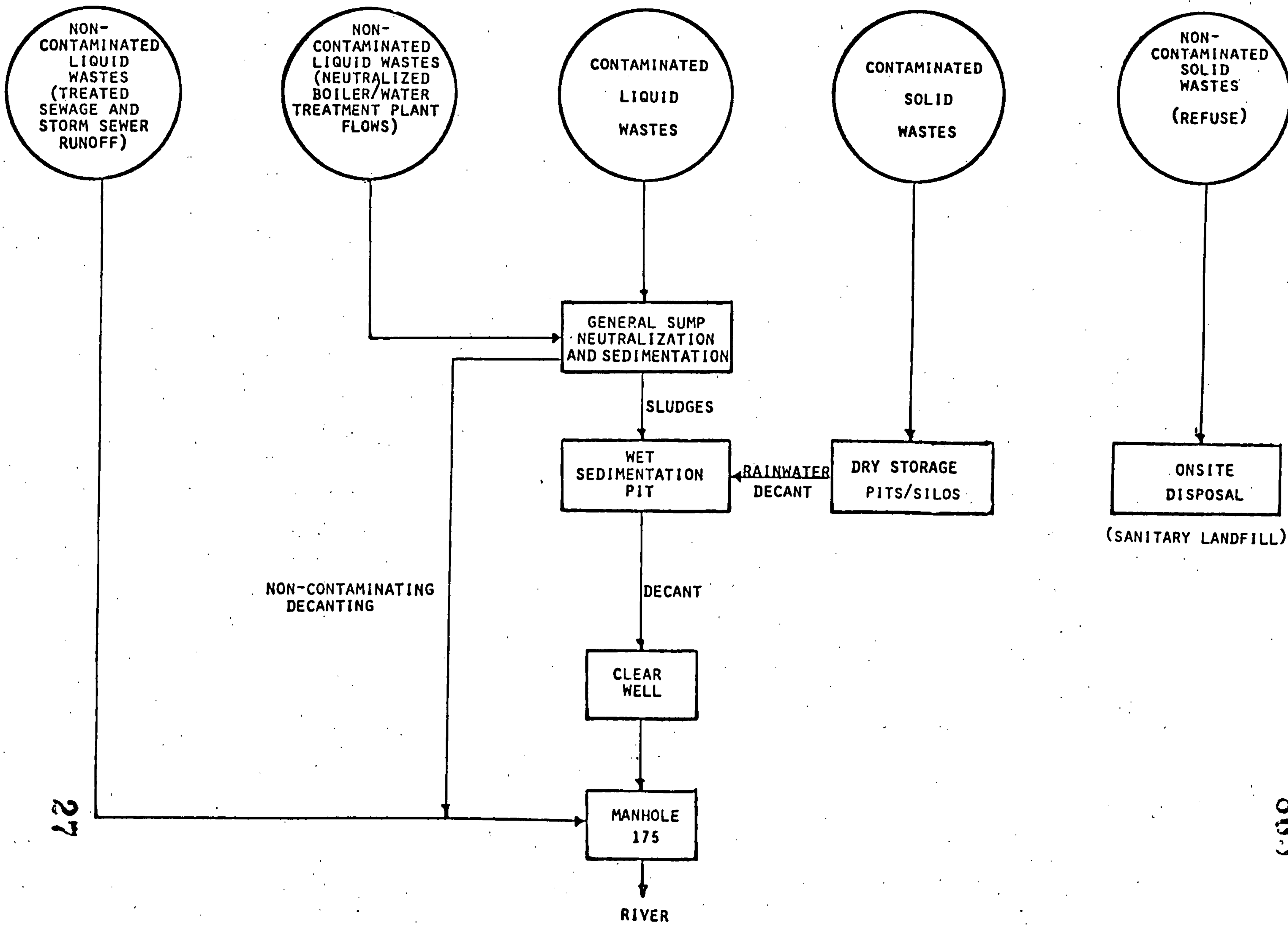
3.2.2 Noncontaminated Waste Materials

Noncontaminated wet solids are generated by Boiler Plant fly ash collection, feed water treatment, and boiler blowdown/ cleaning waste treatment. These noncontaminated solids are discharged to the General Sump, where they can be mixed with the supernatant decanted from contaminated wet wastes as shown in Figure 3-2. In recent years, during which metal production rates were reduced, the noncontaminated solid waste flow accounted for as much as 70 percent of the total solids input to Pit 5. Also, portions of the existing dry storage pits were used for the onsite disposal of noncontaminated solid refuse materials. Now, all noncontaminated wastes are sent to either the sanitary landfill or to sludge ponds.

FIGURE 3-2

FMPC WASTE MANAGEMENT

(1952 - 1983)



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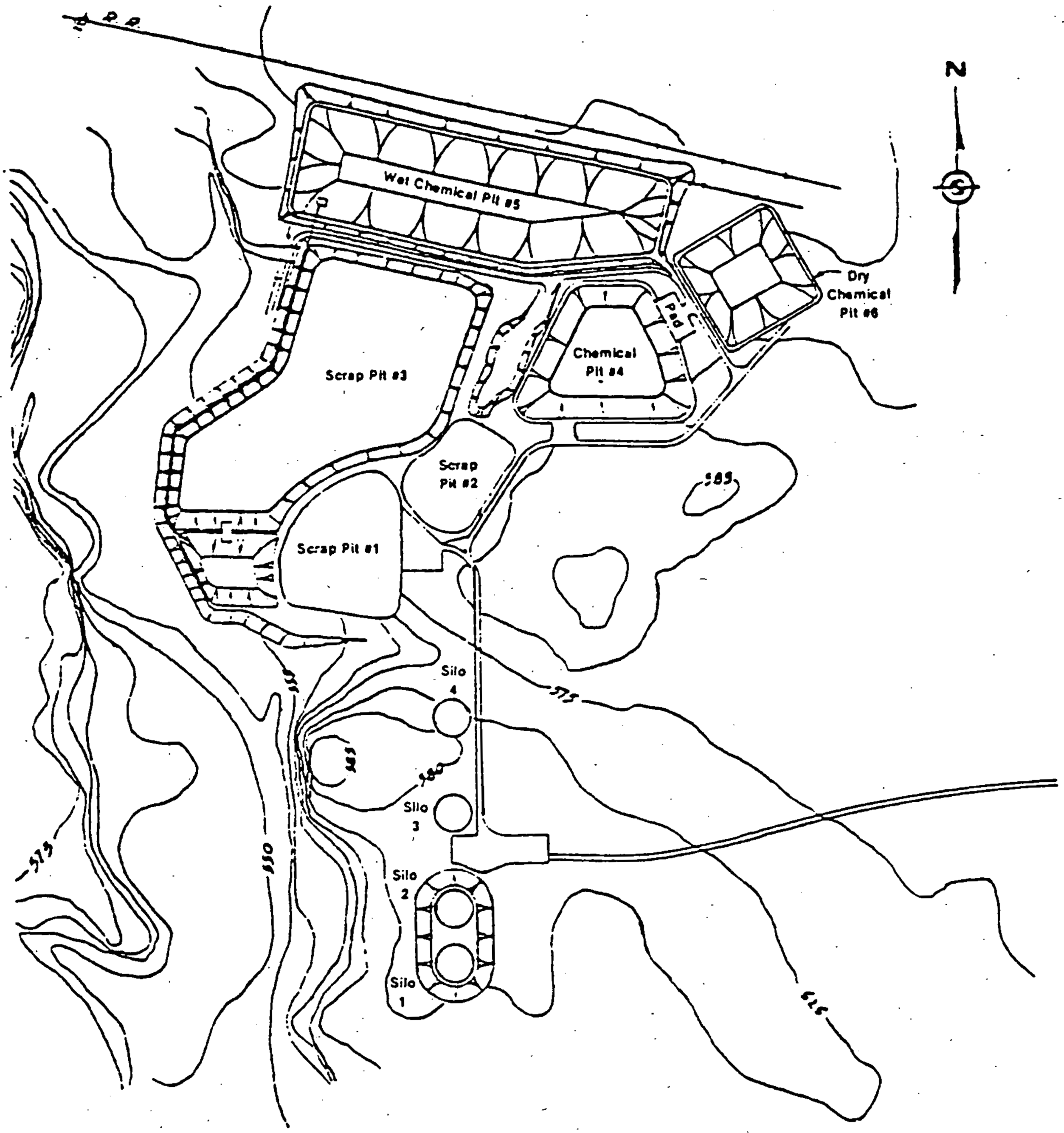
Structure	Type	Volume (Million ft^3)	Status	Contents
Pit 1	Dry	1.08	Retired	Mixed Solids, Dry
Pit 2	Dry	0.351	Retired	Mixed Solids, Dry
*Pit 3	Wet	6.12	Retired	Mixed Sludges, Wet
*Pit 4	Dry	1.43	Being Retired	Slags, Abrasives, Metals, Dry
**Pit 5	Wet	3.10	Removed from Sedimentation Service	Mixed Sludges, Wet
**Pit 6	Dry	0.375	35% Full	Slags, Misc. Materials, Wet and Dry
Silo 1	Dry	0.134	Full	High Radium Tailings, Dry
Silo 2	Dry	0.134	Full	High Radium Tailings, Dry
Silo 3	Dry	0.134	Full	Low Radium Metal Oxides, Dry
Silo 4	Dry	0.134	Empty	

*Clay-lined
**Rubber-lined

FIGURE 3-3: FMPC SOLID WASTE STORAGE FACILITY LAYOUT



Pits 1, 2, and 3 are Retired and Covered.

TABLE 3-2
APPROXIMATE FMPC WASTE STORAGE INVENTORY
(AS STORED, THROUGH AUGUST 31, 1984)

STRUCTURE	WASTE QUANTITY (MT)	URANIUM (KG)	U-235 (KG)	U-235 (%)	THORIUM (KG)	RADIUM-226 (Ci)
PIT 1	40,500	52,000	370	.71	-	UNAVAILABLE
PIT 2	13,000	1,206,000	2,550	.21	400	UNAVAILABLE
PIT 3	255,000	129,000	1,010	.78	400	19
PIT 4	64,935	3,030,068	5,494	.18	61,800	-
PIT 5	87,980	50,279	420	.84	17,000	118
PIT 6	7,813	552,392	1,141	.21	-	-
SILO 1 & 2	8,800	11,200	80	.71	-	1,652
SILO 3	3,500	18,000	130	.72	-	15
TOTALS	481,529	5,048,939	11,195		79,600	1,804

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3.2.3 Interim Processing of Wet Waste Materials

FMPC pits have effectively contained all wastes and no uncontrolled discharges have occurred. However, weathering or differential settling may occur in the future to the extent that the integrity of the present form of below-grade storage cannot be guaranteed indefinitely. Consequently, the conversion of currently generated wastes to a stable, dry form for offsite disposal began in FY-1984. Out of necessity, existing waste management facilities must accommodate continued plant operation until FY-1988, when the planned LLWPS System becomes operational. Pit 6 will continue to be used for dry waste storage until all facilities of the LLWPS System become operational.

Interim processing of all wet solid wastes is illustrated in Figure 3-4. As part of this system, neutralized extraction raffinate and slag leach filter cake slurries that previously went to Pit 5 are being diverted to Plant 8 for filtration. The contaminated wet filter cakes are dried using the rotary kiln and primary calciner in Plant 8 to produce a free-flowing powder, and then packaged into drums for offsite disposal. Filtrates within specifications for uranium and other materials are discharged to the Great Miami River via Manhole-175.

3.3 Monitoring Environmental Discharges

For environmental monitoring purposes, DOE criteria for air and water in uncontrolled areas are used as standards. At the FMPC, criteria for offsite or ambient air are applied to samples collected at the plant boundary. Criteria for offsite water are applied to stream and river samples collected downstream from the point where plant effluent is discharged, but upstream from any known use of the water as a drinking water supply.

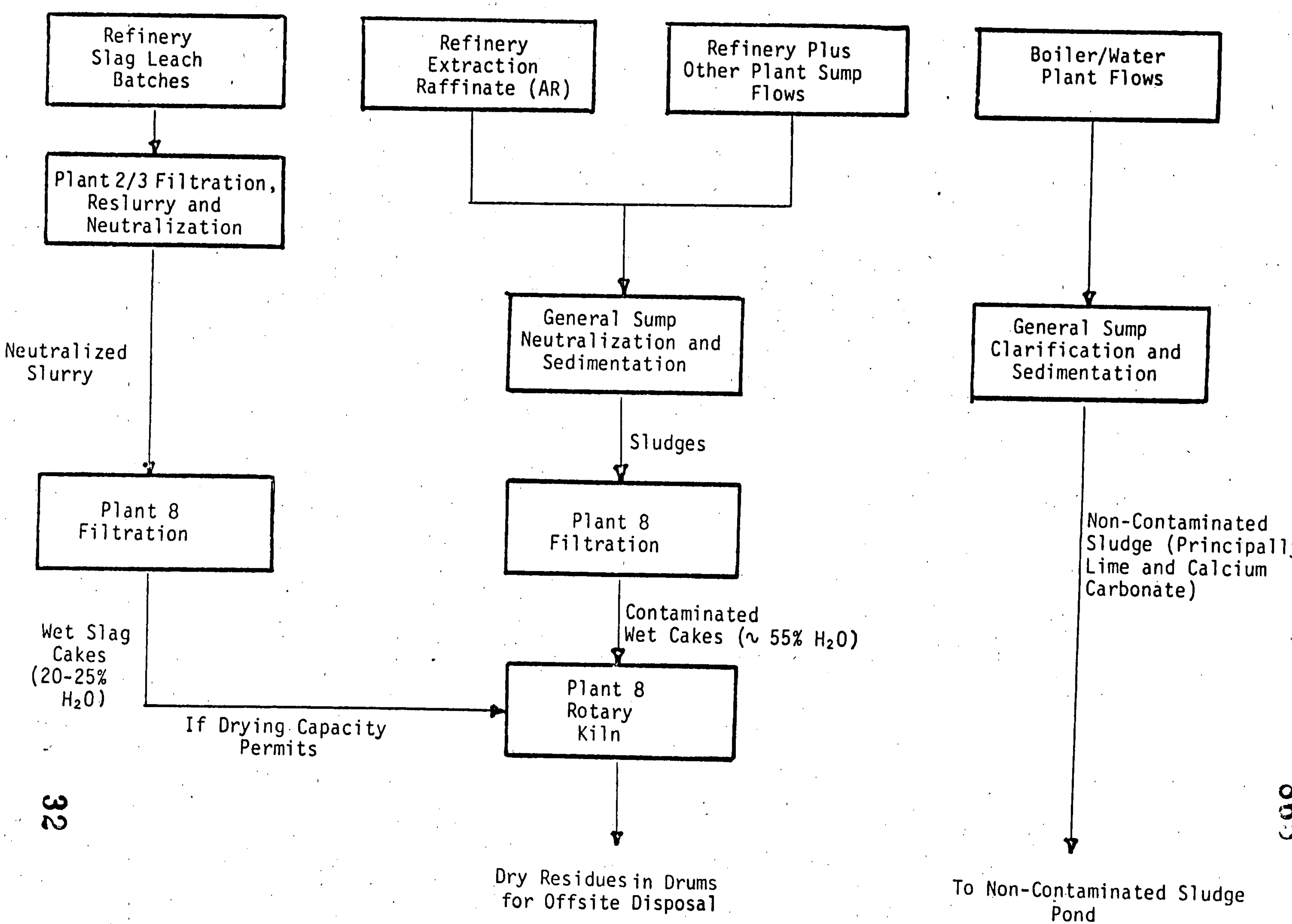
Criteria used for nonradioactive contaminants in ambient air, the Great Miami River and Paddy's Run are taken from standards adopted by the Ohio EPA. In rivers and streams of the State of Ohio, water quality standards apply beyond a mixing zone permitted for industrial and municipal effluents. Specific regulations are discussed in Section 4.

3.3.1 Collection and Analysis of Air Samples

Conversion of impure uranium to reactor-grade feed materials involves operations which generate radioactive particulates in an air stream. Ventilation and air cleaning systems are used to confine this air and remove airborne contaminants, including valuable material which is returned to the production process. The filtered or scrubbed air is exhausted to the atmosphere. Sampling of these stack exhausts is maintained on a continuous schedule to determine the operating condition of the air cleaning systems.

FIGURE 3-4

INTERIM WET WASTE PROCESSING FLOWS



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Samples of particulate matter in ambient air are collected continuously at seven permanent sampling stations located on the outer boundary as shown in Figure 3-5. At each boundary station, air is drawn at a rate of about one cubic meter per minute through an 8-inch x 10-inch filter, which is subsequently analyzed for uranium plus alpha and beta radioactivity.

3.3.2 Collection and Analysis of Water Samples

Water samples are collected at eight locations to determine the effect of the effluent upon the river. Paddy's Run is a small stream which flows along the site's west edge and joins the Great Miami River about two miles from the FMPC boundary. During periods of heavy runoff, excess water in the storm sewer system overflows to a natural drainage ditch which discharges into Paddy's Run. Under normal conditions, all water reaching the storm sewer lift station is pumped through the buried effluent line to the Great Miami River.

Water sampling locations are shown in Figure 3-5. At point W1, upstream from the effluent discharge, a daily grab sample is collected. At the final access point on the waste line, a Parshal Flume type water sampler collects continuously a sample which is proportional to the total flow. This sample is collected and analyzed on a daily basis. Results of these analyses, combined with river flow measurements, are used to calculate contaminant concentrations added to the river at point W2. At point W3, downstream from the discharge point, 24-hour samples are collected by a continuous sampler. Point W4 is at Miamitown, 4.7 miles downstream from the mouth of Paddy's Run. Paddy's Run sampling locations are shown as W5, W7, and W8. Random samples are collected once each week at W4, W5, and W7. A sample is collected at W8 if there is no flow at W7. Point W6 is in the outfall ditch from the Lift Station.

Daily samples from the final access point are analyzed for uranium, alpha and beta radioactivity, chloride, fluoride, nitrate, nonfilterable solids, and pH. The same analyses are made on at least one sample per week from each of the river sampling points. Results of this monitoring have been reported to the State of Ohio on a monthly basis since 1954.

The average concentration of uranium and thorium added to the river was less than 0.001 percent of DOE (ERDA) Radiation Protection Standards for uncontrolled areas. Combined Ra-226 and Ra-228 added to the river was 0.02 percent of the standards. By comparison, the combined average upstream radium concentration was 3.0 percent of the standard.

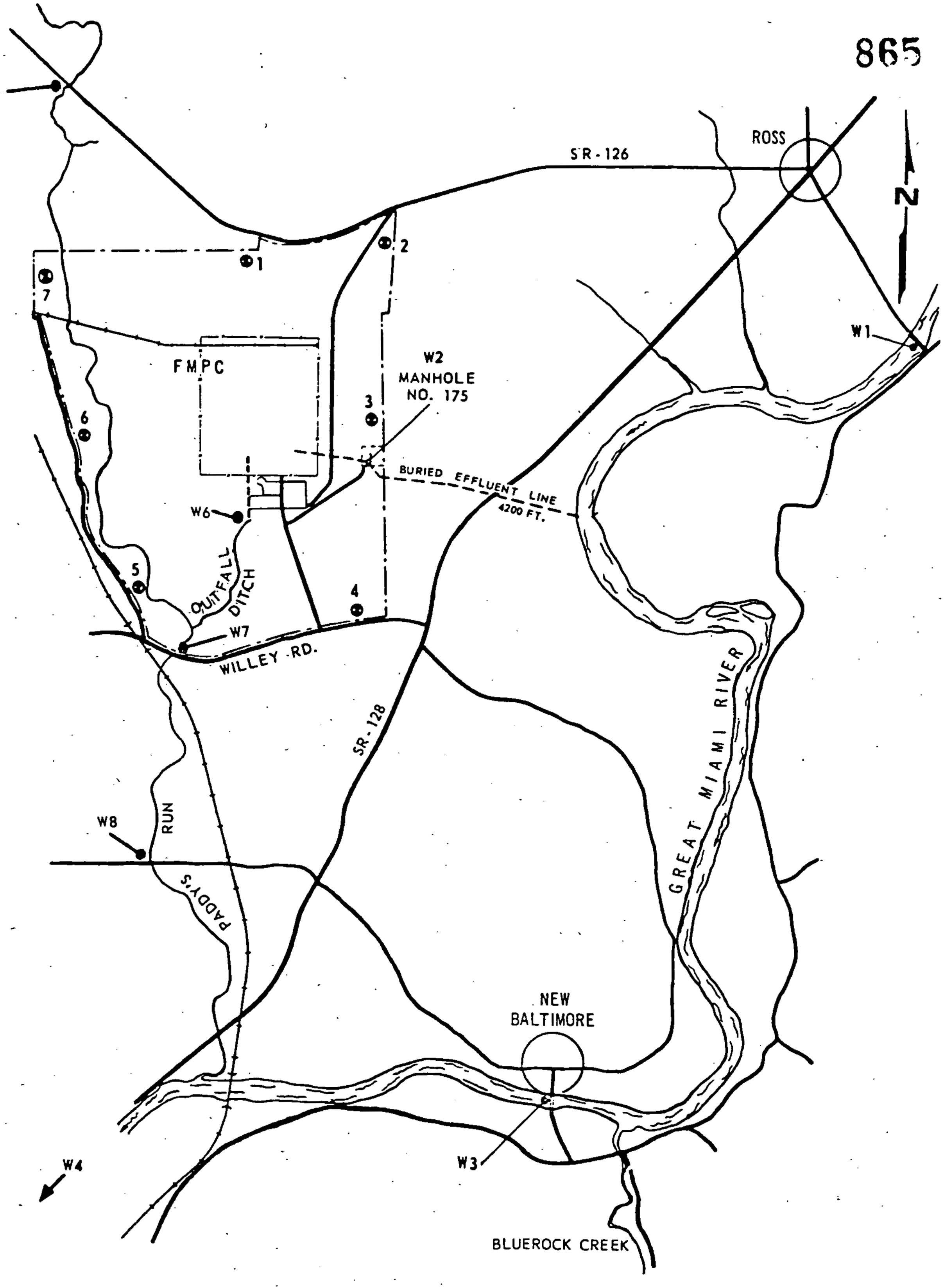

FIGURE 3-5 : FMPC AIR AND WATER SAMPLING LOCATIONS

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⊕ BOUNDARY AIR SAMPLING STATIONS.

W1-W8 - WATER SAMPLING LOCATIONS

SCALE: 1" = 3055'

3.3.3 Test Wells

There are twelve test-well (T) locations at the FMPC, as shown in Figure 3-6. Some locations have both deep (D) and shallow (S) wells. They are utilized to monitor the amount of radioactive contaminants leached to the surrounding area. Samples are taken on a quarterly basis.

Three production wells (P1, P2 and P3) supply the source of water needed for drinking and conducting operations in the production area. Their locations are shown in Figure 3-6, and they are the only source of water utilized at the FMPC.

3.3.4 Collection and Analysis of Soil Samples

Once each year, soil samples are collected at fifteen locations near the boundary air sampling stations and offsite, as shown in Figure 3-7. Each sample consists of six cores, 2 cm diameter and 10 cm deep. The cores are taken about 1.5 meters apart, and are analyzed for uranium to observe the possible contribution from stack effluents.

3.3.5 NPDES Permit

A permit to discharge liquid effluent has been issued to the FMPC by the United States EPA. The permit was issued under a national control program called the National Pollutant Discharge Elimination System (NPDES). Schedules for sampling are specified in the permit and results are reported to the EPA on a quarterly basis.

NPDES sampling points are located at: Manhole-175; Clearwell; Sewage Treatment Plant; and Storm Sewer Outfall Ditch (See Figure 3-8). The parameters which are covered by this permit are listed in Table 3-3. For the first seven months of 1984, there have been twenty-five violations. Half of these have been hexavalent chromium. Seven violations for iron have occurred.

3.3.6 Quality Assurance

Quality assurance is an integral part of the overall environmental monitoring effort. Included among the various laboratory quality assurance practices are daily calibrations of instrumentation and routine analyses of blanks, standard solutions and spiked sample aliquots. The values obtained from these analyses have been within the ranges which indicate that analytical systems are under control and the results being obtained are reliable.

NLO also participates in the DOE Quality Assurance Program conducted by the DOE Environmental Measurements Laboratory (EML) and analyses Quality control samples provided by the United States EPA Environmental Monitoring and Support Laboratory.

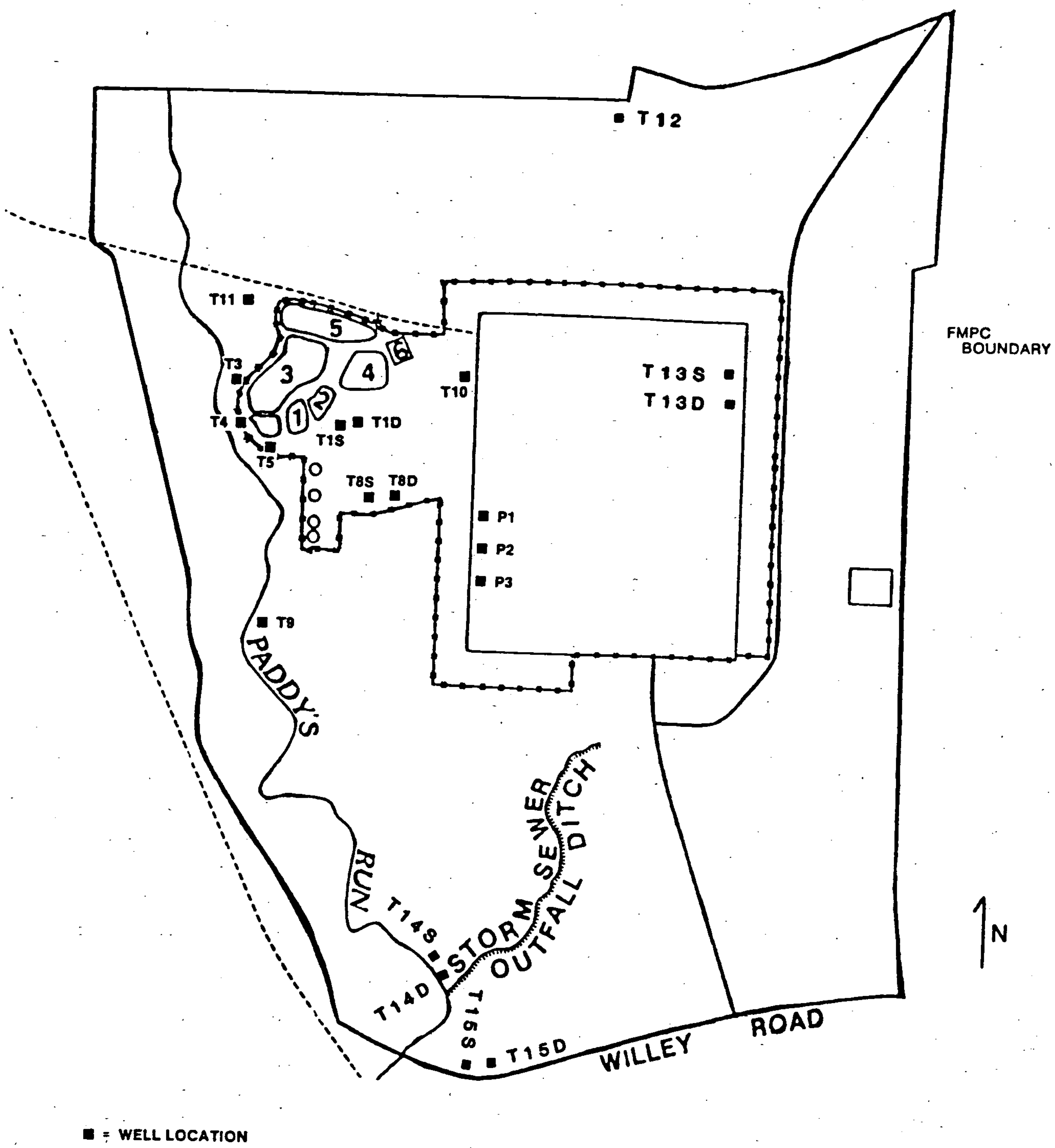

FIGURE 3-6

FMPC Monitoring Well Locations

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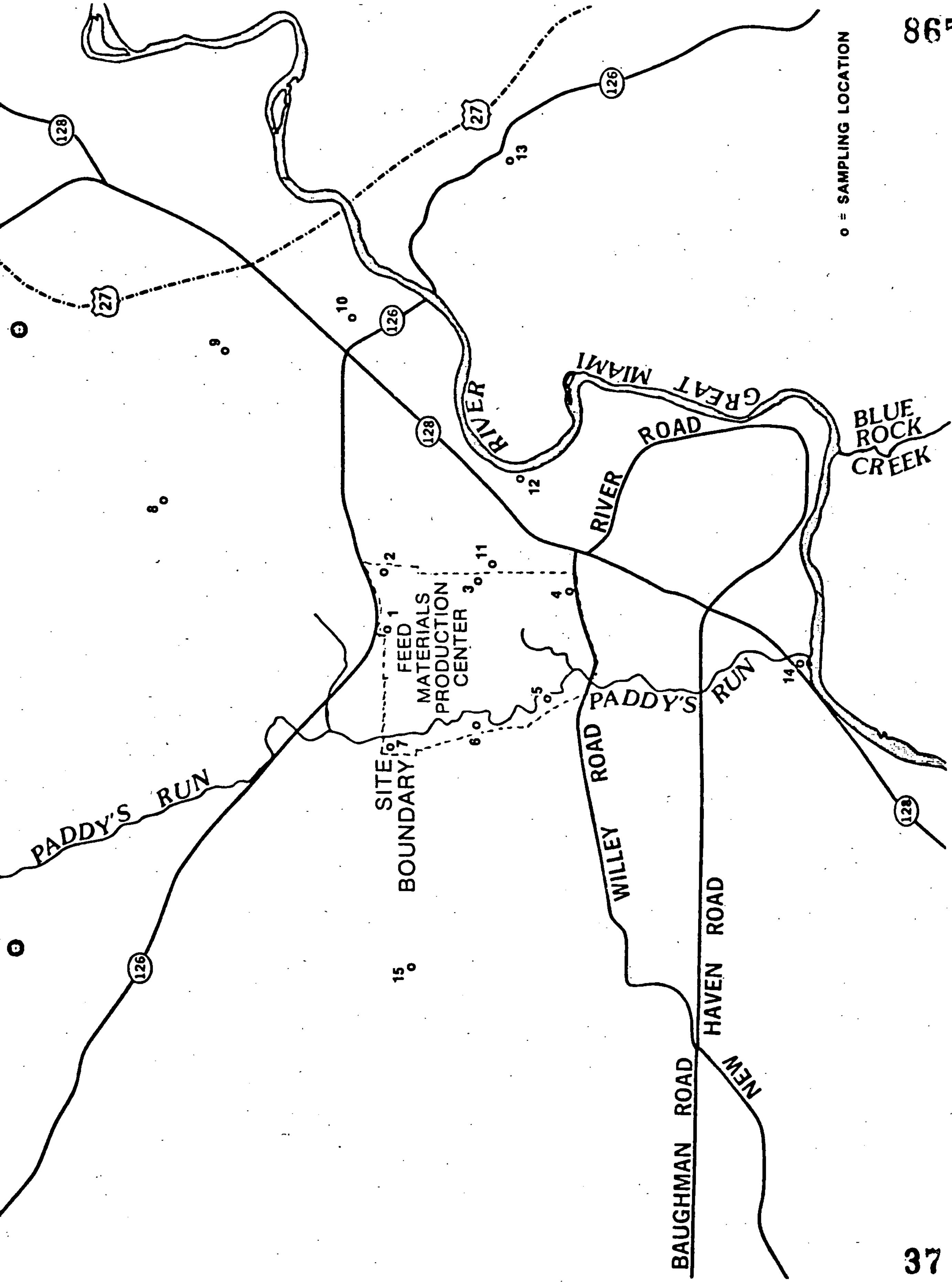

FIGURE 3-7: Soil Sampling Locations

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FIGURE 3-8
FEED MATERIALS PRODUCTION CENTER
ENVIRONMENTAL FEATURES

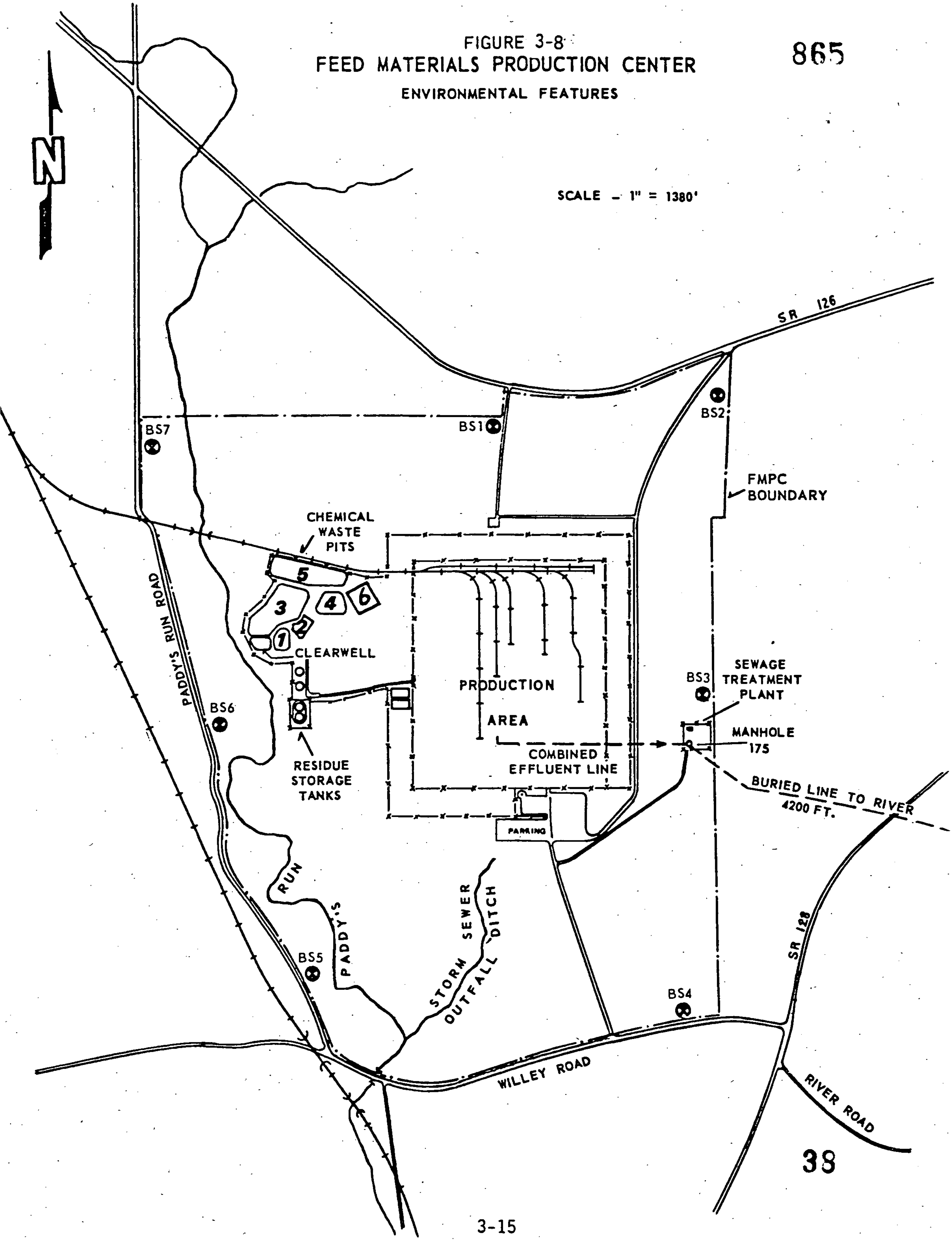

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TABLE 3-3
NPDES SUMMARY(1)

Location	Parameter	Daily Maximum Limit (2) mg/L	Daily Maximum Limit (2) kg/day	Daily Average Limit (2) mg/L	Daily Average Limit (2) kg/day	No. of Violations
Manhole-175	Suspended Solids	60	-- (3)	20	--	
	Nitrate (N)	--	3180	--	1590	1
	Ammonia (N)	--	43	--	28	1
	Oil & Grease	15	--	--	--	
	Residual Chlorine	0.10	--	--	--	
	pH (Std. pH units)	6.5 - 10	--	--	--	
General Sump & Clearwell Combined	Suspended Solids	--	12.8	--	6.2	3
	Chromium (+6)	--	0.008	--	0.004	13
	Chromium (total)	--	0.102	--	0.050	
	Iron	--	0.85	--	0.41	7
	Nickel	--	0.256	--	0.124	
	Copper	--	0.051	--	0.025	
Storm Sewer Lift Station	Suspended Solids	100	--	30	--	
	Oil & Grease	15	--	--	--	
Sewage Treatment Plant	BOD, 5-day	40	10.0	20	5.0	
	Suspended Solids	40	10.0	20	5.0	
	Fecal, coliforms (No. per 100 mL)	2000	--	1000	--	
Storm Sewer Outfall	Suspended Solids	100	--	30	--	
	Oil & Grease	15	--	--	--	

Footnotes:

(1) Data for first seven months of 1984.

(2) Permit limits are in units of mg/L or kg/day except pH and Fecal coliform bacteria.

(3) Not applicable.

3.4 Health and Safety

The reduction of radiation exposures is based on achieving the lowest levels technically and economically practicable. This As-Low-As Reasonably Achievable objective is called ALARA.

Other areas which are addressed by Health and Safety are: Fire Protection; Emergency Preparedness; and Industrial Safety including OSHA.

3.4.1 Reduction of Radiation Exposures

Present ALARA efforts are directed at reducing exposures in remelt operations where the higher beta exposures occur. Near-term improvements are expected from efforts such as improved storage practices, use of shielding, improved housekeeping and ventilation upgrading. Investigation of means to remove surface beta activity in newly cast ingots has shown that acid cleaning is an acceptable method to achieve the desired results. Capital funds have been authorized for a pickling system in Plant 5, and is under construction. A similar system for Plant 9 is planned and will be based on the design of the Plant 5 facility.

Devices that aid in the reduction and monitoring of the incident rate of radiation exposure to the employee are: in-vivo monitoring; respiratory protection; film badges; exposure evaluation; and urinalysis listings. Thermoluminescent dosimeters (TLD's) measure both skin and whole-body (penetrating) radiation doses of all employees on a monthly basis. TLD's are also used to determine wrist doses for workers in reduction and remelt areas. Intake of radioactive materials causes internal exposure, which is monitored through regular and incident bioasssy (urine) sampling and periodic in-vivo (whole-body) counting of exposed personnel.

3.4.2 In Vivo Monitoring

The Oak Ridge mobile in vivo counter is used for measuring radionuclide lung burdens of employees at the FMPC. The mobile counter is made available for monitoring at this site for periods of about six weeks twice a year. A specific number of employees must be counted during each counter visit in order to meet the requirements of our routine monitoring program. These requirements have been established in concurrence with ORO and stipulate how frequently employees must be counted. The frequency is based on the potential of each worker to be exposed to airborne radioactive materials.

3.4.3 Reducing Environmental Discharges

Efforts have been made to reduce airborne uranium emissions by improving existing control systems. A superior type of dust collector bag has been tested and is now in use; a radiation detector has been incorporated into stack samplers so that a prompt alarm is given when there is an abrupt increase in the uranium release rate; administrative controls have been emphasized.

A biodenitrification system is now being constructed as part of Project No. 83-D-146. It will provide greater removal of nitrate nitrogen in the plant waste-water effluent. This system is needed because of a revision in the NPDES permit issued to the FMPC by the Ohio Environmental Protection Agency (EPA). The revision requires a significant reduction in the amount of nitrate, and was to become effective July 1, 1984. However, the Ohio EPA has indicated they will agree to a delay until 1986, when the bioreactor facility is scheduled for completion.

Other water pollution control systems are included in Project No. 83-D-146. The storm water runoff collection improvement system will improve suspended solids removal from this stream. The system will include a 2.5-million-gallon settling pond and associated pumps and piping for discharge of the clarified runoff to the Great Miami River via Manhole-175. Inadvertent spills within the production area of the FMPC will be collected by a 50,000-gallon lagoon for holding until transfer to the General Sump. The Boiler Plant coal pile runoff system will consist of a collection trench system, sump, neutralization bed and pumps for transferring the effluent to the general sump. This system will control pH, total dissolved solids, total soluble solids, iron and other metals in the run-off in accordance with EPA standards. An ultraviolet system has been installed at the Sewage Treatment Plant to replace chlorination as the means for effluent treatment. This action has reduced the concentration of residual chlorine in the plant effluent.

4.0 ANALYSIS OF ENVIRONMENTAL, SAFETY AND HEALTH REQUIREMENTS

Program planning for environmental, safety and health improvements at the FMPC is directed toward compliance with regulatory requirements while attaining projected production schedules for the five year period and beyond.

The FMPC, a contract operated facility for the DOE, places a strong emphasis upon the compliance with all federal, state and local environmental, safety and health regulations. Guidance from DOE orders, in conjunction with these regulations, provides a broad basis for environmental, safety and health program planning. The focus of this plan is upon compliance with the intent of all enacted and pending regulations in the promotion of a strict FMPC policy of environmental enhancement and worker protection that goes beyond just meeting requirements.

The regulations and guidance which form the planning basis for general management of radioactive materials at the FMPC are provided by the Atomic Energy Act and the Nuclear Regulatory Commission (NRC). Guidelines for the attainment of specific environmental, safety and health goals are discussed below.

4.1 Environmental Regulatory Requirements

4.1.1 Liquid Effluents

The Clean Water Act (CWA) set forth the policy for the control and monitoring of water pollutant discharges. The National Pollutant Discharge Elimination System permit program for the FMPC has been delegated to the Ohio EPA. This program establishes monitoring sites, methods and sampling, effluent limitations and analytical needs to ensure compliance with the CWA. Consideration has been given to the application of Best Available Technology to existing and proposed FMPC facilities.

4.1.2 Low-Level Radioactive Wastes

Radioactive waste management programs are conducted in accordance with the guidelines and requirements established by DOE Order 5820.2.

4.1.3 Hazardous and Toxic Wastes

Program planning for the management of hazardous and toxic wastes reflects compliance with the guidelines established under the Resource Conservation and Recovery Act (RCRA) and the Toxic Substance Control Act (TSCA) respectively. Direction for implementation of the requirements of RCRA and TSCA are set forth in DOE Order 5480.2.

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sets criteria for the management of inactive hazardous waste sites. Specific guidance for the implementation of CERCLA has been proposed within draft DOE Order 5480.

4.1.4 Conventional Wastes

Noncontaminated conventional waste management planning has been based upon the applicable guidelines established by the Clean Air Act, the Clean Water Act and the permitting requirements of the Ohio EPA.

4.1.5 Gaseous and Airborne Emissions

Program planning for the control and monitoring of air pollutant emissions is directed toward compliance with requirements of the Clean Air Act. This planning recognizes pending National Emissions Standards for Hazardous Air Pollutants (NESHAP) limitations for airborne radionuclide emissions to the general public (proposed 40CFR61, Volume 48). Planning is also based upon the Ohio EPA requirements for emissions permitting and the application of Best Available Technology.

4.2 Health and Safety Requirements

It is the policy of NLO, Inc. to assure that radiation exposure to employees is limited to the lowest levels technically and economically practicable. The As-Low-As-Reasonably Achievable (ALARA) objective is to reduce personnel and environmental radiation exposures to the lowest levels commensurate with sound economics and operating practices. Even if the basic ALARA objective of reduction of personnel exposures has been met, a corollary ALARA objective must be considered; namely, the effect on the environment. Thus, even though an operation can be carried out with minimal (or even zero) occupational exposure, it still may not meet with ALARA objectives if it imposes an undue burden on the environment.

The ALARA concept has wide applications and serves as the basis for all radiation control activities. These include monitoring of onsite and offsite exposures; close review and followup of unusual exposures; determination, implementation and enforcement of control measures, both for existing and planned operations; and continuous training of employees.

The planning basis for personnel occupational protection from standard industrial and radiation related hazards is provided by guidelines and regulations established by the Occupational Safety and Health Administration (OSHA) and the NRC, respectively. The DOE has adopted the ALARA philosophy.

Changes in regulatory requirements, hints of future changes, increased emphasis on record keeping and training and new directions outlined by the DOE all demand a vigilant approach towards improving the health and safety program. Merely complying with requirements is not adequate - our practices will have to show a solid approach toward reducing industrial injuries and reducing radiation and chemical exposures to as low as reasonably achievable.

5.0 FIVE YEAR ENVIRONMENTAL, SAFETY AND HEALTH IMPROVEMENT PLAN (FY-1986 THROUGH FY-1990)

Water pollution control and waste management projects planned for this period are discussed in Sections 5.1 and 5.2. Locations of principal facilities are illustrated in Figure 5-1. The Biodenitrification and LLWPS Systems will provide the future capabilities for water pollution control and management of low-level radioactive waste materials. Other projects for reducing atmospheric and environmental discharges and improving personnel health and safety are covered in Sections 5.3 and 5.4. Emergency preparedness projects and research and development activities in support of environmental and safety concerns are presented in Sections 5.5 and 5.6. In Section 5.7, plans are outlined for converting the thorium inventory to a form for industry use or shipment offsite.

5.1 Water Pollution Control

Water pollution control facilities, primarily the biodenitrification system, are scheduled to become operational in FY-1986. This $9.5 million project will require $900,000 per year in operating costs. Other projects for environmental water pollution control are listed in Table 5-1, and are discussed in the following sections.

5.1.1 Plant Effluents

Improve Quality of Liquid Effluents

Various systems are used to neutralize and remove solids from plant wastewater. The final effluent contains dissolved chemicals at concentrations which exceed the concentrations in the Great Miami River. Additional treatment systems are planned so that water discharged to the river is of equal quality, or better; funding of $2.0 million is needed in FY-1990.

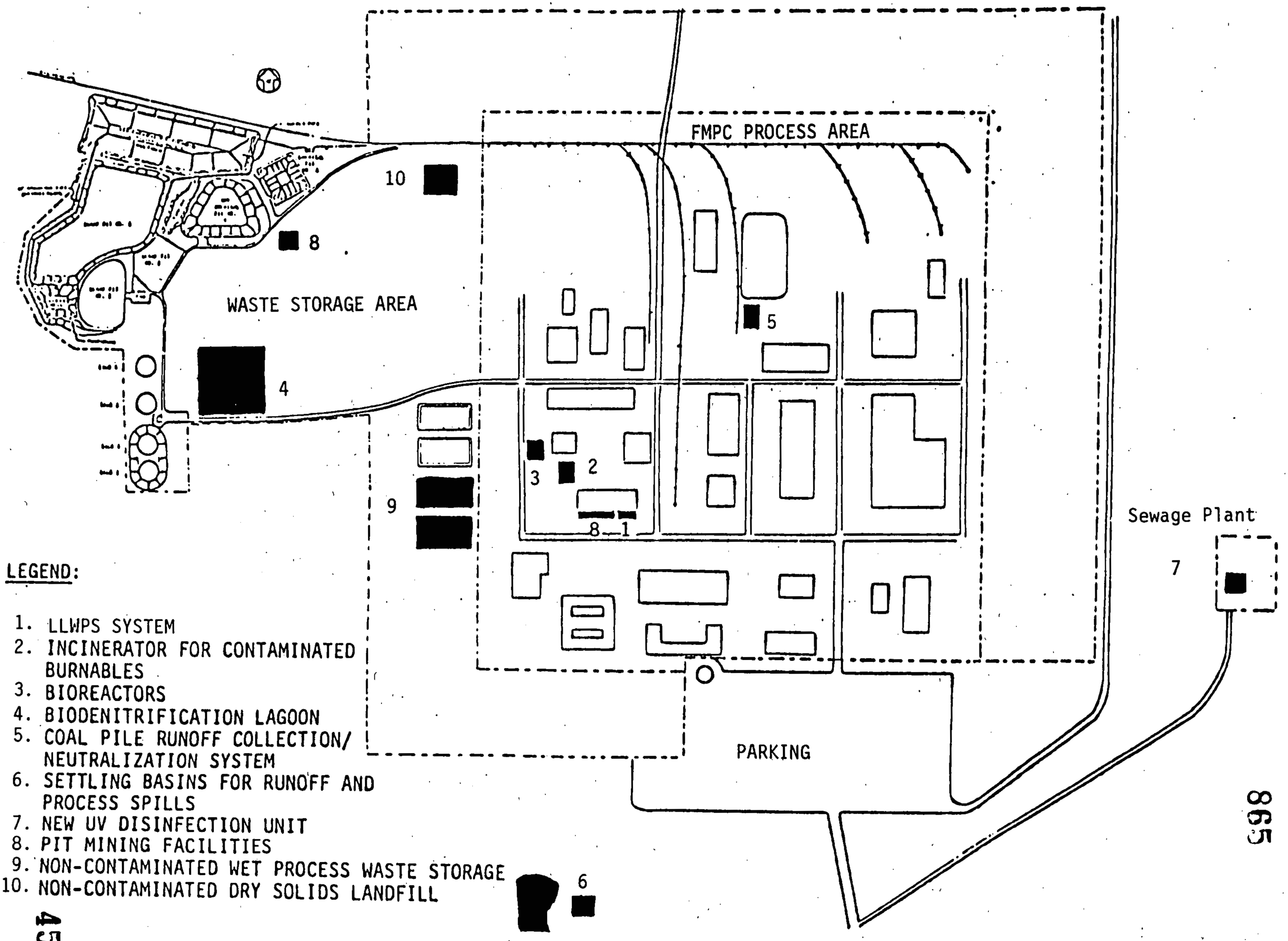
Effluent Volume Reduction Study

The FMPC wastewater discharge permit issued by the Ohio EPA contains limits for the total mass of pollutants. Reduction on the volume of wastewater would allow more efficient treatment of the resulting smaller streams. A study will be undertaken to examine the reduction of wastewater volume and to investigate water recycle and reuse. Funding of $400,000 is needed beginning in FY-1987.

5.1.2 Sewage Treatment Effluent

Funding of $300,000 will be required in FY-1988, for studies directed toward improving the quality of liquid effluents from the Sewage Treatment Plant. Capital requirements will be identified as will the beneficial impacts on the quality of the overall effluent discharged from Manhole-175.

MANAGEMENT FACILITIES



<u>LEGEND:</u>

1. LLWPS SYSTEM
2. INCINERATOR FOR CONTAMINATED BURNABLES
3. BIOREACTORS
4. BIODENITRIFICATION LAGOON
5. COAL PILE RUNOFF COLLECTION/ NEUTRALIZATION SYSTEM
6. SETTLING BASINS FOR RUNOFF AND PROCESS SPILLS
7. NEW UV DISINFECTION UNIT
8. PIT MINING FACILITIES
9. NON-CONTAMINATED WET PROCESS WASTE STORAGE
10. NON-CONTAMINATED DRY SOLIDS LANDFILL

TABLE 5-1
WATER POLLUTION CONTROL PROJECTS
(In $1,000's)

Line Items	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Water Pollution Control, Project No. 83-D-146	9,500**						
Improve Quality of Liquid Effluents	2,000					2,000	
Removal of Uranium from Storm Sewer Water	1,500					1,500	
Total Line Items	3,500	0	0	0	0	3,500	0
General Plant Projects (GPP)							
Controlled Storage Pads - General	1,000		200	250	250	300	
- Plant 1	200	200					
- Plant 2	250	250					
- Plant 4	350	350					
- Plant 9	200	200					
Total GPP	2,000	1,000	200	250	250	300	0
Capital Equipment (CE)							
Leakproof Dikes Around Tanks	100	100					
Total CE	100	100	0	0	0	0	0
TOTAL CAPITAL	5,600	1,100	200	250	250	3,800	0
Operating							
Water Pollution Control System	4,250	650	900	900	900	900	900*
Effluent Volume Reduction Study	400		200	100	100		
Sewage Treatment Effluent Study	300			300			
TOTAL OPERATING	4,950	650	1,100	1,300	1,000	900	900*

* Continuing Annual Requirement
**Project approved and in progress; completion expected during 3rd Quarter FY-1986.

5.1.3 Storm Water Discharges

Removal of Uranium from Storm Sewer Water

Each month, about five kilograms of uranium are discharged to the Great Miami River. Approximately, half is from the General Sump and Clearwell flows and the balance is from the Storm Sewer flow. Most of the uranium in the General Sump and Clearwell flows will be removed by the bioreactors. Then the Storm Sewer will become the major contributor of uranium in the discharge to the river. A system, such as an ion exchange unit, will be installed to remove this uranium; funding of $1.5 million is needed in FY-1990.

Controlled Storage Pads

Seepage-resistant concrete pads will be contructed for open storage of drums, hoppers or tanks containing hazardous materials for future processing. Existing pads will be demolished and replaced as necessary to meet the environmental criteria.

Runoff from these pads must be strictly controlled in order to meet EPA guidelines. Without proper control of liquids on storage pads, ground water and adjoining soil can become contaminated with hazardous materials. Cleanup of contaminated soil and ground water could result in excessive expenditures in the future. This project is expected to cost $1.0 million with funding of $200,000 beginning in FY-1987.

One branch of the Storm Sewer system drains the Plant 1 Storage Pad. Materials that leak or spill onto the pad can enter the Storm Sewer line. Diversion of the storm water is done only when there is a recognized spill. Chronic small releases are washed into the system with rain water runoff. The discharge from the Storm Sewer branch will be collected and combined with the bioreactors. Funding of $200,000 in FY-1986 will be required for the project.

Control Pads will be installed at Plants 2, 4 and 9 at a total cost of $800,000 to be funded in FY-1986.

Leakproof Dikes Around Tanks

Other improvements are needed within the production plants to prevent the inadvertent loss of uranium-bearing process liquors to the Storm Water distribution system. The most important of these is to provide leakproof dikes around all tanks containing uranium solutions. This project is estimated to cost $100,000 in FY-1986.

5.2 Waste Management

The management of both low-level radioactive and noncontaminated waste streams is illustrated in Figure 5-2. Projects and funding requirements for current generation and accumulated low-level radioactive waste materials are discussed in Sections 5.2.1 and 5.2.2. Projects for managing noncontaminated hazardous and conventional waste materials are covered in Sections 5.2.3 and 5.2.4.

Projects for the five year improvement program include plans for the processing and shipping of currently generated waste materials to an approved DOE low-level waste disposal site. Future planning calls for the disposition of stored waste inventories.

5.2.1 Disposition of Current Generation Radioactive Wastes

Contaminated wastes from continuing operations will be processed to a dry form by the Low-Level Waste Processing and Shipping (LLWPS) System for offsite disposal. The LLWPS System must be funded no later than FY-1986. Other projects for managing current generation contaminated wastes are outlined in Table 5-2 and discussed below.

Interim Waste Processing/Shipping

Prior to the completion of the LLWPS System in FY-1988, existing facilities will be utilized to process wet waste streams to a form suitable for shipment to an offsite disposal facility. Total funding of $5.7 million will be required for maintenance, operations, packaging, shipping and disposal of the waste materials through FY-1987.

Low-Level Waste Processing and Shipping System

The LLWPS system will convert all contaminated sludges and dry solids to a uniform dry solid suitable for packaging for offsite disposal. The treatment paths for the various streams involved are diagrammed in Figure 5-3. Depleted slag and various dry scraps will be crushed and screened to the proper form for disposal. Neutralized raffinate and slag leach filter cakes will be fed to a new rotary kiln to dry the material for disposal. A scrubber, NO_x destructor, and dust collectors will control atmospheric emissions from the kiln. Project No. 86-D-174 will cover the construction of the LLWPS system and is estimated to cost $17 million in FY-1986. Operating costs will be $4.0 million per year.

Improved Segregation of Contaminated and Noncontaminated Wastes

To minimize the volume of low-level radioactive wastes generated at the FMPC, a program will be initiated to provide training and facilities for improved segregation of contaminated and noncontaminated wastes. Facilities will cost $125,000 beginning in FY-1987 Operating costs will be $10,000 per year beginning in FY-1987.

FIGURE 5-2

FUTURE FMPC WASTE MANAGEMENT

1988

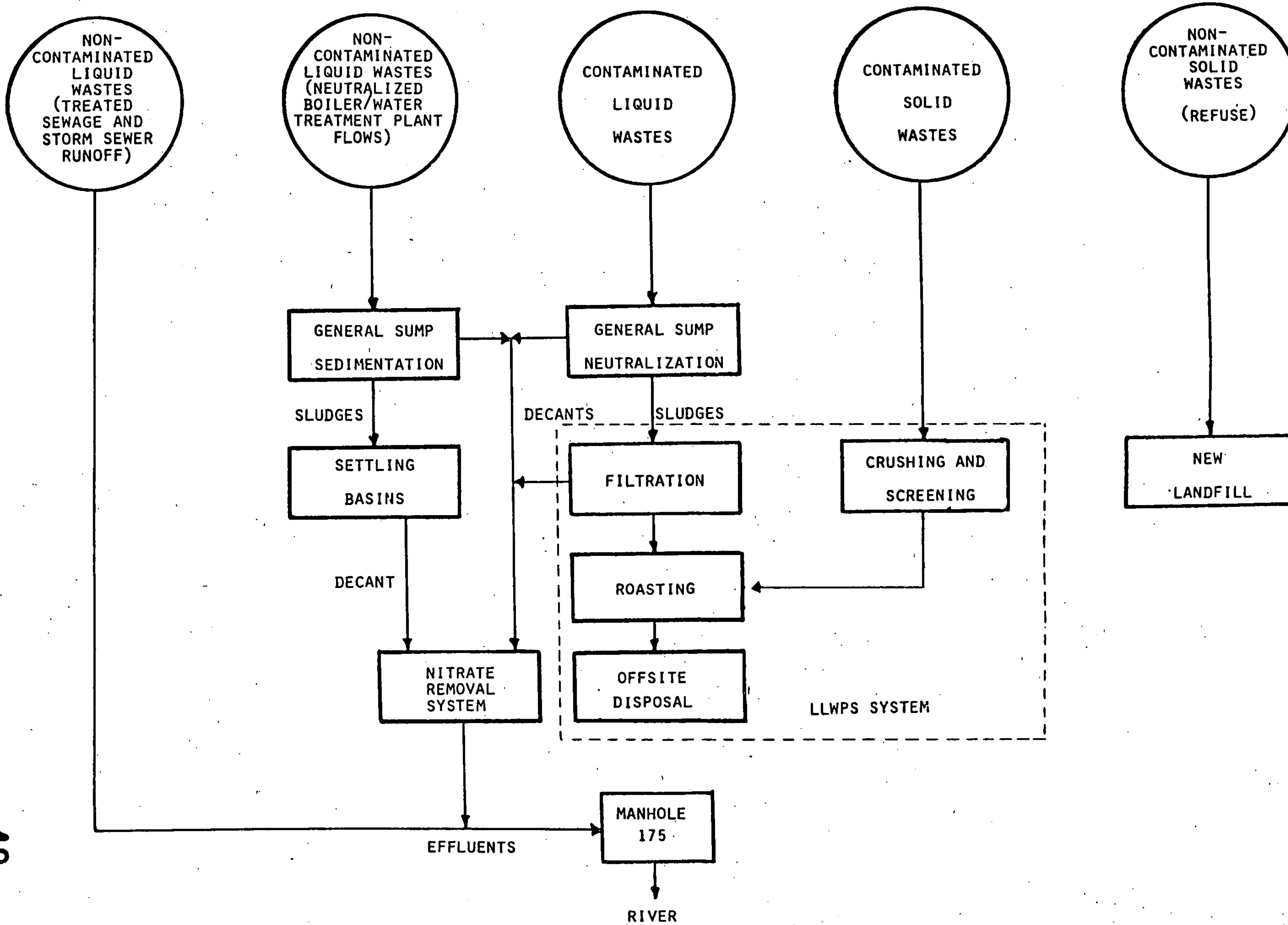


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TABLE 5-2
PROJECTS FOR MANAGING CURRENT
GENERATION RADIOACTIVE WASTES
(In $1,000's)

Line Items	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Low-Level Waste Processing, Project No. 86-D-174	17,000	17,000					
Install Contaminated Waste Incinerator with Facilities for Handling and Burning Shredded Wooden Pallets	1,000		1,000				
Total Line Items	18,000	17,000	1,000	0	0	0	0
General Plant Projects (GPP)							
Improved Waste Segregation	125		50	25	25	25	
Install Graphite Burner	250		250				
Additional Decontamination Capacity	300		300				
Total GPP	675	0	600	25	25	25	0
Capital Equipment (CE)							
Equipment for Radiological Support of Engineering Activities	60		60				
Total CE	60	0	60	0	0	0	0
TOTAL CAPITAL	18,735	17,000	1,660	25	25	25	0
Operating							
Interim Waste Processing/ Shipping	5,700	2,700	3,000				
Low-Level Waste Processing	11,100			3,500	3,700	3,900	4,000*
Improved Waste Segregation	40		10	10	10	10	10*
Volume Reduction of Construction Rubble	100	100					
TOTAL OPERATING	16,940	2,800	3,010	3,510	3,710	3,910	4,010*

*Continuing Annual Requirement

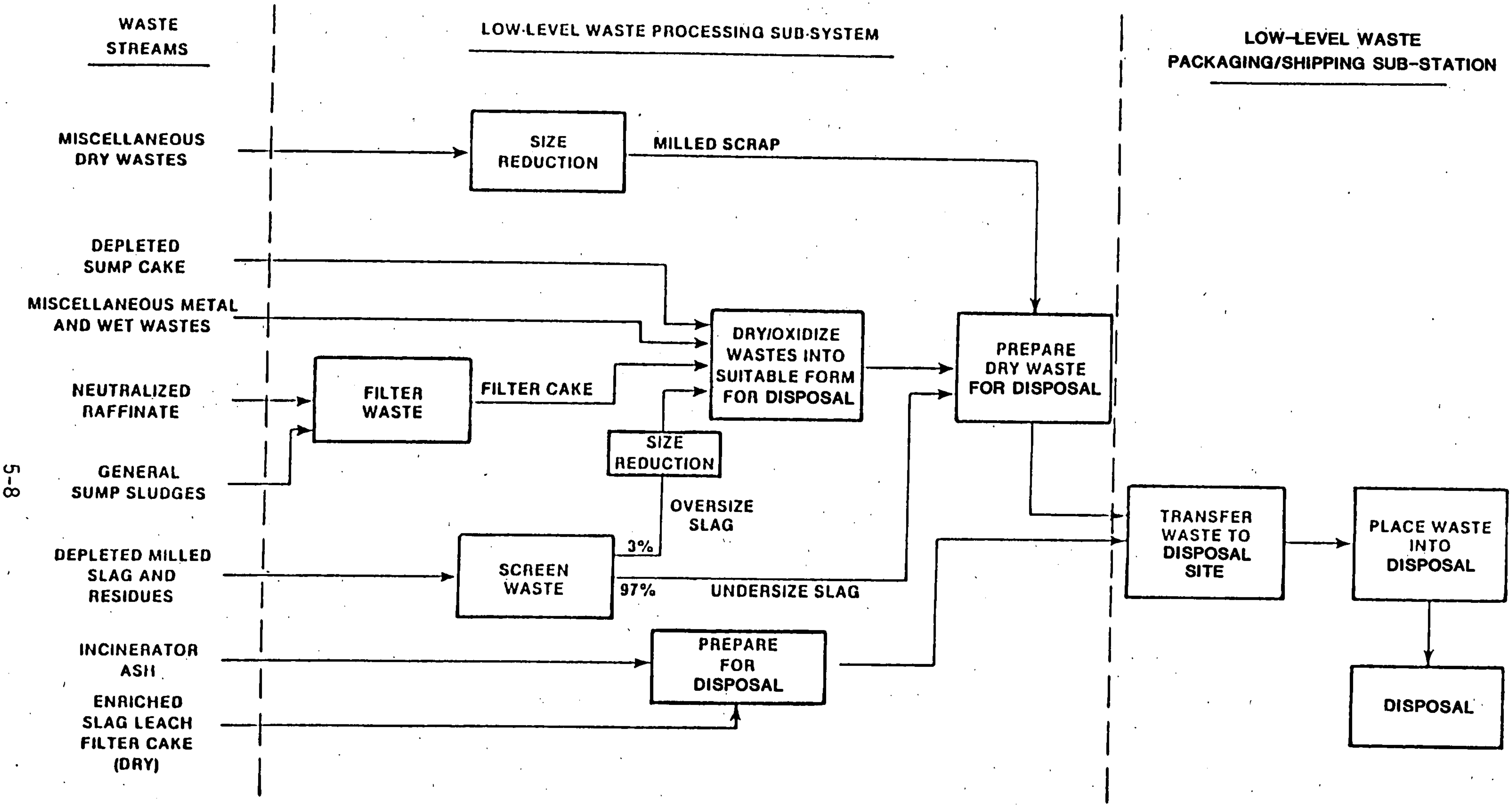

FIGURE 5-3
Functional Flow for FMPC Low-Level Waste Processing and Shipping System

Install Contaminated Waste Incinerator with Facilities for Handling and Burning Shredded Wooden Pallets

An incinerator to become operational in FY-1989, will convert contaminated burnable wastes, including shredded wooden pallets, to an ash suitable for offsite disposal. Emissions equipment will be provided to control particulates and corrosive gases to acceptable levels from this unit. Funding of $1,000,000 is needed in FY-1987.

Install Graphite Burner

Intentions are to cease operation of the existing graphite burner which is not equipped with suitable environmental control systems. A new facility is required to provide for volume reduction of depleted scrap graphite and uranium recovery from enriched graphite scrap. Funding of $250,000 is needed in FY-1987.

Additional Decontamination Capacity

To handle the ever-increasing volume of equipment and scrap requiring decontamination, either a new facility must be constructed or the existing decontamination facility must be enlarged. Contaminated materials are occupying valuable pad storage space and are contributing to ground and liquid effluent contamination. Funding of $300,000 will be needed by FY-1987.

Equipment for Radiological Support of Engineering Activities

During construction and demolition activities, radiological engineering support is required to determine the proper disposition of excavated soil, rubble and scrap. The prompt determination of contamination levels will require more sophisticated instruments than are currently available onsite. These needed instruments include: a thin-window, sodium-iodide detector, such as an Eberline PG-2; a survey meter with the capability for gamma pulse-height analysis, such as the Eberline "Rascal"; and a portable multi-channel analyzer, such as the Canberra-10. Also, uranium-in-soil standards must be prepared. This equipment will allow the prompt determination of the contamination levels so that disposition methods can be decided upon without great delays; funding of $60,000 is needed in FY-1987.

Volume Reduction of Construction Rubble

The many current and planned construction/demolition projects at the FMPC will result in the generation of substantial quantities of rubble. Methods will be investigated and procedures implemented, where applicable, for waste segregation and volume reduction. This will minimize low-level radioactive waste generation. Operating funds of $100,000 will be required in FY-1986.

5.2.2 Processing Accumulated Solid Wastes for Disposal

Accumulated contaminated wastes stored in pits and silos eventually will be retrieved and converted to a dry form for offsite disposal. Current planning calls for remedial activities at the surface impoundments and silos to be done over a ten-year period. Promulgation of draft DOE Order 5480 could significantly advance this time and funding schedule. In the interim, pits will be maintained and covered when full. Projects for managing accumulated contaminated wastes are outlined in Table 5-3 and discussed below.

Removal of Pit Contents

Past waste management practices at the FMPC involved the discard of low-level radioactive waste in surface impoundments and silos. Because of their design, the nature of the wastes contained and their location over an extensive aquifer, these impoundments and silos are considered waste storage and not permanent disposal facilities.

Planning must be initiated for the removal and processing of the stored waste inventories for final disposal. Engineering option studies will be initiated in FY-1985, to identify effective alternatives for material retrieval and disposition. Major line-item capital expenditures estimated to be $66 million are anticipated for construction of required facilities. Annual operating costs of $16.0 million will be incurred beyond the five year improvement planning period.

Disposition of Contaminated Waste Oil Inventory and Studies

The existing liquid waste incinerator does not have sufficient capacity to eliminate the backlog of contaminated oil. Drums of oil are developing leaks and must be removed from storage for redrumming. A large stainless steel tank costing $350,000 must be obtained for transferring drum contents; funding is needed in FY-1986.

Methods will be investigated for eliminating the large backlog and keeping pace with the increased volume of waste organics that will result from increased production. Potential methods include: increasing the capacity of the existing liquid waste incinerator or shipping the accumulated waste oil inventory for storage and/or incineration at a DOE facility. Funding of $55,000 in FY-1987, will be needed for the study.

Establish Data Base for Interim Remedial Actions

A program will be initiated to perform a radiological characterization of the FMPC facility and adjoining areas. A data base will be established to document the extent of contamination to aide in the development of a comprehensive program aimed at performing interim remedial actions. The data base will provide a planning tool for the eventual decommissioning of the FMPC facility. This project will cost $400,000 over the five-year plan period.

TABLE 5-3
PROJECTS FOR MANAGING
ACCUMULATED CONTAMINATED WASTES
(In $1,000's)

Line Items	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Facilities for Removal of Contents from Pits	66,000						66,000
Total Line Items	66,000	0	0	0	0	0	66,000
General Plant Projects (GPP)							
Disposition of Contaminated Waste Oil Inventory	350	350					
Total GPP	350	350	0	0	0	0	0
Capital Equipment (CE)							
Microcomputer for Waste Management Data Storage	10	10					
Total CE	10	10	0	0	0	0	0
TOTAL CAPITAL	66,360	360	0	0	0	0	66,000*
Operating							
Process and Ship Pit Contents	186,000	250	250	500	500	9,000	16,000*
Waste Oil Studies	55		55				
Establish Data Base for Interim Remedial Actions	400		100	100	100	100	
Removal of Contents of the Two (2) K-65 Tanks	25,000	200	200	200	200	200	24,000
Removal of Cold Metal Oxide from Silo No. 3	1,500					500	1,000
Ship Contaminated Ferrous Metal Scrap to K-25	50	50					
Shred All Contaminated Copper Scrap; Store for Eventual Sale or Disposal	180		60	60	60		
Disposition of Contaminated Hazardous Waste Solvents	170		75	75	10	10	
Cover Pits with Protective Membrane and Clean Earth	325	150			175		
Characterize Southfield Disposal Site	50		50				
Characterize the Old Fly Ash Pit Area	50		50				
TOTAL OPERATING	213,780	650	840	935	1,045	9,810	41,000

*Continuing Annual Requirement

Microcomputer Hardware and Documentation for Waste Management

A dedicated microcomputer with associated software is necessary as a comprehensive waste management tool. The microcomputer will enable the establishment of a waste management data base capable of tracking current inventories and shipments of waste materials. Also, it will provide a system where existing waste streams can be modeled and option studies performed to help optimize the waste management system. The system must be compatible with existing DOE waste management computer systems for effective overall coordination of DOE generated waste materials. Funding of $10,000 will be needed in FY-1986.

Removal of K-65 Material

Radium-bearing residues are currently maintained in two concrete silos onsite. Because of concerns over potential migration of contamination into the underlying aquifer, an engineering option study will be initiated to define effective alternatives for processing the K-65 material for permanent disposal. Funding of $200,000 in FY-1986, will start this program estimated to cost $25 million.

Removal of Cold Metal Oxide from Silo 3

Because of concerns over potential migration of contamination into the underlying aquifer, the cold metal oxides should be removed and transferred to a final disposal site. This project is expected to cost $1.5 million starting in FY-1990.

Ship Contaminated Ferrous Metal Scrap to K-25 for Smelting

As a result of past and proposed renovations to the FMPC production facilities, a large quantity of contaminated ferrous metal scrap has been and will continue to be generated. A project has been initiated to load and ship the material to Oak Ridge for eventual smelting. Funding of $50,000 is required to complete the scrap shipment project in FY-1986.

Shred All Contaminated Copper Scrap; Store for Eventual Sale or Disposal

The FMPC has a substantial inventory of contaminated copper scrap. A program will be initiated to shred the contaminated copper scrap for eventual sale or transfer to a permanent disposal facility. Shredding will begin in FY-1985, after installation of an air classifier for the reduction of particulate air emissions. Operations will continue into FY-1989 at a total cost of $180,000.

Disposition of Contaminated Hazardous Waste Solvents

Approximately 12,000 gallons of hazardous waste solvents that are slightly contaminated with uranium are stored in two large tanks on site. Planning will be initiated for shipping this solvent inventory to Oak Ridge for destruction in the DOE toxic waste incinerator at a cost of $170,000 beginning in FY-1987.

Cover Pits with Protective Membrane and Clean Earth

Currently, Pits 4, 5 and 6 are open surface impoundment storage pits and are in active status. Pit 5 has reached its capacity, while available storage space in Pits 4 and 6 is quickly becoming exhausted. An engineering option study will be conducted to determine the most effective method of pit closure to minimize possible migration of contamination to adjoining areas or the underlying aquifer. The selected alternative will be implemented as each individual pit becomes filled. This project will cost $325,000.

Characterize the Southfield Disposal Site

Radioactive debris has been placed in an area located 2100 feet S/SW of the Pilot Plant, between the Patrol road and Paddy's Run and near the old fly ash pile.

Periodic spot radiation readings at ground level reach 0.08 mR/hr. No record has been found of disposals in that area; but, employees do recall seeing construction rubble in the general vicinity. It must be assumed that the rubble was slightly contaminated debris generated from the expansion work in the 1950's. The total surface area involved is not known but the maximum area would be about 100,000 sq ft.

A radiological survey of the field, with test borings, will cost $50,000 in FY-1987. Costs for removing the material will not be known until the survey is conducted.

Characterize the Old Fly Ash Pile Area

Waste oil slightly contaminated with uranium was placed upon the fly ash pile in past years for dust suppression purposes. Radiological characterization will be performed in the area to define the extent of contamination. In the event contamination is detected in quantities which could potentially affect the local environment, remedial actions will then be necessary to remove and stabilize the contaminated materials. Costs will be $50,000 in FY-1987.

5.2.3 Hazardous Waste Materials

Projects for managing noncontaminated hazardous wastes are outlined in Table 5-4 and discussed below.

Facility for Passivation/Storage of RMI Generated Barium Chloride Waste

Approximately 14,000 pounds of spent salt sludges are received annually from the RMI extrusion operation. The salt sludges are composed of approximately 55 percent barium chloride, a hazardous waste requiring disposal in a licensed hazardous waste disposal facility. Since neither the FMPC waste storage pits nor the DOE low-level waste disposal site to which wastes will be sent in the future, are hazardous waste disposal sites, a facility is required for the treatment and/or storage of the salt sludge wastes. Passivation, or treatment of the salt sludge to remove the hazardous component, will render the waste suitable for managing as a low-level radioactive waste. Funding of $75,000 will be required for facilities in FY-1987. Annual operating costs of $10,000 are expected to begin in FY-1987.

Storage Building for Hazardous Analytical Chemicals

Volatile, explosive and hazardous chemicals are now stored within the Analytical laboratory stockroom (W-17) of the Technical Division Building. This is a potentially hazardous location because of its proximity to working personnel.

Personnel must frequently enter the stockroom of W-17 to obtain supplies (non-hazardous chemicals, office supplies, laboratory equipment). The room now used for storage is within the larger stockroom. There is a potential hazard to personnel should the chemicals leak out, volatilize or explode. Such chemicals should be stored in a separate building away from working personnel.

A storage building separated from the main Technical building is needed. The building should be 20 ft. x 20 ft. and need not contain windows. Heating, ventilation and storage shelves should be provided. Funds of $16,000 are needed in FY-1986.

5.2.4 Conventional Waste Materials

Projects for managing noncontaminated conventional waste materials are outlined in Table 5-4 and discussed below.

Improve Solid Waste Incineration

The existing solid waste incinerator is not equipped with a dust collection system, and there has been difficulty in meeting particulate emission standards set by the Ohio EPA. A study costing $5000 must be conducted to determine the feasibility of adding a dust removal system to the existing unit. Funding of $100,000 will be needed in FY-1987.

TABLE 5-4
PROJECTS FOR MANAGING
HAZARDOUS AND CONVENTIONAL WASTES
(In $1,000's)

General Plant Projects (GPP)	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Facility for Passivation/ Storage of RMI-generated Barium Chloride Waste	75		75				
Storage Building for Hazardous Analytical Chemicals	16	16					
Improve Solid Waste Incineration	105	5	100				
Expand Existing Landfill	50	50					
TOTAL CAPITAL	246	71	175	0	0	0	0
Operating							
Passivation of RMI Waste	40		10	10	10	10	10*
Spent Lime Sludge Drying Beds	40		10	10	10	10	10*
TOTAL OPERATING	80	0	20	20	20	20	20*

*Continuing Annual Requirement.

Expand Existing Landfill

To conserve valuable drying capacity for contaminated wastes, the LLWPS system will not combine contaminated and non-contaminated wastes. Therefore, solid wastes from the Boiler Plant, fly ash, neutralized coal pile drainage, feed water treatment sludge and uncontaminated blowdown water will require separate treatment and storage. A landfill will cost $50,000 in FY-1986, to receive these wastes and will begin operation along with the LLWPS system in FY-1988. The landfill will have a capacity of at least 500,000 cubic feet, sufficient for operation through FY-1998.

Spent Lime Sludge Drying Beds

Spent lime sludges from water treatment operations at the FMPC are segregated from radioactive waste streams and disposed of in an existing lime settling pond, which is now nearly filled. New facilities for the segregation and dewatering of these wastes are required. The new sludge drying beds are scheduled for construction during FY-1985, and will be operational in FY-1987, at an annual operating cost of $10,000 per year.

5.3 Reducing Atmospheric and Other Environmental Discharges

Projects for reducing atmospheric and other environmental discharges are outlined in Table 5-5 and discussed in each of the following three sections.

5.3.1 Gaseous and Airborne Emissions

Atmospheric emissions that are of concern to the FMPC are particulates, SO_2 and NO_x. The United States EPA has added radionuclides as hazardous air pollutants subject to possible regulation as airborne carcinogens under Section 12 of the Clean Air Act. Standards being developed by EPA will be applicable to all DOE sites.

The performance of electrostatic precipitators at the Boiler Plant indicates the facility is in compliance with Ohio EPA regulations. Coal having a sulfur content low enough to meet applicable stack emission standards for SO_2 will continue to be used in the Boiler Plant. The gaseous effluent of most concern is NO_x. Since there is no established Federal or State limit for NO_x emissions, a clear stack criterion has been established as an objective for all production operations that generate NO_x. The principal source of airborne radionuclide emissions is the discharge from dust collector stacks. Little improvement can be obtained from minor changes in dust collector and particulate scrubbing operations. Projects for improving the dust collection performance of existing equipment to achieve a reduction in gaseous and airborne emissions are described below.

Installation of HEPA Filters

Plant dust collectors remove more than 99 percent of the dust which reaches the collector bags. Despite this excellent removal efficiency, airborne uranium at the plant boundary is much higher than the normal background level. In the past, this concentration was considered acceptable because it met DOE limits for airborne uranium in uncontrolled areas. Using accepted literature data for uranium uptake and tissue dose rate, the calculated population doses are well within the limits. However, proposed regulatory changes will approximate the expected new lower limits.

Methods and costs for improved dust collection will be studied using data generated from stack monitoring and recording upgrades. Regardless of the type of NESHAPS regulation issued by the U.S. EPA to control offsite exposures, planning is based on the installation of HEPA filters on all dust collectors to achieve an emissions reduction of 50 - 90 percent. The estimated cost to achieve a 50 - 90 percent reduction in dust collector and scrubber emissions is $8.8 million for HEPA filters at fourteen discharge points, beginning with funding of $5.6 million in FY-1987. The remainder of 56 filters will be provided through the Productivity Retention Project.

TABLE 5-5
PROJECTS FOR REDUCING ATMOSPHERIC
AND OTHER ENVIRONMENTAL DISCHARGES
(In $1,000's)

General Plant Projects (GPP)	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Reduce Uranium in Offsite Wells	500		500				
Test Wells for Edge Production Area	120		120				
Total GPP	620	0	620	0	0	0	0
Capital Equipment (CE)							
Installation of HEPA Filters	8,800		5,600	3,200			
Reduce NO_x Discharges	275	275					
High Vacuum Dust Collection System	60	60					
Total CE	9,135	335	5,600	3,200	0	0	0
TOTAL CAPITAL	9,755	335	6,220	3,200	0	0	0
Operating							
Stack Sampler Study	125			125			
Offsite Air Sampling Stations	14	7	7				
Groundwater Study	50	50					
Radionuclide Study of Fish and Benthic Organisms	15		15				
Improve Milk Sampling Program	5	5					
Radionuclide Study of Local Game Animals	8		8				
Investigate Wet-Weather Spring Contamination	50				50		
TOTAL OPERATING	267	62	30	125	50	0	0

Stack Sampler Study

The NLO stack sampler uses a center-line probe to sample stack effluents at an isokinetic rate. Although the present samplers do permit corrective action to be taken in response to a dust collection system failure, it may not satisfy sampling requirements that will be imposed by the expected NESHAPS regulations. The present system, the Y-12 "rake-type" system and the proposed regulations will be studied to recommend, construct, install and test an improved system. Funding of $125,000 will be needed for facilities in FY-1988.

Reduce NO_x Discharges

To maintain clear stack operations in the Refinery and Plant 6 chip pickling operations at higher production levels, improvements in the existing system will be required. This will be covered by the Productivity Retention Project.

Short bursts of NO_x are discharged from Zirnlo decladding operations and when nitric acid tanks are filled at the Tank Farm. All such small sources of NO_x will be studied and systems installed to prevent visible emissions. This project is expected to cost $275,000 in FY-1986.

High-Vacuum Dust Collection System

Thorium residues are now stored in the two Plant 8 silos. If the material cannot be removed via the bottom outlet rotary valves, high vacuum dust collection system will be required for removing residues from the silos. Funding of $60,000 will be needed for capital equipment in FY-1986. Plans for processing thorium residue materials to usable products and storable forms are discussed in Section 5.7.

Offsite Air Sampling Stations

Continuous air samples collected at seven locations on the plant boundary are used to provide data on uranium in air. Until 1984, these data were used to calculate population radiation exposures from uranium inhalation. If proposals by the U.S. EPA are adopted, it will be required to calculate population doses from stack sampling data. In either system, there is no offsite sampling being done to support the population dose assessments and provide added assurance to regulations and the public that offsite concentrations of uranium in air are at the low levels found at the boundary or calculated from the stack data. In FY-1985, two offsite stations will be established, at a total cost of $7000. If warranted, two additional stations will be established in each FY-1986 and FY-1987.

5.3.2 Groundwater

Reduce Uranium in Offsite Wells

In 1984, a groundwater study was started to investigate the sources of elevated uranium concentrations in groundwater at the FMPC and its vicinity, and to recommend appropriate remedial action measures. The study is expected to be completed in March 1985, but could be extended at a cost of $50,000 in FY-1986.

Remedial actions may include removal of waste material from storage locations or installation of new wells followed by groundwater pumping or surface flow diversion. Funds of $500,000 for remedial action must be available FY-1987.

Test Wells for Edge of Production Area

The consultant conducting the present groundwater study believes chemicals may migrate from the production area from spills, leaks and general activities around the production plants. In order to determine if migration is occurring, a series (about 12-15) of shallow test wells will be installed along the south and east side of the production area. If evidence of migration is found, additional wells will be drilled to locate the leading edge of the contaminantion plume. Funding of $120,000 is needed in FY-1987.

5.3.3 Other Programs

Radionuclide Study of Fish and Benthic Organisms

A study will be conducted to determine whether radionuclide bioaccumulation occurs in fish and benthic organisms in the Great Miami River. Any bioaccumulation determined should be studied to determine any importance to the human food chain.

Results of this work would be used to select the appropriate fish species or other organisms for annual sampling and analyses. The analytical data can be used to estimate the potential radiation dose to humans consuming fish from the Great Miami River. This study will be conducted in FY-1987, and is estimated to cost $15,000.

Improve Milk Sampling Program

Sampling has shown no difference in the uranium content of milk from cows grazing onsite and milk from different locations. However, such evidence collected by NLO will be quickly dismissed by critics. The services of a consultant will be obtained to guide the sampling program and to provide an opinion regarding any effect of plant operations on local dairy or beef cattle. Funding of $5,000 is needed in FY-1986.

Radionuclide Study of Local Game Animals

Game animals which inhabit the FMPC site may have an intake of uranium or other radionuclides. When these animals move beyond the site boundary, they could enter the human food chain.

A study will be conducted to trap and analyze animals onsite and in adjoining areas. A determination will be made if the transfer of radionuclides is significant. If a significant transfer is found, appropriate species will be selected for routine environmental sampling. An estimation of the potential radiation dose to humans who hunt and consume such animals will be made. This study will be conducted in FY-1987, and is estimated to cost $8,000.

Investigate Wet-Weather Spring Contamination

A small wet-weather spring southwest of the Pilot Plant contained dissolved uranium when sampled. The services of a consultant will be obtained to investigate the spring flow, conduct sampling and identify the contaminant source. Funding of $50,000 will be needed in FY-1989.

5.4 Health and Safety

The International Commission on Radiological Protection (ICRP) has recommended the use of metabolic models which give higher dose estimates for uranium intakes than the models which form the basis for present DOE limits. If DOE adopts standards based on the newer ICRP models, it will be necessary to modify uranium handling operations to meet the objective of complete containment; that is, no dusting, leaks or spills.

During 1973, Production wage employees in every plant exceeded 10 percent of the Radiation Protection Standard for exposure to the skin of the whole body. Skin doses in excess of 10 percent of the Standard were also received by Mechanical wage employees, Mechanical supervisors, Production Technology personnel and many Production supervisors. During the first seven months of 1984, many positive urinalysis results were obtained for operators in the chemical plants. Therefore, it is not likely that administrative controls and special clothing will be adequate to reduce exposures to new low target levels. Instead, an extensive program of renovation and improvements in every plant will be needed. Improvements will include local shielding and remote handling. Redesign of equipment will be needed to reduce exposures to Mechanical personnel.

While the extent of the required improvements will not be known until the recommended study has been completed, it is expected that many widespread and costly modifications will be required. Specific projects for reducing personnel exposures are discussed in Section 5.4.1. Other projects for improving safety and health are covered in the subsequent sections. All Health and Safety projects are outlined in Table 5-6.

NLO, Inc.
ENVIRONMENTAL, SAFETY
AND HEALTH PLAN

TABLE 5-6
HEALTH AND SAFETY PROJECTS
(In $1,000's)

FY-1985 Issue

Date: 10/1/84

Line Items	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Modernization of Buildings	25,500			25,500			
Material Handling-Plantwide	20,000				20,000		
Total Line Items	45,500	0	0	25,500	20,000	0	0
General Plant Projects (GPP)							
Visitor Issue Center	125			125			
Storage Building - Finished U Metal	598	598					
New Receiving/Shipping Dock	250					250	
Enlarge Female Locker Room/Showers	950	950					
Upgrade Lighting - Plantwide	2,000		500	500	500	500	
In Vivo Monitor Facilities	800**						
Construct Training Facility	250			250			
Total GPP	4,173	1,548	500	875	500	750	0
Capital Equipment (CE)							
High-Pressure Liquid Blaster	130	130					
Portable Vacuum Cleaners	100	100					
Convert from Oil-Base Paints	10	10					
Convert Dry Cleaning System to New Solvent	5		5				
Change General-Use Shop Solvent	5	5					
Improve Services for the Respiratory Protection Program	40			40			
Total CE	290	245	5	40	0	0	0
TOTAL CAPITAL	49,963	1,793	505	26,415	20,500	750	0
Operating							
General Plant Housekeeping	3,000	600	600	600	600	600	600*
Color Coding - Plantwide Piping	800	100	100	100	100	100	300
Plan for Reduction in Exposure Limits	50		50				
Removal of Plant 1 Silos	150			150			
Removal of Abandoned Equipment	4,000	800	800	800	800	800	
Demolition of Plant 7	1,000					1,000	
Asbestos Pipe Insulation	2,800	250	250	250	250	250	1,550
TOTAL OPERATING	11,800	1,750	1,800	1,900	1,750	2,750	2,450

* Continuing requirement.
**Submitted for FY-1985 funding; not included in totals.

5.4.1 Reduction of Radiation Exposures

Operations must be conducted in a manner which assures that both onsite and offsite radiation exposures are limited to the lowest levels technically and economically practicable. Specific items are discussed below:

General Plant Housekeeping

A roving cleaning crew assigned to the Production Division is planned for the FMPC. Current plans are to submit manpower and capital requirements in the FY-1986 budget year. Capital funding of $130,000 is needed for high-pressure cleaning equipment, steam cleaning equipment, etc. Manpower requirements are two supervisors and twenty wage personnel; annual operating costs are estimated to be $600,000.

Although the primary duty of this cleaning crew will be high-level cleaning in all buildings, other general housekeeping items will also be included.

Color Coding - Plantwide Piping

All above ground piping will be color coded to identify and simplify pipe route tracing. Cross-connections will be eliminated during construction. This will be an eight-year project costing $100,000 per year beginning in FY-1986.

Visitor Issue Center

Construct a small building between the NE corner of the Service Building and First Street to provide facilities for visitor clothing and clean-ups. The building will contain a supply of smocks, caps, hard hats, plano safety glasses, goggles and shoe covers for use in the process area. Lockers will be provided so visitors can store personal belongings such as hats, coats and briefcases before entering the process area. A sink will be available for hand washing. Toilet facilities for men and women will be provided. Turnstiles will be used to ensure a correct separation of clean-side and process-side of the building. Funding of $125,000 is required in FY-1988.

Plan for Reduction in Exposure Limits

A study is needed to define requirements for operating the plant if limits for internal and external radiation exposures are reduced to one-tenth of present levels. To stay well within such reduced limits, hand contacts with uranium on highly contaminated items must be minimized. Complete suits for beta shielding would be needed for some maintenance jobs and production operations. Study is expected to cost $50,000 in FY-1987.

Storage Building - Finished U Metal

Large quantities of uranium metal are sent to the Inspection area of Plants 6 and 9 to be checked prior to shipment. The quantities cannot be inspected as fast as produced, nor shipped immediately after inspection. Additional storage area is required to separate radioactive materials from operating personnel, and will include a building with loading/unloading docks. A building size of 15,000 sq ft will be adequate; heating and ventilation will be required. Funding of $598,000 will be needed in FY-1986.

New Receiving/Shipping Dock

To reduce the need for private vehicles to enter the process area, a receiving/shipping facility will be constructed at the fence line. This facility will receive all shipments which now go to Stores or the Service Building. Materials received at this new facility will immediately be moved to other locations. The facility will not be used for storage or receiving/shipping radioactive materials. Funding of $250,000 will be required in FY-1990.

Portable Vacuum Cleaners

The existing portable vacuum systems are worn out. New units are needed where plant vacuum is not readily available. Portable units are used for cleaning dust collectors for maintenance. New units will be designed to limit airborne emissions at a cost of $100,000 in FY-1986.

5.4.2 Removal of Surplus Facilities

Facilities which are surplus or excess to current needs may present potential radiation exposures to FMPC personnel. A program to identify, characterize and decontaminate and/or remove such facilities will be developed as part of environmental, safety and health planning.

Removal of Plant 1 Silos

Offsite discharges of radioactivity will be reduced by the planned removal of the material storage towers located south of Plant 1. Material from the deteriorating storage towers continues to be washed into the Storm Sewer system despite the cleanup and residue removal efforts conducted several years ago. No maintenance has been performed for many years and metal components are heavily rusted. Tiles occasionally drop from the tower facing. It is evident that the structure will eventually be razed. Continued deterioration may make the task more difficult. Removal of the structure will also eliminate the potential damage to the nearby enriched uranyl nitrate solution storage tanks. Funding of $150,000 will be needed in FY-1988.

Removal of Abandoned Equipment - Plantwide

Abandoned equipment will be removed from all plants to eliminate potential hazards to personnel and allow safe and convenient access to equipment now in service. Because of the condition of the abandoned equipment and piping, immediate removal is required to eliminate congested areas and related safety hazards. Housekeeping efforts will be simplified and enhanced. This will be a five-year project costing $800,000 per year beginning in FY-1986.

Demolition of Plant 7

Plant 7 was the former UF_6/UF_4 reduction plant, and was shutdown more than twenty years ago. In the late 1960's, all the abandoned equipment and instrumentation were removed and sold as surplus property. Since that time, the building has been utilized on a limited basis for indoor storage purposes. Only the ground floor is suitable for storage. This space is no longer needed with the completion of the new adjacent warehouse.

Demolition of Plant 7 will be funded in FY-1990, and is estimated to cost $1.0 million. This project will be undertaken to eliminate an increasing health problem caused by the inhabitation of the building by pigeons and birds.

5.4.3 Industrial Hygiene and Safety

Modernization of Buildings

Remove and dispose of building roofing and siding composed of corrugated cement-asbestos. Prepare structure for installation of a new fire and corrosion-resistant siding and roofing. Deterioration because of corrosion and age has weakened the mounting system of these panels.

Remove and dispose of interior flat asbestos sheeting and building insulation. Install new insulation, sheeting and support systems having fire and corrosion resistance. Deterioration because of age, corrosion and physical damage has weakened the mounting system to the point of imminent danger of falling panels. The insulation has become impregnated with radioactive dust and partially collapsed. This will be a $25.5 million project in FY-1988.

Material Handling - Plantwide

This project will provide for acquisition and installation of new materials handling equipment. This will greatly improve operator safety and reduce the exposure of operators to hazardous materials. Costs for this project are estimated to be $20 million in FY-1989.

Asbestos Removal from Pipe

The asbestos insulation on pipe lines has been protected from the elements with various types of jacketing since the insulation was installed. Also, this jacketing prevents the release of asbestos fibers at all times except when tie-ins and repairs are made to these insulated lines. This long term project is expected to cost $250,000 annually.

Enlarge Female Locker Room/Showers

The female locker room and shower areas have been in use since 1981, and were constructed at the expense of facilities in service for over thirty years. The female facilities are in need of expansion. The continuous use of both areas has caused deterioration of the lockers, showers and floors. The lockers are a safety hazard because of corrosion and difficulty of operation. The shower and locker room area will be upgraded at a cost of $950,000 in FY-1986.

Upgrade Lighting - Plantwide

Remove lighting of inadequate intensity and replace with new fixtures meeting current standards and work station requirements. Inadequate lighting is a serious problem for both worker safety and job task quality. In addition, some fixtures have corroded and eventually will require replacement. This project is estimated to cost $2 million beginning with $500,000 in FY-1987.

Convert from Oil-Base Paints for Drum Painting

In order to reduce the emissions of volatile organics and associated fire hazards, the drum reconditioning operation will be converted from oil-base to water base paints in FY-1986, at a cost of $10,000 from miscellaneous capital.

Convert Dry Cleaning System to New Solvent

Perchloroethylene is now used in the laundry for dry-cleaning leather-palm gloves. The system must be converted to a solvent that is not a suspected carcinogen and not regulated by the U.S. EPA under RCRA. Only minor costs are expected for tests of candidate solvents. Revisions to the solvent still may be needed and these revisions may cost $5,000 (miscellaneous capital) in FY-1987.

Change General-Use Shop Solvent

A general-use shop solvent (1, 1, 1 - trichloroethane) is used as a degreaser in the Garage and Mechanical Shops. The use of this solvent must be discontinued and replaced with a solvent that is not regulated by the U.S. EPA under RCRA. Only minor costs of $5,000 (miscellaneous capital) are expected for tests of candidate solvents in FY-1986.

5.4.4 In Vivo Monitoring Facilities

There are serious limitations in the use of the mobile counter at the FMPC. It has been established that employees must be free from exposure for several days prior to being counted in order to obtain reliable monitoring results. Only a fraction of the employees who must be monitored can be counted in this manner because of the limited availability of the mobile counter. Consequently, there are uncertainties in many of the counts which adversely affect the reliability of exposure estimates.

A permanent in vivo radiation monitoring facility is required so that the best possible lung burden estimates can be made by counting exployees at the most opportune time. The facility will incorporate state-of-the-art detectors and techniques in order to obtain the best possible lung burden estimates, especially at very low exposure levels. An estimate of $800,000 has been submitted for funding in FY-1985. It is anticipated that the facility will not be operational until 1987. In the meantime, the DOE-OR mobile counter will continue to be used for in vivo monitoring of employees at the FMPC.

5.4.5 Training

Construct a Training Facility

A training facility will be constructed in the open area between the Service Building and First Street. It will be used primarily by the Health and Safety Division to prepare and give training programs on all health protection subjects. The building will include a large room for about fifty people, and will contain standard audio-visual aids; such as, projectors, videotape players, TV monitors, blackboards, etc. The lecture room will have entrances from both the process and administrative areas. The facility will cost $250,000 in FY-1988.

Improve Services for the Respiratory Protection Program

A permanent respirator fit-testing facility will be constructed and equipped with heating, air conditioning and a respirator ultrasonic cleaning station. The cleaning of used respirators and checking for reuse is now done on a part-time basis. A dedicated facility will improve efficiency of the fit-test program. Recertification of used cartridges prevents the discarding of units that are not damaged and have little or no radioactivity. Funding of $40,000 will be needed in FY-1988 for this project.

5.5 Emergency Preparedness

Emergency preparedness projects for responding to environmental and safety incidents are outlined in Table 5-7 and discussed below.

Upgrade the Emergency Operations Center (EOC)

The existing center is small and contains equipment such as the meteorological tower, television monitoring and telephone switchboard. The communications console design does not provide adequate space for the working officer or for management response to emergency situations. The Center will be enlarged and redesigned for human factor reasons. Console equipment will be upgraded to current technology. Existing equipment, i.e. Honeywell system and meteorological tower, will be integrated into the upgraded system. Facilities for management participation in responding to emergencies will be provided. These include: conference tables, telephones, boards and area maps. The cost of this upgrading has been estimated to be $100,000 for funding in FY-1987.

Upgrade Automatic Sprinklers

The 35 wet and dry pipe sprinklers will be tested. Repairs or replacements are expected to cost $50,000 in FY-1988.

Replace Smoke Detection Systems

The four smoke detection systems in service throughout the FMPC should be replaced with new 24 volt state-of-the-art systems. Replacement parts are difficult to obtain and this hampers repair and prevents expansion. Cost of the replacement is estimated to be $30,000 and is planned for FY-1986.

Atmospheric Dispersion Modeling System

The accident with the greatest potential for an offsite health hazard is the release of a volatile, toxic chemical from the Tank Farm. A release of uranium hexafluoride (UF_6) from the Pilot Plant, could have serious onsite consequence in addition to harmful publicity. Toxic chemical atmospheric dispersion models can be tied in with the existing meteorological tower and sensors to automatically calculate the dispersion of any released material. Systems capable of direct dialing will notify the various emergency response groups. Further, such a system can retain the entire emergency sequence to be reviewed by accident investigators.

The equipment will save time and effort of both the Plant Emergency Director and the Communications Officer. The extra time gained by these personnel can be utilized in mitigating the situation. It would provide more accurate and timely results which would give personnel additional minutes to conduct a full-scale evacuation should one be warranted. A transcript of the entire emergency situation would be available for investigative purposes after the incident. This item has been submitted for FY-1986, and has an estimated cost of $150,000.

TABLE 5-7
EMERGENCY PREPAREDNESS PROJECTS
(In $1,000's)

General Plant Projects (GPP)	Total Estimated Cost	Fiscal Years 1986	1987	1988	1989	1990	Beyond
Upgrade the Emergency Operations Center	100		100				
Upgrade Automatic Sprinklers	50			50			
Replace Smoke Detection Systems	30	30					
Total GPP	180	30	100	50	0	0	0
Capital Equipment (CE)							
Atmospheric Dispersion Modeling System	150	150					
Total CE	150	150	0	0	0	0	0
TOTAL CAPITAL	330	180	100	50	0	0	0

5.6 Research and Development

Nine research and development projects are planned to address environmental, safety and health concerns. The goals and objectives of these projects are discussed below.

5.6.1 Fluidized-Bed Heat Treating of Uranium Metal

Goal - To eliminate the need for using a molten chloride salt bath for heat treating uranium metal.

Objective - To develop and demonstrate that uranium can be heated in a fluidized-bed to produce specified metal structure and crystal orientation.

Uranium metal is heated in molten salt baths for forming or heat treatment, using a mixture of sodium and potassium chlorides. This salt and the residues require special handling to avoid contamination to the environment.

A fluidized-bed will utilize a media heated to the temperature required in an inert gas. Tests are needed to determine if a satisfactory grain structure and orientation can be obtained.

5.6.2 Study to Minimize Radiation from Uranium Metal

Goal - To minimize the amount of beta particles which are emitted from the surface of uranium during melting solidification and subsequent handling.

Objective - To demonstrate that the beta particles emitted from cast uranium can be reduced to levels as low as reasonably achievable.

Melting and casting of uranium produces daughter products, primarily Th-234, which is a strong beta emitter. This causes a more-than-desired exposure to personnel. Test work has shown that this beta emission from Th-234 can be significantly reduced. Large scale tests are in progress.

5.6.3 Material Handling Improvement - Plant 6 Inspection

Goal - To improve the method of handling uranium metal cores through the Inspection area and into the shipping containers.

Objective - To minimize accidents and exposures of personnel to uranium metal by eliminating the manual transfer of cores during inspection.

Finished uranium cores are inspected and transferred to and from each station by physically handling each piece. These operations could be done through the use of robots and other material handling devices.

5.6.4 Study of Operations Affecting Compliance With NPDES

Goal - To develop processing methods which remove objectionable substances from effluents.

Objective - To test methods of removing those quantities of substances from liquid effluents which the EPA designates as pollutants through the NPDES permit system.

This is a continuing Development Department program which studies and recommends the most appropriate methods for avoiding a violation of the EPA's permit for discharge of liquid effluents.

5.6.5 Study of Methods to Reduce NO_x Discharges

Goal - To handle NO_x fumes so that none escape to the air.

Objective - To develop techniques which will convert NO_x gases into a harmless substance.

The processes for producing uranium utilize nitric acid, causing a release of NO_x gases into the atmosphere. This program is aimed at studying methods of treating NO_x releases.

5.6.6 Biodenitrification

Goal - To reduce the nitrate and heavy metal content of liquid effluents to a level permitted by the NPDES using biodenitrification.

Objective - To explore the ability of this system to remove heavy metals (like uranium and copper) from the liquid effluent.

The NPDES permit allows an average of only 62 kg/day of nitrate (N) to be discharged from the site. To comply with this, a biodenitrification facility is scheduled for completion in the first quarter of FY-1986.

Because this is a new technology, additional information is being obtained toward setting up a lab facility for control purposes. So far, there is evidence that this technology may also reduce the amount of heavy metal, like uranium, present in effluent feed.

5.6.7 Decomposition of Reduction Byproducts

Goal - To dispose of the MgF_2 slag which is generated in the reduction of UF_4 with magnesium.

Objective - To convert the MgF_2 into a salable compound and minimize the need for storage and/or burial of reaction byproducts.

The MgF_2 produced in the reduction of UF_4 with magnesium generates the largest quantity of uranium contaminated residue. This program is aimed at finding a means of recovering the values contained in MgF_2, and thus, avoid the need for bulk storage.

5.6.8 Reduction of Sump Cake Volumes and Copper Discharges

Goal - To eliminate copper from liquid effluents.

Objective - To develop techniques of removing copper from neutralized raffinates and reduce the volume of sump cake requiring storage.

Neutralization of aqueous waste streams with lime or caustic is necessary to hold the small amount of residual uranium as a sump cake. This cake also contains copper which must not exit the plant site in quantities over 25 grams per day.

The program is aimed at reducing the amount of copper which leaves the generating site and in turn would reduce the volume of sump cake sent to storage.

5.6.9 Development of Alternate Means of Drying Pit Contents

Goal - To dry wet sludges in pits for offsite disposal.

Objective - To develop a method of removing a large portion of the water in sludges prior to complete drying by calcination.

The lined storage pits are located over an aquifer used for drinking water. The "wet" pits contain sludge and cake which contain uranium. The present plan is to dry this material and drum it for shipping offsite for disposal.

This problem is being studied to find some means of removing water from the residues prior to kiln-drying. A green house located over a sand and pebble bed is being tested.

5.7 Thorium Inventory Management and Processing Planning

The FMPC serves as the thorium repository for the DOE, maintaining long-term storage facilities for a variety of thorium materials. A summary of the FMPC thorium inventory by composition is presented in Table 5-8. Although no significant thorium activity is foreseen in the near-term, the existing inventory must be stabilized for radiological, environmental and industrial safety reasons. To offset operating costs, limited quantities of high purity thorium oxide can be produced for private industry needs.

A plan for processing thorium materials is illustrated in Table 5-9. The initial effort will process 496.5 MT Th low-grade residues into a form suitable for offsite shipping in drums. Low-grade residues and sludges in deteriorating drums would be processed first, followed by stable residues. Removal of 174.6 MT Th stored in the two Plant 8 silos eventually will be necessary because of the slowly deteriorating structural conditions in Plant 8. Unsafe portions of the second floor of Plant 8 were removed during FY-1983. Offsite Th oxides, metal and historical samples totaling 167.2 MT Th will be retained in present form.

A total of 423.6 MT Th high-grade residues and impure thoria gel will be processed to a pure dense oxide for industry needs. All processing equipment located in the Pilot Plant for the purification, precipitation, drying and calcination via the sol gel process must be reactivated. Improvements will be needed for personnel protection during the drying and calcination operations.

Funding of $60,000 for the high vacuum dust collection system in FY-1986 (See Section 5.3.1), will provide for the removal of materials from the Plant 8 silos beginning in FY-1988. All low-grade materials will be drummed for offsite disposal by the end of FY-1990.

Facilities for reactivating and improving the thorium conversion equipment will require funding of $500,000 in FY-1988. Operations will begin in FY-1990, upon completion of all drumming activities. Annual operating expenses will be $500,000 for drumming followed by conversion operations over a four-year period. Shipping costs are not included.

TABLE 5-8
THORIUM INVENTORY COMPOSITION
(Metric Tons Thorium)

Material Form	MT Th	Location
ThO_2 Dense (GE-Bettis)	4.5	Bldg. 67, Bldg. 72
THO_2 Sol Gel	25.9	Bldg. 67
Pilot Plant - WIP	8.9	Pilot Plant Tank #2 and Lab
Impure Thoria Gel	338.3	Pilot Plant Warehouse
Thorium Oxides	174.6	Plant 8 Silo
Thorium Oxalate Cake	1.2	Bldg. 67, Bldg. 72
Thorium Nitrate Crystals	1.7	Bldg. 67
Low-Grade Residues from General Atomic	321.7	Bldg. 65
Offsite Thorium Hydroxide	10.8	Bldg. 67
Offsite Thorium Oxides	74.4	Bldg. 67, Bldg. 72
Thorium Nitrate Solution	0.9	Bldg. 67
ThF_4	0.8	Bldg. 67
Metal	79.9	West Bldg. 65, Bldg. 72, Bldg. 67
Clad Metal	4.4	West Bldg. 65
Alloyed Metal	3.5	West Bldg. 65, Bldg. 67, Bldg. 72
Material Held for Historical Purposes	0.5	Bldg. 67, West Bldg. 65
High Grade Residues (>30% Th.)	35.1	Bldg. 67, West Bldg. 65
Low Grade Residues (<30% Th.)	0.2	Bldg. 67
TOTAL	1087.3	

TABLE 5-9
THORIUM PROCESSING AND DISPOSAL PLAN

Material Form	MT Th	Drum for Offsite Burial	Processing To Suitable Form For Long-Term Storage/Sale					
			Digestion	Extraction	Precipitation	Sol Gel	Dense Oxide	None
ThO_2 Dense	4.5							X
ThO_2 Sol Gel	25.9						X	
Pilot Plant WIP	8.9			X	X	X	X	
Impure Thoria Gel	338.3		X	X	X	X	X	
Thorium Oxides	174.6	X						
High Grade Residues	50.5		X	X	X	X	X	
Low Grade Residues	321.9	X						
Offsite Th Oxides	74.4							X
Metal	87.8							X
Historical Samples	0.5							X
Total	1,087.3							

Summary

Disposition	Material Form	MT Th
Drum for Offsite Disposal:	Thorium Oxides	174.6
	Low-Grade Residues	321.9
		496.5
Retain In Present Form:	ThO_2 Dense	4.5
	Offsite Th Oxides	74.4
	Metal	87.8
	Historical Samples	0.5
		167.2
Process to Usable Form:	ThO_2 Sol Gel	25.9
	Pilot Plant WIP	8.9
	Impure Thoria Gel	338.3
	High-Grade Residues	50.5
		423.6