Oct, 1981

FMEF ENVIRONMENTAL ASSESSMENT
SUPPLEMENT FOR
SECURE AUTOMATED FABRICATION (SAF)

The purpose of this document is to update the FMEF Environmental Assessment[5] to appropriately reflect addition of the Secure Automated Fabrication (SAF) program features into the FMEF facility and to assess any additional environmental effects of construction and operations of the facility which would result from inclusion of these features in the FMEF facility.

Though the SAF program requires considerable rearrangement of equipment and functions, the additional environmental impact of the program is negligible. Figure 1 shows the proposed new layout for the SAF level. Changes at other levels involve additional elevators for personnel access, provisions for plutonium feed material handling and accountability, and required process and utility systems additions.

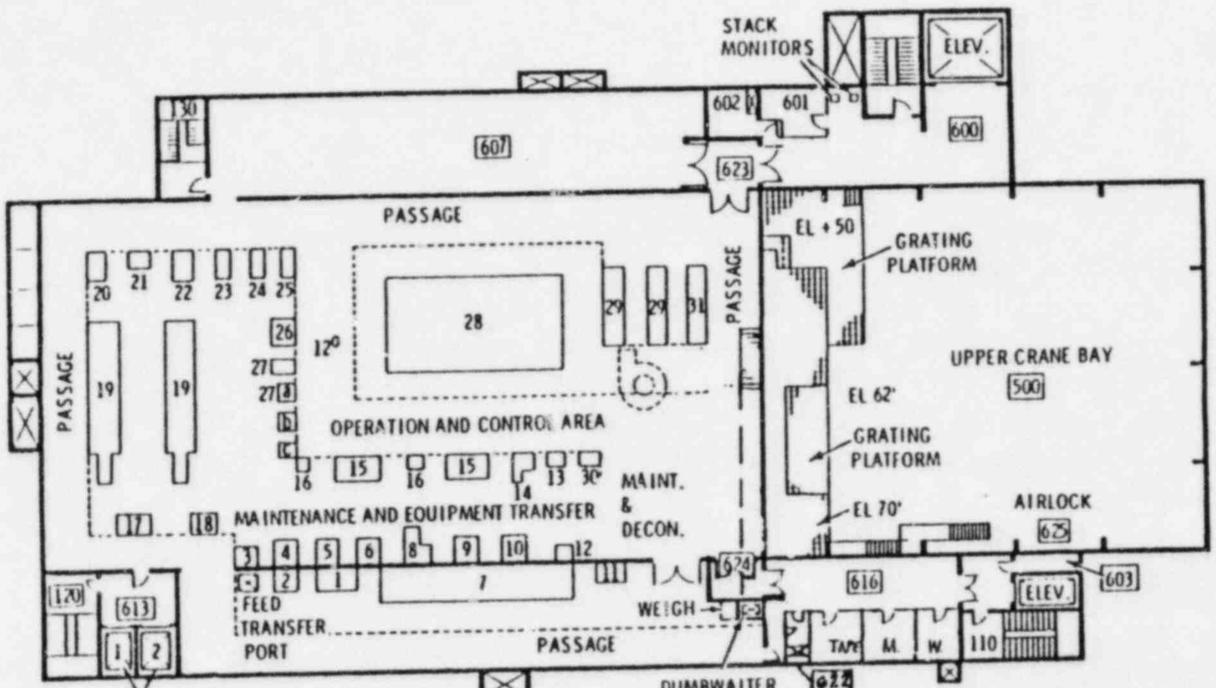
The FMEF will have approximately 175,000 square feet of floor space. The estimated construction cost of this facility is $170 million for project construction start in fiscal year 1979 and completion in fiscal year 1984. An additional $18 million is proposed for the facility additions and $48 million for the SAF line equipment. Design life of the FMEF will be 20 years.

The SAF area contains a modular automated fuel pin fabrication line, a fuel fabrication development laboratory, an equipment maintenance and decontamination room, and related support facilities. Analytical support will be provided by the same laboratories supporting the experimental fuel fabrication area on the floor below. The SAF line will be equipped to fabricate complete fuel loadings (pins) for the FFTF and other LMFBRs. A process flow diagram for SAF is shown in Figure 2.

A typical plutonium feed materials container for fuel development and fabrication would contain up to 8 kilograms (kg) of plutonium dioxide (PuO_2). Isotopic composition (typical) will be as follows:

'SAF' LEVEL FLOOR PLAN

FLOOR ELEVATION + 70'-0"

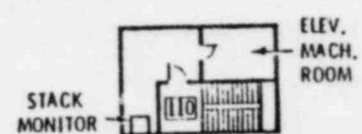


- 600 VESTIBULE
- 601 WOMEN'S TOILET
- 602 MEN'S TOILET
- 603 STORAGE
- 604 JANITOR'S CLOSET
- 605
- 606
- 607 FUEL FAB.
- 608
- 609
- 610
- 611
- 612 WOMEN'S TOILET
- 613 AIR LOCK
- 614 MEN'S TOILET
- 615
- 616 PASSAGE
- 617
- 618
- 619
- 620
- 621
- 622 PERSONNEL DECON.
- 623 AIR LOCK
- 624 AIR LOCK
- 625

SAF PROCESS LINE

1. FISSILE RECEIVING
2. FERTILE RECEIVING
3. BATCHING
4. GREEN SCRAP STORAGE
5. BLENDING
6. WASTE PACKAGING
7. SCRAP RECYCLE
8. MILLING
9. BINDER ADDITION
10. GREEN SCRAP ATTRITION
11. SCRAP STORAGE
12. SLUG DENSITY VERIFICATION
13. PRE-SLUG AND GRANULATE
14. SURGE STORAGE
15. PRESSING
16. PELLET DENSITY VERIFICATION
17. EMPTY BOAT STORAGE
18. SURGE BOAT STORAGE
19. FURNACE
20. RE-SINTER ACCUMULATION
21. PROPERTY ADJUSTMENT
22. BOAT STORAGE
23. BOAT UNLOAD
24. GRINDING
25. PELLET INSPECTION
26. COLUMN MAKE UP
27. PELLET STORAGE
28. PIN LOAD AND WELD
29. U.T. TEST
30. PIN RE-WORK
31. PIN STORAGE

ELEVATION 82'-6"

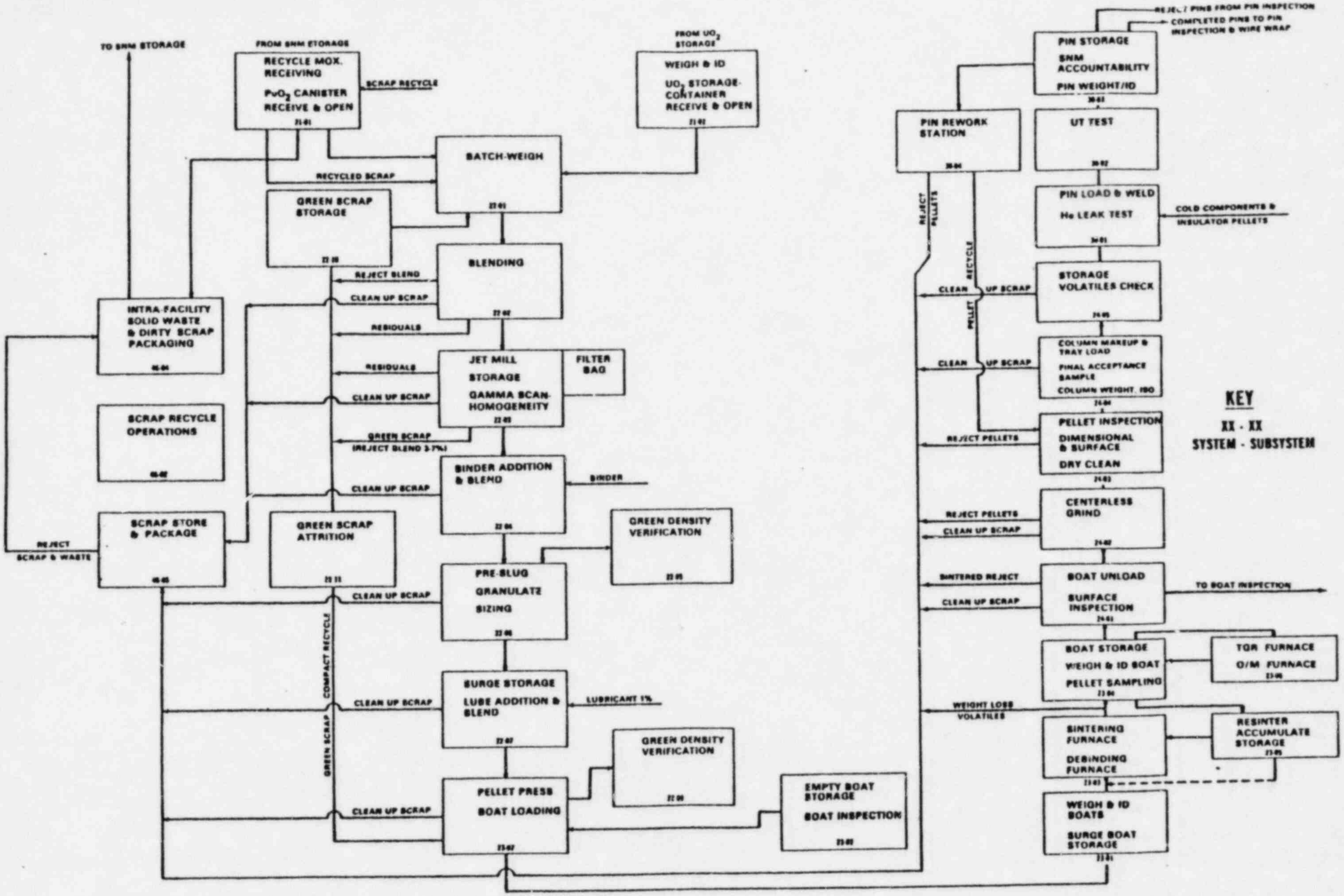


PENTHOUSE

FMEF
SYS. ENGR.
OCT. 1980

Figure 1

SAF UNIT PROCESS BOUNDARIES



^{236}Pu	$8 \times 10^{-6}\%$
^{238}Pu	0.5%
^{239}Pu	72%
^{240}Pu	20.0%
^{241}Pu	6.0%
^{242}Pu	1.5%

The annual amount of in-process PuO_2 used in FMEF, including SAF, will be approximately 4 MT. Maximum vault storage capacity for radioactive material including PuO_2, mixed oxides, uranium, and scrap will not change from 3120 kg. In addition, SAF will add approximately 600 kg of in-process storage, principally mixed oxides.

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.) A special analysis was performed to confirm this for the SAF program. Because of the additional fuel fabrication activities incorporated into the combined facility, material safeguards have been upgraded substantially.

The estimated binder/lubricant usage for FMEF has been increased by approximately 100 gallons with the SAF addition.

Table 2A details the inventories, cleanup, efficiencies, and environmental releases expected during normal operation of the SAF line. The calculated doses to the population resulting from the expected releases are very low. All of the following exposure and dose rates have been calculated based upon the operation of the FMEF facility with the SAF function.

The annual average exposure rate (for FMEF operation) at the 400 Area visitor center from external radiation is 2.5×10^{-8} millirem per hour. The 50-year inhalation dose commitment at this site is 2.9×10^{-8} millirem per hour of inhalation uptake. The corresponding values for SAF operation are 1.74×10^{-15} millirem per hour for external radiation and 1.34×10^{-7} millirem per hour of inhalation uptake. By comparison, the natural background radiation is about 1×10^{-2} millirem per hour.(1) The estimated maximum individual dose rate from all 1979 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 1.5×10^{-3} millirem.

Table 4 provides a summary of the 50-year dose commitments 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 4.6×10^{-3} man-rem.

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

"The Effects on Populations of Exposure to Low Levels of Ionizing Radiation" (BEIR Report)(7) relates population dose to health effects, principally cancer. Based upon Beir III Report estimates using the linear-quadratic hypothesis, the risk to an individual is about 6.7×10^{-6} per 0.1 rem of dose per year. The estimated dose from routine FMEF operations are so low (1×10^{-6} rem per year, total body, for the maximum individual) that no health effects are anticipated.

TABLE 2A: ENVIRONMENTAL RELEASES FROM NORMAL FMEF SAF OPERATIONS

Isotope [1]	Thoughput (MT) [2]	Release Factor [3]	Cleanup [3]	Environmental Release (Ci/Yr)
Pu^{236}	$.32 \times 10^{-6}$	.001	1.25×10^{-8}	$.2 \times 10^{-8}$
Pu^{238}	.02	.001	1.25×10^{-8}	$.34 \times 10^{-5}$
Pu^{239}	2.8	.001	1.25×10^{-8}	$.22 \times 10^{-5}$
Pu^{240}	.8	.001	1.25×10^{-8}	$.22 \times 10^{-5}$
Pu^{241}	.24	.001	1.25×10^{-8}	$.30 \times 10^{-3}$
Pu^{242}	.06	.001	1.25×10^{-8}	$.30 \times 10^{-8}$

1) Istopic composition (typical) of plutonium dioxide (PuO_2) feed material used for fuel development and fabrication.

2) Annual amount of in process PuO_2 estimated to be used during SAF operations.

3) Exhaust gases will pass through a series of three High-Efficiency Particulate Absolute (HEPA) filters before reaching the environs. The HEPA filters will have an efficiency of at least 99.95 percent each.

TABLE 3

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

Organ	FMEF Dose (millirem)	Hanford 1979[3] Dose (millirem)
Total Body	1.5×10^{-3}	5×10^{-2}
Thyroid	2.2×10^{-4}	7×10^{-2}
Bone	9.5×10^{-3}	0.60
Liver	5.3×10^{-3}	
Lung	2.9×10^{-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	4.6×10^{-3}
Thyroid	9.0×10^{-4}
Lung	1.1×10^{-2}
Bone	4.04×10^{-2}
Liver	2.1×10^{-2}

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

*Whole body, lung, bone and liver dose commitments have increased over those in reference 5 because of the larger Pu quantities. Thyroid dose commitments are lower because of improved computer codes adopted for the Hanford reservation and approved by DOE.

TABLE 5

CODES AND PARAMETERS USED FOR 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

Computer Code: DACRIN, Rev. 8-4-80

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

Files Addressed: Organ data library 5-19-80
Radionuclide library, Rev. 1-15-81

Computer Code: PABLM, Rev. 10-15-80

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

Files Addressed: Radionuclide library Rev. 1-15-81
Food transfer library Rev. 2-27-78
Organ data library Rev. 5-19-80
Ground dose factor library Rev. 3-15-78
Bioaccumulation factor library: Hanford specific

Computer Code: SUBDOSA, Rev. 11-3-76

Calculated Dose: Chronic external dose conversion factors for air submersion

Files Addressed: Radionuclide library RNDBET Rev. 11-3-76
Photon data library, GISLIBS Rev. 11-3-76

The addition of SAF will cause an increase of approximately 7000 cubic feet (4000 ft^3 prior to SAF) of uncompacted solid transuranium waste annually. However this waste will be partially compacted and placed in drums. The total number of drums of waste per year for the facility will be approximately 814 drums (712 which do not require shielding, 102 which require shielding). Of this total approximately 350 drums will be considered transuranium waste. All waste 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) Nonradioactive solid waste, approximately 14,000 noncompacted cubic feet per year (12,000 cubic feet prior to the SAF addition), will be disposed of in the landfill operated by RHO. The volume of radioactive liquid waste will not be increased by the addition of SAF.

The environmental consequences and probability of conceivable FMEF accidents have been analyzed, including credible accidents in the SAF area. The postulated FMEF worst case accident remains the same(5). The postulated 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 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)

Alternatives to locating SAF within the FMEF were considered in detail. The no action alternative was unacceptable because breeder reactor fuel will be needed for the FFTF, CRBR, and future breeder reactors. A separate facility to house only SAF functions was not acceptable because of the significantly greater cost (about $100 million) and the inability to provide breeder reactor fuels for early needs (before 1990) due to the time required for design and construction of such a new facility.

Thus, the primary alternatives that were reviewed in detail were modifications to existing facilities (and facilities under construction). Locations within all planned and current facilities were considered [8], as shown in Table 6. FMEF was selected, based on program cost, location of expertise and schedule considerations. Note that many of these facilities are needed for breeder reactor fuel development, even if they are not used for SAF.

Because of the construction sequence the SAF addition will not cause any significant increase in the number of construction workers during the peak construction period. It will however extend the length of the peak construction period at Hanford approximately three months. The anticipated increase in operating personnel due to the SAF addition is approximately 85. These slight increases are not expected to have any socio-economic impact on the area.

The SAF addition will add less than approximately 250 tons of undecontaminable waste from enclosures to the decommissioning effort. It would also add to the volume of soft waste from the cleanup operation such as protective clothing and cellulose wipes.

For further details regarding the FMEF facility itself or its functions and capabilities please reference the FMEF Environmental Assessment July 1980.[5]

TABLE 6

ALTERNATIVE SAF LOCATIONS[8]

Location	Facility	Characteristics	Capacity	Other	Costs
Leechburg, PA	Appolo (B&W)	Unused building with 5600 ft^2 of floor space, manual	∿1 FFTF core per year.	Experience since 1970. 2 MT Pu license.	High
Richland, WA	Mixed Oxide Facility (EXXON)	New facility with 14,000 ft^2 of floor space. All new equipment would be required for production of LMFBR fuel.	1/16 tonne per day (LWR mixed oxide)	100 Kg Pu license. Considerable U fuel experience, little Pu fuel experience.	Very high
Santa Suzanna, CA	Plutonium Facility (AI)-Bldg. 055	Relatively new facility with 18,000 ft^2 of floor space. (5400 ft^2 already devoted to Pu operations). Would need to use Building 100 (∿50 yds. away) for fuel assembly and storage.		Some experience. 3.5 Kg Pu license.	High
Richland, WA	Plutonium Fuels Laboratory (HEDL) - Bldg. 308	Concrete block with 19,400 ft^2 of floor space and 2 existing mixed-oxide powder-to-pin fabrication lines.		Some experience. No license needed Would need to transfer some existing activities.	Very high
Richland, WA	FMEF (HEDL)	Being constructed (completion in Dec. 1983) - 18,000 ft^2 available at 42 ft level. Some support systems could be shared with FMEF.		No license needed. Would need to transfer some activities within FMEF	Moderate
Los Alamos, NM	TA-55 (LASL)	DMA facility w/some space available.		No license needed.	High

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 Project 1 and 4, Woodward Clyde Consultants, 1976.

(3) PNL-3283, Environmental Surveillance at Hanford for CY-1979, J. R. Houston, et al, April 1980.

(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), July 1980.

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

(7) The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, (BEIR Report III), National Academy of Sciences/National Research Council, Washington, D. C., July 1980.

(8) TC-1569, Breeder Fuel Facilities Assessment, Hanford Reservation, Richland, Washington, 1979.

DOE F 1325.8
(7-79)

U.S. DEPARTMENT OF ENERGY

memorandum

DATE JUL 2 5 1980

REPLY TO ATTN OF NE-530

SUBJECT Environmental Assessment, Fuels and Materials Examination Facility (DOE/EA-0116)

TO Robert J. Stern, EV-11

The final version of the subject Environmental Assessment, copy attached, has been completed per EV/OGC instructions. No agencies or individuals were consulted in the preparation of this EA (all work was done at HEDL, RL, and DOE HQ). A distribution list for this EA will be provided as soon as initial distribution is completed. Please contact me directly if additional information is required.

George Sherwood

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Office of Plans and Analysis
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Attachment

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