



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

April 16, 1984

Docket No. 50-289

MEMORANDUM FOR: Roger J. Mattson, Director  
Division of Systems Integration, NRR

Richard H. Vollmer, Director  
Division of Engineering, NRR

Hugh L. Thompson, Jr, Director  
Division of Human Factors, NRR

Themis P. Speis, Director,  
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Richard W. Starostecki, Region I  
Office of the Executive Director  
for Operations

James Lieberman, -Office of the Executive  
Legal Director

FROM: Darrell G. Eisenhut, Director  
Division of Licensing, NRR

SUBJECT: UNION OF CONCERNED SCIENTISTS 2.206 PETITION  
ON TMI-1 EMERGENCY FEEDWATER

Enclosed for your review is a draft interim Director's Decision denying the subject petition with respect to four of the six alleged deficiencies. The draft defers any decision with respect the two remaining deficiencies (E.O. and "aggregate" deficiencies issue) since staff review is not complete. These issues will be addressed in a future, final decision.

Current plans are to issue this interim decision by Friday, April 20. Therefore we request an expeditious review. Please advise us immediately

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of any major comments or problems, and provide all comments by 12:00 p.m. April 18. We plan to have the final document ready for parallel Division Director and ELD concurrence on April 19.

Darrell G. Eisenhut, Director  
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Office of Nuclear Reactor Regulation

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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 INTERIM DECISION UNDER 10 CFR 2.206

I. INTRODUCTION

By Petition for Show Cause dated January 20, 1984 (Petition) and filed before the Commission on January 23, 1984, Ellyn R. Weiss and Robert D. Pollard, on behalf of the Union of Concerned Scientists (Petitioner) requested that the Commission continue the suspension of the Three Mile Island Nuclear Station, Unit 1 (TMI-1) operating license "unless and until the plant's Emergency Feedwater (EFW) System complies with NRC rules applicable to systems important to safety (including safety-grade, safety-related, and engineered safety feature systems)." In support of its request, Petitioner identified five basic deficiencies with the EFW system for which Petitioner seeks resolution prior to resuming power operation at TMI-1: (1) failure of the EFW system to be environmentally qualified; (2) failure of the EFW system to be seismically qualified; (3) the inability of the EFW system to withstand a single component failure; (4) the inaccuracy of the EFW flow instruments; and (5) the inadequacy of the Main Steam Line Rupture Detection System (MSLRDS). Petitioner recognized that one or more

of the identified deficiencies, when viewed individually, would not necessarily pose an "intolerable risk." However, Petitioner contended that "[i]n the aggregate. . . [the deficiencies] thoroughly compromise the reliability of one of the most important safety systems in the plant and destroy the fundamental principle of defense-in-depth espoused by the NRC."<sup>1</sup>

The Petition was referred to the staff on February 3, 1984 for treatment as a request for action pursuant to section 2.206 of the Commission's regulations. As instructed by the Commission, the staff has completed its review of four of the five basic deficiencies cited in the Petition, and for the reasons stated herein, Petitioner's request with respect to those deficiencies is denied at this time. A final decision addressing the fifth basic deficiency (environmental qualification) and the issue of "aggragate" deficiencies will be issued in the future.

## II. THE RESTART PROCEEDING

The TMI-1 EFW system was a principal design issue of the TMI-1 Restart Proceeding, to which Petitioner is a party. Thus, the capability and

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(1) The Petition also implies that there may be emergency procedure and operator training deficiencies related to the EFW system, but it does so only in passing and provides no specific information for staff consideration. Had specific information been provided in this area it would have been considered by the staff. However, by virtue of the Restart Proceeding, the associated certification activities, review activities of NUREG-0737 Action Item I.C.1 (Emergency Operating Procedures), and the verification that procedural changes related to seismic events had been implemented (See III.B.) the staff has performed fairly extensive reviews of the TMI-1 emergency procedure and operator training programs and can find no independent basis related to the Petition upon which to question the adequacy of those programs.

Limitations of the system have been extensively reviewed and evaluated by the staff, GPU Nuclear (Licensee), Petitioner and the TMI-1 Restart Proceeding Licensing and Appeal Boards. Consequently, there is little information in the Petition that was not previously known to the staff. The scope of the Restart Proceeding was, however, limited to events with a nexus to the accident at Three Mile Island Nuclear Station, Unit 2 (TMI-2), (i.e. small-break loss of coolant accidents and feedwater transients). Thus, the Licensing and Appeal Board findings that the TMI-1 EFW system reliability is sufficiently acceptable to permit restart considered only postulated events within the scope of the Restart Proceeding.<sup>2</sup>

The scope of the Petition encompasses that of the Restart Proceeding with respect to EFW. In this respect the Petition is improper in that it attempts to initiate a proceeding to address issues that are already subject to a proceeding to which Petitioner is a party. Specifically, certain aspects of the inability of the system to withstand a single failure, and the inaccuracy of the EFW flow instruments are clearly issues within the scope of the Restart Proceeding, and the staff is not obligated to revisit them. Two other Petition issues may yet be determined to fall within the

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(2) By order dated January 27, 1984, the Commission took review of, among other things, the Appeal Board's treatment of the Licensing Boards quantitative analysis of the reliability of the EFW system. The staff, Licensee, and Petitioner all filed briefs in this regard for Commission consideration.



scope of the Restart Proceeding.<sup>3</sup> Nevertheless, proper consideration of the Petition with respect to the "aggregate" deficiencies issue dictates that the staff consider all aspects of EFW system reliability within the scope of the Petition, regardless of whether they are being concurrently addressed in the Restart Proceeding. In so doing, however, the staff has not conducted a re-review of Restart Proceeding issues and decisions. Rather, the staff has used those decisions and supporting record as a basis from which to continue it's evaluation of the Petition issues.

### III. A. CONSIDERATION OF THE ISSUES

As stated above, the Petition alleges five basic deficiencies with the TMI-1 EFW system, and further alleges that those deficiencies, in the aggregate, thoroughly compromise the reliability of the system. This interim decision addresses four of the alleged five basic deficiencies. It

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(3) The Commission's January 27, 1984 order also took review of whether the issue concerning environmental qualification had been improperly removed from the Restart Proceeding and offered an opportunity for the Parties to comment on the adequacy of the solution proposed for the MSLRDS problem. The staff, in its March 19, 1984 filing, argued that the environmental qualification issue was properly removed from the proceeding, that the proposed MSLRDS solution is adequate with respect to the EFW system concerns of the Restart Proceeding, and, further, that the concerns regarding the potential failure of the non-safety grade MSLRDS to isolate main feedwater leading to the possibility of containment overpressurization are not within the scope of the Restart Proceeding and should properly be addressed during review of this Petition. The UCS filing, dated March 19, 1984, argued that all aspects of both issues should properly be addressed in the Restart Proceeding.

Therefore, if the Commission agrees with the Staff's position in its March 19, 1984 filing, the staff's review of environmental qualification and the MSLRDS concern in this Petition will not be duplicative of Restart Proceeding issues.

does not address the environmental qualification issue, for which staff review is continuing, and it does not address the aggregate will be addressed in a future, final decision.

A. Seismic Qualification of the  
Emergency Feedwater System

The Petition alleges that operation of TMI-1 would pose an undue risk to public health and safety because the EFW system is not seismically qualified.<sup>4</sup> The fundamental contentions in this regard can be characterized as: (1) contrary to NRC regulations, the TMI-1 EFW is not seismically qualified and the licensee does not intend to make it so prior to operating the plant, and (2) the staff's Safety Evaluation on the seismic capability of the TMI-1 EFW system is inadequate.<sup>5</sup> The allegations arise from the staff's review of the seismic capability of the TMI-1 EFW system. As described in the attached safety evaluation, this review evaluated from Generic Letter 81-14, issued to operating pressurized water reactors in February 1982. Generic Letter 81-14 announced the intent to increase seismic resistance, where necessary, in a timely systematic manner to

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4 Seismic qualification of the TMI-1 EFW system was not addressed in the Restart Proceeding because such matters are unrelated to the March, 1979 accident at TMI-2 and the concerns which led to the Restart Proceeding. See Commission Order CLI-83-5 dated March 4, 1983.

5 The staff's Safety Evaluation was provided under letter (J. F. Stolz, (NRC) to H. D. Hukill (GPUN)) dated August 12, 1983.

ultimately provide reasonable assurance that auxiliary/emergency feedwater systems will function after the occurrence of earthquakes up to and including the Safety Shutdown Earthquake (SSE).<sup>6</sup> In this regard, Licensee has committed to modify the TMI-1 EFW system during the refueling outage preceeding Cycle 6 (first refuelint). These modifications will, among other things, improve the seismic capability of the system. The purpose of the earlier staff review of this issue was to determine wheter plant operation could be justified on an acceptable basis for the interim period until system upgrades were complete. In light of the arguements set forth in the Petition, the staff has revisited its position on this issue and its Safety Evaluation and in so doing has reaffirmed that the seismic capability of the TMI-1 EFW system at the time of restart (if permitted) will be acceptable until system upgrades are complete.<sup>7</sup> A detailed evaluation supporting this conclusion is attached hereto.

#### B. Single Failure Capability of the Emergency Feedwater System

The Petition asserts that until the long-term system upgrades are complete the TMI-1 EFW system is vulnerable to single failures which would,

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6 The staff requirement that auxiliary/emergency feedwater systems be seismically qualified first become effective in 1972. The requirement was not backfit to include plants for which certain licensing rulestates had been reached. This was the case for MFI-1; thus, it and a number of other plants do not, and are not required to have seismically qualified auxiliary/emergency feedwater systems. (See attached Safety Evaluation).

7 The Petition provided no information that was not considered during the 1983 staff review of this matter, with one exception. The exception deals with postulated interaction from failures of non-seismic portions of other systems. In our review of this exception, we conclude that there is reasonable assurance that local manual actions will not be precluded by a steam environment during the interim period of operation.



for certain accidents, prevent it from providing cooling water for decay heat removal. In this regard, the Petition correctly states that, at the time of restart, the TMI-1 EFW system will have a single flow control valve in each of the feedwater headers to the two steam generators. Therefore, for those events requiring isolation of one steam generator, such as a main steam line break, steam generator tube rupture (under certain circumstances), or a feedwater line break, a failure of the flow control valve to open in the feedwater header to the intact steam generator could result in an inability to deliver emergency feedwater flow for decay heat removal through the steam generator. Further, the Petition points out that 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.

These system deficiencies were previously known to the staff and fully explored during the Restart Proceedings. In this regard, the staff has previously determined that the system is acceptable for TMI-1 restart on the basis that certain additional short-term modifications will be completed prior to restart.<sup>8</sup> Among these modifications is a change in failure mode for the flow control valves. These valves will fail open on either loss of

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<sup>8</sup> See NUREG-0680, "TMI-1 Restart" dated June 1980 and its Supplement 3 dated April 1981.

instrument air or loss of control power.<sup>9</sup> Further, a separate remote manual control station has been provided in the control room independent of the ICS which will permit the operator to remote manually 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. Twenty minutes is available to the operator to accomplish this.

An additional single failure vulnerability hypothesized by the Petition is that ". . . each EFW flow path contains only a single block (isolation) valve. Failure of this valve would prevent isolation of EFW flow to the steam generator with the broken main steam line or ruptured tube." The existence of a "single block (isolation) valve" in each EFW flow path is new information which the staff believes to be incorrect.<sup>10</sup> Nevertheless, for

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9 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.

10 We believe this information to be incorrect based on our review of the present EFW system design drawings and the Restart Proceeding record. The only valves in the steam generator flow path we can identify are the flow control valves and check valves. There are however, motor operated sectionalizing block valves in the discharge cross-tie header between the EFW pumps. These valves do not serve as steam generator isolation valves as the motor driven EFW pumps discharge downstream of the valves.

those events requiring isolation of a steam generator (main steam or feedwater line break, or steam generator tube rupture), a cavitating venturi has been installed in each EFW supply line to limit EFW flow to the ruptured steam generator and ensure sufficient flow to the intact steam generator. Because of this modification, the main steam line rupture detection system (MSLRDS) signals to the EFW flow control valves have been deleted thus preventing inadvertent EFW isolations caused by failures in the MSLRDS (see III.D.). Since it is desirable to eventually isolate EFW to a ruptured steam generator, the operator would close the appropriate EFW flow control valve. If this valve failed to close, EFW flow to the ruptured steam generator could be stopped by closing the appropriate EFW pump discharge cross-tie sectionalizing valve and tripping the respective EFW pump.

### C. Emergency Feedwater Flow Instrument Accuracy

The Petition asserts that operation of TMI-1 with the existing EFW flow instruments would pose an undue risk to public health and safety because of reported flow instrument oscillations at low flow conditions.<sup>11</sup>

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<sup>11</sup> By letter dated November 23, 1983 (H. D. Hukill (GPUN) to J. F. Stolz (NRC)) licensee advised that testing revealed EFW flow instrument oscillations at low flow conditions (below approximately 100 gallons per minute) in excess of the  $\pm 10\%$  accuracy criteria of NUREG-0680 "TMI-1 Restart". By letter dated February 22, 1984 (H. D. Hukill (GPUN) to J. F. Stolz (NRC)) licensee provided further information indicating that oscillations ranged from a low of  $\pm 4.2\%$  at 600 gpm to  $\pm 10\%$  at 120 gpm. (The oscillations were not quantified below 120 gpm.)

However, this issue falls completely within the scope of the Restart Proceeding, and, consequently, for reasons as set forth above, it was not reconsidered during review of this Petition. 12, 13

#### D. Main Steam Line Rupture Detection System

One purpose of the main steam line rupture detection system (MSLRDS) is to prevent containment pressure from exceeding its design pressure in the event of a main steam line rupture inside containment. The system does this by isolating feedwater flow to a given steam generator when a relatively low pressure is detected in that steam generator. A concern raised in the Restart Proceeding was that spurious actuation of the non-safety grade MSLRDS could inadvertently isolate all feedwater flow to both steam

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12 Petitioner seemingly acknowledges this point insofar as it attaches to the Petition two previous Restart Proceeding filings that it made to the Commission on this very subject. See "Union of Concerned Scientists Response to GPU Letter of December 6, 1983, Regarding Emergency Feedwater Flow Instrumentation" dated December 9, 1983, and "Petitioner Rebuttal to Licensee's Reply Regarding EFW Flow Instrumentation" dated January 6, 1984.

13 By Board Notification dated the staff advised the Commission, Restart Proceeding Boards and Parties, including Petitioner, that it considered the existing TMI-1 EFW flow instruments to be acceptable. The basis for the staff's conclusion is that plant safety with regard to indicating instrument accuracy, as distinguished from actuation trip signal accuracy, is not assured by meeting numerical standards, rather, plant safety is assured by plant operating procedures taking into account the accuracy of the indications available to the operator. The staff determined this to be the case at TMI-1.



generators. Resolution of that concern is being pursued within the Restart Proceeding.<sup>14</sup> In contrast to the Restart Proceeding issue of inadvertent isolation of all feedwater, the Petition hypothesizes that because the MSLRDS is not safety grade, there can be no assurance that the containment will not be overpressurized following a main steam line rupture inside containment, and, therefore, that "operation of TMI-1 would pose an undue risk to public health and safety."

Although the TMI-1 MSLRDS is not safety grade, it is redundant and primarily located outside containment where it would not be exposed to the harsh environment created by a main steam line rupture inside containment.<sup>15</sup> By letter dated February 16, 1984, the licensee informed the staff that the MSLRDS pressure switches located inside containment would be environmentally qualified through replacement with qualified equipment by June 1984. All MSLRDS components located inside containment will then be environmentally qualified. Therefore, in the event of a main steam line rupture inside containment, the MSLRDS would be expected to remain functional and isolate main feedwater flow to the affected steam generator, even after a postulated

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<sup>14</sup> See NRC Staff's Brief Concerning the Commission's Review of Specific Design Issues in ALAB-729, dated March 19, 1984.

<sup>15</sup> The postulated main steam line break event at TMI-1 was evaluated in conjunction with the staff's review of IE Bulletin 80-04, "Analysis of a PWR Main Steam Line Break with Continued Feedwater Addition."

single active failure). For a main steam line break occurring outside containment, the environmental qualification of the MSLRDS is not a concern since the containment would not be affected.

The MSLRDS prevents containment pressure from exceeding its design pressure in the event of a main steam line rupture inside containment. The MSLRDS is not relied on in any direct manner for preventing exposure of the public to any undue risk to health and safety. The two barriers that prevent exposure of the public to the effects of a main steam line rupture are the reactor pressure boundary and the containment boundary. These two barriers would remain intact after a postulated main steam line rupture, with or without the MSLRDS isolating the main feedwater flow to the affected steam generator. Based on our experience with similar plants, if the MSLRDS failed to function, the reactor pressure boundary would be unaffected; and although the containment design pressure may be slightly exceeded, containment integrity would remain intact.

For these reasons, it is our view that the MSLRDS, as designed, and as upgraded with qualified pressure switches inside containment, will isolate feedwater flow to the affected steam generator, even after sustaining a single active failure, and containment integrity would remain intact after a postulated main steam line rupture inside containment.<sup>16</sup>

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<sup>16</sup> Nevertheless, licensee has committed to upgrade the MSLRDS to safety grade status prior to startup from the Cycle 6 refueling outage (next refueling). See GPU Nuclear (H. D. Hukill (GPUN) to J. F. Stolz (NRC)) dated August 23, 1983.

#### IV. Conclusion

Based on the foregoing discussion of Petitioner's allegations, I find no reason to disturb the Three Mile Island Nuclear Station, (Unit 1 operating license at this time. Therefore, for the allegations addressed in this interim decision, I have determined that Petitioner's request that the Three Mile Island Nuclear Station, Unit 1 operating license be suspended unless and until the plant's emergency feedwater system complies with the NRC rules applicable to systems important to safety should be denied. I will issue a final decision on this Petition in the future. A copy of this decision will be placed in the Commission's Public Document Room located at 1717 H Street, N.W., Washington, D.C. 20555. A copy of this decision will be filed with the Office of the Secretary of the Commission for its review in accordance with 10 CFR 2.206(c) of the Commission's regulations.

Harold R. Denton, Director  
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland  
this            day of

Attachment:  
Safety Evaluation

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
SUPPORTING DIRECTOR'S INTERIM DECISION  
UNDER 10 CFR 2.206 (SEISMIC CAPABILITY OF EMERGENCY FEEDWATER)  
METROPOLITAN EDISON COMPANY  
JERSEY CENTRAL POWER AND LIGHT COMPANY  
PENNSYLVANIA ELECTRIC COMPANY  
GPU NUCLEAR CORPORATION  
THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1  
FACILITY OPERATING LICENSE NO. DPR-50  
DOCKET NO. 50-289

INTRODUCTION

On January 20, 1984, the Union of Concerned Scientists (UCS) filed a petition pursuant to 10 CFR 2.206 requesting that the NRC suspend the operating license for Three Mile Island Unit 1 (TMI-1) until the plant's emergency feedwater (EFW) system "complies with the NRC rules applicable to systems important to safety (including safety-grade, safety-related, and engineered safety feature systems)." One of the issues raised by the petition is the seismic capability of the EFW system. That is the subject of this evaluation. The remaining issues raised by the petition are either addressed in the Director's Interim Decision Under 10 CFR 2.206, or remain under review at this time.

In our review, we have considered the petition, the licensee's response to the petition dated February 24, 1984 as amended by submittal dated March 26, 1984, and our earlier evaluation of this matter forwarded to GPU Nuclear under letter dated August 12, 1983.

EVALUATION

The fundamental contention of the petition regarding EFW seismic qualification is that, contrary to NRC regulations which require engineered safety feature (ESF) systems to be designed to withstand the effects of earthquakes, the TMI-1 EFW system is not seismically qualified and the licensee does not intend to make it so prior to operating the plant. To support this contention the petition presents information that deals with: compliance with NRC requirements, the NRC contractor's report, independent evaluation-qualification of valves, loss of water sources, and the effects of flooding. Each of these subject areas is discussed below.

Compliance with NRC Requirements

The petition contends that the TMI-1 EFW system does not satisfy NRC regulations regarding seismic qualification. In this regard, the principal



design criteria for plant systems are established during the construction permit (CP) application review. The TMI-1 CP was applied for in 1967, and issued in 1968. At that time, the EFW system was not classified as an ESF system and thus was not required to be seismically qualified.

The operating license (OL) was subsequently applied for in 1970 and the staff's Safety Evaluation was issued in 1973. During that period Regulatory Guide 1.29 (Safety Guide 29) was issued, but backfit implementation was not included for plants already holding a CP or OL. Thus, the TMI-1 EFW system was not required to be seismically qualified at the time it received its operating license.

Notwithstanding the requirements discussed above, the staff has always intended that there be reasonable assurance that the plant be able to shutdown safely following a seismic event. We recognize that various systems in the plant would be available to remove decay heat. In a generic letter to all PWR licensees dated October 21, 1980, the NRC focused on steam generators and the auxiliary (emergency) feedwater system as the first choice method for accomplishing safe shutdown.

In February 1981, the NRC issued Generic Letter 81-14 to operating PWRs, which announced the intent to increase the seismic resistance, where necessary, in a timely, systematic manner, to ultimately provide reasonable assurance that the auxiliary/emergency feedwater system will function after the occurrence of earthquakes up to and including the Safe Shutdown Earthquake (SSE). Consistent with the staff handling of other backfit type improvements, we have not considered the plant to be unsafe or that plant operations need be curtailed since there is no imminent safety threat. It has been our intent to allow credit for alternate decay heat removal systems for an interim period where necessary while modifications to the auxiliary feedwater system are developed and implemented. In this EFW system seismic review we have treated TMI-1 the same as other operating reactors. We have considered the matter to have been resolved when all seismic improvements have been identified and scheduled for implementation in a timely manner, and continued plant operation during the interim has been justified on an acceptable basis.

#### NRC Contractor's Report

The petition raises questions about the NRC contractor's Technical Evaluation Report (TER) dated October 29, 1982, and a list of "many vital components in the TMI-1 EFW system which are not seismically qualified." This list was a preliminary list developed by an NRC contractor and did not represent the staff's final conclusion. Several items on the list were placed there for information only and are not even part of the EFW system. An example is the control system for the atmospheric relief valves (MS-V4A, B). Other items on the list are not vital to EFW system performance. Some items on the list might fail in a manner that could adversely affect EFW performance if an SSE-level earthquake were to occur; these items became the subjects of upgrade actions. The TER was revised significantly in July 1983 as a result of NRC staff review and discussions with the licensee. Therefore the list and the October 1982 TER are not final information. The NRC staff's final report on this subject was issued on August 12, 1983 and included a copy of the contractor's revised TER as an enclosure.

## Independent Evaluation-Qualification of Valves

The petition claims that the contractor made no independent evaluation of the licensee's claims of seismically qualified components. The petition cites the use of static analysis alone for the valves whereas the NRC Standard Review Plan requires a testing program.

The objective of our review of individual mechanical components was to obtain a best estimate regarding component functionality based upon engineering judgment, not based on strict compliance with any specific set of regulatory requirements (such as those listed in the Standard Review Plan) that a new plant would have to meet. Thus, the review was to identify those components that had not been qualified, not to consider requiring a more modern and sophisticated level of qualification.

In the judgment of the contractor, the valves are most likely able to withstand an SSE and to perform the necessary functions. The licensee has stated that the analysis performed was not just a static analysis but was in fact a dynamic analysis. Further, in our technical experience, if the seismic analysis has shown the valves to be adequate, it is not likely that a testing program would indicate seismic failure. Our conclusion remains that there is reasonable assurance that the valves are able to withstand an SSE and remain functional.

## Loss of Water Sources

The petition claims that sources of cooling water for the EFW system will not be available following an SSE as a result of the postulated failures of the Condensate Storage Tank (CST) low level-alarms, failures of the isolation valves CO-V-14A, B (which isolate the CST's from non-seismic piping to the condenser hotwell), and the inability of an operator to perform local actions due to a postulated steam environment. The enclosed sketch of the EFW system shows the various numbered valves.

The purpose of the CST level alarm, in this context, is to provide information to the operator as to when it is necessary to isolate the CST's from the condenser hotwell. A failure modes analysis has been performed for the CST level alarms. Four failure modes were identified. For the most likely failure mode, the alarm would be generated prematurely, i.e., before the CST reaches the low level setpoint. In this case, the operator would isolate the CST from the non-qualified piping to the condenser hotwell before such isolation would be necessary. Two other failure modes would also generate a premature alarm. One failure mode of the four, which is considered unlikely, involves the complete crimping of the instrument sensing line, causing the level indication to be constant which is not conservative. Licensee believes the operator would be able to detect this failure by the absence of a CST level draw-down indication. Nevertheless, to be more conservative, the licensee has revised its emergency procedures (=1202-30) to require that the operator isolate the CSTs from the non-qualified piping, regardless of the level indication or alarm, as soon as the seismic event occurs. A threshold seismic alarm set at 0.01g is provided in the control room. Therefore, we conclude that the operator action of isolating the CST will not be negated by lack of information as to when such isolation is to be taken. Therefore, the

Lack of seismic qualification of the CST level instrumentation during Cycle 5 would not cause a significant information loss in view of the compensatory measures provided and is therefore acceptable.

Isolation of the CST from the non-qualified piping would normally be a remote manual action in that it would be performed from the main control room. However, the operator may find that his actions are not effective. Failure of the isolation valves (CO-V-14A, B) could occur due to either of two possible causes. The valve could fail to respond to the control room initiation due to loss of electric power to the motor operated valve, due to lack of seismic power cable installation through the turbine building. For this case, an operator would be dispatched to the valve location to close the valve manually. These valves are located in the corridor outside the EFW pump rooms. The failure of the valve due to loss of electric power would not affect the operator's ability to manually operate the valve and a handwheel is provided on the valve for this purpose. This local manual operator action is prescribed by plant procedures (#1202-30). The staff's review of the licensee's analysis indicates that if this procedure is completed within 20 minutes of the seismic event, the quantity of water remaining in one CST will be sufficient. In order to provide additional assurance, we visited the plant, and performed a procedural walk-through and concluded that the operator could get to the area and complete the required actions in less than 15 minutes, with a typical time of about 5 minutes.

Failure of the isolation valve could also occur as a single random failure. In this case local manual actions might not be effective. Since either of the two CSTs has sufficient inventory for the EFW safety function, the loss of one of the tanks due to a valve failure is not unacceptable so long as the CSTs are isolated from each other. Consequently, plant emergency procedures also require that, upon receiving the seismic event alarm, the CST cross-connect valves (CO-V-111A, B) be closed immediately by operator action, either remotely from the control room or locally in the event of a power loss. These valves are located in the same corridor as CO-V-14A, B. Therefore, we conclude that, when the failure of non-seismically qualified components is considered and a single failure is simultaneously considered, the CSTs would still remain capable providing a sufficient source of water for the EFW system. Moreover, in the event both CSTs were to be lost, the plant configuration includes a fully qualified safety-related alternate source of water known as the Emergency River Water System.

The petition claims that local manual actions will be precluded because the environment in the Intermediate Building would prevent entry. The petition asserts that a severe steam environment would be generated due to the failure of the non-seismically qualified components in other systems, namely, the vent stacks (discharge paths) for the safety relief valves (MS-V-22A, F) and the atmospheric dump valves (MS-V-4A, B) which are routed through the floor of the Intermediate Building.

Our review of the EFW system at TMI-1 did not include the interactions due to the failure of non-seismic portions of other systems.

The licensee has stated that there is a low probability of release of steam to the Intermediate Building from these vent stacks, and there is reasonable



assurance, during Cycle 5 operation, that the operator will be able to function in the Intermediate Building. The licensee states in its February 24, 1984 submittal that the potential that the safety valves MS-V22A, B would open has been reduced because the upstream pressure regulating valve MS-V6 has been limited to 65% of its stroke. The licensee also stated that, for the MS-V4A, B atmospheric dump valves, the failure mode is to the closed position upon loss of control air.

The postulated failure of these vent stacks was discussed during our visit to the plant on March 6, 1984. The licensee stated that the vent stacks were designed to the ASME B31.1 piping code. The licensee related that during actual seismic events of significant magnitude, large power generating stations designed to B31.1 suffered only very limited damage and no fluid systems were rendered inoperable. Therefore, the licensee believes that the vent stacks have considerable seismic resistance. The licensee also related to us that their general power plant experience shows that, after the steam release is terminated, the steam dissipates rapidly, and entry can be made in a matter of a few minutes.

During our walkdown of the EFW system, we noted that the atmospheric dump valves (MS-V4A,B), the safety valves (MS-V22A, B) and the associated vent stacks are located in the same compartment as the turbine-driven EFW pump in the Intermediate Building. This compartment is in direct connection (via an open doorway) with the corridor where valves CO-V-14 A, B; CO-V-111 A, B; and the river water system valves are located. It appears therefore that access to the corridor for manual actions could be impeded for a period of time if the vent stacks failed and a steam environment were generated.

The probability and severity of the postulated steam environment would depend upon: the probability that the valves (MS-V4A, B; MS-V22A, B) opened, the probability that the associated vent stack were to fail due to the seismic event, the probability that the valve(s) could not be re-closed or isolated to terminate the steam release, and the time necessary for the released steam to dissipate. Although the atmospheric dump valves may not be necessary for safe shutdown, they are controlled by the Integrated Control System (ICS). Failures of this system, or its inputs, could cause a spurious signal which would open the atmospheric dump valves. We believe that, if such a situation were to arise, the licensee would be able to reclose these dump valves independent of the ICS (via the "manual loader") from the control room and thereby quickly terminate any steam release.

In summary, the likelihood of a significant seismic event at the TMI-1 site during Cycle 5 operation is small, the likelihood that the steam safety valves (MS-V22's) will lift is small, the likelihood that the stacks for these safety valves will fail is small, the likelihood that the atmospheric dump valves will open is small and if they should, any steam release could be terminated quickly, and any steam released to the compartment via the dump valves would dissipate quickly. In view of these considerations, we conclude that there is reasonable assurance, for the interim period of Cycle 5 operation, that local manual actions can effectively compensate for postulated seismically induced failures of the EFW system.



## Effects of Flooding

The petition claims that there was no evaluation of the effects of flooding due to a failure of the non-seismic portions of the EFW system. The petition further claims that such flooding would preclude local manual actions and could cause EFW equipment failures due to spray or submersion.

There are two areas of non-seismically qualified piping related to the EFW system: first, a portion of the recirculation lines downstream of both the flow restricting orifices and the isolation valves and outward toward CST "B"; and second, at the interface with the condensate system, the feed lines from the CST's downstream of isolation valves CO-V-14A,B and outward to the condenser hotwell.

As part of the EFW seismic review, a public meeting was held in Bethesda, Maryland on January 7, 1983. At this meeting, the staff raised the specific question of whether or not the licensee had considered the spray and flooding effects of a failure of the EFW recirculation piping. The licensee stated that such an evaluation had been conducted with the conclusion that such a failure does not lead to the loss of vital EFW equipment. During our March 6, 1984 plant visit and system walkdown, we confirmed the reasonableness of this conclusion. The licensee provided a discussion of this matter in his followup submittal of February 4, 1983.

At the January 7, 1983 meeting, the licensee was asked to address the flooding effects due to a failure of the CST feed lines to the hotwell. The February 4, 1983 followup submittal discusses this evaluation and concludes that the spill from such a failure would occur in the turbine building, not in the intermediate building, thereby having no spray or flooding impact on the EFW system or operator access.

These matters are well documented both in the licensee's February 4, 1983 submittal and the NRC summary of the January 7, 1983 meeting (dated January 16, 1983). As a result of our review of this subject, we find no technical merit to the petition claim regarding flooding by EFW system failures. We conclude that spray or flooding due to the EFW failures would not cause loss of the EFW safety function.

## SUMMARY AND CONCLUSIONS

The UCS 2.206 petition claims that the seismic capability of the TMI-1 EFW system does not satisfy the NRC's regulations and that the licensee does not intend to make it satisfy the requirements prior to operating the plant.

At TMI-1, there is reasonable assurance that a seismic event would not incapacitate the EFW system and therefore the EFW does satisfy NRC regulations. The NRC contractor did in fact conduct an independent evaluation and seismic capability of EFW valves is acceptable. The probability and consequences of a loss of the level instrumentation for the CST are acceptable, and postulated failures do not cause loss of all water stored for the EFW system. The effects of flooding have been evaluated and are acceptable.

Based on the above evaluation, we reiterate the conclusion in our August 12, 1983 Safety Evaluation that, in view of the system modifications planned for the refueling outage prior to Cycle 6 operation (first refueling) and the interim compensatory measures being provided for Cycle 5 operation, there is reasonable assurance that the Emergency Feedwater System at the Three Mile Island Unit 1 would be able to withstand a Safe Shutdown Earthquake and perform its safety function.

