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May 16, 1984 DOCKETED USNRC

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE DIRECTOR OR NUCLEAR REACTOR REGULATION

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

LICENSEE'S AMENDED RESPONSE TO UNION OF CONCERNED SCIENTISTS' PETITION FOR SHOW CAUSE CONCERNING TMI-1 EMERGENCY FEEDWATER SYSTEM

On January 20, 1984, the Union of Concerned Scientists filed a Petition for Show Cause Concerning TMI-1 Emergency Feedwater System. Licensee filed its response to the UCS petition on February 24, 1984, and subsequently filed amended responses on March 26 and April 26, 1984. This third amendment is necessary to reflect additional factual developments which have occurred since the last amendment.

In its discussion of the seismic capability of the EFW system, UCS claimed that, due to the release of steam into the Intermediate Building resulting from the failure of the non-seismic vent stacks for the main steam and atmospheric dump valves, the operator would be unable to perform certain functions in the event of an EFW system malfunction. Licensee has determined that it will be able to install, prior to restart, Seismic I supports for these vent stacks, in order to assure their structural integrity during a seismic event. Licensee

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will also, prior to restart, upgrade the supports for the EFW recirculation line to Seismic I. These modifications had previously been scheduled to be completed during the Cycle 6 refueling outage, as discussed in Licensee's letter of August 23, 1983 (Reference 2 to the Technical Response).

A revised version of the "GPU Nuclear Technical Response to Union of Concerned Scientists' Petition for Show Cause Concerning TMI-1 Emergency Feedwater System" incorporating a discussion of the above-described modifications is enclosed. These and other revisions are indicated by revision bars in the right-hand margin.

Finally, attached hereto is a copy of a letter dated May 10, 1984 from R. F. Wilson to D. G. Eisenhut, which responds to the Staff's May 3, 1984 request for additional information regarding the environmental qualification of the EFW system and which also responds to three questions posed by UCS in its letter of February 13, 1984.

Respectfully submitted,

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Dated: May 16, 1984

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May 10, 1984
5211-84-2114
RFW-0120

Office of Nuclear Reactor Regulation
Attn: D. G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sir:

Three Mile Island Nuclear Station Unit 1 (TMI-1)
Operating License No. DPR 50
Docket No. 50-289
EFW System Environmental Qualification

Your letter of May 3, 1984 requested that GPUN provide (a) information to assist the NRC staff to respond to a February 13, 1984 letter forwarded to the Commission by the Union of Concerned Scientists (UCS) and (b) responses to the NRC Staff's questions relative to the UCS 2.206 petition. Enclosure 1 entitled "EFW System - Safety Grade" discusses our response to the three questions posed in UCS letter dated February 13, 1984. Enclosure 2 entitled "EFW System - Environmental Qualification" discusses EFW system and related equipment in a harsh environment which is qualified or exempted and responds to questions concerning specific EFW System components.

Sincerely,

R. F. Wilson
Vice President-Technical Functions

RFW/mt:0489g

Sworn and subscribed to before me
this 10th day of May, 1984

Notary Public of New Jersey
My Commission Expires Sept. 22, 1987

cc: J. Van Vliet
R. Conte
J. F. Stolz

Enclosure: 1) EFW System - Safety Grade
2) EFW System - Environmental Qualification

Enclosure 1

EFW System - Safety Grade
Response to UCS Letter of February 13, 1984

1. 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 important to safety (including safety-grade, safety-related, and engineered safety feature systems).

Response: The EFW System complies with federal regulations as they apply to TMI-1. At the time of Licensing of TMI-1 the Emergency Feedwater System complied with all applicable regulations and standards which existed at the time for the EFW System. Since the accident at TMI-2, increased focus has been placed on the Emergency Feedwater System as described in IE Bulletin 79-05 (Series) and NUREG-0737. The EFW System at TMI-1 has also been the subject of extensive review as part of the ASLB hearing and review before the ALAB. The ASLB found in its PID that the short-term actions recommended in the Commission's Order and Notice of Hearing to improve the timeliness and reliability of the TMI-1 emergency feedwater system are necessary and sufficient to provide reasonable assurance that the facility can be operated safely in the interim until the system is made safety grade. Attached is a list of modifications which are planned for the Cycle 6 refueling which will make the EFW System safety grade. This list was presented to the Staff in our meeting in Bethesda on April 28, 1984.

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

Response: There are no deficiencies in the EFW System in complying with regulations as they apply to TMI-1. Nevertheless, GPUN has committed to upgrade the EFW System to safety grade. Below is a list of modifications planned for Cycle 6 and compensating measures to be taken until these modifications are complete. Therefore, GPUN believes that TMI-1 can be operated without undue risk to public health and safety as presently configured.

Long Term Items	Measures
1) Redundant Safety Grade EFW Control & Block Valves	The arrangement at restart of the EFV-30A/B control valves is not single failure proof but has the valve fail open on loss of instrument air and loss of control signal. Additionally, the EFW control

		valves are equipped with a handwheel which permits manual operator action to establish flow to the intact steam generator. When there is an initiation of the EFW system, an auxiliary operator will be stationed at the control valve. (See TMI-1 Abnormal Transient Procedure 1210-10.) The auxiliary operator will establish communications with the control room and will control the valves if EFW flow cannot be established from the control room. The Appeal Board found itself "...satisfied with the plant procedures for manual control of the EFW flow control valves." ALAB-729, 17 NRC 814, 833 (1983). The EFV-30s will be environmentally qualified under 10CFR50.49 by restart.
2)	Safety Grade Initiation on 4 PSIG Containment Isolation	This pending modification provides further enhancement of the system in the event of a steam line/feedwater line break. Currently, action is manually initiated by the operator. Dependence on the operator will not result in core uncovery.
3)	Safety Grade Hi OTSG Level (MFW Isolation) and Low Level (EFW Initiation)	Procedural guidance (ATP 1210-1) currently directs the operator to isolate main feedwater based on high OTSG level. Also procedural guidance (ATP 1210-4) directs the operator to manually initiate EFW on low OTSG level. OTSG level is safety grade.
4)	Safety Grade MSLRDS	The Main Steam Line Rupture Detection System (MSLRDS) signals to the EFW control valves, EF-V30A/B, have been deleted to preclude the possibility of unnecessary isolation of emergency feedwater under single failure conditions. In addition, a cavitating venturi installed for each EFW line will limit flow to a ruptured steam generator to minimize the potential of containment overpressurization (or steam generator overfill condition), and will also ensure sufficient EFW flow to the intact steam generator. The MSLRDS is considered to be adequate from a single failure standpoint--that is, a single active failure (such as a pressure switch, solenoid, control relay, 125V DC power source) will not prevent isolation of feedwater. Additionally, a single active failure will not result in inadvertent isolation of feedwater. The MSLRDS is seismic Class I inside containment. Following a main steam line break in the reactor building, the system will function to isolate feedwater from the affected steam generator since qualified pressure switches (for MSLRD) are to be installed in June, 1984 and will be suitable

		for the accident environment. While electrical separation between the redundant circuits is not maintained outside containment (since a few of them run in the same trays/conduits), electrical separation outside containment is not required for a main steam line break inside containment. The MSLRDS, therefore, is adequate for operation until the safety grade modification is installed.
5)	Safety Grade Lo Lo Level Alarm in Control Room for each CST	By letter dated February 4, 1983 (83-040) GPUN provided a failure modes analysis for the existing control grade instrument. Only in the event of a sensing line crimp (due to the transmitter falling) would the transmitter continue to read a static level. However the operator would note that no drawdown is indicated and investigate the problem. It is not credible to assume that each transmitter for each CST would fail in this manner. Therefore, at least one transmitter is expected to be available.
6)	Safety Grade Power to CO-V111A/B and upgrade Cable routing for CO-V14A&B	Although TMI-1 does not have a second isolation valve between SI/SIII piping to the condenser hot well for each line, the condensate storage system is single failure proof. There are two condensate storage tanks (CST) and Technical Specifications water inventory in either tank is sufficient for safe shutdown. The common cross connect between the two condensate pipes (containing CO-V14A/B) has two isolation valves (CO-V111A/B) and closure of either valve (CO-V111A/B) will ensure integrity of one CST inventory if one of the CO-V14A/B cannot be closed. All of the valves involved (CO-V14A/B & CO-V111A/B) are Seismic I and by the end of Cycle 6 refueling outage their cable routing (CO-V14A/B and CO-V111A/B) and power supplies (CO-V111A/B) will also be Seismic I. In the interim, manual operator action will ensure proper operation following a seismic event. The TMI-1 Emergency Procedure for Earthquake (1202-30) and relevant Alarm Response Procedures have been revised to instruct the operator to isolate the damaged Condensate Storage tank from the EFW system by closing valves CO-V14A/B and CO-V111A/B when tank level has reached the Tech. Spec. limit following EFW actuation, and/or following any recognizable seismic event (a seismic instrumentation alarm is available in the control room).

7)	Over Speed Trip Alarm in the CR For Turbine EFW Pump	This indication will provide additional diagnostic information in the control room as to why this EFW pump was unavailable. No specific regulatory requirement addresses this feature.
8)	Safety Grade Auto Control Independent of ICS for OTSG Level	Currently the operator uses safety grade OTSG level independent of ICS to manually control EFW and hence level in the OTSG. This modification will enhance the operation of the EFW system. The relationship between the EFW system and the ICS was considered extensively in the TMI-1 Restart proceeding. Pursuant to Short-term action 1(b) of the Commission's August 9, 1979 Order and Notice of Hearing in that proceeding, Licensee has implemented automatic initiation of the EFW pumps independent of the ICS and, further, has provided separate manual EFW flow control capability in the control room, which will allow the operators to manually control EFW flow to the steam generators in the event of an ICS malfunction. The Licensing Board examined this issue and required no further modifications, finding that the actions taken provided a significant improvement in safety. LBP-81-59, 14 NRC 1211, 1285-86 (Paragraph 802), 1362 (Paragraph 1031) (1981). The Appeal Board also evaluated the matter and considered "...the concerns regarding dependence on the ICS for control of emergency feedwater to be resolved." ALAB-729, 17 NRC 814, 833-34 (1983).

3. For each deficiency or potential deficiency which GPUN 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 GPUN 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?

Response:

The heart of the UCS complaint is not with the improvements yet to be made to the TMI-1 EFW system, but with the schedule for implementing those modifications. It appears to be the UCS position here, as it was in the TMI-1 Restart proceeding, that whenever a safety improvement is endorsed as worthwhile, the plant by definition is not safe to operate until the improvement is implemented. In short, UCS rejects the concept, endorsed by the NRC and reviewing courts, that backfitting safety improvements to operating plants involves the exercise of judgment and may be accomplished in a phased manner over time.

The Commission's backfit regulation, 10 CFR Subchapter 50,109(a), provides that "(t)he Commission may ... require the backfitting of a facility if it finds that such action will provide substantial, additional protection which is required for the public health and safety or the common defense and security." In promulgating that regulation, the Commission stated that: "the rapid changes in technology in the field of atomic energy result in the continual development of new or improved features designed to improve the safety of production and utilization facilities." 35 Fed. Reg. 5317 (1970). Taking steps to improve safety does not mean, however, that a facility is unsafe without the improvements. In applying the backfit rule, the Director previously had held that a decision to retrofit an existing facility does not necessarily imply that it is unsafe, but rather that substantial benefits to the public health and safety can be attained. In the Matter of Petition Requesting Seismic Reanalysis, DD-80-1, 11 NRC 153, 166 (1980).

The UCS concept of the appropriate standard for deciding whether and when to require modifications at operating plants was rejected by both the Licensing and Appeal Boards in the TMI-1 Restart proceeding. ALAB-729, 17 NRC 814, 827-28 (1983)

For the modifications listed in Attachment 1 of this enclosure (attached) compensating measures exist as discussed above. This will increase the reliability of the system which has already been determined to be sufficient for restart. That time period of one cycle is the shortest reasonable time period for modification of this complexity. Areas where compensating activities apply for the EFW system include principally seismic events, main steam line break and main feedwater line break. The probability of these events occurring in the given cycle is low for the magnitudes in the design basis accidents based on review of historical data and piping stress as indicated in our response of February 24, March 26 and April 26, 1984. In conclusion GPUN strongly believes (coincident with findings by NRC staff ASLB and ALAB) that the Emergency Feedwater System as configured at restart can be operated without undue risk to public health and safety and can be operated safely until the first refueling after restart.

Enclosure 1
Attachment 1

EFW LONG TERM UPGRADE MODIFICATIONS

MECHANICAL/STRUCTURAL

- ADD REDUNDANT SAFETY GRADE EFW CONTROL AND BLOCK VALVES

EFW HEAT SINK PROTECTION SYSTEM

- PROVIDE SAFETY GRADE EFW INITIATION ON 4 PSIG CONTAINMENT ISOLATION SIGNAL
- PROVIDE SAFETY GRADE OTSG LEVEL INSTRUMENTATION AND SIGNALS FOR MFW OTSG HIGH WATER LEVEL ISOLATION AND OTSG LOW WATER LEVEL INITIATION OF THE EFW SYSTEM
- PROVIDE A SAFETY GRADE AUTOMATIC CONTROL SYSTEM INDEPENDENT OF THE ICS THAT PERMITS THE EFW SYSTEM TO CONTROL OTSG LEVEL WITHOUT INTERACTION WITH THE MFW SYSTEM
- PROVIDE SAFETY GRADE MAIN STEAM RUPTURE DETECTION AND MFW ISOLATION SYSTEMS
- ADD SAFETY GRADE LEVEL INDICATION AND LOW-LOW LEVEL ALARM IN THE CONTROL ROOM FOR EACH CONDENSATE STORAGE TANK

EFW LONG TERM EP&I MODIFICATIONS

- PROVIDE A SAFETY GRADE POWER SUPPLY TO VALVES CO-V111A/B AND UPGRADE THE CABLE ROUTING FOR POWER SUPPLY TO VALVES CO-V14A/B TO SEISMIC CLASS I CRITERIA
- PROVIDE AN OVERSPEED TRIP ALARM IN THE MAIN CONTROL ROOM FOR THE TURBINE DRIVEN EFW PUMP (EF-P-1)

Enclosure 2

EFW System - Environmental Qualification

In Attachment 2 to your letter of May 13, 1984 you requested additional information related to the Environmental Qualification of the EFW system to assist you in responding to the UCS 2.206 petition of January 20, 1984.

Attachment 1 to enclosure 2 provides in tabular form a list of EFW and related equipment located in a harsh environment. A number of these components have been previously identified as not requiring qualification and are summarily explained. The additional items identified were audited during your visit on May 7 and 8 to GPUN corporate offices. Documentation concerning these additional items were reviewed and comments were discussed.

Attachment 2 to enclosure 2 provide the basis for exempting the EFW and related system components in a harsh environment noted in Attachment 1.

Attachment 3 to this enclosure provides responses to questions asked about certain indications related to the EFW System in a harsh environment.

Enclosure 2
Attachment 1

EFW ELECTRICAL EQUIPMENT LOCATED IN A HARSH ENVIRONMENT
INCLUDING ALL QUALIFIED EQUIPMENT

Equipment	Manufacturer	Model	Tag No(s).	TER Item No.	Qualification Status
Motorized Valve Actuators	Limitorque	SMB-0	EF-V2A&B	11	Qualified based upon Limitorque Reports B0058 and B0027.
Motorized Valve	Limitorque	SMB-000	EF-V1A&B	15	Qualified based upon Limitorque Reports B0058 and B0027.
Pump Motors	Westinghouse	HP 450	EF-P2A&B	51	Qualified based upon Westinghouse Report WCAP 7829 (Written vendor confirmation in process), GPUN calculation 1101x-5350-020 for the motor bearings, and TMI-1 Procedure 1420-Y-15 for splices.
Cable Instrument	Continental Wire & Cable Co.	Silicon Rubber Insulation		107	Qualified based upon GPUN calculation 1101X-5350-70 and Anaconda letter of 2/15/84.
Cable, Power & Control	Kerite			106	Qualified based upon FRC reports. Submergence qualification verification ongoing based upon Kerite generic tests described in Kerite letter of 5/4/84.
Diodes	Square D	JTXIN6071A		Replaced	No longer required. Diodes are used as suppression devices across ASCO solenoid valve coils. No ASCOs are used.
Terminal Block	States	NT		110	Qualified based upon various tests and data shown on SCEW sheet.
Flow Transmitters	Foxboro	NE 130M	FT-791, 799, 782, 788	None	Qualified based upon Wyle Report 45592-4.
E/P Converters	Bailey	RP-1211C	SP-V5A&B	60	Replaced by I/P converters Conoflow model GT25CA1826. Qualification will be based upon Conoflow reports 3021 and 3419.

Equipment	Manufacturer	Model	Tag No(s).	TER Item No.	Qualification Status
Limit Switches	NAMCO	D2400X2	LSA/MSV06 LSB/MSV-6	66	Associated with the turbine drive EFP which does not require qualification. No electrical interconnection to a functional system.
Limit Switches	NAMCO	D1200G2	LSA/MSV-13A&B LSB/MSV-13A&B	67	Associated with the turbine drive EFP which does not require qualification. No electrical interconnection to a functional system.
Limit Switches	Fisher		LS/EFV-30A&B	None	These switches are electrically disconnected.
Solenoid Valves	ASCO	LB8201C94	SV3/EF-V-30 A&B SV4/EF-V-30A&B	26	These solenoid valves are no longer installed in the plant. No ASCOs are used in equipment requiring qualification.
Solenoid Valves	ASCO	8300C68G	SV1/EF-V-30 A&B SV2/EF-V-30A&B	28	These solenoid valves are no longer installed in the plant. No ASCOs are used in equipment requiring qualification.
Solenoid Valves	ASCO	LB83146	SV/EF-V-8A, B&C	31	These solenoid valves are electrically disconnected and locked open with a collar.
D/P Switches	Barton	277A	FI-S-77, 78 & 79	77	These switches associated with EF-V-8 have been electrically disconnected.
Cable	Anaconda	FREP/CPE insulation		None	Qualified based upon Anaconda Report 80282 FRC Report F-C 4836-2 and Anaconda letter of 5/4/84.
Cable	Boston Insulation Wire			None	Qualified based upon BIW Report B 915 (written vendor confirmation in process).
Motorized Valve Actuator	Limitorque	SMB-1	MSV-2A/B	None	Qualified based upon Limitorque Reports B0058 and B0027.

Equipment	Manufacturer	Model	Tag No.(s)	TER Item No.	Qualification Status
			COV-14A/B		Exempted per attachment 2
			COV-111A/B		Exempted per attachment 2
			ASV-4		Exempted per attachment 2
			EFP-1		Exempted per attachment 2
			EFV-4&5		Exempted per attachment 2
			MSV-4A/B		Exempted per attachment 2
			MSV-6		Exempted per attachment 2
			MSV-1A,B,C,D		Exempted per attachment 2
			MSV-10A/B		Exempted per attachment 2
			MSV-13A/B		Exempted per attachment 2
			PT 65, 71 & 75		Exempted per attachment 2
			TE-230		Exempted per attachment 2
			EFV-15A/B		Exempted per attachment 2
			ST-8		Exempted per attachment 2
			MSV-8A/B		Exempted per attachment 2

Enclosure 2
Attachment 2

Emergency Feedwater and Related Equipment in a Harsh Environment
To Be Exempted from Qualification Under 10CFR50.49

1. COV-14A/B (Condenser Hotwell/CST cross connect) have been exempted from the master list of equipment within the scope of the EQ program based on the following [COV-14A/B are motor operated valves which are normally open and which have indication in the Control Room.]:

   - Should COV-14A/B fail closed, there would be no effect on EFW delivery.

   - Should COV-14A&B remain open following a High Energy Line Break (HELB) in the Intermediate Building, delivery of condensate to the EFW pumps is ensured based on the fact that COV-12 (for COV-14A); COV-7; COV-8; and COV-13 (for COV-4B) can be closed to maintain condensate storage tank inventory (ATP 1210-10).

     a. COV-12 (this a normally closed, motor operated valve with a 1E power supply) is located in the non-harsh environment of the Turbine Bldg. (If the valve fails open it can be manually closed locally.)

     b. COV-13 or COV-8 (COV-13 is motor operated valve powered from a non-1E power source; COV-8 is an electro-pneumatic level control valve with a IE DC power supply. Flow from the CST to the condenser would cause these valves to go closed on high hotwell level) have handwheels for local manual closure and are located in the non-harsh environment of the Turbine Bldg.

   - No electrical failure to COV-14A or B due to harsh environmental conditions would cause degradation of the 1E power supply system.

   - There is no electrical interconnection between COV-14A or B and any other required system function.

   - Operator action is based on CST level and is not relied upon by operators.

2. COV-111A/B (CST Cross Connect) have been exempted from the master list of equipment within the scope of the EQ program based on the following. [COV-111A&B are motor operated valves which are normally open and powered from a non-1E power source and which have indication in the Control Room.]:

   - These valves are not required to change position following a HELB in the Intermediate Bldg. (Closed for a seismic event.)

- o Should either or both COV-111A or B close due to a failure, EFW delivery is not affected.

- o Also, no electrical failure due to the environmental conditions would result in the valve failure in the closed position.

- o No electrical failure to COV-111A and B due to harsh environmental conditions would cause degradation to the 1E power supply system.

- o There is no electrical interconnection between COV-111A and B and any other required system function.

- o Valve position is not necessary to mitigate the event.

3. ASV-4 (Aux Steam Supply Isolation) has been exempted from the master list of equipment within the scope of the EQ program based on the following. [The ASV-4 valve is a normally closed, motor operated valve supplied with a non-1E power supply and with indication in the Control Room.]:

   - o Under LOCA and MSLB sufficient flow is provided to the OTSGs by a single motor driven EFW pump. (See GPUN letter dated 3/22/83). The steam driven EFW pump is not required for accidents which produce a harsh environment in the Intermediate Building. Failure of ASV-4 in the open position would have no deleterious effect upon the required EFW system function.

   - o No electrical failure to ASV-4 due to a harsh environmental conditions would cause degradation to the IE power supply system.

   - o There is no electrical interconnection between ASV-4, and any other required system function.

   - o The operator takes no action on position indication.

4. EFP-1 (Turbine Driven Pump) has been exempted from the master list of equipment within the scope of the EQ Program based on the following:

   - o EFP-1 does not contain any necessary electrical components.

5. EFV-4 & EFV-5 (River Water Supply) have been exempted from the master list of equipment within the scope of the EQ program based on the following. [EF-V4 and 5 are locked closed, motor operated valves with 1E power supplies. The breakers for these valves are locked open (operating procedure 1106-6).]:

   - o An emergency river water source is not required to mitigate the consequences of an HELB in the Intermediate Building.

   - o With the breakers locked open, there is no position indication.

6. MSV-4A/B (Atmospheric Dump) have been exempted from the master list of equipment within the scope of the EQ Program based on the following. [MSV-4A and B are normally closed, pneumatically operated valves, supplied with non-1E power to an I/P converter and with indication in the Control Room.]:

   - o The valves are not required to mitigate the consequences of an HELB or LOCA for hot (licensed) shutdown.

   - o Exposure to harsh environmental conditions can not cause either MSV-4A and B valves to fail into the open position.

   - o MSV-4A and B contain electric limit switches. These limit switches provide indication in the main control room only. They have no interconnection to other system functions. Heat removal during HELB is assured using primary to secondary heat transfer which relies on instrumentation unaffected by the HELB. (See NAMCO Limit Switch discussion in Enclosure 2, Attachment 3. of this letter.)

7. MSV-6 (Steam Supply to EFP-1) has been exempted from the master list of equipment within the scope of the EQ program based on the following:

   - o MSV-6 is a non-electric, pneumatic valve. The only electrical components associated with this valve are limit switches. (See discussion of NAMCO Limit Switches, Enclosure 2, Attachment 3 of this letter.)

8. MSV-1A/B/C/D (Main Steam Isolation) have been exempted from the master list of equipment within the scope of the EQ Program based on the following. [The MSV-1A, B, C and D valves provide main steam line isolation in the event of a steam line break and have indication in the Control Room:

   - o Should the MSV-1A thru D valves fail, the isolation function is achieved with the CV-1 thru 4 (turbine control valves) valves and/or SV-1 thru 4 (turbine stop valves) valves (located in a non-harsh environment).

   - o The MSV-1A thru D valves are stop-check valves providing an additional assurance of main steam isolation.

   - o Between the MSV-1A thru D valves and the turbine control valves the following major lines may need to be isolated in the event of a steam line break to prevent blowdown of both OTSGs.

     - steam supply to the main feed pumps
     - steam supply to the turbine gland seal system.

     Both of the above lines are isolatable via either local manual action (non harsh environment) or via remote control from the control room.

- o No electrical failure to the MSV-1A thru D valves due to harsh environmental conditions would cause degradation to the 1E power supply system.

- o There is no electrical interconnection between the MSV-1A thru D valve and any other required system function.

- o Closure of the MSIV is based on overcooling, not valve position indication.

9. MSV-10 A/B (Low pressure Steam Supply to EFP-1) have been exempted from the master list of equipment within the scope of the EQ Program based on the following. [MSV-10A & B are normally closed, motor operated valves, supplied with DC power and with indication in the Control Room.]:

   - o These valves are not required to mitigate the consequences of a LOCA or HELB in the Intermediate Building.

   - o No electrical failure to MSV-10A and B due to harsh environmental conditions would cause degradation to the 1E power supply system.

   - o There is no electrical interconnection between MSV-10A and B and any othe required system function.

   - o Operator action is based on overcooling considerations, not valve position indiciation.

10. MSV-13A/B (Steam Supply to EFP-1) have been exempted from the master list of equipment within the scope of the EQ Program based on the following. [MSV-13A and B are normally closed, solenoid operated pneumatic valves, supplied with DC power.]:

    - o These valves are not required to mitigate the consequences of an HELB or LOCA.

    - o Should the valves fail into the open position, the OTSGs could be isolated via closure of MSV-2A and B in conjunction with check valves MSV-9A and B.

    - o No electrical failure to MSV-13A and B due to harsh environmental conditions would cause degradation to the 1E power supply system.

    - o There is no electrical interconnection between MSV-13A and B and any other required system function.

    - o MSV-13A and B contain electric limit switches. These limit switches provide indication in the main control room only. They have no interconnection to other system functions. Heat removal during HELB is assured using primary to secondary heat transfer indication which is unaffected by the HELB. (See NAMCO limit switch discussion in Enclosure 2, Attachment 3 of this letter.)

11. PT-65, 71 & 75 (EFW Pumps Discharge Pressure) have been exempted from the master list of equipment within the scope of the EQ program based on the following. [PT-65, 71 & 75 monitor EFW discharge pressure. The output of these pressure transmitters is displayed in the control room, and provide the operator an input relative to pump operation.]:

    - o These pressure transmitters are referenced in procedures used to mitigate the consequences of an HELB or LOCA. However, other qualified instrumentation provided to the operator with data concerning the operation of the EFW pumps are used to verify EFW flow. These other instrumentation indications are steam generator pressure and level, emergency feedwater flow, primary coolant system temperature and pressure, and incore thermocouple temperature.

12. TE-230 (Bearing Cooling Water Temperature for the Turbine Driven EFP) has been exempted from the master list of equipment within the scope of the EQ Program based on the following:

    - o Since EFP-1 is not required to mitigate the consequences of an HELB in the Intermediate Building and LOCA, TE-230 need not be included into the EQ Program. Additionally, there is not direct indication of TE-230 in the control room, rather, TE-230 is input to the plant computer data logger.

    - o A failure of TE-230 has no effect on DC power.

13. EFV-15A/B (Bearing Cooling Water Regulating valves in Supply to Turbine Driven EFP) have been exempted from the master list of equipment within the scope of the EQ Program based on the following [no indication in the Control Room]:

    - o EFV-15A and B contain no electrical components, and are therefore, not included within the scope of the EQ program.

14. ST-8 (EFP-1 Pump Speed) has been exempted from the master list of equipment within the scope of the EQ Program based on the following. [ST-8 provides EFP-1 speed indication in the control room.]:

    - o ST-8 indication is not called for in plant procedures and hence, the operators do not rely upon this instrumentation to indicate pump operation. Other qualified instrumentation are utilized to verify pump operation including EFW flow, steam generator level, reactor coolant system pressure and temperature and core temperature.

    - o Failure of ST-8 has no effect on DC power.

15. MSV-8 A/B (Turbine Bypass Isolation) have been exempted from the master list of equipment within the scope of the EQ Program based on the following (MSV-8A/B are normally open motor operated valves supplied with 1E power with indication in the Control Room):

- o MSV-8A/B are not required to mitigate the consequences of an HELB in the Intermediate Building.

- o Should MSV-8A/B be needed to close to prevent blowdown of both OTSG's the MSV-3A thru F (located in a non harsh environment) provide the isolation function.

- o No electrical failure to MSV-8A/B due to harsh environmental conditions would cause degradation to the 1E power supply system.

- o There is no electrical interconnection between MSV 8A/B and any other required system function.

- o The operator does not rely on valve position for action.

For the above items, GPUN has determined that the function is not needed for HELB (with Loss of Offsite Power) with a single active failure.

Enclosure 2
Attachment 3

Justification For Exempting Certain EFW System
Electrical Equipment

A. NAMCO Limit Switches

1. An analysis of the effects that failure of the limit switches could have on other electrical equipment important to safety, e.g., if the switches are used in an interlock circuit for other equipment.

Response: These limit switches for MS-V6 and MS-V13A&B provide indication only in the Main Control Room. They have no interconnection to other system functions.

2. A discussion of the emergency procedures used by the Operator, whether the operator is directed to rely on information from these limit switches for valve positions, how and when the operator will manually and "immediately" reduce overfeeding of the OTSGs in the event the limit switches on MSV-6 fail, and why qualified EFW flow and OTSG level preclude the operator from being misled if the limit switches on MS-V13 A&B fail.

Response: The principal procedures used by the Operator in a MSLB accident are:

ATP 1210-3 Excessive Cooling

ATP 1210-10 Abnormal Transient Rules Guides and Graph

OP 1106-6 Emergency Feedwater System.

These procedures require verification that 3 EFW pumps start; EFW pump discharge pressure is 1010 psig, EFW flow (if below OTSG level setpoint); and EFV-30's control OTSG level at setpoint. The operator would follow EFW throttling criteria (of ATP 1210-10 Section 1.5) to prevent overfilling.

3. A discussion on the desirability of the operator needing to "immediately (manually)" reduce overfeeding the OTSGs because of failure of MS-V6 limit switches, and the desirability of relief valves lifting because of MS-V13A&B limit switches failing.

Response: As discussed above the operator is observing the EFW system throttling criteria (not MS-V6/MS-V13 indication). As discussed in TMI-1 restart report overfeeding does not become a problem. (RR Supplement Part 2 Question 2)

The pressure control valve (MS-V6) upstream of valves MS-V22A/B was modified to limit its travel at 65% of stroke to protect the EFW pump turbine from overpressurization due to the failure of any steam supply valves. This reduces the potential for opening of valves MS-V22A/B. In addition, these valves will not lift simply because the EFW turbine driven pump is started.

In our letter of 2/10/84 (5211-84-2038, Attachment II, Item I.G.1) we noted that under LOCA and MSLB sufficient flow is provided to the OTSGs by a single motor driven EFW pump. The referenced analysis (in GPUN letter dated 3/22/83) was for LOCA and LOFW (Loss of Feedwater). This analysis has been supplemented by analysis reported in our letter of 12/9/83 (also for LOCA and LOFW). EFW flow requirements for LOFW bound the flow requirements for MSLB.

B. Fisher Limit Switches

1. Same as 1 above for limit switches.

Response: These limit switches are not connected electrically and therefore have no electrical interconnection to system functions.

2. A discussion of the emergency procedures used by the operator and whether these procedures direct the operator to rely on information from these limit switches.

Response: As discussed in A 2 above the procedures listed apply. No reliance is placed on position indication of the EFV-30 valves. These limit switches are not electrically connected.

C. ASCO Solenoid Valves

1. An analysis of the effects that failure of the solenoid valves could have on other electrical equipment important to safety, e.g., disruption of Class 1E power on the circuit to which the solenoid valves are connected.

Response: The ASCO solenoid were once connected but now have had electrical leads lifted and instrument air has been disconnected. These modifications were performed as part of the deletion of the MSLRDS signal to the EF-V30's (no longer installed) and the removal of the EF-V8's control function.

2. For TER item No. 31, formally submit on the docket the justification for qualification exemption.

Response: As discussed in our response to C.1, these ASCO solenoid valves should be placed in NRC category III.B "Equipment not in the Scope of the Review."

D. Barton D/P Switches

1. Address failure of these D/P switches similar to 1. above for the limit switches.

Response: The EF-V8 valves have had their electrical leads lifted, instrument air tagged out and a collar installed on the valve to physically prevent change in position. There is no electrical interconnection of these switches with other system functions.

2. A discussion of the emergency procedures used by the operator and whether these procedures direct the operator to rely on information from these D/P switches.

Response: Since these switches are not in operation there is no reliance in procedures on the operation of these valves (EF-V8A/B/C).

3. Formally submit on the docket the justification for qualification exemption.

Response: These flow switches are for the EFW pump recirculation lines. The EF-V8 valves is now locked open therefore these switches are not in the scope of 50.49 and should be placed in Category III.B. As discussed above there is no adverse interaction with safety systems and no way to mislead the operator.

Attachment
REVISION #3 (May 16, 1984)

GPU NUCLEAR TECHNICAL RESPONSE TO UNION OF CONCERNED SCIENTISTS' PETITION FOR SHOW CAUSE CONCERNING TMI-1 EMERGENCY FEEDWATER SYSTEM

I. Introduction

The UCS Petition describes what UCS alleges to be deficiencies in the Emergency Feedwater (EFW) System at TMI-1 as it will be configured at the time of plant restart and throughout Cycle 5 operation. Each of the alleged deficiencies is addressed below. While the UCS Petition concentrates on perceived shortcomings in the EFW system, these allegations should not be weighed in a vacuum, but rather should be assessed with an understanding of the capabilities of the EFW system and the substantial improvements made to the qualification and reliability of that system since the accident at TMI-2. In brief, Licensee has already implemented the following modifications to the EFW system:

- safety-grade automatic starting of the EFW pumps;
- control of EFW independent of the ICS;
- condensate storage tank low-level alarm;
- safety-grade steam generator level indications, independent of the ICS;
- redundant two-hour air supply in the event of a loss of all AC power;
- EFW flow control valves' failure mode modified to fail open on loss of instrument air;
- addition of flow-limiting cavitating venturis in each EFW line; and
- safety-grade EFW flow indication. R.3

The additional modifications which will be undertaken during the Cycle 6 refueling outage will result in a fully safety-grade EFW system. Contrary to UCS's assertion that

Licensee admitted, in our August 23, 1983 submittal, that the "EFW system needs to be upgraded" in order to provide increased reliability to mitigate design basis accidents (UCS Petition at 4, emphasis added), Licensee's submittal was merely noting the "purpose" of the additional, long-term modifications. (Ref. 2.) Licensee stands by its original position that the TMI-1 EFW system is sufficiently reliable to allow operation during Cycle 5, pending completion of the long-term modifications.

II. Environmental Qualification

UCS alleges that the TMI-1 EFW system is not environmentally qualified, and begins the discussion in its petition on this point with a reference to General Design Criterion 4 of Appendix A to 10 C.F.R. Part 50. As relevant background for this and other references in the UCS Petition to the General Design Criteria, the Staff's finding associated with the issuance of the TMI-1 operating license is quoted:

> The Three Mile Island Unit 1 plant was designed and constructed to meet the intent of the AEC's General Design Criteria, as originally proposed in July 1967. Construction of the plant was about 60% complete and the Final Safety Analysis Report (FSAR) had been filed as Amendment 12 with the Commission before publication of the revised General Design Criteria in February 1971 and the present version of the criteria in July 1971. As a result, we did not require the applicant to reanalyze the plant on the basis of the revised criteria. However, our technical review did assess the plant against the General Design Design Criteria now in effect and we conclude that the plant design conforms to the intent of these newer criteria. (Ref. 1 at 3-1.)

With respect to safety-related electrical equipment, the NRC has been pursuing environmental qualification (i.e., compliance with GDC-4) on a generic basis first through IE Bulletin 79-01B, and now through its regulation on environmental qualification of electric equipment important to safety for nuclear power plants, 10 C.F.R. § 50.49, which first became effective June 30, 1982. Pursuant to section 50.49, TMI-1 is to achieve final environmental qualification of the electric equipment within the scope of that section by March 31, 1985. The EFW system has been included in the overall evaluation of TMI-1 under these generic programs.

Focusing upon a steam line break outside of containment, UCS states ". . . GPU recognizes that the TMI-1 EFW system is

not qualified for the hostile environmental conditions resulting from a main steam line break." UCS Petition at 6. What GPU in fact stated in the reference cited by UCS, which describes long-term modifications to the system, is that:

> Equipment which is part of the EFW system or which is required to act in support of this system and which is located in the Intermediate Building, shall either be upgraded to be qualified for the hostile environmental conditions resulting from a Main Steam Line Break (MSLB) in this building or be replaced with qualified equipment or be relocated to an environmentally acceptable location which is otherwise suitable for their safety function. (Ref. 2, Enclosure at 11.)

While UCS asserts that ". . . several pipes carrying steam or high temperature water are located in the Intermediate Building . . .", UCS Petition at 6, the 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.

The implications for the EFW system of a high energy line break in the Intermediate Building were recognized in the original licensing of TMI-1. As a result of an analysis of the consequences of all the postulated breaks in the Intermediate Building, utilizing criteria and guidelines provided by the Staff, corrective actions were identified. These included shielding of the EFW suction line and installation of additional piping restraints to prevent pipe whip damage and the failure of a line connected to one steam generator from causing the failure of a line connected to the other steam generator. In addition, a significantly augmented inservice inspection of critical welds was instituted for the postulated break locations. The Staff's conclusion was stated as follows:

> The staff has evaluated the assessment performed by the applicant and has concluded that the applicant has analyzed the facilities in a manner consistent with the criteria and guidelines provided by the staff. The staff agrees with the applicant's selection of pipe failure locations and concludes that all required accident situations have been addressed appropriately by the applicant. Furthermore, the staff has evaluated the locations where increased inservice inspection is proposed in lieu of plant modification and we find this justified and acceptable. (Ref. 1 at 10-7.)

The augmented inservice inspection program for the Main Steam system is incorporated in the TMI-1 operating license (No. DPR-50, Technical Specification 4.15).

The harsh environment in the Intermediate Building following a main steam line break is being addressed in the review for TMI-1 under IE Bulletin 79-01B and section 50.49. UCS argues that the current status is not known of EFW system components for which the Technical Evaluation Report (TER) concluded that environmental qualification had not been established, and that "it is known that many vital components in the TMI-1 EFW remain incapable of functioning properly during a steam line break." UCS Petition at 7, 8.

As UCS and the Staff are aware, the deficiencies identified in the Franklin Research Center TER on TMI-1, dated November 5, 1982, were predominantly based on the uncertainty by Franklin Research Center as to whether Licensee had adequate documentation to demonstrate the qualification of the identified equipment (although Franklin had not requested the documentation). The purpose of the October 5, 1983 meeting with the Staff was not to achieve final resolution of the TER deficiencies, as UCS implies, but to discuss Franklin's concerns. (UCS also inaccurately represents the December 16, 1983 meeting. Licensee discussed 120 equipment deficiencies, not 120 types of equipment having deficiencies. The 120 deficiencies address the entire plant and not just the EFW system -- the focus of the UCS Petition.) There is no equipment at TMI-1 classified by the NRC in the category II.b, "EQUIPMENT NOT QUALIFIED." (Ref. 3, TER at 4-3.) As discussed below, some equipment is classified category II.a, "EQUIPMENT QUALIFICATION NOT ESTABLISHED."

While UCS may not be aware of the current status of the specific components identified in its petition, Licensee documented the resolution of outstanding qualification items in letters to the Staff of February 10 and 22, 1984 and May 7 and 10, 1984 (Refs. 4, 24, 27, 28) and by the Revised Technical Response. The environmental qualification of the TMI-1 EFW system under 10 C.F.R. §50.49 will be completed by June, 1984, including replacement of the Bailey E/P Converters for the EFW control valves with qualified I/P Converters. (Licensee has continued to work on improving the schedule for this modification, which had been set for the Cycle 6 refueling outage, and has now determined that it will be completed by June, 1984.) Thus, the environmental qualification of the TMI-1 EFW system poses no undue risk to the public health and safety and does not provide an appropriate basis for the UCS Petition. R.1 R.3 R.1

III. Seismic Qualification

The seismicity analysis for the licensing of TMI-1 indicated that the Pennsylvania area is relatively inactive seismically, based upon 200 years of historical data and 40 years of instrumental data. The TMI site is characterized by infrequent earthquakes of low intensity. This low intensity corresponds to a ground acceleration of 0.04g. (Ref. 5, section 2.8.) The Seismic I portion of TMI-1 was designed to withstand a ground acceleration of 0.12g acting horizontally for the Safe Shutdown Earthquake (SSE) condition (Ref. 5, section 5.1.2), which exceeds the 0.1g specified ground acceleration of Appendix A to 10 C.F.R. Part 100. Consequently, the portions of the TMI-1 EFW system that are Seismic Category I are designed to more severe criteria than NRC regulations require. Mechanical portions of the EFW system that are not now Seismic Category I are designed to the requirements of ANSI B31.1, "Power Piping." Fossil power plants and conventional portions of nuclear power plants designed to this standard have exhibited significant seismic resistance. (Refs. 6, 7; Ref. 8 at 2.)

It is clear that while Staff guidance for seismic qualification of PWR auxiliary feedwater systems has been evolving over a long period of time, the evaluation to determine how to backfit seismic requirements to earlier plants has not resulted in the imposition of specific seismic requirements. (Ref. 9.) In its information request of February 10, 1981 (Ref. 8), the Staff stated:

> Although we are not at this time requesting that the AFW System be modified to be in conformance with the facility design seismic requirements, we have stated that our plan is to increase the seismic resistance, where necessary, to ultimately provide reasonable assurance that the system will function after the occurrence of earthquakes up to and including the SSE.

Licensee has made numerous submittals of information to the Staff, in response to Generic Letter 81-14, on the seismic qualification of the TMI-1 EFW system. The Staff's contractor, Lawrence Livermore National Laboratory (LLNL), has reviewed these responses and issued Technical Evaluation Reports dated October 29, 1982 and July 7, 1983. While the first TER identified deficiencies in Licensee's responses, LLNL concluded in its second TER that, with the actions taken and planned by Licensee (i.e., the long-term EFW modifications detailed in Reference 2), the TMI-1 EFW system will be fully qualified to Seismic Category I at the next refueling outage (prior to start

up for Cycle 6 operation). Based upon this TER and its own evaluation of Cycle 5 operation, the Staff has concluded that there is reasonable assurance that the TMI-1 EFW system will be able to withstand a SSE and perform its safety function. (Ref. 10.)

UCS challenges this conclusion, apparently, in its assertions that the TMI-1 EFW system is not seismically qualified and that operation of TMI-1 therefore would pose an undue risk to the health and safety of the public. As the assessment below will demonstrate, the UCS Petition is without technical merit and does not undermine the validity of the Staff's previous safety evaluation.

A major fault in the UCS Petition is the extensive reference, in the present tense, to findings in the first TER issued by LLNL, while virtually ignoring the second TER. UCS Petition at 9-15 (especially the list of "many vital components in the TMI-1 EFW system which are not environmentally qualified," UCS Petition at 10-11).

In its final TER, LLNL concluded that the TMI-1 EFW system piping, valves, structures and power supplies possess a SSE level of seismic capability, and that the initiation/control system will possess such capability after the Cycle 6 refueling outage.

The available information, which provides reasonable assurance that the EFW system will perform its safety function after a SSE, and that has been ignored by the UCS Petition (at 10-11), includes:

a. Recirculation lines of the EFW pumps. The TMI-1 Emergency Procedure for Earthquakes (1202-30) calls for closing of the Condensate Storage Tank B isolation valve (CO-V-176) and the EFW pump recirculation isolation valves (EF-V20A/B and EF-V22) if the EFW pump recirculation lines are ruptured. (Ref. 11, Item 1.) Licensee had originally planned to upgrade the supports for the EFW pump recirculation line to Seismic I during the Cycle 6 refueling outage, but has continued to work on this modification during the current shutdown. Licensee will now complete this modification prior to Restart. R.3

b. Portions of the EFW suction piping to the condenser hotwell, for which there are no double isolation valves between the seismic Class I piping and the non-seismic Class I piping. Although TMI-1 does not have a second isolation valve between SI/SIII piping to the condenser hot well for each line, the condensate storage system is single failure proof. There are two condensate storage tanks (CST) and Technical Specifications water inventory in either tank is sufficient for safe shutdown. The common cross connect between the two condensate pipes

(containing CO-V14A/B) has two isolation valves (CO-V111A/B) and closure of either valve (CO-V111A/B) will ensure integrity of one CST inventory if one of the CO-V14A/B cannot be closed.

All of the valves involved (CO-V14A/B & CO-V111A/B) are Seismic I and by the end of Cycle 6 refueling outage their routing (CO-V14A/B and CO-V111A/B) and power supplies (CO-V111A/B) will also be Seismic I. In the interim, manual operator action will ensure proper operation following a seismic event.

The TMI-1 Emergency Procedure for Earthquake (1202-30) and relevant Alarm Response Procedures have been revised to instruct the operator to isolate the damaged Condensate Storage Tank from the EFW system by closing valves CO-V14A/B and CO-V111A/B when tank level reaches the Tech Spec limit following EFW actuation, and following any recognizable seismic event (a seismic instrumentation alarm is available in the control room). (Ref. 12, TER Item 2.)

c. EFW pumps' minimum flow valves (recirculation valves) and their controlling flow switches and associated circuitry. The EFW pumps' minimum flow valves (EF-V8A/B/C) are seismically qualified. (Ref. 25.) The fact that their controlling flow switches and circuitry are not seismically qualified has been resolved by locking open EF-V8A/B/C. This will prevent the possibility of dead heading the EFW pumps, and sufficient flow will still be available to the steam generators. (Refs. 18, 19.)

d. Electro-pneumatic converters for the EFW flow control valves, EF-V-30A and EF-V-30B. The E/P Converters will be replaced by June, 1984 with seismically qualified I/P Converters. A seismic event will not result in a failure of the converters for the EFW flow control valves and thus sufficient flow will be established for the EFW system to perform its safety function. R.1

e. Condensate storage tank low level alarms. The actions described above in "a, b and c" will ensure sufficient inventory in the Condensate Storage Tanks and a sufficient flow path to the steam generators for the EFW system to perform its safety function. (Ref. 11, Item 1.) Licensee has reviewed the failure modes in a seismic event for the condensate tank level instrumentation, (Ref. 11, Item 3.), and concluded that only in the event of a transmitter sensing line crimp (due to the transmitter falling) would the transmitter continue to read a static level. However the operator would note that no drawdown is indicated and investigate the problem. It is incredible to assume that both transmitters would fail in this manner. Therefore, at least one transmitter is expected to be available.

In the Restart proceeding, the Licensing Board recognized and explicitly endorsed for Cycle 5 operation the non-safety-grade CST low-low level alarms as adequate pending the installation of safety-grade alarms during the Cycle 6 refueling outage. LBP-81-59, 14 N.R.C. 1211, 1363-64, 1373 (¶¶ 1033, 1037, 1059). These low-low alarms use the same transmitter as the low level alarms.

f. Circuitry for main steam dump isolation valves MS-V2A, MS-V2B, MS-V8A and MS-V8B. Since the EFW system safety function can be achieved with the motor driven EFW pumps without relying on the turbine driven pump, the circuitry for these valves is not essential and need not be seismically qualified. (Ref. 10, TER at 5; Ref. 12, Item 7.)

g. Circuitry for condensate storage tank isolation valves CO-V10A, CO-V10B, CO-V14A and CO-V14B. The only non-seismic parts of the circuitry for valves CO-V10A/B are the cable routing through the turbine building and the electric power supplies. CO-V10A/B are normally open and are not required to change position for the system to become operational. Valves CO-V10A/B are locked open now and there is no need to seismically qualify the circuitry for these valves. The only non-seismic part of the controls for valves CO-V14A/B is the cable routing through the turbine building. CO-V14A/B are normally open and are required to change position for the system to become operational if a pipe break occurs in the hotwell makeup piping. (Ref. 19.) Manual closing of CO-V14A/B is provided as discussed above in "b".

h. Circuitry for condensate storage tank cross connect valves CO-V111A and CO-V111B. The non-seismic parts of the circuitry for valves CO-V111B are the cable routing through the turbine building and the electric power supplies. CO-V111A/B are not required to change position for the system to become operational. (Ref. 19.) (See "b" above.)

i. Control systems for the atmospheric relief valves MS-V4A and MS-V4B. These valves are within the seismic boundary and will maintain their structural integrity during a seismic event. However, the control of these valves is not essential for safe hot shutdown and, therefore, the control system need not be seismically qualified. These valves will remain closed on loss of instrument air or loss of electrical signal. The MSV-4A/B can be manually operated.

j. Vent stacks for both the main steam relief and atmospheric dump valves. UCS argues that "it is very likely that the operator will not be able to enter the Intermediate Building to isolate the leak following an earthquake because of steam released to the building by failure of equipment which is not seismically qualified" -- the vent stacks for MS-V-22A/B and MS-V-4A/B valves. UCS Petition at 13.

The pressure control valve (MS-V6) upstream of valves MS-V22A/B was modified to limit its travel at 65% of stroke to protect the EFW pump turbine from overpressurization due to the failure of any steam supply valve. This reduces the potential for opening of valves MS-V22A/B. In addition, these valves will not lift simply because a vent stack fails or the EFW turbine driven pump is started.

Licensee previously had evaluated the design of the vent stacks for these valves and found that these vent stacks were classified non-seismic and were designed for dead weight and discharge loads only. However, the supporting scheme for the MS-V22's stacks was judged by inspection to be seismically acceptable. (Ref. 14, Question 1 of Enclosure 1; Ref. 15.) Also, as noted in item "i" above, operation of MSV-4A/B is not required for safe hot shutdown and the failure mode of these valves is closed. Nevertheless, Licensee had originally planned to upgrade the supports for the MS-V4A/B and MS-V22A/B to Seismic I during the Cycle 6 refueling outage, but has continued to work on these modifications during the current shutdown. Licensee will now complete this work prior to Restart. Therefore, the EFW System components will be protected from a steam environment created by a postulated vent stack break and the operator will be able to function in the Intermediate Building. R.3

k. Main steam isolation valve circuitry. Circuitry for these valves (MSV-1A, B, C, D) is not essential for plant shutdown (since the EFW turbine driven pump is not needed) and need not be seismically qualified. (Ref. 10, TER at 5; Ref. 12, Item 9; Ref. 11, Item 9.)

Following the dated list which is evaluated above, the UCS Petition proceeds to criticize use of a "static analysis" to establish the seismic qualification of valves. UCS Petition at 11. The very Standard Review Plan passage quoted by UCS belies its claim that static analysis has been rejected by the NRC: "Analysis without testing is acceptable if structural integrity alone can assure the intended function." UCS Petition at 12. Further, the seismic analyses for the 47 EFW valves utilized as inputs accelerations which were determined from a dynamic analysis of the EFW piping system -- using the response spectrum approach specified in the Standard Review Plan. The valves and their characteristics (i.e., center of gravity, weights and geometry) were realistically included in the dynamic model of the piping system. The piping was analyzed considering the Operating Basis Earthquake, and the acceleration results were then doubled to account for the SSE pursuant to the TMI-1 FSAR. This approach is conservative since the increase in damping of the piping system during the SSE was not considered.

The accelerations used to analyze the valves were generated using a fully qualified, realistic, "state of the art" dynamic analysis of the EFW piping system. The dynamic model has been checked during the TMI-1 review in response to IE Bulletins 79-02 and 79-14, which showed that the pipe routing support locations and pipe support construction are consistent with the analysis.

The analyses applied the dynamic acceleration from the piping analysis to the valve internals, pressure boundaries and actuators in a static manner, along with other consequential loads. This approach is justified because the valve internals are sufficiently stiff to preclude dynamic amplification within the valve itself.

Here, stress analysis of the valves, considering accelerations derived from a dynamic analysis of the EFW piping system, reveals that the highest stress in the valves -- considering consequent loads due to the SSE, internal pressure and deadweight -- ranges from 3 to 91 percent of the ASME Code allowable stress values. (These ASME allowable stresses are based on a safety factor of at least four, considering the ultimate strength of the materials.) This means that both the structural integrity and operability of the valves are assured because the materials experience stresses and strains within their elastic limits. Consequently, deformations are small and temporary, such that the moving parts inside the valves and actuators are not affected. For all of these reasons, the valve analyses are valid.

As shown above, the TMI-1 EFW system has the capability to perform its safety function following a seismic event, coincident with loss of offsite power with a single failure of any active component. Even if the inventory from either one or both Condensate Storage Tanks is depleted due to the single failure of isolation valve CO-V14A or B, a secondary backup supply of river water is available from the reactor building emergency cooling pumps -- an entirely seismic Class I supply, although establishment of this supply may require operator action in the Intermediate Building. (Ref. 14, Question 1 of Enclosure 1, Enclosure 2 at 5.)

UCS states that GPU apparently performed no evaluation of the potential effects of flooding the Intermediate Building from failure of the EFW system, and concludes that this is a "significant omission." UCS Petition at 14. It might be if it were true, but it is not. Licensee has evaluated the condensate piping from valves CO-V14A/B to the turbine building wall to determine if this piping will stay intact during an earthquake. Seismic stress analysis of the condensate piping has included the restraining capability of the supports in the non-seismic piping from the valves CO-V14A/B to the Turbine

Building wall and into a portion of the piping that extends into the Turbine Building. These supports, which have a combined restraining capability in three directions, will result in low seismic stresses in the non-seismic part of the system. If a pipe rupture is postulated beyond these supports, the break would be isolated and will not cause flooding in the Intermediate Building. Furthermore, there are no components vital to the EFW system which can be adversely affected by spray from a broken EFW pump recirculation line. (Ref. 11, Item 1.) Finally, the procedural action (discussed above) to isolate the recirculation line will limit the leakage rate through this small line and avoid a flooding problem.

With respect to a main feedwater line break, the time required to jeopardize EFW equipment is presently 5.5 minutes, not 86 seconds -- UCS Petition at 15, n. 40. (Ref. 16.) However, prior to restart, Licensee will have completed additional modifications which will extend to 25 minutes the time available to the operator to terminate flooding in the Intermediate Building before EFW components not qualified for submergence would be adversely affected. As described in Licensee's letter 5211-84- , dated May , 1984, from H.D. Hukill to J.F. Stolz, structural modifications to the Intermediate Building which will provide more volume for the accumulation of flood water will be completed in June 1984. (Ref. 26.) This modification had previously been scheduled for completion prior to startup from the Cycle 6 refueling outage. (Ref. 2, Attachment at 5.) In addition, evaluation of the stress analysis for the main feedwater lines from containment penetration to the turbine building indicates that the maximum stress levels from combined operating and seismic conditions are at most 46.5 percent of the limits designated as the potential pipe rupture stress level. (Ref. 5, Section 4.0 of Appendix 14A.) The results of these stress analyses show that the non-seismic portion of the main feedwater lines inside the Intermediate Building has seismic resistance. Consequently, there is a low probability that a main feedwater line break would cause flooding in the Intermediate Building following a seismic event. R.2 R.3 R.3

Finally, Licensee notes that UCS repeatedly cites to the plans for further hardware modifications to the EFW system (Ref. 2) as support for the proposition that the system is not seismically qualified, and asserts that GPU has concluded that at restart the TMI-1 EFW system cannot withstand a Safe Shutdown Earthquake. UCS Petition at 16. In contrast, it is Licensee's position that the TMI-1 EFW system at restart, considering accomplished modifications and with the implementation of the plan of procedural actions described above, will be able to perform its system function, in the unlikely event it should be called upon to do so following a design basis seismic event during Cycle 5 operation.

IV. Single Component Failure

UCS states that "[t]he TMI-1 EFW system does not meet the single failure criterion because there is only a single flow control valve in the pipe used to deliver EFW to each steam generator." UCS Petition at 19, 20. UCS does not address, however, the design modifications already accomplished which improve the reliability of the system.

The Main Steam Line Rupture Detection System (MSLRDS) signals to the EFW control valves, EF-V30A/B, have been deleted to prevent unnecessary isolation of emergency feedwater under single failure conditions. In addition, a cavitating venturi installed for each EFW line will limit flow to a ruptured steam generator to prevent containment overpressurization (or steam generator overfill condition), and will also ensure sufficient EFW flow to the intact steam generator. (Ref. 17.)

At restart, the arrangement of the EF-V30A/B controls will result in the valves failing open on either loss of instrument air or loss of control signal. Additionally, the EFW control valves are equipped with a handwheel which permits manual operator action to establish flow to the intact steam generator. When there is an initiation of the EFW system or failure of an EFW control valve, an auxiliary operator will be stationed at the control valves. (See TMI-1 Abnormal Transient Procedure 1210-10.) The auxiliary operator will establish communications with the control room and will control the valves if EFW flow cannot be established from the control room. R.1

Isolation of EFW flow, if required, to a ruptured steam generator can be achieved either by closing the affected EFW control valve or by closing the discharge header sectionalizing valves (EF-V2A/B), and then tripping the respective EFW pump.

UCS next states that "[a]nother way in which the EFW system does not meet the single failure criterion is that the EFW flow control valves are presently controlled by the Integrated Control System (ICS) which is not safety grade." UCS Petition at 20. The relationship between the EFW system and the ICS was considered extensively in the TMI-1 Restart proceeding. Pursuant to Short-term action 1(b) of the Commission's August 9, 1979 Order and Notice of Hearing in that proceeding, Licensee has implemented automatic initiation of the EFW pumps independent of the ICS and, further, has provided separate manual EFW flow control capability in the control room, which will allow the operators to manually control EFW flow to the steam generators in the event of an ICS malfunction. The Licensing Board examined this issue and required no further modifications, finding that the actions taken provided a significant improvement in safety. LBP-81-59, 14 N.R.C. 1211, 1285-86 (¶ 802),

1362 (¶ 1031) (1981). The Appeal Board also evaluated the matter and considered ". . . the concerns regarding dependence on the ICS for control of emergency feedwater to be resolved." ALAB-729, 17 N.R.C. 814, 833-34 (1983).

In addition, Licensee notes that the ICS has a reliable, uninterruptible, on-site power supply. It is normally fed from an inverter which is powered from the "A" diesel backed 480 Volt AC bus. When the 480 Volt bus is unavailable, the inverter takes its power directly from one of the DC station batteries. In the unlikely event of an independent inverter failure the ICS power supply will be switched to a regulating transformer which is fed directly from the same 480 Volt AC bus. The independent manual control stations described in the previous paragraph are powered from a different inverter which is backed up by a separate set of DC station batteries. In the event of an independent failure of this inverter, the power supply for the manual control stations automatically switches to an alternative source backed by the "B" diesel generator.

In summary, means are available during Cycle 5 operation to prevent the EFW system from being disabled by a single component failure.

V. Emergency Feedwater Flow Instrumentation

UCS attacks the adequacy of the new EFW flow indicators, alleging that the replacement of the unqualified sonic flow devices by differential pressure (D/P) transmitters "amounts to a request for exemption from the short-term lessons learned requirement for safety grade EFW flow instruments." UCS Petition at 24. (UCS's complaints regarding the EFW flow indicators are currently pending before the Commission in the Restart proceeding by virtue of UCS filings dated December 9, 1983 and January 6, 1984.) UCS here is patently wrong; as detailed in our submittal to the Staff of August 25, 1983, the EFW flow instrumentation meets all applicable environmental, seismic and other safety-grade criteria. (Ref. 20, Attachment at 1, 2).

UCS's complaints regarding the qualification of the EFW flow indicators rest upon its claim that this instrumentation does not "meet the ± 10% accuracy requirement in effect during the restart hearing." UCS Petition at 24. As Licensee reported, at low EFW flow conditions (i.e., below approximately 120 gpm), cavitation of the EFW flow control valves (EFV-30's) due to low flow against negligible backpressure resulted in indications of EFW flow oscillations outside ± 10% of the flow rate. (Ref. 21; Ref. 22, Attachment at 1). However, recently reported test data, requested by the NRC (Ref. 23), confirm that at flows of 120 gpm and above, the flow oscillations

recorder [illegible] within ± 10% (e.g., at 200 gpm flow rate the oscillations were ± 7.5% (15 gpm); at 600 gpm, the oscillations were ± 4.2% (25 gpm).) (Ref. 22, Attachment at 1.) (The oscillations reported were measured on recorder traces. The EFW flow meter face contains 25 gpm graduations and thus these small oscillations combined with meter damping are not readable on the meter itself. (Ref. 22, Attachment at 1.)) Further, as discussed in Licensee's most recent submittal, operators are directed to refer to the EFW flow indicators only in limited circumstances (i.e., upon EFW actuation with steam generator (SG) level below the SG level setpoint) and, additionally, are instructed not to rely on EFW flow indication for flow control at rates below 225 gpm. (Ref. 22, Attachment at 2.) Thus, it is clear that the EFW flow indicators are sufficiently accurate to perform their intended function.

With respect to UCS's reliance on the ± 10% accuracy requirement, Licensee would merely note that (while this criterion was part of an interim clarification of lessons learned requirements dated October 30, 1979) Item II.E.1.2 of NUREG-0737, which sets forth the latest position and clarification for EFW flow indication, contains no such set accuracy requirement. (Moreover, the Licensing Board decision itself makes no reference to this ± 10% accuracy requirement. LBP-81-59, 14 N.R.C. 1211, 1362 (¶ 1029) (1981).) Rather, as recognized by UCS, NUREG-0737 merely referenced IEEE Standard 279-1971 which states, in pertinent part, that the system design basis shall document the "minimum performance requirements including . . . system accuracies." See "UCS Rebuttal to Licensee's Reply Regarding EFW Flow Instrumentation," (January 6, 1984) at 5, quoting IEEE 279-1971, § 3(9). Licensee contends that its documentation of EFW flow indication accuracy meets this requirement and, moreover, that the earlier ± 10% accuracy criterion is met at EFW flows of 120 gpm and above.

VI. Main Steam Line Rupture Detection System

UCS asserts that the Main Steam Line Rupture Detection System (MSLRDS) ". . . is not safety grade and requires modifications so that a single failure will not prevent isolation of main feedwater to the steam generator affected by a main steam line break." UCS Petition at 29. As UCS notes, the potential for inadvertent isolation of feedwater was considered in the TMI-1 Restart proceeding as a part of the emergency feedwater reliability issues. LBP-81-59, 14 N.R.C. 1211, 1373-74 (¶¶ 1060-64) (1981). The Appeal Board found that the operators' capability to bypass the MSLRDS and manually open the EFW flow control valves if the MSLRDS isolates feedwater inadvertently is an adequate solution for restart. ALAB-729, 17 N.R.C. 814, 834, 887-88 (1983). In an Order (January 27, 1984)

issued in the TMI-1 Restart proceeding after the UCS Petition was filed, the Commission called for comments on the adequacy of Licensee's proposed solution to the MSLRDS "problem."

In its submission of August 2, 1982 to the Staff, Licensee described the design changes to the MSLRDS to prevent unnecessary isolation of emergency feedwater under single failure conditions. (Ref. 17.) In addition to those changes, existing pressure switches inside containment for MSLRD (Static-O-Ring devices) will be replaced by June, 1984, with fully qualified pressure switches. (Ref. 4.) Therefore, in the event of a main steam line rupture in containment, the pressure switches will be capable of performing their intended function. All components of the MSLRDS located inside containment will then be environmentally qualified. The following describes the MSLRD system configuration:

1. Each steam generator (S.G.) has two outgoing steam lines, each line has two pressure switches for MSLRD.

2. Each S.G. has a parallel combination of startup and main FW control valves, and each control valve has a motor operated block valve upstream.

3. Upon MSLRD, the FW is isolated from the affected S.G. by closing its control valves and the block valves. Valve isolation logic is as follows:

   A. Startup and Main Control Valves (FW-V16A/B & FW-V17A/B):

      (1) For isolation purposes, each valve is provided with two paths in the pneumatic control circuit; however, only one path is required to achieve isolation.

      (2) Each isolation path in the pneumatic control circuit has two solenoids. Each solenoid is energized by a separate pressure switch upon MSLRD. Both solenoids in either of the control paths must be energized for isolation.

      (3) The solenoids in the same control path are powered from the same source but the two paths receive power from separate sources.

B. Block Valves:

(1) For Main FW Controls Valves (FW-V5A/B):

Two pressure switches associated with either of the pneumatic control paths (discussed in paragraph 3.A.2) must detect MSLR to cause a closure signal for the block valves. In this case, the isolation signals from RED & GREEN sources are tied together. Also the power for both the block valves is from the same source.

(2) For startup FW Control Valves (FW-V92A/B):

Separate power sources are available to the motor operators. A single failure will prevent block valve isolation, but the same failure will not prevent control valve isolation.

4. On loss of instrument air, the control valves (FW-V16A/B and 17A/B) will fail closed which will result in FW isolation.

5. Electrical Separation. Outside containment the MSLRDS circuits are not all routed in safety-related trays and therefore separation is not maintained throughout.

In conclusion, the MSLRDS is considered to be adequate from a single failure standpoint -- that is, a single active failure (such as a pressure switch, solenoid, control relay, 125V DC power source) will not prevent isolation of feedwater and will not result in inadvertent isolation of feedwater. The MSLRDS is seismic Class I inside containment. Following a main steam line break in the reactor building the system will function to isolate feedwater from the affected steam generator since qualified pressure switches (for MSLRD) to be installed by June, 1984 will be suitable for the accident environment. While electrical separation between the redundant circuits is not maintained outside containment, since a few of them run in the same trays/conduits, electrical separation outside containment is not required for a main steam line break inside containment. The MSLRDS, therefore, is adequate for operation until the fully safety grade modification is installed.

VII. Conclusion

There is reasonable assurance that the emergency feedwater system at TMI-1, as modified for restart and as augmented with plant procedures, will perform its function if called upon to do so.

Richard F. Wilson
Vice President-Technical
Functions
GPU Nuclear Corporation

Sworn to and subscribed before me this 16th day of May, 1984.

Notary Public

ANNETTE M. LONGO
Notary Public of New Jersey
My Commission Expires Sept. 29, 1987

My commission expires _____.

REFERENCES

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2. GPU Nuclear letter 5211-83-232 to NRC, Long Term EFW Mods (NUREG 0737 II.E.1.1), August 23, 1983.

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11. Attachment 1 to GPU Nuclear letter 5211-83-040 to NRC, EFW Seismic Qualification, February 4, 1983.

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13. GPU Nuclear letter 5211-83-133 to NRC, EFW Seismic Qualification, May 2, 1983.

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18. GPU Nuclear letter 5211-83-055 to NRC, EFW Seismic Qualification Supplement, March 22, 1983.

19. GPU Nuclear letter 5211-82-018 to NRC, EFW Seismic Qualification-Electrical, February 16, 1982.

20. GPU Nuclear letter 5211-83-231 to NRC, EFW Flow Devices -- D/P Transmitters, August 25, 1983.

21. GPU Nuclear letter 5211-83-346 to NRC, EFW Flow Devices (D/P) Testing, November 23, 1983.

22. GPU Nuclear letter 5211-84-2032 to NRC, EFW Flow Instrumentation, February 22, 1984.

23. USNRC letter to GPU Nuclear, January 18, 1984.

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25. GPU Nuclear letter 5211-82-216 to NRC, Seismic Qualification of Emergency Feedwater System, September 14, 1982.

26. GPU Nuclear letter 5211-84- to NRC, Intermediate Building Flooding Modification, May , 1984. R.2

27. GPU Nuclear letter 5211-84-2110 to NRC, Environmental Qualification of Electrical Equipment, Supp. 3, May 7, 1984. R.3

28. GPU Nuclear letter 5211-84-2114 to NRC, EFW System Environmental Qualification, May 10, 1984.

May 16, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE DIRECTOR OF NUCLEAR REACTOR REGULATION

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "Licensee's Amended Response to Union of Concerned Scientists' Petition for Show Cause Concerning TMI-1 Emergency Feedwater System" and Revision 3 of "GPU Nuclear Technical Response to Union of Concerned Scientists' Petition for Show Cause Concerning TMI-1 Emergency Feedwater System" were served this 16th day of May, 1984 by deposit in the U.S. Mail, first class, postage prepaid, to all those on the attached Service List.

Thomas A. Baxter

Thomas A. Baxter, P.C.

Dated: May 16, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289
	)	
(Three Mile Island Nuclear Station, Unit No. 1)	)	

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