Wayne H. Jens
Vice President
Nuclear Operations

Detroit Edison

Fermi-2
6400 North Dixie Highway
Newport, Michigan 48166
(313) 586-4150

June 12, 1985
NE-85-0722

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Youngblood:

Reference (1) Fermi 2
NRC Docket No. 50-341

Subject: Fermi 2 Process Control Program

Please find attached the proposed Fermi 2 Process Control Program (PCP). It covers solidification and/or dewatering using the NUS supplied temporary processing and solidification system and solidification using the permanently installed asphalt extruder/evaporator. The approval of this PCP is needed to support heatup phase and thus is needed approximately one week after initial criticality. It should be noted that this material has been submitted informally in the past during the review process leading to issuance of the Fermi 2 Technical Specifications.

Testing of the permanently installed solidification system will begin soon after initial criticality. Testing will confirm the parameters for proper solidification of waste. The test results relating to solidification will be submitted for review by the NRC staff upon completion.

Please direct any questions to Mr. O. K. Earle at (313) 586-4211.

Sincerely,

Wayne H. Jens

Enclosure

cc: Mr. P. M. Byron
Mr. M. D. Lynch
Mr. C. R. Nichols
USNRC: Document Control Desk
Washington, D.C. 20555

FERMI 2 PROCESS CONTROL PROGRAM

The Fermi 2 Process Control Program (PCP) covers three distinct processes for solidification or dewatering of radioactive waste. The three processes are described below:

1. For the dewatering of NUS Corporation "TRANSFIX" temporary liquid radwaste system disposable pressure vessels, Fermi 2 will follow the PCP described in the NUS document FI-002 Revision C which was submitted in a letter to the NRC dated October 11, 1984.

2. For the solidification of radioactive waste using the NUS Corporation temporary radwaste solidification system, Fermi 2 will follow the PCP described in the NUS document SS-001 Revision F, with approved Procedure Change Request (PCR) SS-001/F1, which was submitted in a letter to the NRC dated December 18, 1984.

3. For the solidification of radioactive waste using the Fermi 2 permanent solid radwaste system, Fermi 2 will follow the PCP described in Attachment 1.

The General Supervisor - Radwaste is responsible for the implementation of the Fermi 2 PCP. Nuclear Quality Assurance will audit the solidification and dewatering of radioactive waste including record keeping activities in accordance with QAPR 24.

PROCESS CONTROL PROGRAM FOR THE PERMANENTLY INSTALLED FERMI 2 RADWASTE SOLIDIFICATION SYSTEM

I. Introduction

Long-term experience with various binding agents used to solidify radioactive waste indicates that stringent process controls are required to assure that complete solidification takes place.

The purpose of this document is to identify process parameters within which the Fermi 2 radwaste solidification system must be operated to obtain complete solidification. Solidification of radwaste at Fermi 2 using permanent plant equipment is accomplished using a Waste Chem Inc. (Werner and Pfleiderer Corporation) (WPC) Volume Reduction and Solidification System (VRS). This system is described in the Topical Report, "Radwaste Volume Reduction and Solidification System", Report No. WPC-VRS-001, November 1976 with Revision 1, May, 1978.

The WPC-VRS System utilizes a thermal process and thermoplastic binder material (asphalt) to reduce the volume, and encapsulate and solidify process wastes. Thermoplastic materials reversibly soften (liquify) when heated and harden (solidify) when cooled. This solidification process is insensitive to waste feed chemistry; i.e.,pH, chemical species, etc., and requires only the removal of heat to assure complete solidification.

II. Solid Waste System Description

A. Solidification

The WPC-VRS System is a one-step VRS process. A heated extruder/evaporator is employed to evaporate free water, mix and disperse radioactive waste in an asphalt matrix, and discharge the product into 55 gallon drums. Volume reduction is achieved by evaporation of water from the waste/asphalt mixture through devolatilizing ports located along the length of the machine. The extruder/evaporator is maintained at elevated temperatures to control the evaporative rate and maintain the waste/asphalt mixture in a fluid state until it is discharged into a container. Cooling to ambient temperatures causes the asphalt/waste mixture to harden and form a freestanding monolith. Elevated process temperatures assure complete evaporation of free water; hence, no free water is present in the end product. A detailed description of the solidification system can be found in Section 11.5 of the Fermi 2 FSAR, and details of the various systems and interfaces are contained in FSAR Figures 11.2-2 (Sheets 1 and 3) and 11.2-1 (Sheets 7-12 and 14).

B. Sources of Wastes

Wastes to be processed by the permanent solid waste system are of three types:

1. Powdered resins and slurries from the reactor water clean-up system, the condensate demineralizers, backwash of the fuel pool and radwaste system filter/demineralizers, and radwaste system etched disc filters.

2. Bead resins from the liquid radwaste system demineralizers.

3. Concentrates from the liquid radwaste evaporator bottoms and chloride waste tank.

During normal operations, powdered resins, sludges, and bead resins are processed through the centrifuge from the centrifuge feed tank. The dewatered radwaste is then "dry fed" by gravity to the extruder/evaporator.

Additionally, powdered resins and sludges may be "slurry fed" directly to the extruder/evaporator from the centrifuge feed tank. Bead resins may also be "slurry fed" to the extruder/evaporator from the slurry feed tank. Because of the larger amounts of water which must be handled by the extruder/evaporator in the slurry feed mode, processing times will be somewhat longer, although product adequacy will be unaffected.

Concentrated solutions of radsalts from the radwaste evaporators are fed directly to the extruder/evaporator.

Regardless of the feed mode, waste feed rates are automatically measured and regulated. Asphalt feed rates are automatically adjusted based on the waste feed rates to provide the desired binder/ waste ratio.

III. Variables Influencing End Product Properties

Certain process variables have a direct bearing on the properties of the final product which relate to the ability to form a freestanding monolith with no free water. Plant procedures will detail the sampling requirements necessary to insure proper solidification. The system will normally be operated with the extruder feed within a specified pH range in order to protect equipment from corrosion, and operations within this range will assure proper solidification and end-product.

In accordance with the foregoing limitations, the following variables influence the properties and consistency of the final solid product:

A. Asphalt type;

B. Waste chemical species being incorporated into the asphalt matrix;

C. Ratio of waste-to-asphalt; and

D. Process temperature.

A detailed discussion of the effect and limitations placed on each of the foregoing items follows:

A. Asphalt Type

WPC recommends use of an oxidized petroleum-based asphalt, conforming to ASTM-D-312-71, Type III requirements. This grade of asphalt has a low, residual, volatile content, and a high molecular weight. At room temperature, and at all normal ambient conditions, this material is a freestanding monolith.

B. Waste Chemical Species

The waste chemical makeup might be expected to influence the ability of the extruder/evaporator to form a satisfactory product. In their Topical

Report, WPC describes results of testing performed to demonstrate the ability of the extruder/ evaporator system to produce an adequate product. The simulated waste systems tested are conservatively representative of the Fermi wastes expected to be processed by the extruder/evaporator (boric acid and sodium sulfate should not be present in Fermi wastes).

In support of the Fermi 2 installation, WPC performed additional testing to confirm the adequacy of operation with dry feeds such as those resulting from processing by the centrifuge. These results confirm the adequacy of product produced using the dry feed mode.

WPC has placed a limit of 1 percent oil in the waste feed streams. An extensive review of the entire Fermi liquid and solid radwaste processing systems failed to identify a credible mechanism for concentration of oil in solid waste processing feed streams, such that the 1 percent limit would be approached. Nevertheless, a process limit of 1 percent oil in the waste-feed stream to the extruder will be maintained. Implementing procedures will detail the methods used to ensure this limit is met.

C. Ratio of Waste to Asphalt

The limits for the ratio of waste to asphalt to ensure an acceptable product are presented in Table 1. If the ratio of waste-to-asphalt were to exceed the limits, the end product viscosity will increase and the end product may exhibit a grainy texture. This could result in "pyramiding" of the product in the container with a loss of filling efficiency. With lower than specified ratios, product properties approach those of pure asphalt, resulting in loss of volume reduction. In any event, the product will be a freestanding monolith upon cooling. Constant viewing of the product texture during container filling is available to the operator through a Closed Circuit Television Camera.

Desired waste-to-asphalt ratios in the product are maintained automatically by a coordinated proportioning feed system to the extruder/evaporator. In all feed modes, the solids content of the waste stream is measured prior to initiation of feed flow. The measured solids content is used to determine the proper waste and asphalt feed control settings by consulting a graph in the operating procedure. A separate graph will be provided for each waste species and each feed mode.

In the centrifuge feed mode, the flow rate to the centrifuge is controlled automatically using a flow control valve. With a uniform feed, the centrifuge will provide a uniform flow of dried (approximately 40-50 w/o solids) product as feed to the extruder/evaporator.

In both slurry feed modes and in the concentrates feed mode, constant waste flow rates are maintained by flow measurement with feed back control to variable speed metering pumps.

D. Process Temperature Profile

A proper temperature profile along the length of the extruder is required to ensure that free water is not discharged. The process temperature ranges for each of the Fermi 2 waste types are given in Table 1.

Low temperature alarms are provided to alert the operator to a low temperature out-of-specification condition.

Should an out-of-specification condition persist for two (2) minutes, the extruder/evaporator will be automatically tripped to prevent free water from being discharged into the container. Under this condition, residual free water in the extruder/evaporator cannot be discharged since the residual heat content of the machine itself is sufficient to evaporate it.

IV. Spent Filters

Spent cartridge filters will either be air-dried, compacted, and disposed of as Dry Active Waste (DAW), placed in drums with an absorbent as required, or placed in drums to be filled with asphalt.

Spent cartridge bundles from the Waste-Collector Oil Coalescer or from the Floor Drain Oil Coalescer will be encapsulated in asphalt. Each bundle will be thoroughly drip dried, placed in a drum, transferred to the turntable of the solidification system, and thereupon filled with asphalt/waste mixture from the extruder/ evaporator.

This method of oil filter encapsulation will be proven during the preoperational test.

V. Conformance to 10CFR Part 61

(Land Disposal of Radioactive Waste)

A. Fermi-2 will meet the waste classification requirements of 10CFR61.55 by the following:

1. Measuring gamma-emitting radionuclides and using interim correlation factors based on calculational methods described in the Atomic Industrial Forum's "Methodologies for Determining the Classification of Low-Level Radioactive Wastes From Nuclear Power Plants."

2. Carrying out a sampling and analysis program necessary to determine subsequent specific correlation factors to be used for the plant.

3. If the subsequent sampling and anaylsis program indicates results such that the correlation factors being used may not give upperbound limits, then the wastes will be stored until they can be classified on the basis of correlation factors developed from actual sample analysis.

B. Fermi 2 will meet the waste form requirements of 10CFR61.56 when solidifying waste using the extruder/ evaporator by the following:

1. Class A wastes (as defined by 10CFR61.55) will be solidified in accordance with this PCP. The end-product of this solidification process meets the requirements of 10CFR61.56a for this class of waste.

2. Prior to the solidification of class B and C wastes (as defined by 10CFR61.55) with the installed Fermi 2 asphalt extruder system, waste-form test data will be submitted to the NRC for approval. Prior to such approval, class B and C wastes will either be: a) dewatered and shipped in approved High-Integrity Containers, or b) solidified by a mobile vendor using an approved PCP.

TABLE 1

PROCESS PARAMETERS TO
ENSURE PROPER PRODUCT

TEMPERATURE PROFILES*

Resins/Sludges

Zone	1	2	3	4	5	6	7	8
Temperature (°F)	140max	160-200	230-270	260-320	320-350	350-380	350-380	180-200

Evaporator Bottoms

Zone	1	2	3	4	5	6	7	8
Temperature (°F)	140max	160-200	230-270	260-320	320-350	350-380	350-380	320-370

WASTE/ASPHALT RATIOS*

Evaporator Bottoms $\leq$ 50/50

Resins/Sludges $\leq$ 50/50

LIMIT ON OIL IN FEED STREAM

One percent

ASPHALT TYPE

Meet ASTM D-312-71, Type III

*The values given in this section are tentative. The preoperational test program will determine the high and low ranges of these variables for acceptable solidification. Final operating points and acceptable ranges will then be incorporated in a revision to this PCP.