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FMEF/EXPERIMENTAL CAPABILITIES

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FAST, THERMAL, & FUSION REACTOR EXPERIMENTS

CONFERENCE

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HANFORD ENGINEERING DEVELOPMENT LABORATORY
Operated by Westinghouse Hanford Company, a subsidiary of Westinghouse Electric Corporation, under the Department of Energy Contract No. DE-AC14-76FF02170
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DISCLAIMER

FMEF/EXPERIMENTAL CAPABILITIES

INTRODUCTION

The Fuels and Materials Examination Facility (FMEF), under construction at the Hanford site north of Richland, Washington, will be one of the most modern facilities offering irradiated fuels and materials examination capabilities and fuel fabrication development technologies. Located less than 460 m (1500 feet) west of the newly operational Fast Flux Test Facility (a unique test reactor used for development of fast breeder reactor fuels, materials and reactor components), the FMEF is being constructed for the U. S. Department of Energy.

Scheduled for completion in 1984, the FMEF will provide examination capability for fuel assemblies, fuel pins and test pins irradiated in the FFTF.

Various functions of the FMEF are described in this paper, with emphasis on experimental data-gathering capabilities in the facility's Nondestructive and Destructive examination cell complex.

MISSION

Four major activities will be performed in the FMEF:

1. Nondestructive and destructive post-irradiation examination of FFTF fuels and materials experiments.
2. Fabrication of FFTF fuel experiments for testing.
3. Development of fuel fabrication equipment and techniques.
4. Incorporation of a Secure Automated Fabrication (SAF) facility for fabrication of FFTF and advanced breeder reactor fuels.

TECHNICAL OBJECTIVES

Once operational, FMEF will have provisions for dismantling, examining and reconstructing up to 20 FFTF fuel assemblies and 15 nonfuel assemblies per year. It will provide for screening and nondestructive examination of up to 2,000 pins per year, and have storage capacity for 5500 pins and 15 FFTF assemblies. FMEF will also provide facilities for fabrication of 1,000 test pins per year and storage for the required quantities of Special Nuclear Material (SNM). In addition, capabilities for development of fuel fabrication equipment and fabrication of 6 metric tons of oxide fuel per year are provided. Functional areas in the facility include the Nondestructive Examination (NDE) cell, Destructive Examination (DE) cells, a neutron radiography facility, an analytical chemistry level, an SNM storage area, fabrication development area, test pin fabrication line, and fuel fabrication area. When the process building is completed, it will contain more than 15,500 sq. m (167,000 square feet) of examination, fabrication and support areas.

NONDESTRUCTIVE EXAMINATION CELL

The NDE cell is a large inerted hot cell, 12.2 m (40 feet) wide, 30.5 m (100 feet) long and 16.8 m (55 feet) high. It has 22 work stations dedicated to handling and examining irradiated pins and assemblies. Each of the work stations is equipped with two master/slave manipulators, a lead glass shielded window and an array of penetrations and service plugs. The NDE cell is also equipped with two Electromechanical Manipulators and two 7-1/2 ton remotely operated cranes.

Assemblies entering the NDE cell are transferred by a remotely operated cooling grapple suspended from one of the cranes. The assemblies will be

cleansed of sodium at the sodium removal station located at the east end of the NDE cell before the examination and dismantling cycle begins. Before the assembly is dismantled, length measurements, flat-to-flat measurements, bow and twist, surface examinations, temperature readings, gas flow and pressure drop through the bundle will be made. After those examinations are completed, the assemblies are dismantled, and pins are removed and placed in a process or storage magazine for transfer either to storage or one of the examination stations. Nondestructive pin examination will begin with a screening process which includes pin identification, pin weighing, bow and length classification, surface examination, gamma scanning and neutron radiography. Approximately 30% of the pins screened are planned to undergo a more detailed nondestructive examination. Wire wrap will be removed, and examinations such as profilometry, bow and length, precision and gross gamma scan, eddy current testing, fission gas sampling and pin leak check will be conducted. (See Figure 1, Building Cutaway, and Figure 2, FMEF NDE Process Flow Diagram)

DESTRUCTIVE EXAMINATION CELL

The DE cell complex is composed of a pin cutting cell, a sample preparation cell, two metallography cells, two polishing cells, two grinding cells, an organic waste process cell and four analytical chemistry cells. Several techniques will be used to examine fuel pins within this complex. These include: the determination of fuel-to-clad gap, bond and fuel interactions, the detection of any melting characteristics, void distributions, retained fission gas, fissile distribution, fuel microstructure and fission product distribution. (See Figure 3 for destructive examination process flow)

NEUTRON RADIOGRAPHY

The FMEF includes a neutron radiography facility with direct access for specimens coming from the Nondestructive Examination cell. It is here that fuel pins and assemblies are examined by neutron radiography, which is provided by a 1,000 kW TRIGA research reactor located on the DE cell level (-35 foot) elevation of the building. Specimen positioners will accept pins or assemblies in the NDE cell and transport specimens vertically to a position in line with one of the two available beam tubes for this process to be conducted.

ANALYTICAL CHEMISTRY LABORATORIES

The analytical chemistry laboratories support test pin line, waste management and fabrication development operations by providing laboratory space for close coupled chemistry development. These operations will be supported by routine analysis and provided with backup calibration measurements for SNM receiving, nondestructive assay and storage. Special nonroutine analyses can also be made when required, to develop new analytical methods in support of fuel development.

SNM STORAGE

The primary function of the SNM storage system is to store fast reactor fuel with minimum radiation exposure to personnel and enhance SNM safeguards. The shielded storage facility is located on the FMEF chemistry level and interfaces with accountability computers to maintain inventory and control.

FABRICATION DEVELOPMENT

The fabrication development area is to provide facilities for fuel fabrication process and equipment evaluation prior to installation in the test pin line. The equipment/process development portion of the breeder fabrication development program will develop techniques to reduce personnel exposure and improve fuel performance, while providing for processing reference and alternate fuels manufacturing.

TEST PIN LINE

The primary function of the test pin line is to fabricate experimental test pins. Test pin fuel is fabricated for FFTF experiments using conventional pellet and fuel pin fabrication equipment.

FUEL FABRICATION AREA

Located in the upper (70-foot) level of the FMEF is an area reserved for fuel fabrication. Fuels for the FFTF and other advanced breeder reactors will be fabricated here.

FMEF, 1984

Scheduled for operation in December of 1984, FMEF will be an important element in the development of remote fuel fabrication technology in support of this Nation's breeder program.

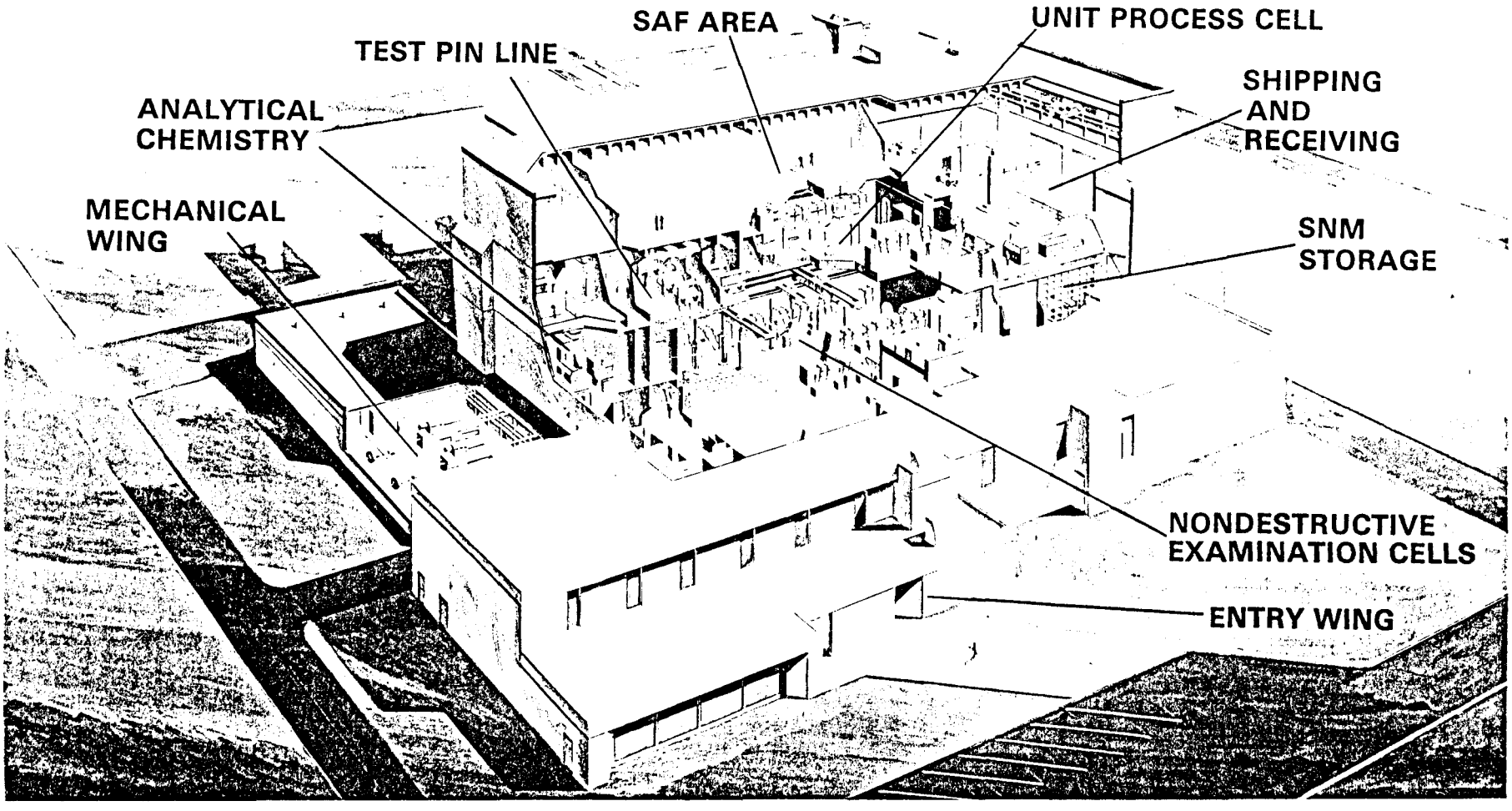

Figure 1 FMEF Cutaway

NDE CELL PROCESS

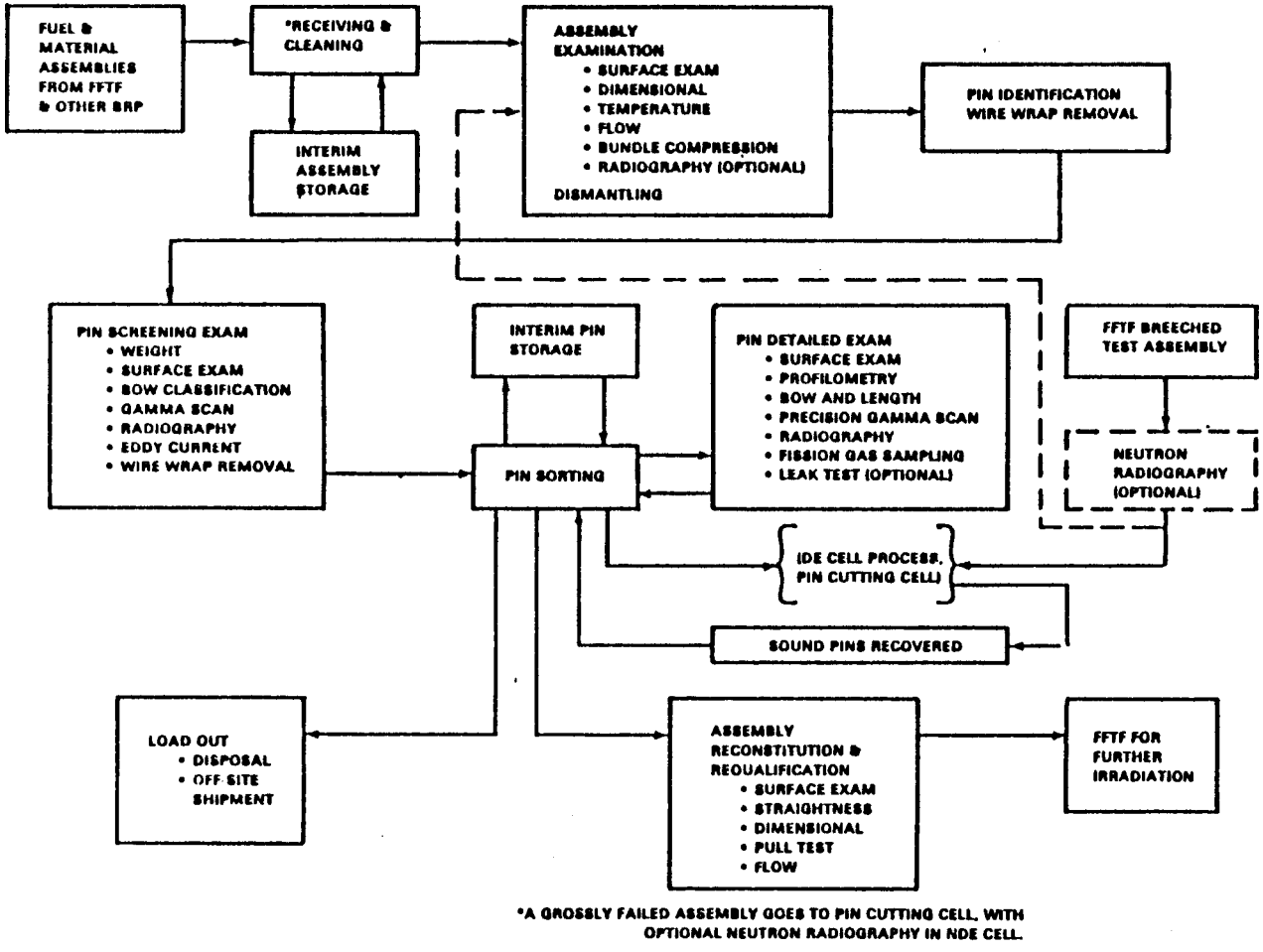

Figure 2 FMEF NDE Cell Process Flow Diagram.

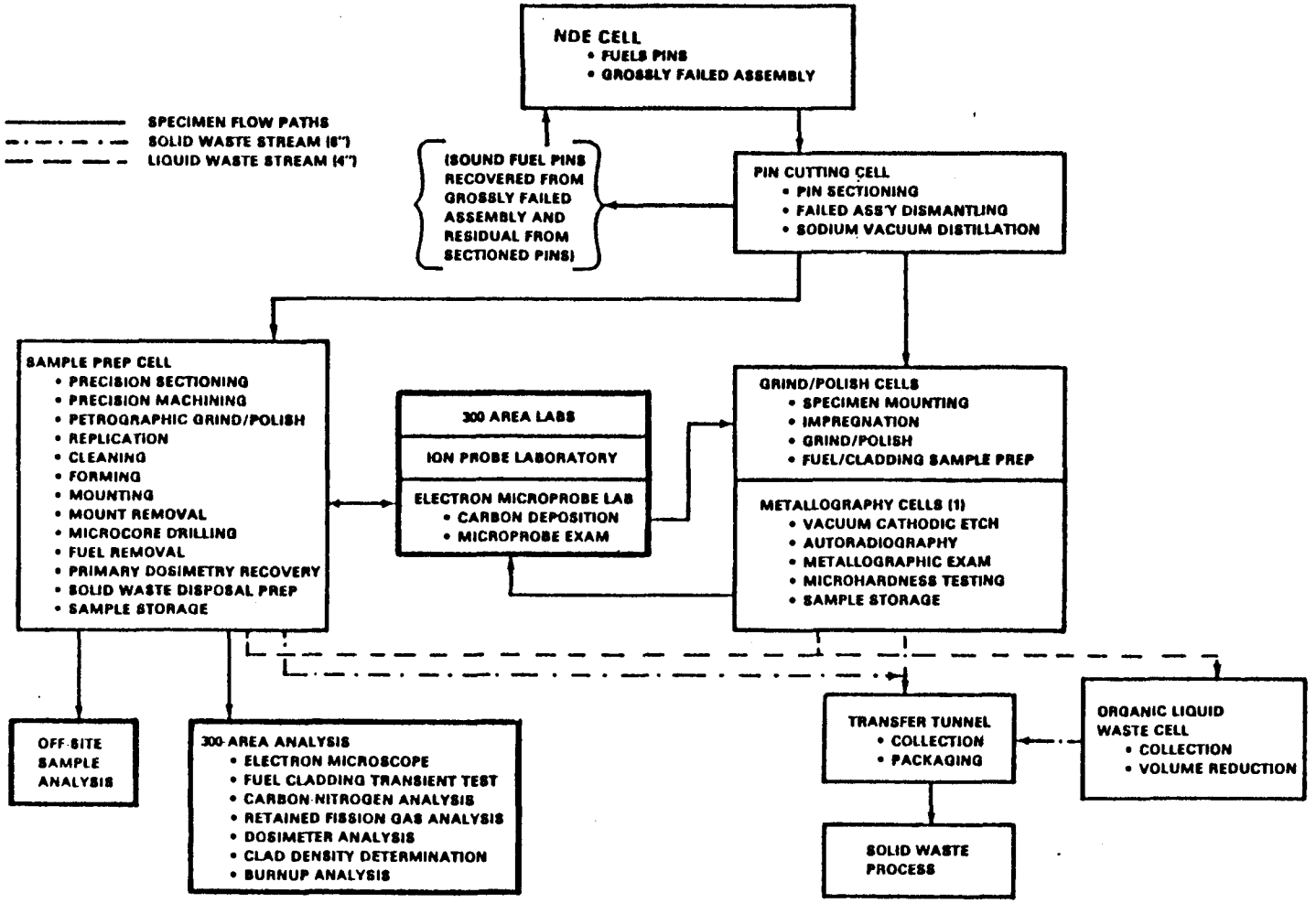

Figure 3 FMEF DE Cell Process Flow Diagram.

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