DD-84-22

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION
Harold R. Denton, Director

In the Matter of	)	
	)	Docket No. 50-289
GPU NUCLEAR CORPORATION	)	
	)	(10 CFR 2.206)
(Three Mile Island Nuclear Station, Unit 1)	)	

DIRECTOR'S DECISION UNDER 10 CFR 2.206

I. INTRODUCTION

In a petition dated January 20, 1984, the Union of Concerned Scientists (hereinafter referred to as UCS or petitioner) identified five alleged deficiencies with the Three Mile Island Nuclear Station, Unit 1 (TMI-1) Emergency Feedwater (EFW) system which it sought to have resolved prior to resumption of power operation at the facility.[1] In addition, the petitioner contended that in the aggregate, the deficiencies it had identified with the EFW system compromised that system's reliability. In an "Interim Director's Decision Under 10 CFR 2.206", DD-84-12, 19 NRC 1128, issued on April 27, 1984, the staff tentatively resolved four of the five issues raised by petitioner, and deferred resolution of the fifth issue, concerning environmental qualification

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[1] UCS identified the following deficiencies with the EFW system in its January 20, 1984 petition:

1. failure of the EFW system to be environmentally qualified
2. failure of the EFW system to be seismically qualified
3. inability of the EFW system to withstand a single component failure
4. inaccuracy of the EFW flow instruments
5. inadequacy of the Main Steam Line Rupture Detection System

See Petition at 1; DD-84-12 at 1.

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of the EFW system, as well as the aggregate deficiency issue, pending further review by the staff. Concurrent with issuance of the interim decision, the Commission requested that the staff provide three categories of information requested by UCS in a letter of February 13, 1984, to the Commissioners. In addition, the petitioner filed a supplemental petition on May 9, 1984 based on the results of an NRC audit of the licensee's environmental qualification records. UCS specifically requested that the Commission: 1) direct the staff to independently verify the existence and technical sufficiency of the licensee's environmental qualification documentation for all electrical components in the EFW system and all other systems required for proper operation of the EFW system; 2) direct the NRC Office of Investigations (OI) to investigate whether the licensee made material false statements to the NRC in connection with the environmental qualification program; and 3) direct the NRC Office of Inspector and Auditor (OIA) to investigate whether the staff provided false or misleading information to the Boards or Commission, or has been "derelict in its duty" with respect to the environmental qualification program at TMI-1. The supplemental petition was referred to the staff for treatment as part of the pending petition. The licensee amended its February 24, 1984 response to the January petition by submittals dated March 26, April 26, May 16, and May 31, 1984. The licensee similarly responded to the supplemental petition pursuant to the staff's request under 10 CFR 50.54(f) on June 11, 1984.

The staff has now completed its review of all alleged EFW system deficiencies cited in the petition and the matters identified in the supplemental petition. Accordingly, this decision: (1) updates with respect to seismic qualification, and otherwise affirms the interim Director's Decision; (2) provides the staff's basis for denying the petition with respect to the environmental qualification and "aggregate" deficiency issues raised by UCS; (3) describes the staff's disposition of the items of additional relief requested in the supplemental petition, and (4) provides the information requested by UCS in its letter of February 13, 1984.

II. INTERIM DIRECTOR'S DECISION

The interim Director's Decision provided the staff's review for three of the five issues identified by the petitioner with respect to the TMI-1 EFW system: (1) the failure of the EFW system to be seismically qualified, (2) the inability of the EFW system to withstand a single component failure, and (3) the inadequacy of the Main Steam Line Rupture Detection System (MSLRDS).[2] For each of these alleged deficiencies the staff concluded,

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[2] As explained in the interim decision, I declined to consider the petitioner's request with respect to the accuracy of EFW flow instrumentation, as that issue had been fully explored in the TMI-1 restart proceeding. See DD-84-12, 19 NRC at 1130-31. Moreover, the precise issue raised by the petitioner, EFW flow instrumentation accuracy, was the subject of responses filed before the Commission, as well as a Board Notification within the context of the restart proceeding. Subsequent to issuance of the interim Director's Decision, the Commission issued its decision on TMI-1 Restart proceeding design issues. See Metropolitan Edison Company (Three Mile Island, Unit 1), CLI 84-11, __ NRC __ (July 25, 1984). That decision was silent with respect to the flow indicators, leaving undisturbed the staff's determination, as expressed in Board Notification 84-088, that the existing TMI-1 EFW flow instruments were acceptable. See also DD 84-12, 19 NRC at 1130-31.

for reasons set forth in the interim decision, that the requested action was not warranted at that time. Upon further consideration, the staff's view with respect to these issues remains as stated in the interim decision. In this regard, no new information pertaining to the alleged single component failure and MSLRDS deficiencies has been identified since the time of issuance of the interim decision which would persuade me to reach conclusions different from those expressed in DD-84-12.

New information has, however, developed regarding the seismic capability of the EFW system. This new information, described below, generally pertains to assuring operator access to the intermediate building for required manual actions for the interim period of operation until system upgrades are complete, and provides additional support for the previous findings in this area.

Seismic Qualification of the Emergency Feedwater System

The licensee plans to perform a number of modifications to, among other things, upgrade the seismic capability of the EFW system during the first refueling outage following restart.[3] Upon completion of these modifications, the TMI-1 EFW system will be capable of totally remote operation following a safe shutdown earthquake (SSE), even if that SSE should lead to an intermediate building harsh environment due to a postulated failure of any non-seismically qualified high energy line. To assure EFW system operability following an SSE in the interim, the licensee, if necessary, would dispatch an operator to the intermediate building to perform local manual actions.[4]

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[3] See Letter from H. D. Hukill (GPU) to J. F. Stolz (NRC) (August 23, 1983); Letter from R. F. Wilson (GPU) to D. G. Eisenhut (NRC) (May 10, 1984); Summary of April 27, 1984 meeting with GPU Nuclear regarding the Three Mile Island, Unit 1 Emergency Feedwater System (May 2, 1984).

[4] See Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Director's Interim Decision Under 10 CFR 2.206 (Seismic Capability of Emergency Feedwater), Three Mile Island Nuclear Station, Unit No. 1 (April 27, 1984).

The petition alleges, among other things, that operator access to the intermediate building may not be possible following an SSE because of a harsh environment created by the postulated failure of non-seismically qualified intermediate building systems.

Petitioner specifically postulated the failure of non-seismically qualified vent stacks from safety relief valves (MSV-22A, B) and atmospheric dump valves (MSV-4A, B). Failure of these vent stacks while steam is flowing through them could result in an intermediate building harsh environment that would prevent operator access. The staff addressed this matter in the interim Director's Decision and concluded, based primarily on probabilistic arguments, that reasonable assurance existed that intermediate building local manual actions would not be precluded because of a harsh environment resulting from vent stack failure following an SSE for the interim period of operation until system upgrades are complete. See DD-84-12, 19 NRC at 1132 (referencing Safety Evaluation of the Office of Nuclear Reactor Regulation Supporting Interim Director's Decision Under 10 CFR 2.206 (Seismic Capability of Emergency Feedwater)). However, in a meeting with the staff on April 27, 1984, the day of issuance of the interim Director's Decision, and in its third amended response to the petition, the licensee committed to install seismically qualified restraints on those vent stacks prior to any restart, thus eliminating any possible concern regarding vent stack failure following a seismic event and the possible resultant intermediate building harsh environment.[5]

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[5] See Summary of April 27, 1984 meeting with GPU Nuclear regarding the Three Mile Island, Unit 1 Emergency Feedwater System, (May 2, 1984); Licensee's Amended Response to Union of Concerned Scientist's Petition For Show Cause Concerning TMI-1 Emergency Feedwater System (May 16, 1984).

Prior to this commitment, the licensee had planned for the vent stack modification to be completed during the Cycle 6 refueling outage. In addition, the licensee committed to upgrade the supports for the EFW pump recirculation lines to seismic class I prior to restart. This modification had previously been scheduled for completion during the Cycle 6 refueling outage. See id.

The licensee has since completed installation of these seismic restraints and the modification has been inspected and found acceptable by NRC regional inspectors. See Inspection Report 50-289/84-22.

Since the petition addressed only the potential failure of the non-seismically qualified vent stacks, the interim decision was directed only to this occurrence. However, there are other non-seismically qualified intermediate building systems whose failure following an SSE could result in a harsh environment. Since the issuance of the interim Director's Decision, the staff has continued its review in this regard to evaluate the potential interactions from all non-seismically qualified intermediate building systems whose failure following an SSE could create an intermediate building harsh environment.

Of particular concern to the staff was the non-seismic class I main feedwater line that crosses the intermediate building. Failure of this line during a seismic event would create a harsh environment and prevent access to the intermediate building.[6] In its Amended Response to Union of Concerned Scientists' Petition For Show Cause Concerning TMI-1 Emergency Feedwater System (May 16, 1984), the licensee references the TMI-1 Final Safety Analysis Report (Updated Version), which indicates that the maximum intermediate building main feedwater line primary and secondary stress (including deadweight, thermal, internal pressure and seismic stresses) is 46.5% of the stress level at which a high energy pipe break should be postulated.[7] However, these calculations were based upon an operating base earthquake (OBE), which is of lesser severity

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[6] Failure of this main feedwater line would also result in intermediate building flooding which would threaten EFW system operability since the EFW system is low in the building. Although arguably not cited by petitioner as a basis for its request, the staff has, nevertheless, pursued this matter See Section III. infra.

[7] See also Letter from H. D. Hukill (GPU) to J. F. Stolz (NRC) (April 13, 1984).

than an SSE. Consequently, the licensee subsequently provided, by letter dated June 4, 1984, the results of additional stress calculations indicating that the maximum main feedwater line pipe stress, based on an SSE, is also well within the stress level at which a high energy pipe break should be postulated. The staff has reviewed the results of these calculations and is able to conclude that an adequate margin exists for the intermediate building main feedwater line, and accordingly, reasonable assurance exists that the line would withstand an SSE without rupture. In addition, further EFW system upgrades will be complete in the long-term which will make operator access unnecessary.

In response to a staff request, the licensee also performed similar analyses of the other non-seismic class I intermediate building lines whose failure could result in harsh environments.[8] Staff review of the results of these stress analyses lead to the conclusion that the stresses are within acceptable limits so as to provide reasonable assurance that the non-seismic class I intermediate building lines would withstand an SSE without rupture. Based upon these calculations for intermediate building main feedwater and non-seismic class I lines, the staff is able to conclude that there is reasonable assurance that a harsh environment in the intermediate building will not result following an SSE. Accordingly, intermediate building operator access for local manual EFW system operation following an SSE would not be precluded for the interim period of operation until system upgrades are complete.

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[8] See Letters from J. F. Stolz (NRC) to H. D. Hukill (GPU) (June 25, July 24, and August 8, 1984) and Letters from H. D. Hukill (GPU) to J. F. Stolz (NRC) (July 16, July 30, and September 7, 1984).

Although not specifically cited as a deficiency by petitioner, the staff has also reviewed whether non-seismically mounted intermediate building components or equipment, such as ventilation ducts, could fail following an SSE so as to inhibit operator access to the EFW equipment or otherwise impair EFW system operation. This review included a staff walkdown of the TMI-1 intermediate building on May 22, 1984, and a later walkdown by the licensee.[9] The licensee, in a July 16, 1984 letter, provides the disposition of the potential deficiencies identified during the walkdowns. That letter also provides some indication of the thoroughness of the walkdown. The two minor modifications identified as necessary by the licensee during its walkdown (anchoring radiation monitor RMA-2, and replacing ladder mounting bolts) have been completed by licensee and will be inspected by NRC regional inspectors. Based upon a review of the information provided in licensee's submittal, and the knowledge gained by the staff during its walkdown of the TMI-1 intermediate building, the staff concludes that there is reasonable assurance that operator access to the intermediate building and the vicinity of the EFW system will not be impaired by the failure of non-seismically mounted components and equipment following the occurrence of an SSE for the interim period of operation until system upgrades are complete. Similarly, the staff concludes that there is reasonable assurance that EFW system operation will not be impaired as a result of an SSE event. Accordingly, the staff finds that, for the reasons set forth in the interim Director's Decision and as supplemented herein, no further action need be taken prior to restart with respect to the seismic qualification of the EFW system.

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[9] See Letter from H. D. Hukill (GPU) to J. F. Stolz (NRC) (July 16, 1984).

III. ENVIRONMENTAL QUALIFICATION OF THE TMI-1 EFW SYSTEM

The petition alleges, among other things, that the TMI-1 EFW system is not environmentally qualified as required by NRC regulations. Petitioner's specific concern rests with the environmental qualification of electrical equipment as required by 10 CFR §50.49.[10] To support its request, petitioner cites a December 10, 1982 staff safety evaluation report addressing TMI-1 environmental qualification, a November 5, 1982 technical evaluation

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[10] The petition specifically cites General Design Criterion 4 from 10 CFR Part 50, Appendix A "Environmental and missile design bases" which applies to structures, systems and components important to safety. However, it is clear from the petition that UCS's concerns rest solely with the environmental qualification of electrical equipment.

In the restart proceeding, the Licensing and Appeal Boards held that the issue of environmental qualification of electrical equipment was removed from the restart proceeding by the Commission's generic rulemaking on the subject. By order dated January 27, 1984, the Commission took review of these decisions. Petitioner's position in response to the January 27 order was that the Licensing and Appeal Boards erred in these decisions and that the issue of environmental qualification of electrical equipment should be addressed in the restart proceeding. See Union of Concerned Scientists' Brief on the Commissions Review of ALAB-729 (March 19, 1984) at 2-9. Staff's position was that the Licensing and Appeal Boards did not err and that the issue was, in fact, removed by the Commission's generic rulemaking. See NRC Staff's Brief Concerning the Commissions Review of Specific Design Issues in ALAB-729 (March 19, 1984) at 3-13.

By CLI-84-11, dated July 26, 1984, the Commission decided that the generic rulemaking had not entirely removed the issue of environmental qualification from the restart proceeding. The Commission decided that environmental qualification encompassing the environments, locations and equipment with a nexus to the TMI-2 accident is within the proceeding. The Commission therefore directed the staff to certify that TMI-1 electrical equipment which is required to mitigate small break loss of coolant accidents and loss of feedwater transients and which is located in containment and the auxiliary building is environmentally qualified for radiation. Since the TMI-1 EFW system electrical components subject to environmental qualification are located in the intermediate building, and not in containment or the auxiliary building, petitioner's allegation does not duplicate restart proceeding issues.

report prepared by Franklin Research Center (FRC TER) on the same subject, and two meetings between the licensee and the staff, which petitioner attended, on October 5 and December 16, 1983.[11] The petition provides no information that was not previously known to the staff.

There are three aspects that must be considered in making environmental qualification determinations: (1) defining harsh environments in which electrical equipment may be required to operate, (2) defining which electrical electrical equipment may be required to operate in the harsh environment, and (3) demonstrating that the required equipment is qualified to operate in the harsh environment. Although the petition focuses on the third aspect of environmental qualification cited above, the staff's review led it to address, in varying degrees, all three aspects of environmental qualification for the TMI-1 EFW system. For reasons as set forth below and presented in detail in the attached Safety Evaluation Report dated September 13, 1984, the staff concludes that the TMI-1 EFW system is environmentally qualified as required by NRC regulations.

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[11] The safety evaluation and technical evaluation reports were issued under letter dated December 10, 1982. See Letter from J. F. Stolz (NRC) to H. D. Hukill (GPU). The October 5, 1983 meeting is documented by licensee submittal dated February 10, 1984. See Letter from H. D. Hukill (GPU) to J. F. Stolz (NRC). The December 16, 1983 meeting is documented by Summary of Afternoon Meeting With GPU Nuclear Corporation on December 16, 1983 (December 22, 1983).

Definition of Harsh Environment

In its initial response to the Petition,[12] the licensee stated that:

> [T]he intermediate building environmental qualification program has utilized two specific main steam line breaks (24 inch and 12 inch), which produce the most severe environment for electrical equipment. Other breaks in the feedwater lines produce a much less severe environment and are not the basis for qualification.

This statement is correct with respect to intermediate building pressure, temperature and humidity. However, a main feedwater line break in the intermediate building would also create a flooding hazard that would not be provided by a main steam line break. In this regard, in GPU Nuclear Technical Data Report (TDR) No. 250, Revision 1, "Review of Intermediate Building Flooding Following a Feedwater Line Break in the Intermediate Building of TMI-1", dated January 9, 1984, the licensee concluded that adequate time may not be available for operator action to mitigate intermediate building flooding from a main feedwater line break before the flood level reaches the EFW pumps, which are the lowest EFW system electrical components not qualified for submergence. The staff was provided a copy of TDR No. 250 during a March 20-21, 1984 environmental qualification audit [13] and, by letter dated March 29, 1984, raised this concern with licensee and also requested additional, clarifying

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[12] See Licensee's Response to Union of Concerned Scientists' Petition for Show Cause Concerning TMI-1 Emergency Feedwater System (February 24, 1984), attachment at 3.

[13] A complete discussion of the purpose of the file audits is provided below and in the attached Safety Evaluation.

information. The licensee responded by letter dated April 13, 1984 and subsequently provided "Licensee's Amended Response to Union of Concerned Scientists' Petition for Show Cause Concerning TMI-1 Emergency Feedwater System", dated April 26, 1984, in which the licensee committed to perform intermediate building modifications that would increase the time available for operator action from approximately five minutes to 25 minutes.[14] These modifications have subsequently been completed by the licensee[15], and will be inspected by NRC regional inspectors. The staff considers the 25 minute time frame to be adequate time for an operator to diagnose the event and take the necessary mitigating actions. Neither the petition nor the staff's review identified any other areas for concern with respect to the definition of intermediate building harsh environments.

Electrical Equipment Required to Operate in Harsh Environment

With respect to defining which EFW electrical equipment would be required to operate in a harsh environment, and therefore would be subject to the requirements of 10 CFR 50.49, the staff requested that the licensee provide such a list during a March 8, 1984 meeting.[16] The licensee

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[14] These modifications had previously been planned for the Cycle 6 refueling outage. See letter from H. D. Hukill (GPU) to J. F. Stolz (NRC) (August 23, 1983).

[15] See Letter from H. D. Hukill (GPU) to J. F. Stolz (NRC) (August 1, 1984).

[16] See Summary of Meeting With GPU Nuclear Corporation on Environmental Qualification (March 19, 1984).

provided a working list for staff use during the March 20-21 environmental qualification file audit and subsequently presented and discussed a list at an April 27, 1984 meeting with the staff.[17] At the April meeting the staff expressed certain reservations as to the methodology used by licensee to develop the list and shortly thereafter requested licensee to provide clarification.[18] The principal staff concerns focused on (1) whether the licensee had used a systematic approach in developing the list, and (2) whether the licensee had properly documented its review, particularly with respect to the bases for excluding equipment from environmental qualification. This issue was further discussed with the licensee during the May 7-8, 1984 environmental qualification file audit. During these discussions it became apparent that the licensee's methodology for identifying equipment subject to environmental qualification may not have given adequate consideration to electrical equipment from non-safety related systems whose operation may be needed for, or whose spurious operation might jeopardize, operation of a safety-related system.[19] With respect to emergency feedwater, the methodology did not consider whether certain interfacing main steam or condensate system (non-safety related) components would be required to operate to assure EFW system operability for the events in question. The licensee fully addressed this matter and provided additional information in its response to the staff's May 3, 1984 letter.[20]

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[17] See Summary of April 27, 1984 Meeting with GPU Nuclear Regarding the Three Mile Island, Unit 1 Emergency Feedwater System (May 2, 1984).

[18] See Letter from D. G. Eisenhut (NRC) to H. D. Hukill (GPU) (May 3, 1984).

[19] The staff viewed these deficiencies as programmatic ones not limited to the EFW system. This information prompted the staff's May 25, 1984 letter to the licensee requesting information on the overall TMI-1 environmental qualification program.

[20] See Letter from R. F. Wilson (GPU) to D. G. Eisenhut (NRC) (May 10, 1984).

Upon review, the staff concluded that the licensee had identified those electrical components of the EFW system required to be environmentally qualified, with the exception of the licensee's exemption of condensate system valves from environmental qualification (i.e., COV-14A,B and COV-111A,B). The staff would require that these valves be environmentally qualifiifed, because operation of these valves in a harsh environment may be necessary as backup to postulated single failures. The staff subsequently advised the licensee of its position, and the licensee agreed to include the valves in its environmental qualification program.[21]

Therefore, based upon the review activities described above, the staff concludes that licensee's environmental qualification program encompasses that electrical equipment located in a harsh environment whose operation may be necessary to assure EFW system operability in a harsh environment. A complete list of components is provided in the attached safety evaluation.[22]

Qualification of Electrical Equipment

The third and final aspect of the staff's review, and the true focus of the petition's environmental qualification allegation, addresses the issue of whether the specific electrical equipment subject to environmental qualification has been adequately demonstrated to remain operable in the prescribed harsh

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[21] See Letter from J. F. Stolz (NRC) to H. D. Hukill (GPU) (June 25, 1984), and Letter from H. D. Hukill (GPU) to J. F. Stolz (NRC) (August 6, 1984).

[22] The staff's activities did not, however, include a rigorous review of whether licensee had adequately identified equipment at the sub-component level (e.g. the identification of splices, terminal blocks and motors within a valve operator). The petition makes no allegations in this regard and the staff identified no basis for pursuing this matter during its review.

environment, and whether adequate documentation of any such demonstration exists.[23] The petition draws heavily from the Franklin Research Center technical evaluation report (FRC TER) which contained a number of environmental qualification issues that were unresolved at the time of its issuance in November 1982. The staff was continuing its review of the licensee's resolution of the FRC TER deficiencies at the time of receipt of the petition.

To address this allegation the staff performed an initial audit of the TMI-1 EFW system environmental qualification files on March 20-21, 1984. Audit results were provided to the licensee by letter dated April 25, 1984.[24] As described in the April 25 letter, the staff concluded that the files did not adequately demonstrate environmental qualification of EFW system electrical components and that the deficiencies were both general in nature and component-specific. The licensee endeavored to address the deficiencies and the staff subsequently performed a second audit on May 7-8, 1984 with similar results. Additional audits were performed on May 24, June 25, and August 6, 1984. Comments were provided to the licensee at the conclusion of each audit session.[25] Based upon the findings from the August 6, 1984 audit, the staff is able to conclude that the TMI-1 environmental qualification files

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[23] In the most fundamental sense, a component is considered environmentally qualified if (1) it has been successfully tested for a harsh environment (e.g. pressure, temperature, radiation, chemical spray) that is more severe than what it would see in the plant and (2) a similarity is established between the tested component and the component installed in the plant.

[24] See Letter from J. F. Stolz (NRC) to H. D. Hukill (GPU) (April 25, 1984).

[25] Audit notes were provided to the petitioner in a letter from J. F. Stolz (NRC) to E. R. Weiss (UCS) (August 7, 1984).

adequately demonstrate the environmental qualification of EFW system electrical equipment.

The specific details of the audits and file deficiencies are described in the attached safety evaluation. However, two components warranting special mention are the converters for the EFW flow control valves. The licensee had initially proposed a justification for continued operation for these components since no qualification testing data was available.[26] The justifications were based upon probabilistic arguments and the availability of feed and bleed cooling as a backup for core cooling.[27] At the March 8, 1984 meeting, the staff advised the licensee that it could not accept the proposed justification without substantial additional review. The licensee subsequently committed to replace the converters with environmentally qualified components,[28] and regional inspectors have verified that this modification is complete. Other required equipment replacements, as described in the safety evaluation, have been verified by regional inspectors. See Inspection Report 50-289/84-22.

In view of the foregoing discussion, the staff concludes for reasons set forth above, that the appropriate harsh environments are defined, that the electrical equipment essential for EFW operation are properly identified, and that adequate documentation exists to demonstrate the qualification of all essential equipment. Adequate actions have been taken to assure that the TMI-1 EFW system is environmentally qualified in accordance with NRC regulations. No further action need be taken before restart.

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[26] See Licensee's Response to Union of Concerned Scientists' Petition for Show Cause Concerning TMI-1 Emergency Feedwater System (February 24, 1984).

[27] The feed and bleed core cooling mode does not rely upon the steam generators for decay heat removal. The staff believes that there is a high probability that feed and bleed is a viable means of core cooling, but it has not been reviewed from the standpoint of a design basis event.

[28] See Licensee's Amended Response to Union of Concerned Scientists' Petition for Show Cause concerning TMI-1 Emergency Feedwater System (March 26, 1984).

Notwithstanding this conclusion, however, the staff's initial audit findings regarding the unacceptability of the licensee's environmental qualification files for EFW components, and the deficiencies identified in licensee's methodology for identifying components required to be qualified, raised questions as to the adequacy of licensee's overall environmental qualification program. Therefore, the staff, by letter dated May 25, 1984, requested that the licensee reaffirm the adequacy of its overall environmental qualification program in several specific areas.[29] The licensee's response is pending.[30] However, with respect to the environmental qualification of electrical equipment within the scope of the TMI-1 restart proceeding (equipment required to mitigate small break loss of coolant accidents and loss of feedwater transients) the Commission has directed the staff to certify such equipment with respect to radiation. See Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1) CLI-84-11, __ NRC __ (July 26, 1984). Thus, in addition to the environmental qualification required by the Commission under the restart proceeding, the staff is continuing its 10 CFR 50.49 environmental qualification review for TMI-1, which will include further auditing, on an expedited basis.[31] Should the staff develop information from these audits indicating further action with respect to the TMI-1 environmental qualification program is necessary, appropriate action would be taken at that time.

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[29] See Letter from D. G. Eisenhut (NRC) to H. D. Hukill (GPU) (May 25, 1984).

[30] The staff expects to receive a response from the licensee in October 1984.

[31] Environmental Qualification file audits are routinely performed for nuclear power plants in the licensing phase. The staff plans to conduct similar audits for all operating reactors.

IV. THE SUPPLEMENTAL PETITION

By supplemental petition dated May 9, 1984 (supplemental petition), the petitioner requested further relief in connection with the EFW system. UCS based its request upon information contained in the staff's April 25, 1984 letter to the licensee expressing concerns regarding the environmental qualification of the TMI-1 EFW system as a result of the findings of the first TMI-1 environmental qualification file audit. See Section III, supra. Petitioner compares this information with previous information and statements in correspondence and points out apparent inconsistencies and contradictory statements that it attributes to both the licensee and the NRC staff.[32] Based upon these apparent inconsistencies, petitioner requests three additional specific items of relief:

1. As a precondition to restart, the staff should be directed to independently verify that documentation exists and that it is technically sufficient to demonstrate environmental qualification of each and every electrical component in the emergency feedwater system and in every other system required for proper operation of the emergency feedwater system.

2. The Office of Investigations should be directed to immediately investigate whether GPU has made material false statements to NRC in connection with the environmental qualification program. Because this issue bears directly on GPU's competence and integrity, the investigation should be completed before a vote on restart.

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[32] By filing dated July 31, 1984, petitioner responds to an earlier licensee response regarding the supplemental petition. In this filing petitioner notes apparent inconsistencies between licensee's response to the supplemental petition and other correspondence and information. Petitioner appears to have provided this filing to reinforce its earlier allegations since it explicitly requests no additional relief. However, the filing does imply that the staff should expand its audit activities beyond the EFW system. The staff intends to conduct this review as explained in Section III, supra.

3. The Office of Inspector and Auditor should be directed to investigate and determine whether the NRC staff has provided false or misleading information to the Boards or to the Commission, or has been derelict in its duty in connection with the issue of environmental qualification in TMI-1.

See Supplemental petition at 10-11.

With respect to the first request, the staff, by virtue of the review activities described herein and in the attached safety evaluation, has performed the independent verification requested by petitioner and concluded that the documentation is technically sufficient to demonstrate the environmental qualification of each electrical component in the EFW system and in every other system required for proper operation of the EFW system. Accordingly, the first request has been substantially satisfied by the review activities undertaken by the staff.

In considering petitioner's second request, the technical staff reviewed the documentation related to the licensee's environmental qualification program and identified certain statements made by licensee in connection with the TMI-1 environmental qualification program which the staff believed to be invalid. These statements were forwarded to the Office of Investigation (OI). After reviewing the statements identified by the technical staff, OI initiated an evaluation to determine whether the matter warrants a full investigation. Accordingly, the staff has satisfied petitioner's request to the extent that OI is examining the TMI-1 environmental qualification issue. Should OI decide to conduct a full investigation of the matter, the staff would take appropriate action based upon the results of that investigation.

Upon its receipt, the supplemental petition was referred to the Office of Inspector and Auditor to determine whether the staff acted improperly with

respect to the issue of equipment qualification at TMI-1. This action essentially satisfies the petitioner's request.[33]

V. AGGREGATE DEFICIENCIES

Background

Each of the five basic deficiencies alleged in the petition have either been addressed herein or in the interim Director's Decision. However, in its January 20 petition, UCS further contends that "one or more of the identified deficiencies, when viewed individually, would not necessarily pose an 'intolerable risk'", but that "[i]n the aggregate...[the deficiencies] thoroughly compromise the reliability of" the EFW system. Petitioner provides further clarification of its aggregate deficiencies concern in its letter of May 1, 1984 directed to the Director, Office of Nuclear Reactor Regulation. The petitioner described its concern as depending "largely upon the findings regarding the specific EFW deficiencies; to the extent that the specific deficiencies we note in the petition are borne out, the point about the 'aggregate effect' is strengthened and vice versa. Therefore, the major issue is certainly whether the specific deficiencies we cite exist and/or have been corrected."

To properly focus the petitioner's concern about aggregate deficiencies, a brief review of staff's findings regarding each of the five alleged basic deficiencies is necessary. First, as discussed in this decision, the staff

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[33] It should be noted that a request for an investigation by OIA of internal NRC personnel matters does not fall squarely within the class of requests contemplated by 10 CFR 2.206. Section 2.206 permits interested members of the public to request initiation of enforcement proceedings with respect to any license.

concludes herein that the TMI-1 EFW system is environmentally qualified. Second, the staff concluded in the interim Director's Decision that there are no MSLRDS deficiencies. Third, as the staff concluded in Board Notification BN 84-088, dated April 24, 1984, the EFW flow instrumentation is sufficiently accurate for its intended purpose. Fourth, as stated in the interim Director's Decision, the TMI-1 EFW system may be susceptible to single failures which could, for certain accidents, prevent it from performing its intended safety function. Fifth, the staff concluded in the interim Director's Decision as modified herein, that the TMI-1 EFW System would be capable of performing its intended safety function following an SSE, but that conclusion relies, in part, upon operator access to the intermediate building for local manual actions. Accordingly, the valid deficiencies to be considered in a review for aggregate deficiencies are (1) potential EFW system single failure vulnerabilities, and (2) EFW system seismic limitations to the extent that intermediate building access for local manual action may be necessary.

There is also a time element to the aggregate deficiencies issue. That is, licensee is committed to upgrading the EFW system after one cycle of operation. See Section VI, infra. This upgrade will correct both the potential single failure vulnerabilities and the seismic limitations. The possibility of aggregate deficiencies poses, therefore, a concern only for one cycle of operation. The issue then becomes one of whether, in light of potential single failure vulnerabilities and seismic limitations, the TMI-1 EFW system would be capable of performing its intended safety function for the one cycle of operation until such time as system upgrades are complete.

The staff believes that the specific review of each individual deficiency as presented herein and in the interim Director's Decision, which was performed in accordance with normal review practice, has shown that an aggregate deficiency does not exist in the EFW system. The following description is provided, nevertheless, to explain the basis for the staff's conclusion and to conveniently summarize the capabilities and limitations of the TMI-1 EFW system expected at the time of restart.

The staff has reviewed, using current licensing criteria, those event or accident scenarios necessary to determine the integrated effect of all valid EFW system deficiencies within the scope of the petition. For example, staff reviews of the EFW system for seismic and environmental qualification acceptability concurrently considered postulated single failures for each of these reviews. These reviews also included, where appropriate, the potential interaction from other intermediate building systems such as postulated failures that could cause a harsh environment or a seismic failure that would adversely affect the EFW system function. In that staff reviews have included limiting accident scenarios and the potential effects of failures and interactions, the staff reviews provide a basis for assessing the overall capability of the EFW system in an aggregate sense. The conclusion of these reviews is that the TMI-1 EFW system, as configured at the time of restart, will be capable of performing its intended safety function for the one cycle of operation, i.e., until the system upgrades are complete.[34]

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[34] The staff acknowledges that the differences between the EFW system at the time of restart versus after the cycle 6 refueling do present a difference in system reliability which might, if compounded in many small ways, give rise to an aggregate concern of the kind suggested in the petition. However, the aggregate deficiencies in this instance include only two of the many circumstances in which the EFW system could be called upon to function, and the staff considers these instances of compounded effect to be acceptable. See Section VI, infra.

The event scenarios of interest are seismic events, and intermediate building high energy line breaks which expose EFW system single failure vulnerabilities and also create harsh environments. Although the staff has concluded herein that the TMI-1 EFW system is environmentally qualified, that issue was nevertheless considered in these scenario reviews so as to provide a means of verifying that all components required for EFW system operation (i.e., EFW system components as well as components from other systems) that could be subjected to an intermediate building harsh environment were identified and included in the environmental qualification program. Moreover, each event was analyzed individually as prescribed by staff licensing criteria. Associated consequences, such as a harsh environment resulting from a high energy line break, were assumed with the initiating event. A concurrent random single failure was also assumed.

With respect to intermediate building high energy line breaks, the staff considered whether operability of the EFW system could be affected by common-mode component failures due to harsh environments. With respect to seismic events, the principal concern of the staff was whether the failure of non-seismically qualified intermediate building component(s) could create intermediate building environments during seismic events which would preclude operator access to perform required local manual actions.

EFW System Response During High Energy Line Breaks

All four main steam lines and one of the two main feedwater lines transit the intermediate building. The intermediate building also houses all active EFW system components that could be subjected to a harsh environment. As indicated in the interim Director's Decision, a non-mechanistic rupture of either the intermediate building main steam line or main feedwater line would create an event in which the EFW system must operate and a harsh environment for the EFW. Therefore, the possibility of potential common mode failures due to a harsh environment must be considered. As noted in Section III, supra, all electrical components situated in the intermediate building whose operability is essential for proper operation of the EFW system are environmentally qualified. In particular, the staff notes that the electric motor driven EFW pumps, the EFW pump suction and the discharge cross-connect valves, the EFW flow control valves and the EFW flow indicators are qualified for an intermediate building harsh environment. All intermediate building condensate or main steam system electrical components required to operate to assure EFW initiation and operation following a non-mechanistic intermediate building main steam or feedwater line break are environmentally qualified. The staff further notes that the failure of any unqualified main steam, condensate and/or EFW system electrical components due to an intermediate building harsh environment from a main steam line or feedwater line break will not jeopardize EFW system operation.

If a postulated concurrent single random failure of the flow control valve in the EFW feedwater header to the opposite steam generator were to

occur in this situation, the EFW system could be rendered ineffective.[35] The staff considers this to be an acceptable situation for one cycle of operation as a result of the interim modifications described in the interim's Directors Decision. See DD-84-12, 19 NRC at 1133-34. See also Section VI, infra. Therefore, the staff concludes that the aggregate deficiencies of the TMI-1 EFW system will not jeopardize system operability due to harsh environments following an intermediate building main steam or feedwater line rupture.

EFW System Response During Seismic Events

The staff previously concluded in the interim Director's Decision that reasonable assurance exists that the TMI-1 EFW system would be able to perform its intended safety function following the occurrence of a safe shutdown earthquake (SSE) and concurrent single active failure. See DD-84-12, 19 NRC at 1131-32. In reaching that conclusion, the staff concluded that there is also reasonable assurance that required-local manual actions would not be precluded by an intermediate building harsh environment resulting from a postulated failure of non-seismic portions of other systems, namely, the vent stacks relief valves (MSV-22A, B) and the atmospheric dump valves (MSV-4A,B) for the interim period of Cycle 5 operation. However, as described in Section II, supra, the licensee has installed seismically qualified restraints on those vent stacks, thus eliminating any concern regarding vent stack failure.

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[35] Occurrence of the postulated event would not, however, necessarily mean that the affected steam generator must be isolated. In this regard, The TMI-1 abnormal transient operator guidance (ATOG) program contains provisions for feeding an affected steam generator under certain circumstances.

Based upon the licensee's action and the additional seismic interaction review set forth in Section II, supra, the staff is able to conclude that there is reasonable assurance that no intermediate building high energy lines will fail during an SSE, and that operator access to perform required local manual actions to assure EFW system operability for the interim period of operation until system upgrades are complete is therefore assured.

In that staff reviews have included the applicable accident scenarios coupled with both potential effects of failures and interactions, the staff reviews provide an adequate basis for assessing the capability of the EFW system in an aggregate sense. Based upon these reviews, the staff finds there is reasonable assurance that the TMI-1 EFW system will perform its intended safety function for the postulated events within the scope of the petition, with one exception. The exception involves the postulated situation of a postulated main steam line or main feedwater line break accident requiring isolation of the affected steam generator compounded by the worst cause single random failure. This exception has been previously addressed in the interim Director's Decision and found acceptable for one cycle of operation. See also Section VI, infra. Therefore, the staff's previous conclusion regarding the acceptability of the TMI-1 EFW system for the interim period of operation until such time as system upgrades are complete remains unchanged, and the staff contemplates no further action prior to restart.

VI. PETITIONER'S LETTER OF FEBRUARY 13, 1984

By letter to the Commission dated February 13, 1984, the petitioner, among other things, recommended that the Commission direct the staff to answer three specific questions regarding the TMI-1 EFW system. The Commission subsequently requested that the staff respond to these questions when it considered the petitioner's request for relief.[36]

The first question posed by UCS asked the staff to:

> Identify each specific aspect of the TMI-1 EFW system which does not comply or is not known to comply with the regulations applicable to systems imporant [sic] to safety (including safety-grade, safety-related, and engineered safety feature systems).

At the time of licensing of TMI-1, EFW systems were not considered safety related systems. Consequently, relatively few regulations and standards applied.[37] Moreover, the applicability of regulations, absent any backfitting requirements, is established at the time of plant licensing. Within this framework, the TMI-1 EFW system complied with all regulations and standards applicable to that system, and this continues to be the case today. However, EFW systems are now considered safety-related such that EFW systems for new plants must meet safety-related system criteria in accordance with the staff's Standard Review Plan (NUREG-0800).[38] In this regard, the staff has reviewed

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[36] See Memorandum from S. J. Chilk (NRC) to W. J. Dircks (NRC) (April 24, 1984).

[37] See also Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Interim Director's Decision under 10 CFR 2.206 (Seismic Capability of Emergency Feedwater), Three Mile Island Nuclear Station, Unit No. 1 (April 27, 1984.)

[38] See Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, (NUREG-0800), (July 1981), Section 10.4.9. Standard Review Plans provide guidance for the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. A system in conformance with the Standard Review Plan is generally considered to also be in conformance with the applicable regulations.

the TMI-1 EFW system, as it will be configured at the time of restart. This review identified that the TMI-1 EFW system does not meet the regulations applicable to plants currently being licensed in one respect.[39] That is, the TMI-1 EFW system, as configured at the time of restart, will not meet the single failure criterion for certain events.[40]

Specifically, the TMI-1 EFW system at the time of restart will have a single flow control valve in each of the feedwater headers to the two steam generators.[41] Therefore, for those events which may, under certain circumstances, require isolation of one steam generator, such as a main steam line break, steam generator tube rupture or a feedwater line break, failure of the flow control valve to open in the EFW header to the intact steam generator could result in an inability to deliver emergency feedwater flow for decay heat removal through the intact steam generator. Further, a single failure in the Integrated Control System (ICS), which currently controls the EFW flow control valves, could also result in an inability to deliver EFW flow by preventing the flow control valves from opening. Evaluation of these deficiencies is discussed in the response to Question 2, infra.

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[39] The staff had previously performed and submitted into testimony such a review during the TMI-1 Restart Proceeding. See NRC Staff Supplemental Testimony of J. Wermiel and J. Curry Regarding Emergency Feedwater System Reliability (Board Question 6). TMI-1 Restart Proceeding Transcript (TR) at 16,718. The staff notes that the TMI-1 EFW system currently complies with 10 CFR §50.49 (Environmental Qualification of Electrical Equipment) by virtue of the fact that licensee has completed replacement of certain components and performed Intermediate Building flooding modifications as described in Section III, supra.

[40] See 10 CFR Part 50 Appendix A, Criterion 44.

[41] This discussion was previously provided in the Interim Director's Decision, but it is repeated here nevertheless for completeness. See Interim Director's Decision Under 10 CFR 2.206, DD-84-12, 19 NRC 1128, 1133-34 (April 27, 1984).

The second question raised by UCS asks that:

> [F]or each deficiency or potential deficiency identified in response to item 1 above, explain whether and why the staff believes that TMI-1 can be operated without undue risk to public health and safety before correction of the deficiency or potential deficiency.

The staff has been aware of the system deficiencies identified in response to UCS question 1 for some time, and the issue has been fully explored during the restart proceeding. The staff considers the TMI-1 EFW system to be acceptable, provided that certain short-term modifications are completed prior to restart.[42] Among these modifications is a change in failure mode for the flow control valves. These valves will fail so as to permit full EFW flow on either loss of instrument air or loss of control power.[43] Further, a separate remote manual control station independent of the ICS has been provided in the control room. This modification will permit the operator to remotely open the EFW flow control valves should they fail closed due to an ICS malfunction. The flow control valves could also be manually opened locally by means of a hand wheel.[44]

In the long-term, the licensee will install redundant EFW flow control and block valves and provide safety-grade automatic steam generator level

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[42] See NUREG-0680, TMI-1 Restart (June 1980) and Supplement 3 to NUREG-0680 (April 1981).

[43] The restart proceeding record shows that the flow control valves fail to the mid position on loss of control signal. However, by filing dated March 26, 1984, counsel for licensee indicated that the existing flow control valve converters would be replaced with environmentally and seismically qualified converters by June 1984, and that with these new converters the flow control valves would fail to the open position on loss of control power.

[44] In accordance with a decision of the Atomic Safety and Licensing Board, the TMI-1 operating license will be conditioned to require that an auxiliary operator be dispatched to the EFW flow control valve area, upon any EFW auto-start condition, until the EFW system is made fully safety-grade. See Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1) ALAB-729, 17 NRC 814, 833 (1983). Admittedly, access would most probably be precluded following an intermediate building high energy line break.

control by no later than the first refueling outage following restart (Cycle 6 refueling).[45] Completion of these modifications prior to startup following Cycle 6 refueling is a specific Board-imposed condition from the restart proceeding.[46] The licensee is also performing a number of additional long-term EFW system modifications beyond those described above.[47] These additional modifications are generally intended to improve EFW system reliability pursuant to NUREG-0737, Items II.E.1.1 "Auxiliary Feedwater System Evaluation" and II.E.1.2 "Auxiliary Feedwater System Automatic Initiation and Flow Indicator" and to alleviate the need to rely upon compensatory operator action to assure system operability following a seismic event.

The petitioner's third question focuses on the need for modifications after one cycle of operation. UCS asks that:

> [F]or each deficiency or potential deficiency which the staff believes need not be corrected before the first refueling outage after restart, explain why that deficiency ever needs to be corrected. In other words, if the staff believes that the plant can be operated without undue risk to public health and safety until the first refueling, why would modifications be needed to assure public health and safety after the first refueling?

The staff concludes that the short-term modifications cited above provide reasonable assurance that the TMI-1 EFW system will be adequately reliable to protect the public health and safety. The staff further concludes that the

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45 See Summary of April 27, 1984 Meeting with GPU Nuclear Regarding the Three Mile Island, Unit 1 Emergency Feedwater System, Docket 50-289 (May 2, 1984), and letter from R. F. Wilson (GPU) to D. G. Eisenhut (NRC) (May 10, 1984).

46 See Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-81-59, 14 NRC 1211, 1363, 1373 at ¶ 1036, 1037, 1059 (1981); NUREG-0680, at C8-36 and Supplement 3, at 36-38; Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-82-27, 15 NRC 747 (1982) and Staff's Response to Licensing Board's Directive to Report Details of its Enforcement Plan in the Form of a Supplemental Initial Decision (February 1, 1982).

47 See Summary of April 27, 1984 Meeting with GPU Nuclear Regarding the Three Mile Island, Unit 1 Emergency Feedwater System, Docket 50-289 (May 2, 1984), and letter from R. F. Wilson (GPU) to D. G. Eisenhut (NRC) (May 10, 1984).

long-term modifications (Cycle 6 modifications) will provide an additional improvement in safety. This approach of short and long-term modifications is consistent with general staff practice regarding safety improvements insofar as the short-term modifications provide an acceptable means for addressing a safety concern for the interim period of time until the preferred, long-term solution can be designed and implemented.[48] Specifically, with respect to the single failure vulnerabilities of the flow control valves, the staff considers the short-term modification to be acceptable essentially because the valves have been modified so that they fail open, permitting full flow, on either a loss of control signal or air. Upon completion of the long-term modification, however, the availability of redundant flow control valves to each steam generator will permit continued flow of emergency feedwater even with an assumed single failure. Similarly, the short-term control system modifications provide an acceptable means of mitigating the consequences of an ICS failure, while the long-term modification will result in a control system that will not be disabled by a single failure.

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[48] The thrust of petitioner's question three, and the staff's response thereto, generally parallel the respective parties positions on this matter in the TMI-1 Restart Proceeding. The Staff's position in that proceeding was upheld by the Licensing Board and Appeal Board. See NRC Staff Testimony of Denwood F. Ross, Jr. Relative to the Sufficiency of the Proposed Additional Requirements (Board Question 2), TR at 15,555; Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-81-54, 14 NRC 1211, 1364 at ¶1138 (1981). See generally Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), ALAB-729, 17 NRC 814 (1983).

VII CONCLUSION

The staff has determined that it is unnecessary to institute show cause or further enforcement proceedings with respect to the TMI-1 EFW system. The petitioner's request to initiate such proceedings is denied. As described in this decision and the interim Director's Decision, DD-84-12, 19 NRC 1128 (1984), the staff has determined that the TMI-1 EFW system is environmentally qualified, that there is reasonable assurance with respect to single component failures that the system will be adequately reliable to perform its intended safety function, and that the main steam line rupture detection system (MSLRDS) is adequate. As the staff has maintained in the restart proceeding, it views the existing EFW flow instruments to be acceptable. The staff has also determined that, with the interim compensatory measures instituted by the licensee, there is reasonable assurance that the EFW system would remain operable following a safe shutdown earthquake (SSE). Upon considering in the aggregate those EFW system deficiencies identified by the petition, the staff has determined that the TMI-1 EFW system, as configured at the time of restart, will be capable of performing its intended safety function for the one cycle of operation until the system upgrades are complete.

Accordingly, the staff contemplates no further action with respect to the EFW system prior to restart. Moreover, the staff has substantially satisfied the requests made by petitioner in its supplemental petition by

conducting detailed audits of the TMI-1 environmental qualification file, and identifying and referring to the Office of Investigation statements in the licensee's submittals the staff views to be invalid. The staff by this decision, has also provided to petitioner the information requested in petitioner's letter of February 13, 1984.

A copy of this decision will be provided to the Secretary for the Commission's review in accordance with 10 CFR 2.206(c).

HR Denton

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland
this 25th day of September 1984