Douglas R. Gipson
Senior Vice President
Nuclear Generation

Detroit Edison

Fermi 2
6400 North Dixie Highway
Newport, Michigan 48166
(313) 586-5249

November 21, 1996
NRC-96-0128

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

References:
1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) NRC letter, dated September 26, 1996, "Resolution of Spent Fuel Storage Pool Safety Issues: Issuance of Final Staff Report and Notification of Staff Plans to Perform Plant-Specific Safety Enhancement Backfit Analyses, Fermi 2"

3) NRC Memorandum dated July 26, 1996, from James M. Taylor to Chairman Jackson et. al., "Resolution of Spent Fuel Storage Pool Action Plan Issues" (attached to Reference 2 letter)

4) Fermi 2 Updated Safety Analysis Report, Revision 7a, September 1995 (as amended by approved changes to be submitted in UFSAR Revision 8)

5) NUREG-0798, Safety Evaluation Report Related to the Operation of Enrico Fermi Atomic Power Plant, Unit No. 2, July 1981

Subject: Fermi 2 Comments on Resolution of Spent Fuel Pool Safety Issue - Infrequently Used Backup Cooling System

In the Reference 2 letter, the NRC stated its intention to conduct a plant-specific regulatory analysis to evaluate potential safety enhancement backfits pursuant to 10CFR50.109(a)(3). This action was taken on the basis that Fermi 2 appears to be reliant on infrequently operated backup Spent Fuel Pool (SFP) cooling systems to

A001

address long-term: Loss of Offsite Power (LOOP) events and mechanical failures, as documented in the Reference 3 NRC report. The letter also solicits comments on the accuracy of the staff's understanding of the plant design, the safety significance of the above "design feature" (reliance on infrequently used backup SFP cooling systems), the cost of potential modifications to address the design features, or the existing protection from the above design concerns which may be provided by administrative controls or by other means. The purpose of this letter is to provide Detroit Edison's perspective on the spent fuel pool issues as described in References 2 and 3, as they pertain to the Fermi 2 plant.

Background

Section 4.1 of the Reference 3 NRC staff review categorized the Fermi 2 plant as:

> *". . . more reliant on infrequently operated backup cooling systems than other similar plants because of the absence of an onsite power supply for the primary SFP cooling system or low relative capacity of the primary cooling system."*

The supporting discussion for this category of plants from Section 3.2.5 of the same NRC staff report further amplified the staff concerns for this category of plants as follows:

> *". . . The final category of operating reactors are those reactors reliant on infrequently operated backup SFP cooling systems to address long-term LOOP events and mechanical failures. The staff will examine administrative controls on the availability of the backup cooling systems during refueling and technical analyses demonstrating the capability of these backup systems to cool the SFP at the ten operating reactors in this category to determine the need for further regulatory analyses."*

The Reference 2 letter from the NRC reiterates certain information from the Reference 3 report, including the characterization of the Fermi plant and their intent to conduct plant-specific regulatory analyses to evaluate the potential safety enhancement backfits pursuant to 10CFR50.109(a)(3) as a result of the staff findings.

Fermi 2 Plant Design - Spent Fuel Pool Cooling

As described in Section 9.1.3 of the Fermi 2 Updated Final Safety Analysis Report (UFSAR), the Fuel Pool Cooling and Cleanup System (FPCCS) and the Residual Heat Removal (RHR) System are used for spent fuel pool (SFP) decay heat removal. The FPCCS consists of two fuel pool cooling pumps; two heat exchangers; two filter-demineralizers; two skimmer surge tanks; and associated piping, valves, and

instrumentation. The two fuel pool cooling pumps are connected in parallel, as are the two heat exchangers. The FPCCS cools the spent fuel pool by transferring decay heat through the FPCCS heat exchangers to the Reactor Building Closed Cooling Water (RBCCW) System. The information contained in UFSAR Section 9.1.3 (Reference 4) demonstrates that the FPCCS capability is sufficient to remove the decay heat of six one-third cores discharged at 18-month intervals shortly after the most recent fuel discharge to the pool.

In the context of the characterization of Fermi with a group of plants reliant on infrequently operated backup SFP cooling systems to address *long-term LOOP events and mechanical failures*, it is not clear that the NRC Staff was fully aware of certain key design attributes of the Fermi 2 FPCCS and its support systems.

Electrically, the Fermi 2 FPCCS pumps are powered from Class 1E buses that are, in turn, powered by the onsite emergency diesel generators. The FPCCS pump loads are shed on a diesel generator auto-start, but can subsequently be manually restarted by the operator without realignment to a different bus. This allows the control room operator to selectively restart the primary spent fuel pool cooling flow to the FPCCS heat exchangers. Similarly, the RBCCW pumps are also powered from class 1E buses and can be restarted by an operator subsequent to an initial LOOP event to provide the intermediate heat transfer function on the FPCCS heat exchanger secondary flow side. RBCCW transfers its heat to the General Service Water (GSW) system. The GSW pumps are not powered from 1E buses, but are powered from buses that can be fed by both offsite power sources and by the onsite Combustion Turbine Generator (CTG) used for the Fermi 2 station blackout recovery. The start and loading of the CTG is proceduralized in the existing abnormal operating procedure for Loss of Offsite Power. This minimizes the possibility that a long-term LOOP can alone result in the long-term loss of the FPCCS.

Mechanically, the FPCCS has parallel redundancy in the skimmer surge tanks, FPCCS pumps, FPCCS heat exchangers, filter demineralizer units (with bypass capability), and fuel pool cleanup return lines and diffusers. Mechanical equipment common to both loops is limited to certain segments of common piping and several valves. As a result, the system has limited vulnerability to a sustained loss of function due to mechanical failures. Loss of a single pump or heat exchanger will result in only partial loss of FPCCS heat removal capability.

As described in Section 9.1.3 of the UFSAR, the spent fuel pool has the capacity to accommodate a full core offload in addition to the aforementioned six one-third cores offloaded from previous operating cycles. In such a scenario, the pool decay heat load is analytically predicted to exceed the capacity of the FPCCS, resulting in the need for additional cooling capability. In such cases, the heat removal capability is provided by the RHR system. When the reactor vessel is flooded and the pool gates

are removed, there are several different procedurally controlled combinations of FPCCS and RHR heat removal capability and lineups available to remove decay heat from the vessel and pool.

In the limiting case, backup cooling is provided to the fuel pool by means of a permanently piped cross tie to the RHR system. Section 9.1.3 of the UFSAR explains that in this mode of operation, one RHR pump and the corresponding RHR division heat exchanger will provide the means to cool the fuel pool. The UFSAR further explains that this cooling circuit is established by opening cross-tie valves V8-3264 and V8-3029 and closing FPCCS valves V8-3006 and V8-3253 (UFSAR Figure 9.1-23). For the designed piping configuration, the RHR pump will deliver approximately 3500 gpm, and the RHR heat exchanger is capable of removing the "maximum heat load" corresponding to a full core offload and six one-third cores discharged to the pool from previous operating cycles. To ensure the availability of backup cooling via the RHR system, the cross-tie piping, the FPCCS piping from the skimmer tanks to the first anchor downstream of valve V8-3006, and the FPCCS piping from the first anchor upstream of valve V8-3253 to the fuel pool diffusers are Seismic Category I. Current plant procedures refer to this lineup and use of the RHR for spent fuel pool cooling as the "Fuel Pool Cooling Assist" mode.

The Seismic Category I RHR cross-tie design provision for spent fuel pool cooling was described in the original FSAR, was reiterated in the Reference 5 Operating License Safety Evaluation Report (SER) as one of the considerations in granting the initial operating license, and is described in the current UFSAR. One of the principal licensing bases for the backup spent fuel pool cooling capability as described in the Reference 5 SER is the ability to prevent fuel pool boiling. Additional key attributes of the RHR cross-tie capability include the following:

- The hardware is permanently installed, requiring only valve alignments and RHR pump operation in accordance with existing operating procedures. The operation of the RHR cross-tie does not require the installation of spool pieces, temporary instrumentation, or the need for special communications equipment to support its operation.

- As described in the Reference 5 SER, there is sufficient time to make one RHR division available, commence backup fuel pool cooling, and prevent pool boiling in the event that the FPCCS is lost either during refueling with a full core offloaded or during power operation.

- The current Fermi 2 RHR system operating procedure specifically addresses the use of the RHR cross-tie in the fuel pool cooling assist mode.

Prior to commercial plant operation in September of 1984, the Fermi 2 backup fuel pool cooling capability using the RHR system in the fuel pool cooling assist mode was tested as part of the preoperational test program. This mode has not been used for fuel pool cooling since the initial testing for either routine or emergency use, due to the availability of preferred options of pool decay heat removal. The RHR system has, however, been used alone or in conjunction with the FPCCS for vessel and spent fuel pool decay heat removal utilizing the shutdown cooling mode during each of the past refueling outages. The RHR fuel pool cooling assist mode has been maintained as part of the UFSAR and plant procedures since initial plant operation.

In summary, although the Fermi 2 fuel pool cooling assist mode of RHR, as described in the UFSAR, is an infrequently used backup capability for spent fuel pool decay heat removal, it is a viable means of heat removal, as supported by the plant hardware and existing system operating procedures. In addition, the capability for powering the required FPCCS components and support systems from onsite backup AC power sources and the redundancy of key mechanical components in the system minimize the vulnerability of the normal FPCCS heat removal capability to long-term LOOP events or mechanical failures.

Safety Significance - Loss of Spent Fuel Pool Cooling

During initial plant licensing, the NRC required Detroit Edison to perform a dose calculation to determine the bounding consequences of a hypothetical fuel pool boiling accident, notwithstanding that the Fermi 2 licensing basis for the backup SFP cooling capability is to prevent pool boiling. The analysis concluded that the offsite doses resulting from the hypothetical scenario are a small fraction of the 10 CFR Part 100 guidelines, and that the design criteria applied to the spent fuel pool cooling system are adequate to provide reasonable assurance that the plant can be operated without undue risk to the health and safety of the public. This analysis was added to the FSAR at the request of the NRC, but not discussed in the Reference 5 SER because fuel pool boiling was beyond the Fermi 2 licensing basis. The analysis has, however, been maintained and remains part of Section 9.1.3 of the Fermi 2 UFSAR.

The results of the offsite dose analysis described in the UFSAR are as follows. The calculations estimate the 2-hr thyroid (inhalation) dose at the site boundary to be 0.04 rem for both radioactive and non-radioactive makeup water. The 30-day thyroid (inhalation) dose at the low-population zone for radioactive makeup is 0.044 rem; whereas for non-radioactive makeup, the 30-day dose is 0.032 rem. For comparison, the 10 CFR 100 Guidelines for the 2-hour site boundary are 25 rem whole body and 300 rem thyroid, and for the total duration low-population zone, 25 rem whole body and 300 rem thyroid.

In summary, Detroit Edison maintains that sufficient hardware and procedural provisions assure that fuel pool boiling can be prevented, the final method being through the use of the RHR system as the sole means of removing heat from the spent fuel pool. Analyses are included in the Fermi 2 UFSAR that demonstrate that the bounding offsite dose consequences of fuel pool boiling are a very small fraction of the 10 CFR 100 guidelines. Therefore, postulated pool boiling has already been demonstrated to not be safety significant.

Existing Protection Provided by Administrative Controls

The Reference 2 letter solicits comments on the existing protection which may be provided by administrative controls or other means related to the issue of infrequently used backup spent fuel pool cooling systems. The following information relating to the RHR system operating procedure for the fuel pool cooling assist mode and existing practices related to decay heat management is provided to supplement the discussion of the system design.

The current revision of the Residual Heat Removal System Operating Procedure 23.205 (Revision 53) provides prerequisites as well as a detailed procedure for the alignment, startup, operation, and shutdown of the RHR system fuel pool cooling assist mode. The procedure provides the operator the following important information to assure successful operation of the system in the fuel pool cooling assist mode:

- a clear statement of the prerequisites for using this mode (to maintain specified spent fuel pool temperatures if the FPCCS is not capable of maintaining the specified temperatures)

- guidance alerting operators that a loop of RHR must be declared inoperable in order to be used for Fuel Pool Cooling Assist, and a listing of potentially applicable Technical Specifications to consider when preparing to use the mode

- concise instructions to allow the RHR pump to be started without the normal suction path and to lift specified leads in order to prevent the affected minimum flow bypass valve from opening and creating a potential fuel pool drain path

- guidance on system operation to monitor and control equipment

The RHR fuel pool cooling assist mode procedure has been revised recently, demonstrating that the plant staff is aware of the UFSAR commitment to this backup fuel pool cooling mode.

Decay heat management has been an integral part of the planning and execution of all past refueling outages, as well as the presently ongoing fifth refueling outage (RFO5). This was discussed in detail with the NRC Fermi 2 NRR Project Manager during his April 1996 visit to the plant for the purpose of collecting information related to the Fermi 2 spent fuel pool and decay heat management practices. During that visit, documentation was provided pertaining to the third and fourth Fermi 2 refueling outages (RFO3 and RFO4) to illustrate how decay heat loads and available primary and secondary decay heat removal capability were planned and tracked through each of the outage schedule "windows" for two outages where full-core off-loads were performed. The fuel pool cooling assist mode of RHR is one of several RHR lineups available for use when a division of RHR division is available as a primary or secondary means of decay heat removal. The pre-outage plan and adherence to the plan assured that significant margin existed at all times to assure decay heat removal. The documents reviewed ("Defense-in-Depth" studies) showed that time to pool boiling, assuming loss of the primary decay heat removal system, was considered as one of the bases for assessing the adequacy of available secondary decay heat removal systems. Detroit Edison remains committed to maintaining an emphasis on decay heat management for future refueling outages as outage management practices evolve.

Potential Cost of Backfits

As stated above, Detroit Edison believes that the existing backup SFP cooling capability provided by the RHR system hardware, the existing system operating procedure, and present decay heat management practices collectively provide a viable, as well as licensed, means of assuring that fuel pool boiling is prevented. In addition, Section 9.1.3 of the Fermi 2 UFSAR contains an offsite dose analysis that supports the conclusion that postulated spent fuel pool boiling is not safety significant.

In this context, it is difficult to define the cost of "backfits" to address the NRC staff concern that the fuel pool cooling assist mode of the RHR system is used infrequently without having a specific alternative to evaluate. If the intent of the "backfit" is to require modification of the Fermi 2 plant to provide a fully redundant, high capacity, safety-related spent fuel pool cooling system, the cost of the "backfit" could be in excess of $20 million. This extreme option considers the potential need for modifying affected electrical and mechanical support systems and addressing various regulatory issues such as electrical separation, fire protection safe shutdown, and equipment qualification.

Detroit Edison is not planning any modifications related to the spent fuel pool backup capability at this time, on the basis that the existing fuel pool cooling assist mode of the RHR system and its associated procedures provide a viable backup to the FPCCS and that postulated fuel pool boiling is not safety significant.

Summary

In summary, Detroit Edison agrees with the Reference 3 NRC staff report that the licensed backup spent fuel pool capability for the Fermi 2 plant, the fuel pool cooling assist mode of the RHR system, is infrequently used. However, Fermi routinely uses the RHR in other configurations to perform numerous functions, including decay heat removal from the spent fuel pool and reactor vessel during refueling operations. The existing plant hardware configuration and existing system operating procedures for the fuel pool cooling assist mode of the RHR system collectively constitute a viable safety-related backup to the FPCCS to prevent fuel pool boiling in the event the FPCCS is not available to perform its heat removal function for any reason. This capability makes use of permanently installed equipment and does not require the temporary installation of hardware such as spool pieces, the use of special instrumentation, or special communications capability. Furthermore, the FPCCS pumps, RBCCW pumps, and GSW pumps are powered from buses provided with onsite backup AC power sources, minimizing fuel pool cooling vulnerability to a sustained loss of offsite power. In addition, the two FPCCS loops have redundancy in key mechanical components including the circulating pumps and heat exchangers allowing individual loop operation, minimizing vulnerability to loss of a mechanical component. Notwithstanding that fuel pool boiling is beyond the plant licensing basis, the Fermi 2 UFSAR includes an analysis that demonstrates that fuel pool boiling, if postulated, is not safety significant, independent of its probability. On the basis of these factors, Detroit Edison is not planning any further backfit activities in response to the Reference 2 NRC letter at this time

This letter does not contain any new commitments.

If you have any questions related to this response, please contact Mr. Peter W. Smith at (313) 586-4097.

Sincerely,

cc: A. B. Beach
M. J. Jordan
A. J. Kugler
A. Vegel