DOE/EA-0116

ENVIRONMENTAL ASSESSMENT
for the
FUELS AND MATERIALS EXAMINATION FACILITY

Hanford Site
Richland, Washington

JULY 1980

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PURPOSE OF THIS DOCUMENT

The Fuels and Materials Examination Facility (FMEF) and the High Performance Fuel Laboratory (HPFL) were originally proposed to be constructed as separate facilities in the 400 Area of the Hanford Site near Richland, Washington. The environmental effects of these two facilities were described and evaluated in the FMEF Environmental Assessment[5] and the HPFL Final Environmental Impact Statement, ERDA-1550.[6]

For economic reasons, the two facilities will no longer be built as separate facilities. The FMEF facility plans have been modified to incorporate some of the features of the proposed HPFL facility while retaining essentially all of the capabilities of the original FMEF proposal.

The purpose of this document is to update the FMEF Environmental Assessment[5] to appropriately reflect addition of certain HPFL features into the FMEF facility and to assess the environmental affects of the facility which resulted from inclusion of HPFL features into the FMEF facility.

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FUELS AND MATERIALS EXAMINATION FACILITY

ENVIRONMENTAL ASSESSMENT

1.0 DESCRIPTION OF THE PROPOSED ACTION

This project proposes to provide a facility, the Fuels and Materials Examination Facility (FMEF), with fuel development, fuel fabrication, and irradiated fuel and materials examination capabilities in support of the Fast Flux Test Facility (FFTF) and other reactors in the Liquid Metal Fast Breeder Reactor (LMFBR) program. The FMEF will have approximately 170,000 square feet of floor space. The estimated construction cost of this facility is $170 million for project construction start in fiscal year 1979 and completion in fiscal year 1984. Design life of the FMEF will be 20 years.

The FMEF will contain laboratory space and facilities to support the development of fuel fabrication processes, equipment, and handling systems for fuel materials emitting various amounts of radiation. Laboratory space is also provided for fabrication of FFTF and other LMFBR fuel experiments and to accommodate the radioactive analytical functions which support fuel fabrication activities. Postirradiation examination activities will be carried out mainly in a centrally located shielded cell complex. This cell complex will have capabilities for both nondestructive and destructive examination as well as equipment for disassembly and reassembly of fuel and other reactor core component assemblies.

A ground level entry wing will provide offices, a lunch room, change rooms, and other support facilities for the operation staff and security personnel.

Figures 1 through 7, following, show the layouts of the six building floor levels and a longitudinal cross section of the building.

The fuel fabrication area includes a unit process cell, a receiving and assay cell for highly radioactive fuel materials, a test pin line for fabrication and storage of test fuel pins, and related development laboratories. Analytical support activities, including chemical and instrumental analyses and nondestructive assay, are located on an adjacent floor.

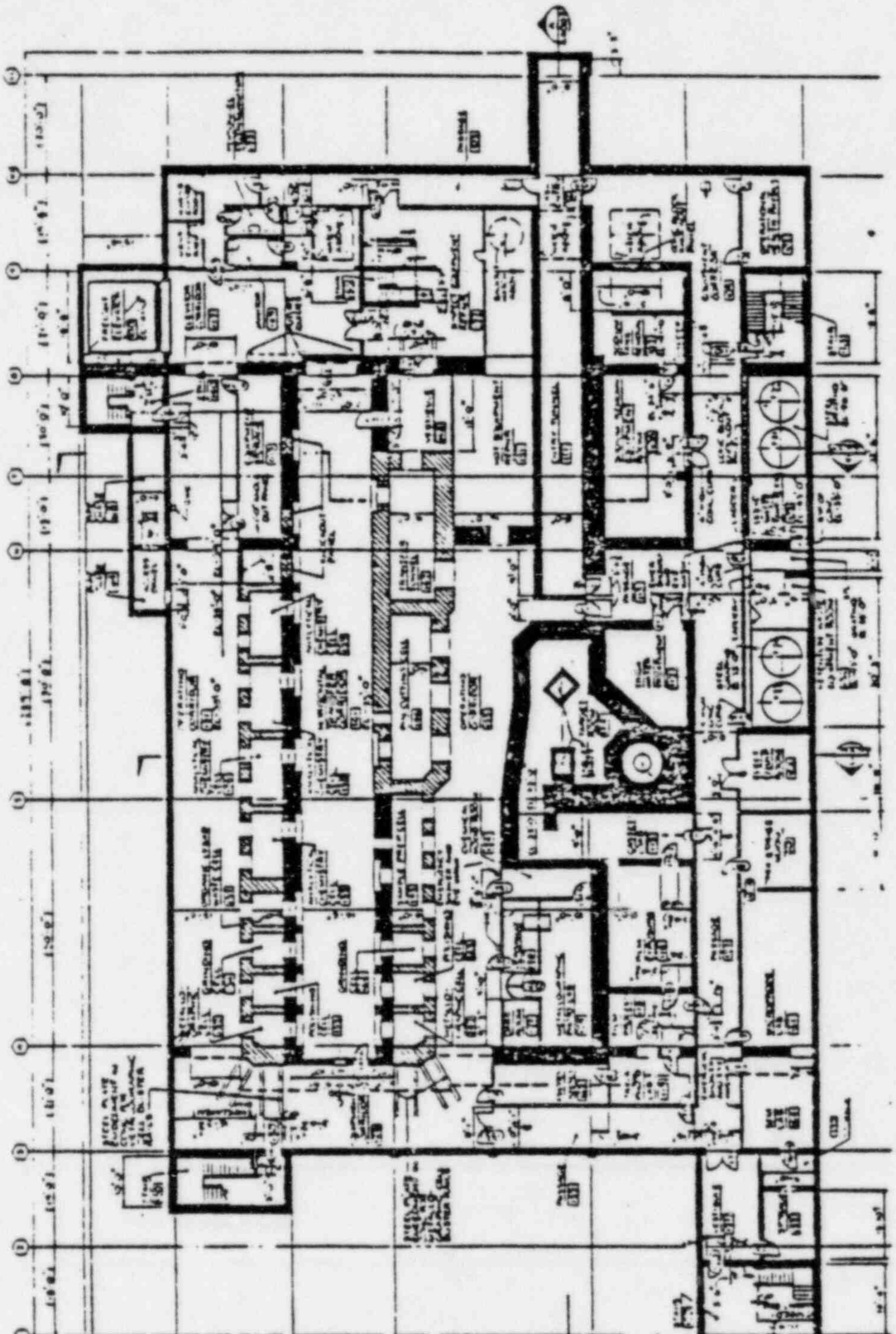
FMEF will be equipped to perform the following fuel development and fabrication functions. These functions are described in detail in the High Performance Fuel Laboratory (HPFL) Final Environmental Impact Statement, ERDA-1550,[6] Section 2.1.2.

(1) Receive special nuclear material in powder form and prepare feed stock.

(2) Analyze fuels and fuel materials.

(3) Fabricate test fuel pins for the FFTF and other LMFBR's.

(4) Develop fuel manufacturing processes, equipment, and handling systems which meet established safeguards, security, safety, and environmental criteria.

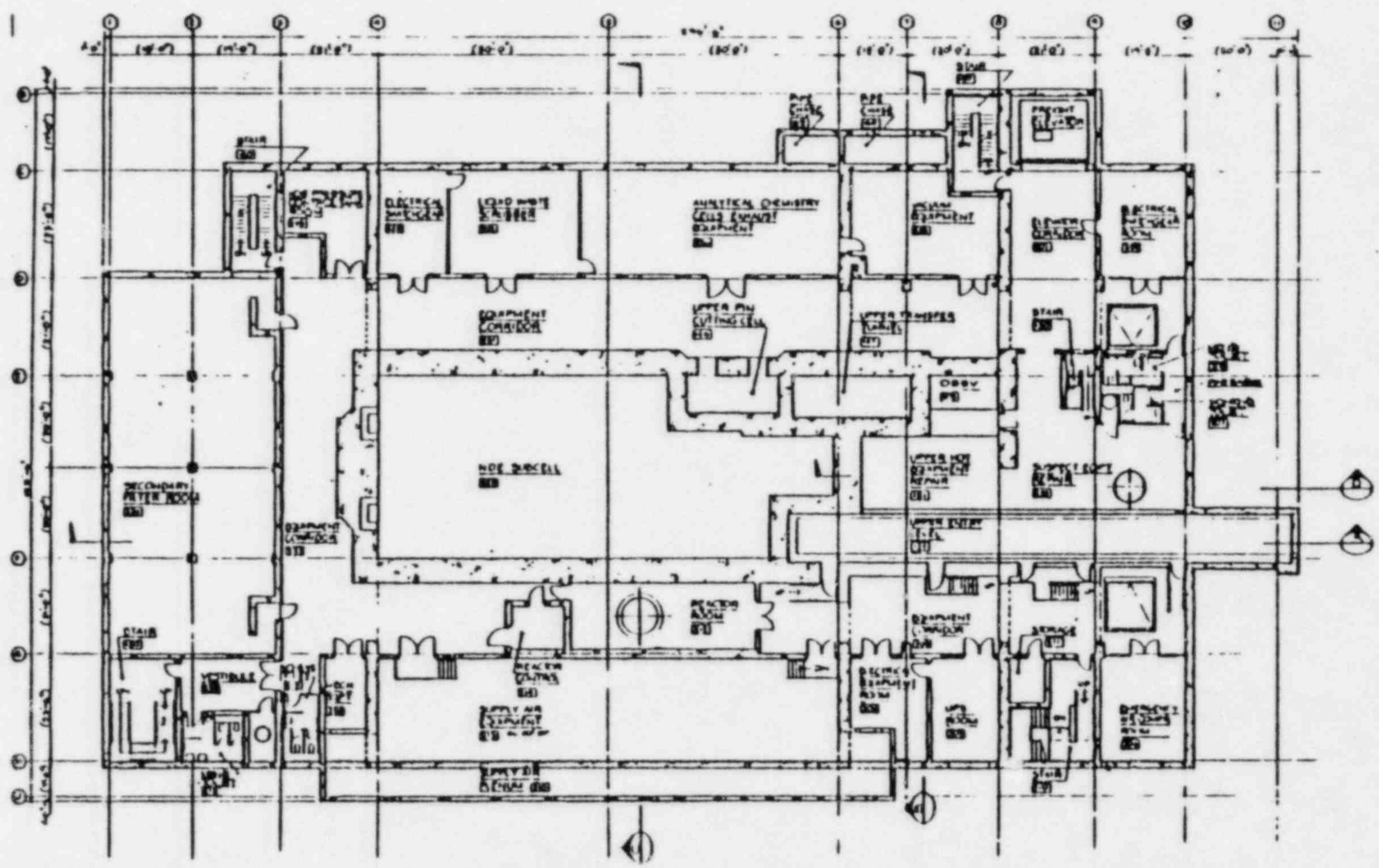


FMEF ARCHITECTURAL FLOOR PLAN

DESTRUCTIVE EXAMINATION CELL LEVEL -35'-0"

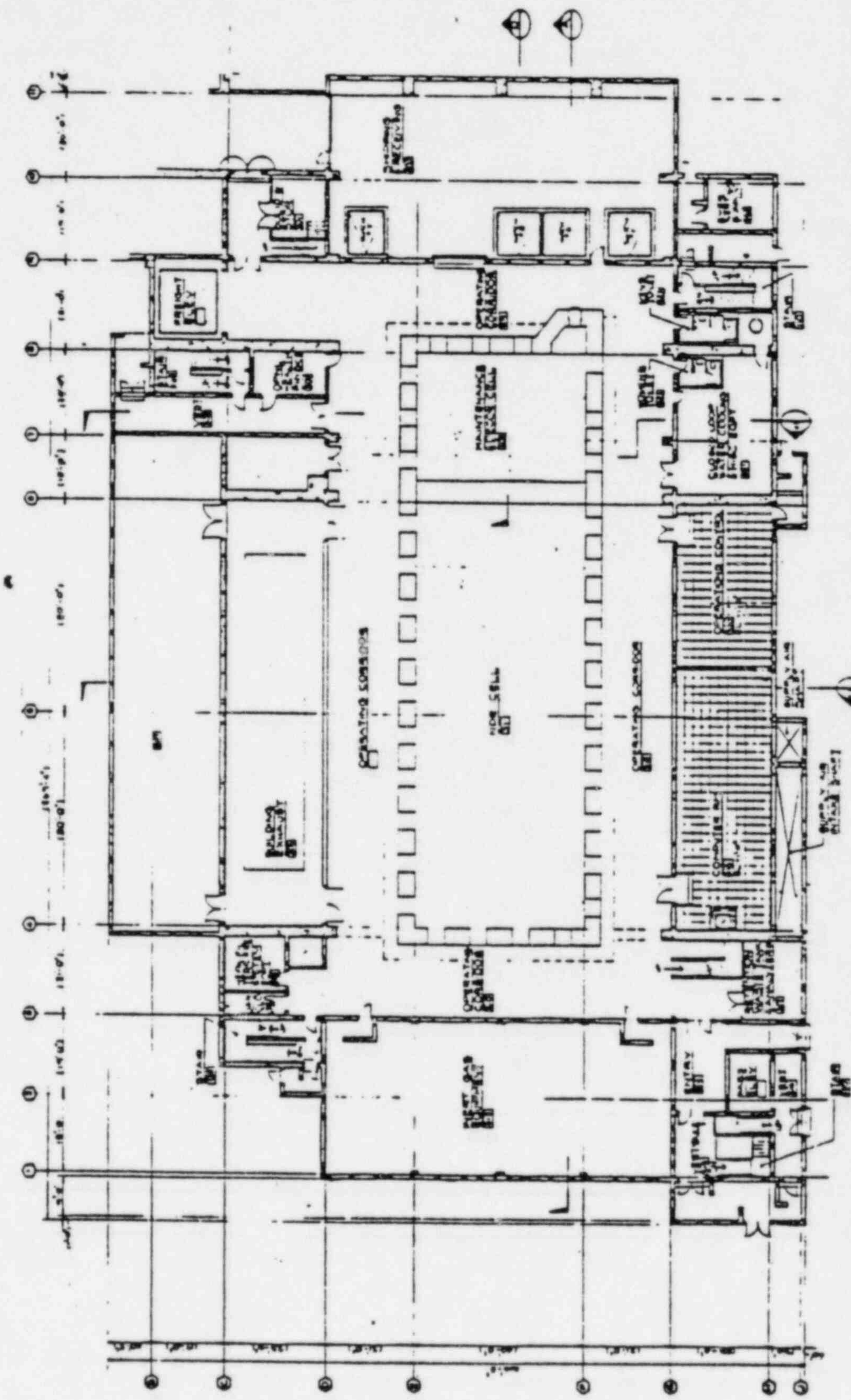
Figure 1

Figure 2
4



FMEF ARCHITECTURAL FLOOR PLAN

EQUIPMENT LEVEL -17'-6"

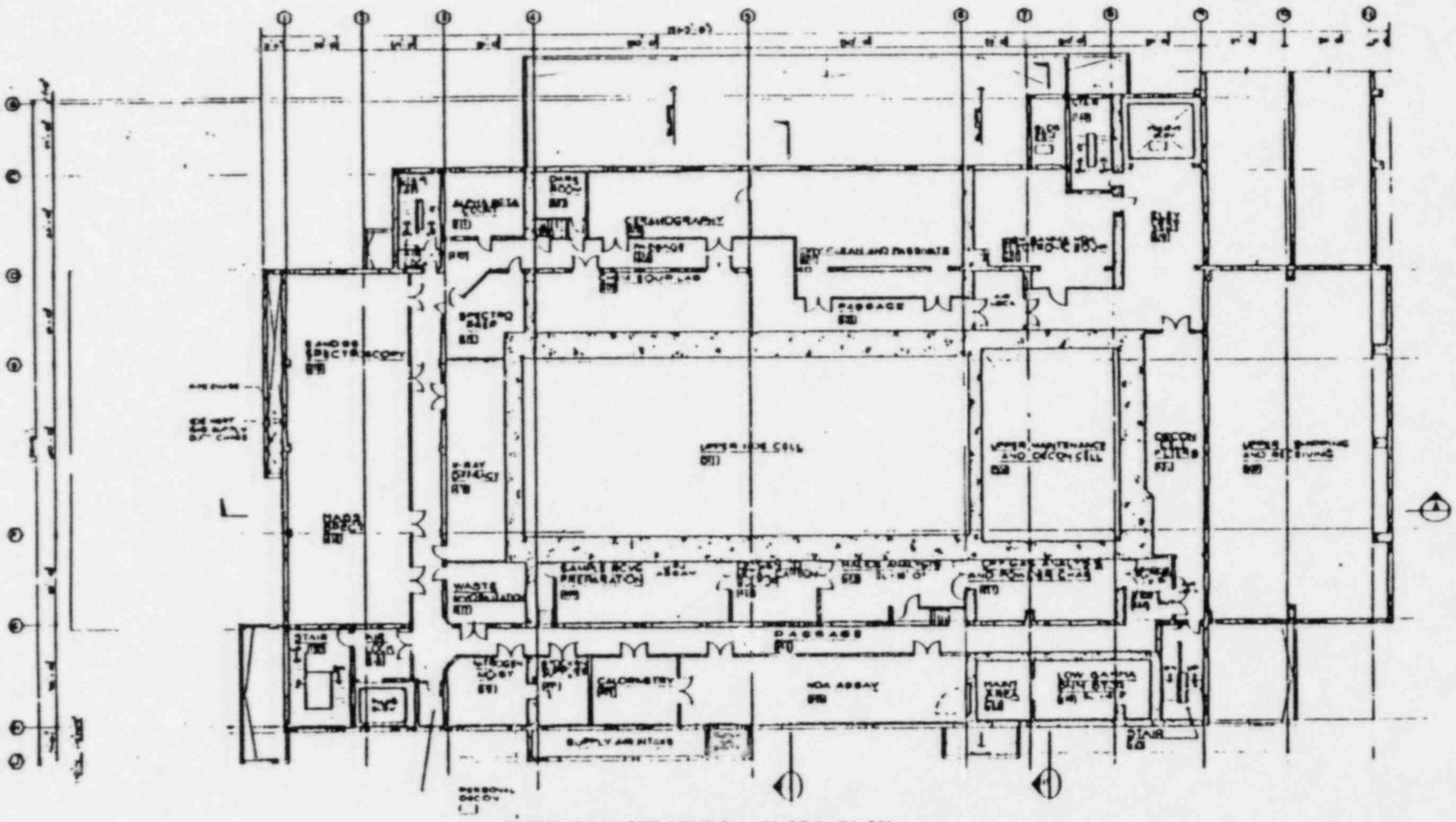


FMEF ARCHITECTURAL FLOOR PLAN

ENTRY LEVEL 0'-0"

Figure 3

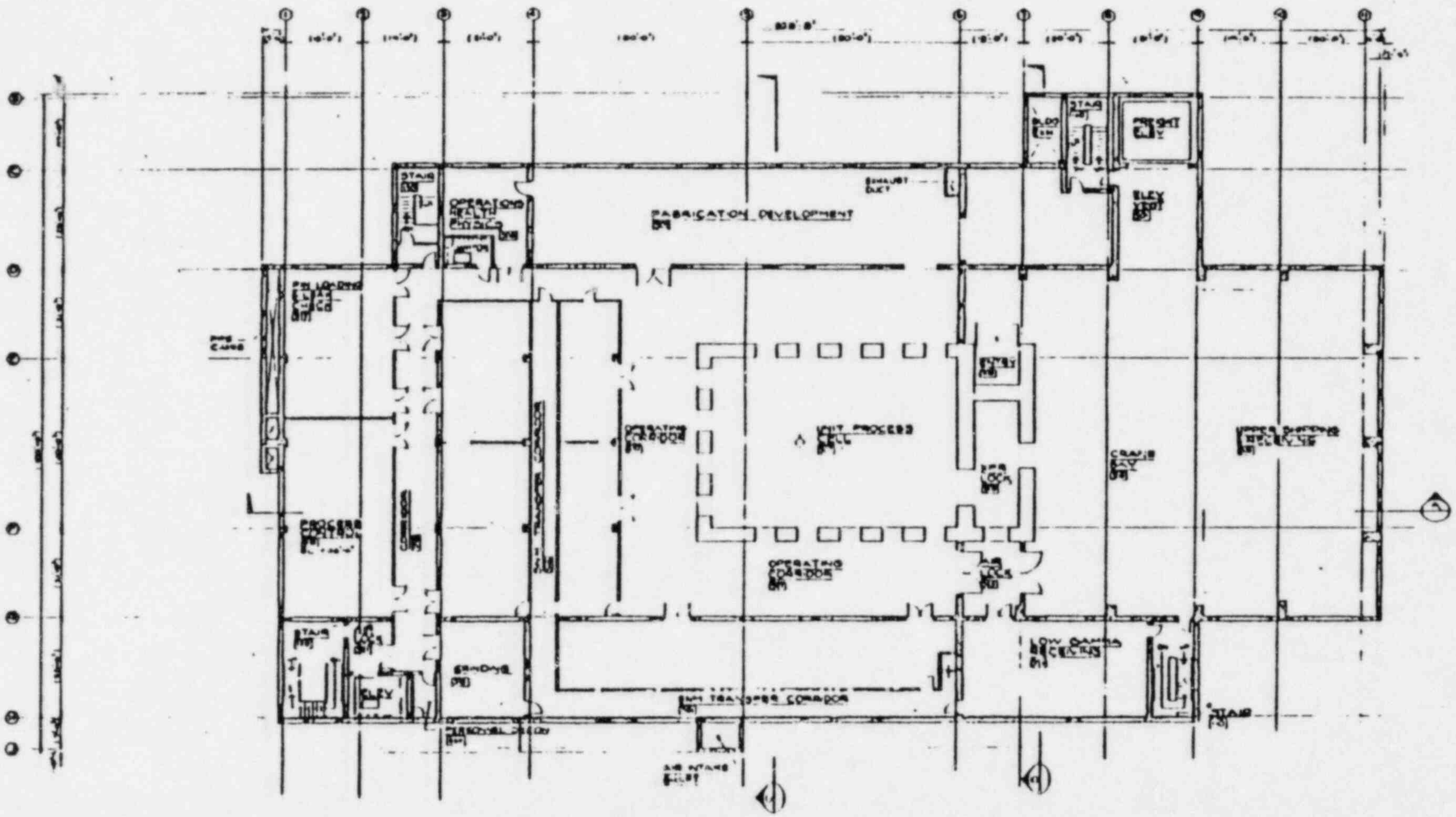
Figure 4



FMEF ARCHITECTURAL FLOOR PLAN

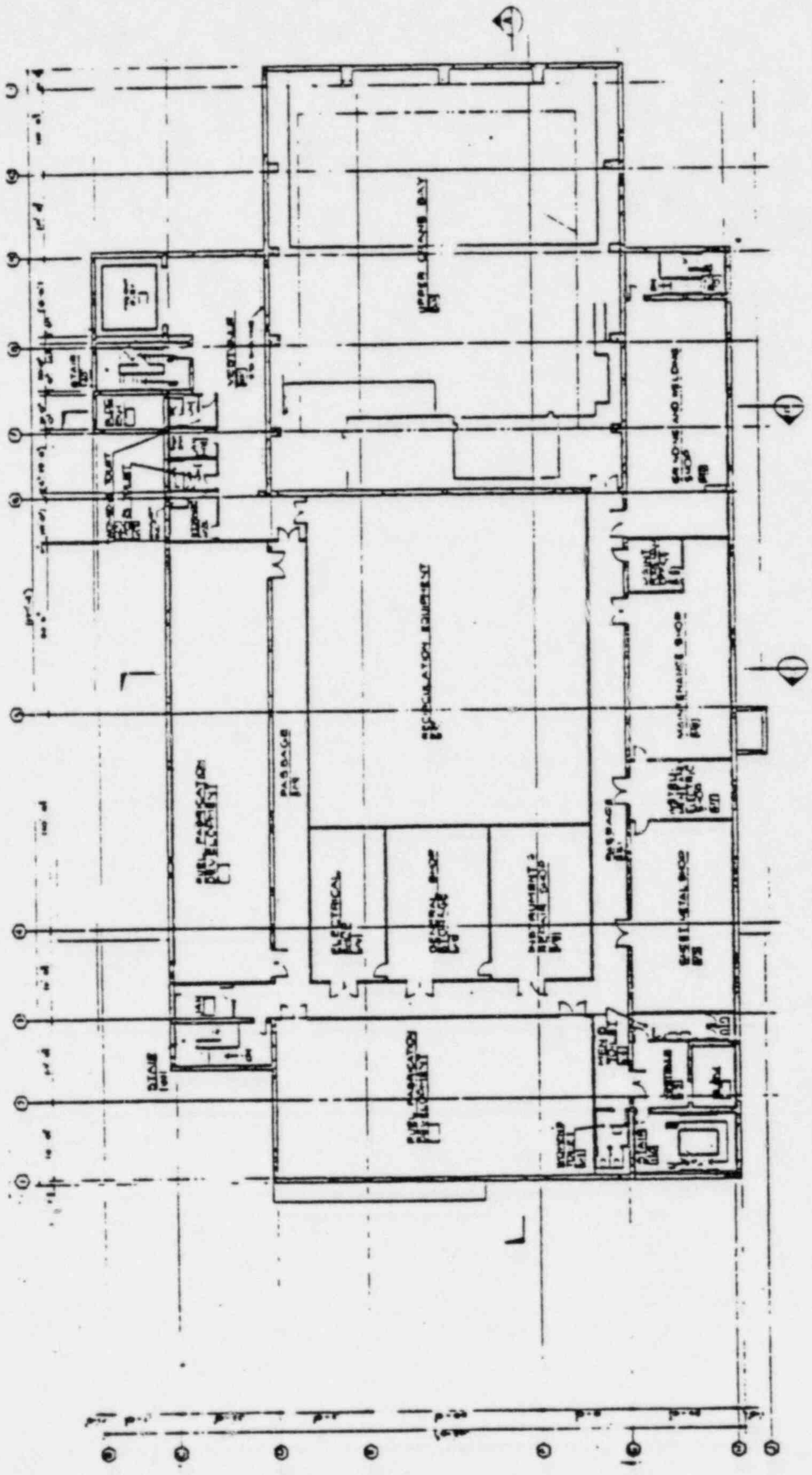
CHEMISTRY LEVEL +21'-3"

Figure 5



FMEF ARCHITECTURAL FLOOR PLAN

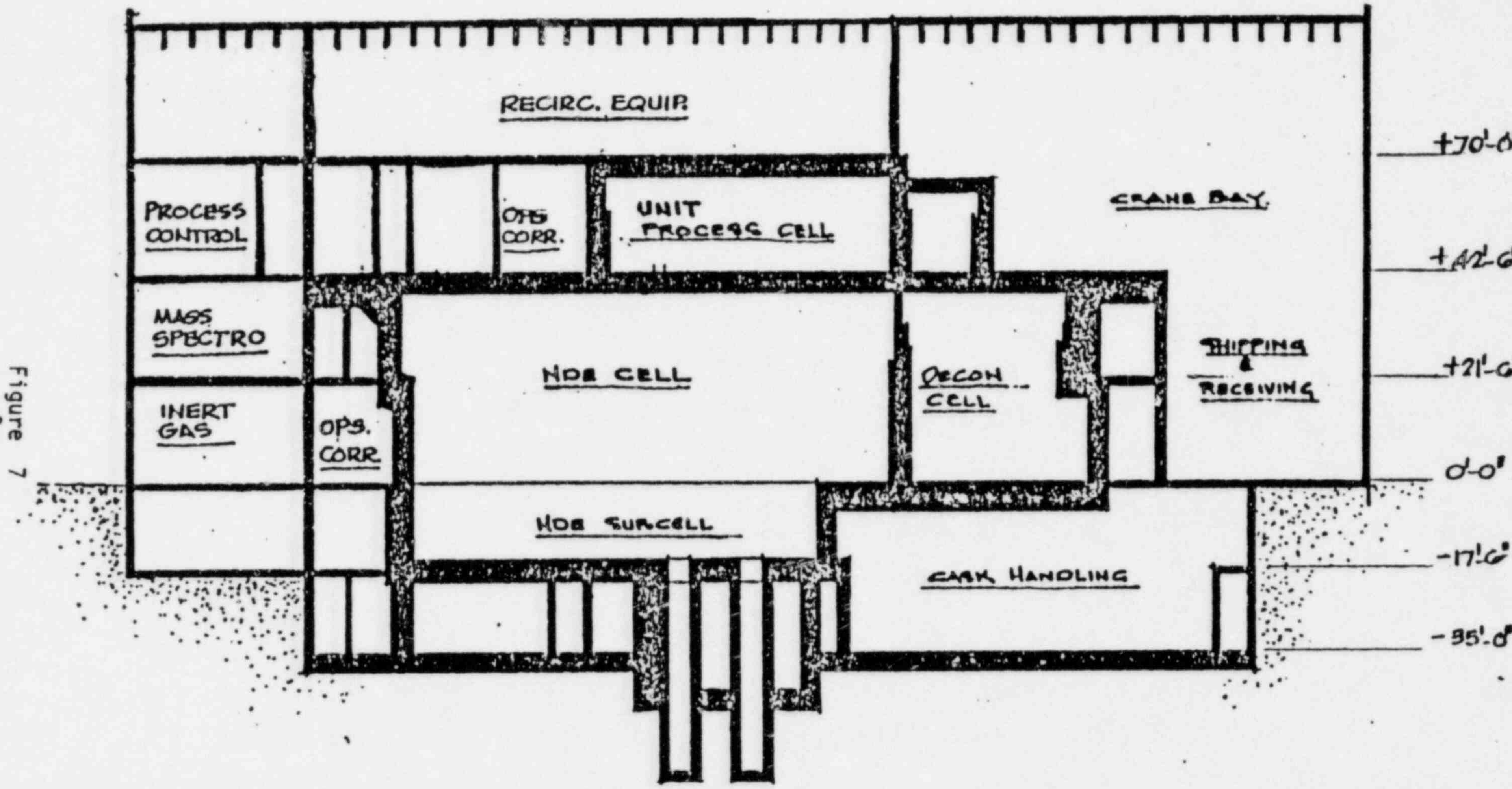
FUEL FABRICATION LEVEL +42'-6"



FMEF ARCHITECTURAL FLOOR PLAN

LOFT LEVEL +70'-0"

Figure 6



FMEF ARCHITECTURAL
LONGITUDINAL SECTION

Figure 7

The central examination cell complex includes a nondestructive examination cell, a number of destructive examination cells, a decontamination cell, a fuel pin cutting cell, shielded cask entry and transfer tunnels, and equipment repair areas. FMEF will be equipped to perform the following fuels and materials examination functions.

(1) Receive, clean, nondestructively examine, and disassemble irradiated FFTF and other LMFBR fuels, materials, and core components.

(2) Nondestructively and destructively examine individual fuel, blanket, and absorber pins.

(3) Reassemble selected fuel assemblies or other materials for additional irradiation after nondestructive examination.

(4) Store irradiated fuels and materials awaiting examination or disposition.

(5) Prepare irradiated fuel pins, materials, and metallurgical and chemical samples for shipment to other examination facilities, reprocessing facilities, or disposal sites.

The criteria which determine facility size are based upon programmatic needs for fuel development, fuel fabrication activities, irradiated fuels and materials activity, and the need to examine full-size fuel assemblies from the FFTF and later LMFBR's. The criteria are also based upon the need to examine a statistically significant number of the many different types of fuel, blanket, and absorber pins irradiated in the FFTF under the wide variety of neutron flux and temperature conditions expected in later reactors. The FMEF operational goals for fuel development and fabrication will be to fabricate test pins for irradiation in the FFTF and other LMFBR's. Fuel fabrication equipment and processes will also be developed and tested. A flow diagram for the test pin line is given in Figure 8.

A typical plutonium feed materials container for fuel development and fabrication would contain 2 kilograms (kg) of plutonium dioxide (PuO_2). Isotopic composition (typical) would be as follows:

^{236}Pu	$8 \times 10^{-6}\%$
^{238}Pu	0.5%
^{239}Pu	54%
^{240}Pu	20.0%
^{241}Pu	6.0%
^{242}Pu	1.5%

The annual amount of in process PuO_2 used in the combined FMEF will be approximately 430 kg; this compares to approximately 825 kg per year in the separate FMEF and HPFL. Maximum storage capacity for radioactive material including PuO_2, mixed oxides, uranium, and scrap in the combined FMEF is approximately 3,120 kg versus approximately 48,000 kg in the HPFL.

The FMEF operational goals for fuel and materials examination will be to examine irradiated fuel assemblies to identify the important pins for further examination, perform detailed nondestructive examination on a meaningful number of pins, and perform destructive examination on a selected number

TEST PIN LINE
PROCESS FLOW

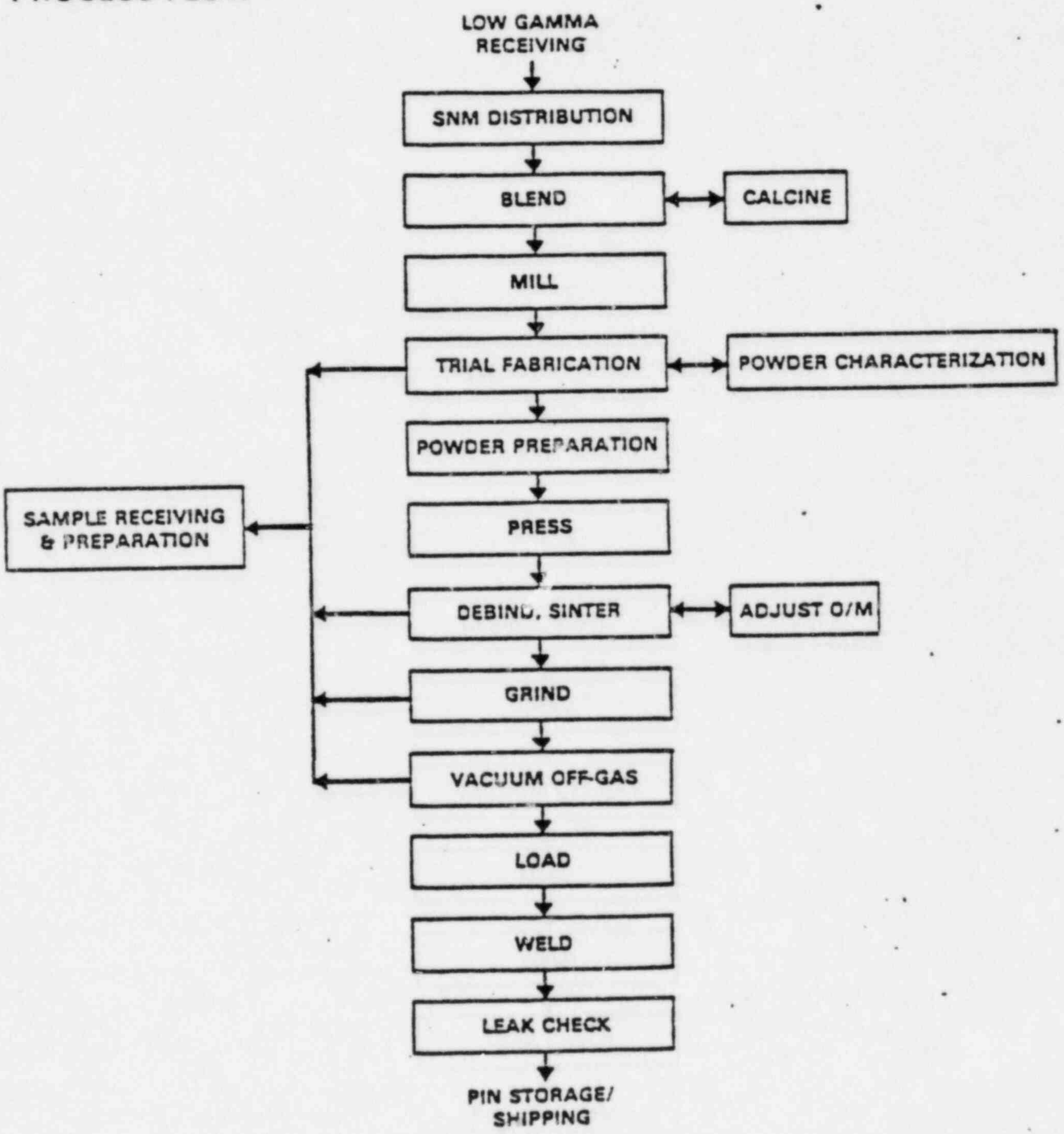


Figure 8

of specimens. A flow diagram for examination activities is given in Figure 9.

A typical FFTF fuel assembly examined in FMEF will contain 217 fuel pins that have been irradiated for three reactor cycles at a power level of 5 megawatts. This assembly will experience approximately 140 days of radioactive decay at FFTF prior to transfer to the FMEF for evaluation and testing. As currently planned, approximately 200 fuel pins will be destructively examined annually.

The facility is designed to totally contain all radioactivity in the event of the design basis tornado and design basis earthquake (both 10^{-6} probability per year). Special building construction and special equipment such as automatic dampers and automatic isolation doors are used to assure containment. Because of the fuel fabrication activities incorporated into the combined facility, safeguards security has been upgraded substantially. Safeguards security measures (e.g., site perimeter fences, guards and controlled site access, and surveillance) will be similar to those described in the HPFL Final Environmental Impact Statement, ERDA-1550,[6] Section 2.3.6.1.4.

Exhaust gases from cells and gloveboxes will pass through a series of three High-Efficiency Particulate Absolute (HEPA) filters before reaching the environs. Exhaust gases from those areas which contain irradiated fuel materials will also pass through an activated charcoal filter. The HEPA filters will have an efficiency of at least 99.95 percent. The activated charcoal used for halogen removal will remove better than 99.99 percent of elemental iodine and would be expected to remove approximately 95 percent of

FMEF EXAMINATION MATERIAL FLOW

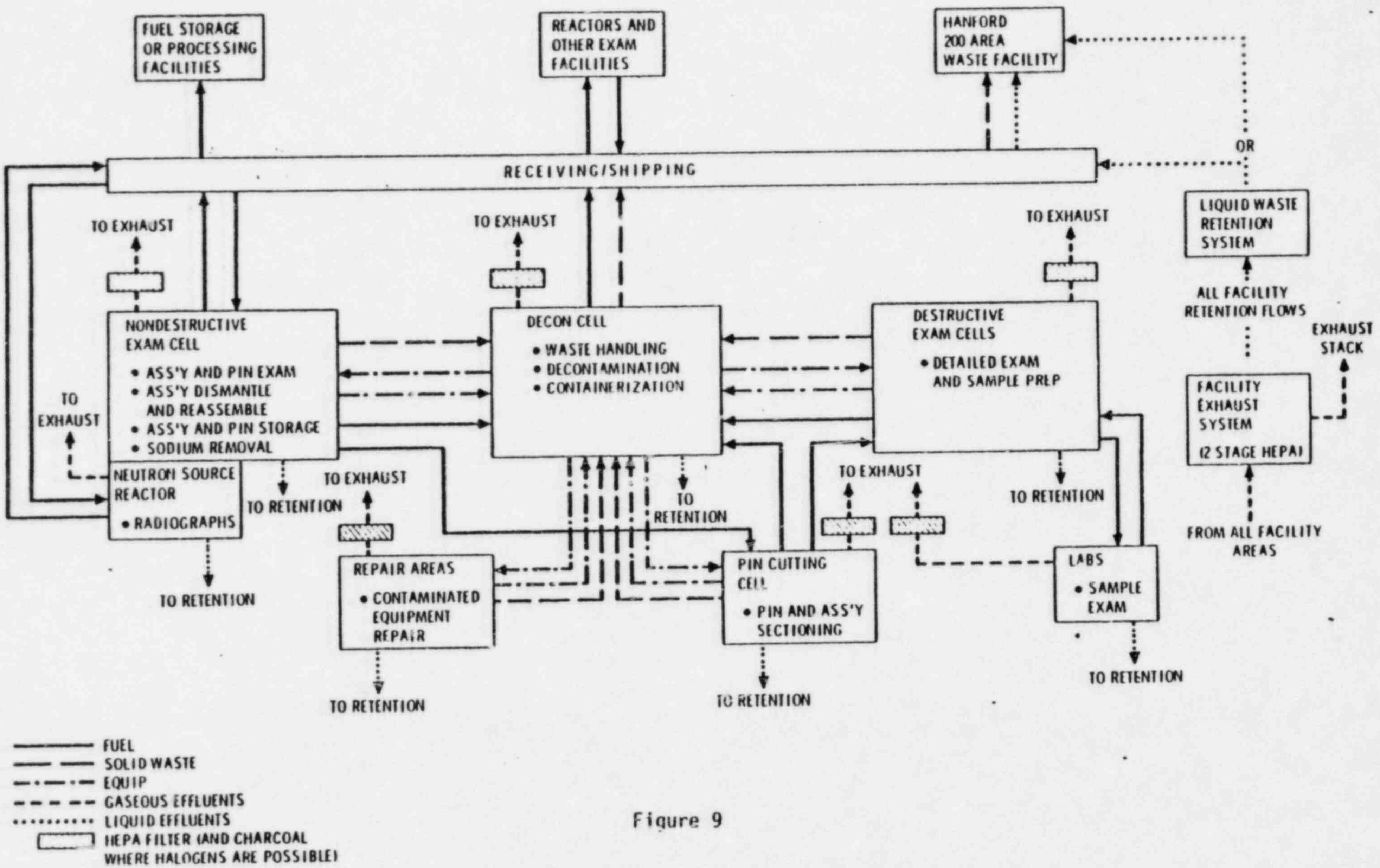


Figure 9

any incident methyl iodide. Exhaust from the remainder of the FMEF will pass through at least two HEPA filter banks.

Exhaust from the FMEF will be monitored for radioactivity by continuous air monitors. Process waste water from FMEF, consisting mainly of cooling water, will be monitored continuously for radioactivity. The concentration of radionuclides in the process waste water will be below concentrations listed in Table II, Annex A of DOE Manual Chapter 0524, "Standards for Radioactive Protection," before it is discharged to ground. In the event that significant radioactivity is detected in either the process waste water or sanitary waste water, it will be diverted to the Radioactive Liquid Waste Sewer. Sampling or continuous monitoring of these water streams will be utilized to provide the necessary control. Waste from the Radioactive Liquid Waste Sewer will be transported to the 200 Area for waste treatment as discussed in the "Final Environmental Impact Statement, Waste Management Operations, Hanford Reservation," ERDA-1538, December 1975.(1) Radioactive liquid waste volume will be approximately 130,000 gallons per year. Other waste water, process and sanitary, will be discharged to the leaching ponds in the 400 Area. Continuous samples obtained as water enters the leaching ponds will be analyzed for radioactivity, pH, and major process chemicals.

All solid radioactive and nonradioactive waste will be disposed of or be retrievably stored by Rockwell Hanford Operations as described in ERDA-1538. Solid radioactive waste volumes will consist of approximately 4,000 cubic feet of transuranium wastes and 10,000 cubic feet of nontransuranium wastes annually.

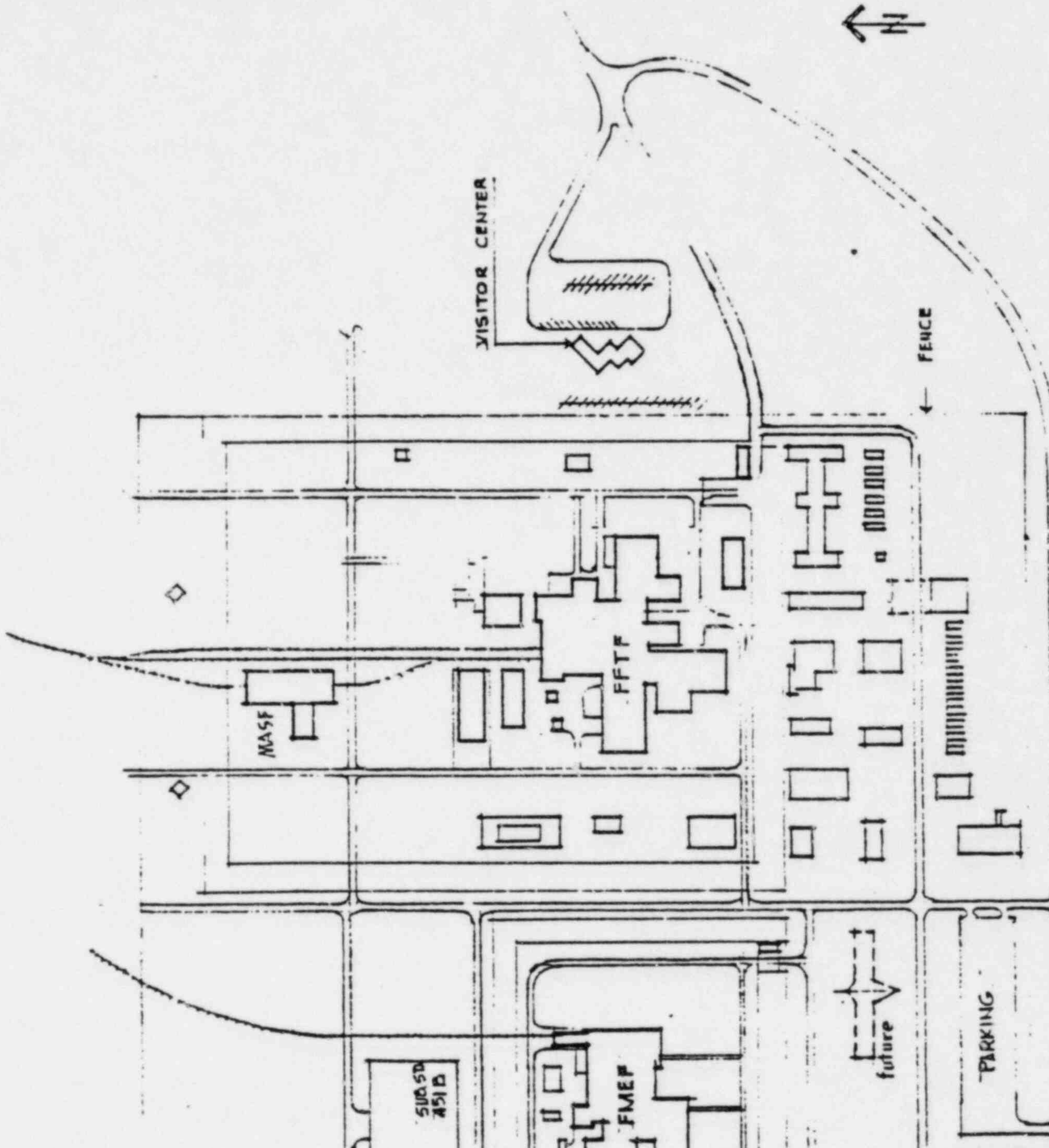
2.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The FMEF will be located in the 400 Area of the Hanford Site west of the FFTF as shown in Figure 10.

The 559 square mile federally owned Hanford Site is located in parts of Benton, Grant, and Franklin Counties in south central Washington State. Access to the Hanford Site is controlled for reasons of national security, health, and safety considerations. Figure 11 shows the facilities on, and the land use of, the Hanford Site. Activities on the site include a single plutonium production reactor (all others have been deactivated), fuel reprocessing, waste management activities, fuel fabrication, laboratory facilities, ecological studies, and the construction of the FFTF and commercial nuclear power plants.

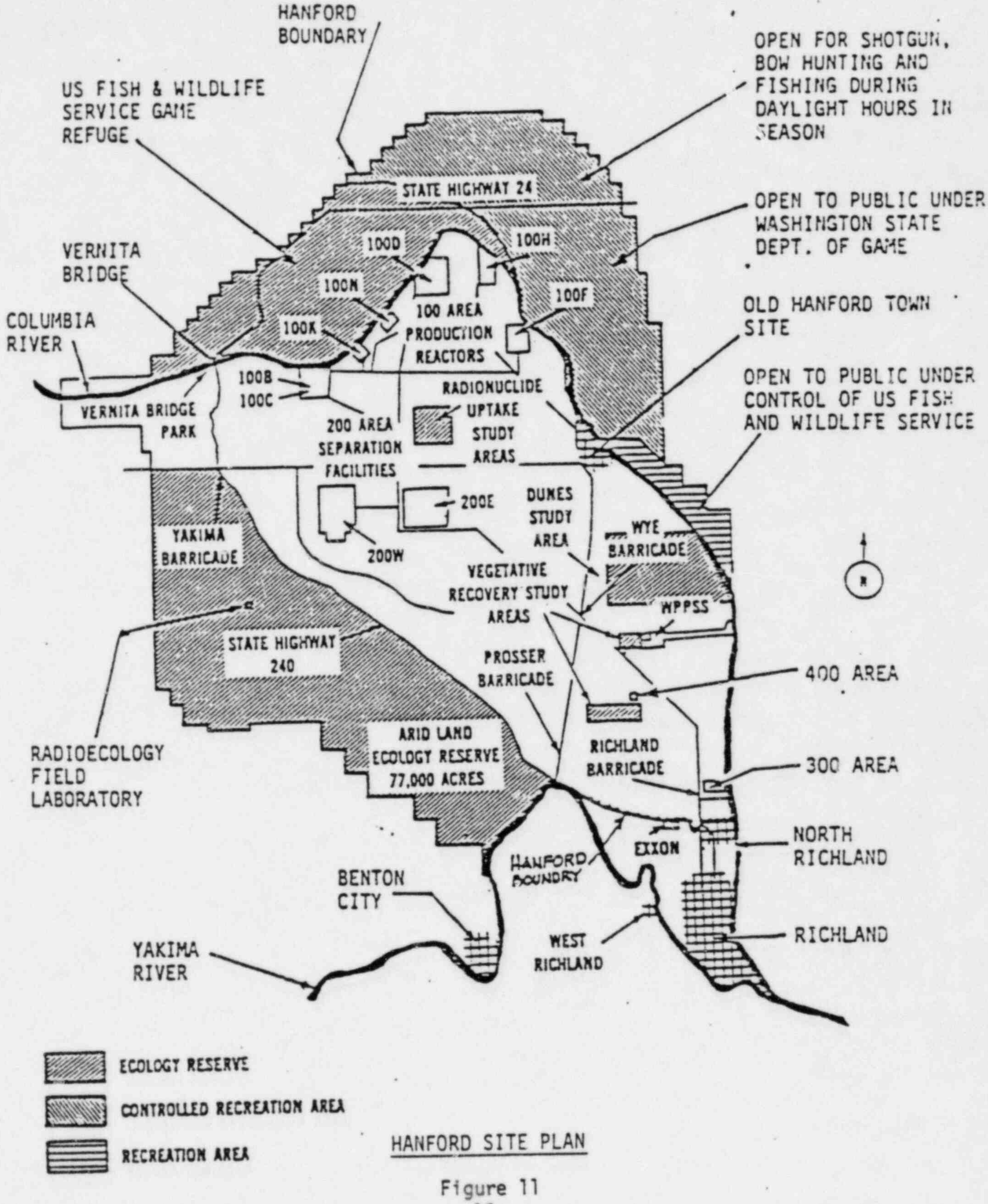
The 400 Area is approximately 4 1/2 miles from the west bank of the Columbia River, 12 miles from the city center of Richland, Washington, 4 1/2 miles north-northeast of the closest point of the city limits, and 3 miles southwest of the closest facility on the site (Washington Nuclear Plant No. 2). The closest site boundary is approximately 4 1/2 miles to the south-southeast, which is also the closest point to the 400 Area at which a dwelling could be built.

Development of the 400 Area is in support of the Department of Energy's (DOE) breeder reactor program. At present, 400 Area facilities consist of the FFTF, a number of temporary buildings utilized in the construction of the FFTF, the administration building, and the Visitor's Center. The FFTF is a nuclear



FMEF CIVIL LOCATION PLAN (400 AREA)

Figure 10



HANFORD SITE PLAN

Figure 11

reactor complex designed for irradiation testing of fuels and materials to be used in future LMFBR's. This facility is the major research and development test vehicle in the LMFBR program.

Adjacent to the Site are residential suburban, corporate city, agricultural, industrial and commercial, scenic, recreational, and general use land areas. The predominate use of land within the 50-mile radius of the 400 Area is agriculture.

The Tri-Cities (Richland, Kennewick, and Pasco) are the nearest population centers to the construction site. The Tri-Cities are located to the south and downstream of the 400 Area along the Columbia River. The Tri-Cities have a combined population in excess of 80,000. The population residing within a 50-mile radius of the 400 Area is estimated to be approximately 260,000.

The Tri-City area has experienced substantial population and economic growth over the past years. Annual growth rate for the Tri-City area was about 0.5 percent[2] in the 1960's and 1.5 percent[2] in the years 1970-1974. The anticipated annual growth is about 1.2 percent[2] until 1990, when it is expected to decline to about 0.8 percent.[2] The school systems are at or near full enrollment, and water and sewage systems are insufficient to meet peak demands. Other community facilities and services are increasing rapidly to serve the increase in population. The construction force impact of FMEF is shown in Figure 12, compared with Washington Public Power Supply System

(WPPSS) projects located on the Hanford Site. Impact is minor but positive in that it tends to stabilize the work force.

Radiological data are collected on and off the site to provide reliable estimates of the radiological impact of activities on the site. Environmental data collected during 1978 is summarized in "Environmental Surveillance at Hanford for CY-1978," PNL-2932, April 1979.[3] Data collected during 1978 showed compliance of Hanford operations with all applicable state and Federal radioactive standards. Offsite levels of radionuclides attributable to Hanford operations during 1978 were indistinguishable from background levels.

A full description of the Hanford Site features is given in the final environmental impact statement "Waste Management Operations," ERDA-1538, December 1975.[1] The Site is part of the Columbia Basin geologic province which encompasses about 50,000 square miles. This province is underlain by the vast field of flood lava of the Columbia River Basalt Group. Late in the Pliocene epoch, large floods scoured and carved the Ringold formation surface beneath the Hanford Site. These floods deposited the sediments now found on the site. These sands and gravels underlying the site provide excellent protection against seismic damage. On the basis of the damage that has been experienced since 1840, the U.S. Coast and Geodetic Survey assigned the area a Zone 2 seismic probability, implying the potential for moderate damage from earthquakes.

The 400 Area is about 4 1/2 miles from the nearest river, the Columbia River. No water will be removed from the river for the FMEF, nor will liquid effluents be discharged to the river. Water needs for the facility will be met by wells in the 400 Area. The 400 Area is more than 100 feet above the ground water table. Grade level at the facility site is 550 feet, which is more than 100 feet above the maximum probable flood. The 100-year maximum flood projected by the U.S. Corps of Engineers is 740,000 cubic feet per second (ft^3/s), which is estimated to produce a river crest at River mile 348 (due east of 400 Area) of 369 feet above mean sea level (msl). The Probable Maximum Flood, also calculated by the U.S. Corps of Engineers, is based on the concurrence of the worst of several natural phenomena, including a record snowfall in the mountains, no melting of this snow until spring, then warm, heavy rain. This hypothetical flood has a flow of 1,440,000 ft^3/s, and it is estimated to produce a crest level at River mile 348 of 386 feet above msl.

The climate on the site is mild and dry. While occasional periods of high wind are characteristic of the region, tornados are rare in Washington and tend to be small with little damage when they do occur.[1]

The vegetation mosaic of the Hanford Site consists of eight major kinds of shrub-steppe communities. Much of the vegetation in the 400 Area was removed during previous construction activity. Among mammals on the site, the mule deer is the only big game mammal normally found on the site, while the cottontail rabbit is the only small game mammal. Mammals most commonly found in this region are pocket mice, deer mice, jackrabbits, coyotes, and mule deer. There are no endangered species found in the construction area.[1,6] Review of the National Register of Historic Places and the Washington State Register of Historic Places indicates that there are no historical structures or archaeologic sites in the immediate vicinity of the FMEF.[6]

3.0 DESCRIPTION OF THE POTENTIAL ENVIRONMENTAL IMPACTS

Potential environmental impacts of the FMEF during construction, operation, and site restoration phases have been evaluated and results are presented in this section. In summary, no significant adverse environmental impacts are expected with construction or operation of the FMEF. Little additional impact is expected as a result of construction activities over those associated with FFTF. Construction should have only minimal effects on the local community. Construction and operation of the FMEF will result in the irretrievable commitment of only moderate amounts of materials and supplies. The principal construction materials will include approximately 1,700 tons of structural and reinforcing steel and 22,000 cubic yards of concrete. Approximately 7,200 tons of magnetite ore will be utilized in the high density concrete cell structures. In addition, moderate quantities of welding rods, inert gases, and other miscellaneous construction materials will be consumed, as well as the petroleum based fuels required to power construction machinery.

Materials and supplies consumed during operation of the facility will include relatively small quantities of uranium and plutonium fuel materials, stainless steel, and other metals used in fuel cladding and associated hardware.

During routine operation of the FMEF, there will be releases of very small quantities of mixed fission products and transuranium nuclides (see Table 2), but the calculated doses to the nearby population resulting from these releases are negligible (see Table 4). The calculated maximum dose to an offsite individual from the maximum credible accident (cask drop accident, 77 millirem whole body dose commitment) is comparable to that received from natural background radiation.

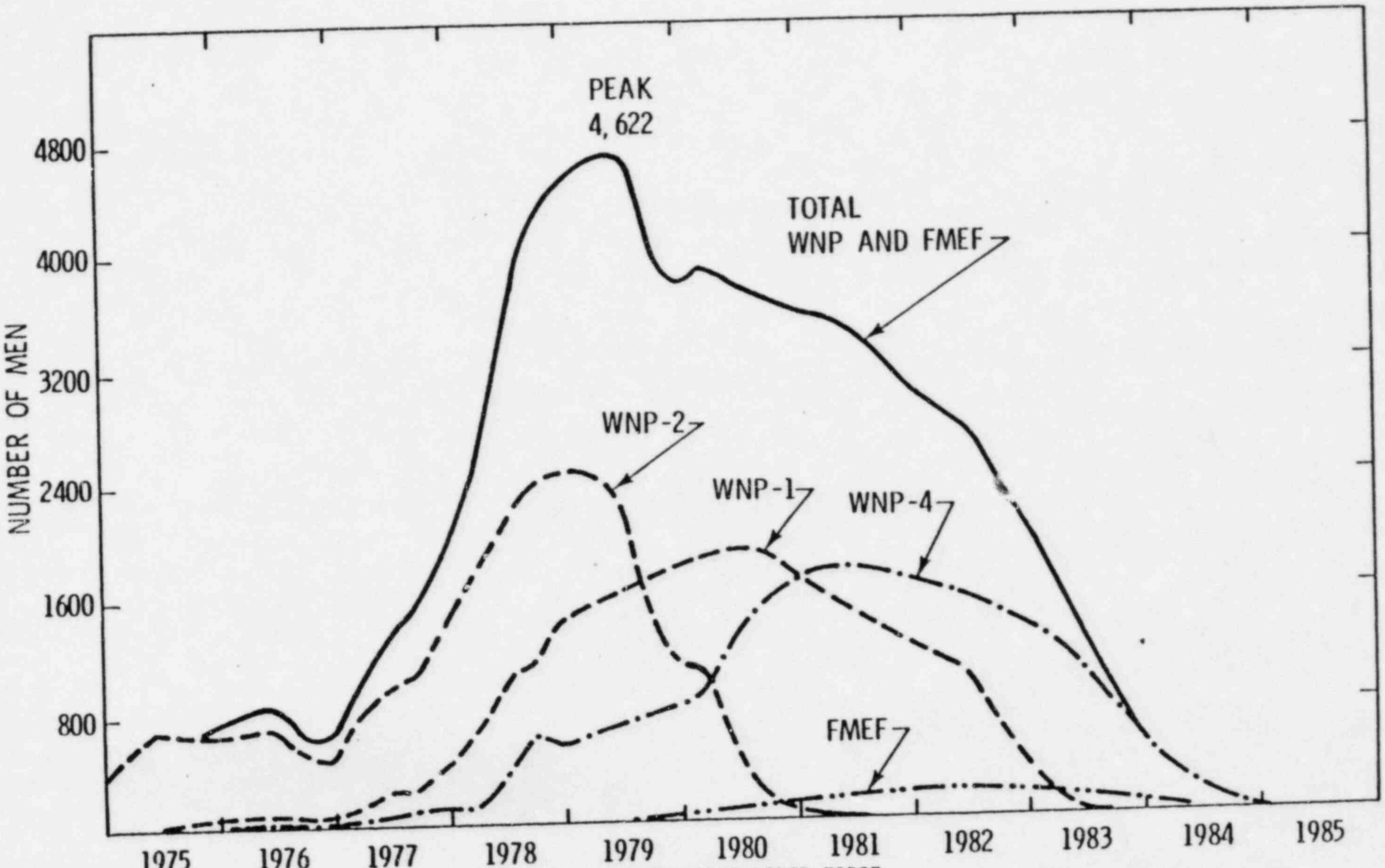
a. Construction

Much of the land affected by the FMEF will already have been disturbed by other 400 Area activities. As a result, little additional impact is expected at the construction site. The effects of the FMEF will be primarily to prolong the time the area remains in a disturbed state. Approximately 10 acres of land within the 400 Area will be diverted for the FMEF and its grounds, with an additional 30 acres used for the duration of construction. Existing native desert vegetation in the committed land will be destroyed, as will the existing population of pocket mice. Other impacts on local biota will only be temporary. Highway, rail, and electrical transmission links to the 400 Area have already been furnished during construction of the FFTF. An additional link to a new transmission line connected to a different point on the Bonneville Power Authority distribution grid is planned. Apart from this line, no additional offsite land will be required for the FMEF.

Excavation of subsoil will be required for construction of foundation and subgrade areas of the facility. Soil not used as backfill (approximately 30,000 cubic yards) will be disposed of in an onsite landfill. Despite dust control measures (oiling and watering), blowing of dust and sand from disturbed areas will occur locally during construction and until these areas are stabilized by revegetation. Natural recovery of disturbed areas will be slow. Cheat grass will reseed itself annually but 30 to 40 years will be required for reinvasion by sagebrush and bitter brush.[6] The isolation of the 400 Area will prevent any distinguishable increment in airborne dusts beyond the Hanford site.

Both precipitation at the site and waste water from construction activities will seep into the soil in the immediate vicinity, with no runoff to surface streams. Since typical precipitation penetrates the soil to a maximum of 3 feet before returning to the surface by capillary action, percolation to ground water should be minimal. No significant impact on ground water quality is expected in view of the soil characteristics, the approximately 140 feet to the water table, and the source of the construction water supply (400 Area well).

Construction of the FMEF may have some minimal effects on the local community. Construction will require a peak employment of approximately 260 people, with an average work force of approximately 170 people over the 5-year construction period. It is estimated that approximately 75 percent of the FMEF construction force will originate from the present population. The FMEF could create slight additional demands for housing and community services, but it is more likely that the result will be continued utilization of housing and services available after peak construction employment levels have passed. The effect from imported FMEF construction force should be minimal. Overall effects of the project on the community



CONSTRUCTION LABOR FORCE

Figure 12

will be beneficial as a result of the stabilizing effect of diversification.

b. Operation

A preliminary list of chemicals and estimated quantities to be consumed annually during operation of the FMEF is given in Table 1. Workers will be protected in handling these chemicals by use of special clothing and other protective devices as well as remote handling in some cases. Most of the chemicals will be incorporated into facility radioactive wastes and will be neutralized before removal from the facility. Quantities of reactive chemicals released to the environs will be very small and in dilute form. Operation of the FMEF will also require approximately 29,000 gallons per day of water from the 400 Area wells and 570 kilovolt-ampere of electrical energy. The electrical energy will be drawn from the Bonneville Power Pool and will be supplied from an indeterminate mix of hydroelectric, fossil, and nuclear fuels. Two independent 115 kilovolt supplies, both from the Bonneville Power Pool, will supply a common switchyard which in turn serves the facility.

Table 2 details the inventories, cleanup, efficiencies, and environmental releases expected during normal operation of the FMEF. The calculated doses to the population resulting from the expected releases are very low. The estimated maximum dose rate at the 400 Area boundary is approximately 2.9×10^{-8} millirem per hour to the whole body. By comparison, the natural background radiation is about 0.01 millirem per hour.(1) The estimated maximum individual dose

TABLE 1

ESTIMATED CHEMICALS AND USAGE FOR FMEF

Waste, Power and Sanitary Treatment Chemicals	*Usage Per Year
$KMnO_4$	2,000#
NaCl	50,000#
NaOH	2,500#
H_2SO_4	10,000#
$AL_2(SO_4)_3$	5,000#
Cl_2	2,000#
Na_3PO_4	3,000#
Na_2SO_3	5,000#
Aerosol(R)** OT	100#
Decontamination Cell Chemicals	
KMnO	50#
Na_2SO_4	50#
NaOH	1,000#
Cleaning Agents	
TURCO 4306B	5 gal.
TURCO 451B	5 gal.
TURCO 4512-A	5 gal.
General Facility	
Wax Stripper	100 gal.
Soap	150 gal.
Wax	300 gal.

*Basis - Total Table 1, Environmental Assessment, "Fuels and Materials Examination Facility," (5), plus Table 2.3-3, Final Environmental Impact Statement, "High Performance Fuel Laboratory," ERDA-1550, September 1977 (6).

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TABLE 2: ENVIRONMENTAL RELEASES FROM FMEF NORMAL OPERATION

Isotope	Ci/Assembly	Throughput Factor	Release Factor	Cleanup	Environmental Release (Ci/Yr)*
Kr^{85}	290	.92	.3	1	80
Sr^{89}	6231	.92	.001	1.25×10^{-8}	7.0×10^{-7}
Sr^{90}	1856	.92	.001	1.25×10^{-8}	2.1×10^{-8}
Ru^{106}	51,130	.92	.01	1.25×10^{-8}	6.0×10^{-6}
Cs^{134}	1876	.92	.01	1.25×10^{-8}	2.1×10^{-8}
Cs^{137}	4827	.92	.01	1.25×10^{-8}	6.0×10^{-8}
Pu^{239}	359	.92	.001	1.25×10^{-8}	4.5×10^{-9}
Pu^{240}	205	.92	.001	1.25×10^{-8}	2.8×10^{-9}
Pu^{241}	9400	.92	.001	1.25×10^{-8}	1.1×10^{-7}
Pu^{242}	.05	.92	.001	1.25×10^{-8}	5.0×10^{-13}
Np^{239}	.07	.92	.001	1.25×10^{-8}	7.5×10^{-13}
I^{131}	.03	.92	.3	.01	8.0×10^{-5}
H^{3}	3.	.92	1	1	2.7
Cm^{242}	5,100	.92	.001	1.25×10^{-8}	5.8×10^{-8}

*Based on all operations in the FMEF including destructive testing of 200 pins/year.

rate from all 1978 Hanford operations was 1×10^{-5} millirem per hour.[3] Table 3 summarizes the calculated 50-year dose commitments resulting from a 1-year intake for the maximum individual (residing all year) 4.5 miles east-southeast of the facility. This individual's 50-year total body dose commitment for a 1-year intake would be 1.1×10^{-3} millirem.

Table 4 provides a summary of the 50-year dose commitment to the Year 2000 population living within a 50-mile radius of the FMEF. The 50-year whole body dose commitment to this population group would be 2.3×10^{-3} man rem.

Table 5 lists the documentation and computer codes utilized in the FMEF dose calculations.

The "Considerations of Health Benefit - Cost Analysis for Activities Involving Ionizing Radiation Exposure and Alternatives" (BEIR Report)[7] relates population dose to health effects, principally cancer. Based upon BEIR Report estimates using the linear hypothesis, the risk to an individual is about 1.6×10^{-4} per 0.1 rem of dose per year. The estimated doses from routine FMEF operations are so low ($\sim 1 \times 10^{-6}$ rem per year, total body, for the maximum individual) that no health effects are anticipated.

All solid radioactive wastes (approximately 10,000 cubic feet per year) will be packaged and monitored to comply with Hanford waste management procedures, administered by Rockwell Hanford Operations (RHO). These wastes will be buried at the 200 Area burial grounds.[1]

TABLE 3

MAXIMUM 50-YEAR DOSE COMMITMENT TO AN INDIVIDUAL (ONE-YEAR INTAKE)

Organ	FMEF Dose (millirem)	Hanford 1978[3] Dose (millirem)
Total Body	1.1×10^{-3}	$8. \times 10^{-2}$
Thyroid	3.5×10^{-3}	.15
Bone	$5. \times 10^{-6}$	$1. \times 10^{-2}$
Liver	1.1×10^{-3}	
Lung	1.2×10^{-3}	

For comparison, the total estimated dose to soft tissue from weapons test fallout and natural radioactivity is 75 to 100 millirem per year.[1] For further comparison, existing DOE radiation standards permit 500 millirem per year for the whole body.

TABLE 4

50-YEAR DOSE COMMITMENT TO YEAR 2000 POPULATION LIVING WITHIN 50 MILES OF FMEF

Organ	Dose (man rem)
Whole Body	2.3×10^{-3}
Thyroid	7.1×10^{-3}
Lung	2.0×10^{-3}
Bone	1.1×10^{-5}
Liver	2.0×10^{-3}

For comparison, the annual whole body population dose is about 25,000 man rem from natural radioactivity for the Year 2000 population.[1]

TABLE 5

DOCUMENTATION OF FMEF DOSE CALCULATIONS

Meteorological Conditions: WPPSS 2-year data, annual average

Dispersion Model: Gaussian, Pasquill parameters

X/Q: 400 area visitor center 5.9×10^{-6} sec/m^3 @ 610 m E,
maximum individual 2.0×10^{-6} sec/m^3 @ 8.1 km E,
80 km population 8.4×10^{-3} person sec/m^3

Release Height: Ground level

Population Distribution: Year 2000, 251,000(6)

Computer Code: DACRIN, Rev. 3-31-78

Calculated Dose: Chronic inhalation, maximum individual and 80 km population, first year dose and 50-year dose commitment

Files Addressed: Organ data library, Rev. 3-7-79
THERMA, Rev. 10-29-75

Computer Code: FOOD, Rev. 8-1-78

Calculated Dose: Chronic ingestion and ground contamination exposure, maximum individual and 80 km population, first year dose and 50-year dose commitment

Files Addressed: Radionuclide library, Rev. 3-15-78
Food transfer library, Rev. 2-27-78
Organ data library, Rev. 6-26-79
Ground dose factor library, Rev. 3-15-78

Computer Code: GRONK, Rev. 7-23-79

Calculated Dose: Chronic air submersion, fencepost individual, maximum individual and 80 km population, first year dose and 50-year dose commitment

Files Addressed: GIN, Rev. 8-7-79
TONIC, Rev. 7-23-79

Nonradioactive solid waste (approximately 12,000 noncompacted cubic feet per year) will be disposed of in the landfill operated by RHO. Contaminated waste water (approximately 130,000 gallons per year) will be sent by railroad tank car to the Hanford 200 Area for treatment to reduce volume and safely store radioactive material. This volume of waste is well within the 200 Area's present capabilities.* Water requirements and disposal will cause only localized effects on the ground water (cone of depression at well, water mound under pond). All radioactive and nonradioactive wastes will be handled in a manner similar to that described in ERDA-1538[1] and will meet applicable standards. The environmental effects of these wastes will be negligible and will not effect the conclusions reached in ERDA-1538.

The environmental consequences and probability of conceivable FMEF accidents have been analyzed. The postulated FMEF worst case accident[5] (cask drop accident) could result in a 77 millirem whole body 50-year dose commitment maximum to an individual 1.5 miles from FMEF (the nearest distance for public approach) and 180 man rem whole body 50-year commitment to the year 2000 population within 50 miles of FMEF. The estimated occurrence probability of this accident is 3×10^{-6} per year. A 77 millirem whole body dose commitment associated with routine operations is less than the 500 millirem allowed by DOE[4] for members of the general public, and it is

*A total of 177 cribs, of which 144 have been deactivated, 8 were not used, 10 are in standby; and 15 are in use.[1] (A crib can handle about 1 million gallons per year.)

also extremely improbable. The 180 man rem 50-year population exposure is not only improbable, but is small when compared to the annual whole body population dose from natural radioactivity of about 25,000 man rem.[1] All offsite radioactive material shipments would be subject to the regulations and requirements of the Nuclear Regulatory Commission and Department of Transportation. The postulated worst offsite transportation accident[6] (a collision between a gasoline transport vehicle and a vehicle carrying one kilogram cans of plutonium waste) would result in an 196 man-rem whole-body 50-year dose commitment to the year 2000 population with 50 miles of FMEF. The probability of such an accident would be less than 10^{-10} per year.

Operation of FMEF will provide employment for about 200 people. Most of the operational jobs are expected to be filled by reassignment of present Hanford Engineering Development Laboratory (HEDL) personnel. The FMEF is only one relatively minor component of current HEDL activities, and WPPSS, and nonnuclear economic development. Considering the construction peak in 1979 and the other Hanford construction projects, the indirect effects of FMEF operations should be very slight.

c. Site Restoration

The FMEF is being designed to facilitate decontamination and decommissioning of buildings and equipment. However, the destructive and nondestructive examination cells and the associated examination equipment will, most likely, require extensive decontamination and may not be economically feasible to convert to other industrial or office use. The same is true of the fuel fabrication cell and equipment. Office and administrative areas would be readily available for other use with minimal or no decontamination required. The surrounding land could be available after decommissioning. However, the cell areas would not be restored to uncontrolled use.

4.0 CONFLICTS WITH FEDERAL, STATE, REGIONAL, OR LOCAL PLANS

Construction and operation of the FMEF will not conflict with applicable regulations of the United States, the State of Washington, or Benton County. The proposed site on the Hanford Site lies within an area designated by both the state and county as suitable for industrial use, with nuclear facilities specifically permitted. Construction and operation of the facility will be planned and carried out in such a way as to conform to Federal, state, and local regulations, including those concerning air and water quality, wildlife protection, industrial and occupational safety, and transportation.

5.0 ENVIRONMENTAL IMPLICATIONS OF ALTERNATIVES

Alternatives to FMEF that were considered include not providing FMEF and its fuel fabrication and postirradiation examination capability, construction of two separate facilities, one for fuel fabrication (HPFL) and one for post-irradiation examinations (FMEF), construction of the facilities at other locations, and providing the necessary capabilities through modification of existing facilities.

The overall objective of the breeder reactor fuels and materials program is to develop the technology for fuel, cladding, structural, absorber, and other materials which are required to establish a safe, reliable, and competitive commercial breeder industry when it is needed for the national interest. It is essential that data be available from the different types of fuel assemblies and the materials contained therein to meet the fuel program objectives of low doubling time, high temperature operation, high reliability and plant availability, long lifetime, and low fuel cycle cost leading to improved economics. It is also vital to verify the performance of new, larger fuel assemblies being operated for the first time under neutron flux conditions up to three times higher than possible in the EBR-II; thus enabling the fuel composition, the fuel burnup rate and the neutron flux to be prototypic of future design conditions. Failure to provide the data and performance verification will mean not only that the fuel and blanket assembly designs will have to be highly conservative with attendant high cost, but also that key information will not be available for future LMFBR development. Environmental and economic costs resulting from not providing or delaying this technology include the commitment of the limited reserves uranium and fossil fuels at an increasing cost to the public.

The Hanford Site was selected as the location for the FMEF because of several advantageous characteristics of this area, some of which are peculiar to Hanford. Since extensive fuels and materials expertise currently exists at Hanford, siting the FMEF there will facilitate the exchange of ideas and concepts pertaining to this technology. In addition, the Hanford FMEF location is within the same area of the Site as the FFTF, the major source of irradiated fuels and materials requiring examination. Alternate sites for the FMEF have their own particular set of characteristics which render them less desirable, including the probability of more serious environmental and socio-economic impacts.[6] At Hanford, the environmental impacts would be minimal and associated mainly with the loss of approximately 40 acres of waterless habitat. Significant socioeconomic impacts would be associated primarily with some relatively small additional demand on the local housing market. This situation is likely to be mitigated by continued construction of dwellings in the Tri-Cities.

Some locations would have only marginal utility as an FMEF site, due to significant negative physical and/or socioeconomic impacts. Alternates which were examined include several older facilities at Hanford as well as facilities at several offsite locations. Existing facilities have serious limitations due to the need for extensive modifications, inability to handle items of the large sizes involved, existing heavy workloads, and other limitations.

Overall, no satisfactory substitute exists for the FMEF. The FMEF will be a highly versatile facility with low operating costs, minimal environmental hazards, and will be located to minimize transfer costs and risks. Limiting factors in the use of existing facilities include the problems involved in providing adequate safeguards, upgrading to current seismic and tornado resistance requirements, higher radiation levels involved in fabricating fuels utilizing high-exposure plutonium, transporting short-decay-time fuel assemblies, inability to handle fuel and material assemblies of FFTF or larger size, inadequate fabrication capabilities, inability to perform nondestructive and destructive examination on fuel and material assemblies of FFTF or larger size, and interference with presently assigned examination programs. Modification of existing facilities for the required fabrication capabilities and assembly size, while possible, would be quite costly. Normal operation of properly modified existing facilities should not have any more environmental effect than the FMEF but, in accident conditions, the FMEF would provide more protection for the environment. One major improvement in protection would be the high resistance of the new structure to seismic and tornado events. Thus, the alternative of modifying existing facilities, when compared to constructing a new one, does not reduce environmental impact and appears to be cost ineffective.[6] Considerable cost savings were realized by combining the HPFL and FMEF into one facility. No adverse environmental impact results from combining the facilities and the construction impact is lessened somewhat, because less ground area is disturbed by the construction. Thus, the alternate of separate facilities is considered to be less desirable than the combined facility.

In addition to the Hanford Site, six other sites were evaluated which potentially met the necessary criteria for location of a facility such as the FMEF. These sites include the Nevada Test Site, Las Vegas, Nevada; the Idaho National Engineering Laboratory, Idaho Falls, Idaho; the Argonne National Laboratory, Argonne, Illinois; the Oak Ridge National Laboratory, Oak Ridge, Tennessee; the Savannah River Laboratory, Barnwell County, South Carolina; and the Los Alamos Scientific Laboratory, Los Alamos, New Mexico.[6]

These locations were evaluated both as to their physical and environmental characteristics and as to the socioeconomic effects which would result from FMEF construction and operation. The evaluation revealed no location better suited than Hanford as a site for the FMEF.

6.0 DECONTAMINATION AND DECOMMISSIONING

If, in the future, the determination is made to convert the facility to uses other than fuel examination and fabrication, it will be thoroughly decontaminated and decommissioned. Most of the facility can be decontaminated, however, in-cell equipment and fuel fabrication equipment could not be economically decontaminated and would become waste. Examples of this equipment are Standard Exam Stations, dismantling machines, gloveboxes, grinders, etc. In-cell cranes, manipulators, and other material handling equipment could be retained for use in the converted facility. The total volume of waste from the undecontaminatable equipment and ductwork is expected to be less than approximately 700 tons. In addition, there will be large volumes of softwaste resulting from the cleanup operation, such as protective clothing and cellulose wipes. Liquid waste from the cleanup operation is expected to be very low. (All waste will be packaged for burial and will be buried by the Hanford waste management contractor.) Cells and fuel materials storage areas for which there might be no future use could be closed off after decontamination and left in a static condition.

REFERENCES

(1) ERDA-1538, Final Environmental Impact Statement, Waste Management Operations, Energy Research and Development Administration, Hanford Reservation, Washington, December 1975.

(2) Socioeconomic Study: WPPSS Nuclear Projects 1 and 4, Woodward Clyde Consultants, 1976.

(3) PNL-2932, Environmental Surveillance at Hanford for CY-1978, J. R. Houston, et al, April 1979.

(4) Radiation Protection, ERDA Manual Chapter 0524, Energy Research and Development Administration, April 8, 1975.

(5) Environmental Assessment for the Fuels and Materials Examination Facility (FMEF), February 1977.

(6) ERDA-1550, Final Environmental Impact Statement, High Performance Fuel Laboratory (HPFL), Hanford Reservation, Richland, Washington, September 1977.

(7) Considerations of Health Benefit - Cost Analysis for Activities Involving Ionizing Radiation Exposure and Alternatives, (BEIR Report II), National Academy of Sciences/National Research Council, Washington, D.C., April 1977.