December 13, 1988

Docket No. 50-289

DISTRIBUTION
Docket File
NRC & Local PDRs
Gray File
SVarga
BBoger
SNorris
RHernan
OGC
DHagan
EJordan
BGrimes
TBarnhart(4)
Wanda Jones
EButcher
ACRS(10)
GPA/PA
ARM/LFMB

Mr. Henry D. Hukill, Vice President
and Director - TMI-1
GPU Nuclear Corporation
P. O. Box 480
Middletown, Pennsylvania 17057

Dear Mr. Hukill:
SUBJECT: ISSUANCE OF AMENDMENT (TAC NO. 64205)

The Commission has issued the enclosed Amendment No. 147 to Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit No. 1, (TMI-1) in response to your letter dated December 10, 1986.

The amendment incorporates requirements for operability and calibration frequencies for the Reactor Coolant Inventory Trending Systems in the TMI-1 Technical Specifications.

A copy of the related Safety Evaluation is also enclosed (Enclosure 2). Notice of Issuance will be included in the Commission's bi-weekly Federal Register notice.

This letter also transmits the staff's Final Safety Evaluation (Enclosure 3) of the TMI-1 system for detecting inadequate core cooling required by Order dated December 10, 1982 and described by NUREG-0737 Item II.F.2. The staff finds that the TMI-1 system meets the requirements.

Sincerely,

original signed by

Ronald W. Hernan, Senior Project Manager
Project Directorate I-4
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 147 to DPR-50
2. Safety Evaluation
3. Final Safety Evaluation

cc w/enclosures:
See next page

LA:PDI-4	PM:PDI-4	D:PDI-4	RSB	OTSB	OGC
SNorris	RHernan:bd	JStolz	~~RJones~~ Phillips	REmch	R Bachmann
11/10/88	11/10/88	11/10/88	12/5/88	12/5/88	12/8/88

CP1

CC DF01

1/1

8812190062 881213
PDR ADOCK 05000289
P PDC

Mr. Henry D. Hukill
GPU Nuclear Corporation

Three Mile Island Nuclear Station,
Unit No. 1

cc:

G. Broughton
O&M Director, TMI-1
GPU Nuclear Corporation
Post Office Box 480
Middletown, Pennsylvania 17057

Richard J. McGoey
Manager, PWR Licensing
GPU Nuclear Corporation
100 Interpace Parkway
Parsippany, New Jersey 70754

C. W. Smyth
TMI-1 Licensing Manager
GPU Nuclear Corporation
Post Office Box 480
Middletown, Pennsylvania 17057

Ernest L. Blake, Jr., Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N.W.
Washington, D.C. 20037

Larry Hochendoner
Dauphin County Commissioner
Dauphin County Courthouse
Front and Market Streets
Harrisburg, Pennsylvania 17120

David D. Maxwell, Chairman
Board of Supervisors
Londonderry Township
RFD#1 - Geyers Church Road
Middletown, Pennsylvania 17057

Richard Conte
Senior Resident Inspector (TMI-1)
U.S.N.R.C.
Post Office Box 311
Middletown, Pennsylvania 17057

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, Pennsylvania 19406

Robert B. Borsum
Babcock & Wilcox
Nuclear Power Generation Division
Suite 525
1700 Rockville Pike
Rockville, Maryland 20852

Governor's Office of State Planning
and Development
ATTN: Coordinator, Pennsylvania
State Clearinghouse
Post Office Box 1323
Harrisburg, Pennsylvania 17120

Thomas M. Gerusky, Director
Bureau of Radiation Protection
Pennsylvania Department of
Environmental Resources
Post Office Box 2063
Harrisburg, Pennsylvania 17120

Docketing and Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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

METROPOLITAN EDISON COMPANY

JERSEY CENTRAL POWER & LIGHT COMPANY

PENNSYLVANIA ELECTRIC COMPANY

GPU NUCLEAR CORPORATION

DOCKET NO. 50-289

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 147
License No. DPR-50

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by GPU Nuclear Corporation, et al. (the licensee) dated December 10, 1986, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

8812190074 881213
PDR ADOCK 05000289
P PDC

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.c.(2) of Facility Operating License No. DPR-50 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 147, are hereby incorporated in the license. GPU Nuclear Corporation shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance, to be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

John F. Stolz, Director
Project Directorate I-4
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: December 13, 1988

ATTACHMENT TO LICENSE AMENDMENT NO.147

FACILITY OPERATING LICENSE NO. DPR-50

DOCKET NO. 50-289

Replace the following pages of the Facility Operating License and the Appendix A Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change.

Remove	Insert
iii	iii
vi	vi
--	3-128
--	3-129
4-7a	4-7a

TABLE OF CONTENTS

Section		Page
3.16	SHOCK SUPPRESSORS (SNUBBERS)	3-63
3.17	REACTOR BUILDING AIR TEMPERATURE	3-80
3.18	FIRE PROTECTION (DELETED)	3-86
3.19	CONTAINMENT SYSTEMS	3-95
3.20	DELETED	3-95a
3.21	RADIOACTIVE EFFLUENT INSTRUMENTATION	3-96
3.21.1	RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION	3-96
3.21.2	RADIOACTIVE GASEOUS PROCESS AND EFFLUENT MONITORING INSTRUMENTATION	3-100
3.22	RADIOACTIVE EFFLUENTS	3-106
3.22.1	LIQUID EFFLUENTS	3-106
3.22.2	GASEOUS EFFLUENTS	3-111
3.22.3	SOLID RADIOACTIVE WASTE	3-118
3.22.4	TOTAL DOSE	3-119
3.23	RADIOLOGICAL ENVIRONMENTAL MONITORING	3-120
3.23.1	MONITORING PROGRAM	3-120
3.23.2	LAND USE CENSUS	3-125
3.23.3	INTERLABORATORY COMPARISON PROGRAM	3-127
3.24	REACTOR COOLANT INVENTORY TRENDING SYSTEM	3-128
4	SURVEILLANCE STANDARDS	4-1
4.1	OPERATIONAL SAFETY REVIEW	4-1
4.2	REACTOR COOLANT SYSTEM INSERVICE INSPECTION	4-11
4.3	TESTING FOLLOWING OPENING OF SYSTEM	4-28
4.4	REACTOR BUILDING	4-29
4.4.1	CONTAINMENT LEAKAGE TESTS	4-29
4.4.2	STRUCTURAL INTEGRITY	4-35
4.4.3	DELETED	4-37
4.5	EMERGENCY LOADING SEQUENCE AND POWER TRANSFER, EMERGENCY CORE COOLING SYSTEM AND REACTOR BUILDING COOLING SYSTEM PERIODIC TESTING	4-39
4.5.1	EMERGENCY LOADING SEQUENCE	4-39
4.5.2	EMERGENCY CORE COOLING SYSTEM	4-41
4.5.3	REACTOR BUILDING COOLING AND ISOLATION SYSTEM	4-43
4.5.4	DECAY HEAT REMOVAL SYSTEM LEAKAGE	4-45
4.6	EMERGENCY POWER SYSTEM PERIODIC TESTS	4-46
4.7	REACTOR CONTROL ROD SYSTEM TESTS	4-48
4.7.1	CONTROL ROD DRIVE SYSTEM FUNCTIONAL TESTS	4-48
4.7.2	CONTROL ROD PROGRAM VERIFICATION	4-50

LIST OF TABLES

TABLE	TITLE	PAGE
1.2	Frequency Notation	1-8
2.3-1	Reactor Protection System Trip Setting Limits	2-9
3.1.6.1	Pressure Isolation Check Valves Between the Primary Coolant System and LPIS	3-15a
3.5-1	Instruments Operating Conditions	3-29
3.5-1A	Quadrant Tilt Limits	3-34a
3.5-2	Accident Monitoring Instruments	3-40c
3.5-3	Post Accident Monitoring Instrumentation	3-40d
3.21-1	Radioactive Liquid Effluent Monitoring Instrumentation	3-97
3.21-2	Radioactive Gaseous Process and Effluent Monitoring Instrumentation	3-101
3.23-1	Radiological Environmental Monitoring Program	3-122
3.23-2	Reporting Levels for Radioactivity Concentration in Environmental Samples	3-126
4.1-1	Instrument Surveillances Requirements	4-3
4.1-2	Minimum Equipment Test Frequency	4-8
4.1-3	Minimum Sampling Frequency	4-9
4.1-4	Post Accident Monitoring Instrumentation	4-10a
4.19-1	Minimum Number of Steam Generators to be Inspected During Inservice Inspection	4-84
4.19-2	Steam Generator Tube Inspection	4-85
4.21-1	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements	4-88
4.21-2	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements	4-91
4.22-1	Radioactive Liquid Waste Sampling & Analysis Program	4-96
4.22-2	Radioactive Gaseous Waste Sampling & Analysis Program	4-102
4.23-1	Maximum Values for the Lower Limits of Detection (LLD)	4-118

Amendment No. ~~55~~, ~~72~~, ~~100~~, ~~106~~, ~~116~~, ~~137~~, ~~142~~, 147

JUL 1 8 1988

3.24 Reactor Coolant Inventory Trending System (RCITS)

Applicability

Applies to the operability requirements for the Reactor Coolant Inventory Trending System (RCITS) when the reactor is critical.

Objectives

To assure operability of RCITS instrumentation which may be useful in diagnosing situations which could represent or lead to inadequate core cooling.

Specification (See NOTE below)

3.24.1 Reactor Coolant Inventory Trending System (RCITS)

(a) One channel of the two channels shall be OPERABLE. A channel is composed of a hot leg level and a RV head level. With no channels OPERABLE, operation may continue and immediately initiate corrective action to return at least one channel to OPERABLE status as soon as possible. If at least one channel is not restored within 30 days, details shall be provided in the Monthly Operating Report. These details shall include cause, action being taken and projected date for return to OPERABLE status.

(b) One void fraction channel in each Reactor Coolant loop shall be OPERABLE. With no channels OPERABLE, operation may continue and immediately initiate corrective action to return at least one channel to OPERABLE status as soon as possible. If at least one channel is not restored within 30 days, details shall be provided in the Monthly Operating Report. These details shall include cause, action being taken and projected date for return to OPERABLE status.

Bases

The RCS Inventory Trending System (RCITS) provides indication of the trend in water inventory in the hot legs and reactor vessel during the approach to inadequate core cooling (ICC). In this manner RCITS provides additional information to the operator to diagnose the approach of ICC and to assess the adequacy of responses taken to restore core cooling.

NOTE: This specification is approved only to the end of Cycle 8 of operation. At that time, an amendment must be proposed by GPUN that is consistent with the Standard Technical Specifications(STS) resulting from the NRC-initiated Technical Specification Improvement Program.

The RCITS is required to be operable (as defined previously) when the plant is critical.

The RCITS is an information system to aid the operator during the approach to inadequate core cooling. There is no regulatory limit for this system.

Inoperability of the RCITS removes the availability of an information system. Other useful instrumentation for inadequate core cooling will be available.

The RCITS is not a required system to mitigate evaluated accidents. It may be useful to have the RCITS operable but will not cause an adverse impact if it is not operable.

The LCO action statement provides the level of emphasis required for an information system. This allows the plant to continue to operate and not to force an unneeded shutdown.

Reference

FSAR Update Section 7.3.2.2.c.10

Table 4.1-1 (Continued)

CHANNEL DESCRIPTION	CHECK	TEST	CALIBRATE	REMARKS
49. Saturation Margin Monitor	S(1)	M(1)	R	(1) When T_{ave} is greater than 525°F.
50. Emergency Feedwater Flow Instrumentation	NA	M(1)	R	(1) When T_{ave} is greater than 250°F.
51. Heat Sink Protection System				
a. EFW Auto Initiation Instrument Channels				(1) Includes logic test only.
1. Loss of Both Feedwater Pumps	NA	Q(1)	R	
2. Loss of All RC Pumps	NA	Q(1)	R	
3. Reactor Building Pressure	NA	Q	R	
4. OTSG Low Level	W	Q	R	
b. MFW Isolation OTSG Low Pressure	NA	Q	R	
c. EFW Control Valve Control System				
1. OTSG Level Loops	W	Q	R	
2. Controllers	W	NA	R	
d. HSPS Train Actuation Logic	NA	Q(1)	R	
52. Backup Incore Thermocouple Display	M(1)	NA	R	(1) When T_{ave} is greater than 250°F.
53. Chlorine Detection System Instrumentation	W	M	R(1)	(1) Calibration is a one concentration point check (need not be traceable to NBS standards)
54. RCS Inventory Trending System				
a. Level	NA	NA	R	
b. Void Fraction	W	NA	R	

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

Enclosure 2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 147 TO FACILITY OPERATING LICENSE NO. DPR-50

METROPOLITAN EDISON COMPANY
JERSEY CENTRAL POWER & LIGHT COMPANY
PENNSYLVANIA ELECTRIC COMPANY
GPU NUCLEAR CORPORATION

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-289

INTRODUCTION

By letter dated December 10, 1986, GPU Nuclear Corporation (the licensee) requested changes to the Three Mile Island Unit 1 (TMI-1) Technical Specifications. The proposed change would incorporate operability and surveillance requirements for the Reactor Coolant Inventory Trending System (RCITS). This system was installed in response to a December 10, 1982 Order for Modification of License from the NRC, which required installation of instrumentation for detecting inadequate core cooling (ICC) in accordance with NUREG-0737, Item II.F.2. The RCITS is the last segment of ICC instrumentation to be installed at TMI-1 and to be added to the Technical Specifications.

The RCITS is neither given credit nor is required in the evaluation accidents in the TMI-1 Final Safety Analysis Report and is not relied upon for reactor trip or initiation of any plant safety systems. It is intended solely to enhance the operator's ability to understand and manage transients and events by providing additional corroborative information.

EVALUATION

The RCITS consists of two subsystems, one to indicate increasing coolant void fraction when one or more reactor coolant pumps are in operation and another to indicate coolant level in the hot leg piping and reactor vessel head area when no reactor coolant pumps are operating. Both subsystems are intended to provide the plant operators with an indication of approaching core uncovery due to loss of coolant inventory (i.e., formation of steam bubbles in the hot leg).

8812190077 881213
PDR ADOCK 05000289
P PDC

During the staff's review and evaluation of this license amendment request, consideration was given to action that should be required in the event of instrument inoperability. One extreme would be to require plant shutdown if less than a minimum number of channels were inoperable. This requirement has been implemented in the Technical Specifications for a number of plants. The NRC intends that all channels of RCITS be available to the operators in case of an accident involving possible inadequate core cooling to the extent achievable, ideally without inducing major transients (i.e., shutdown and cooldown) on the plant. It is for this reason that the NRC has required incorporation of RCITS into the Technical Specifications. In amending the Technical Specifications for other nuclear power plants (e.g., Turkey Point Units 3 and 4), the staff has taken the position that the facility may continue to operate if both channels of RCITS are lost if an alternate method of monitoring the reactor vessel inventory is initiated and a formal report is provided to the NRC indicating the cause of failure, action being taken and projected date for returning RCITS to operable status. Similar provisions have also been approved in the Technical Specifications for Palo Verde Units 1, 2 and 3.

The Technical Specifications proposed for the TMI-1 RCITS by GPU Nuclear contain provisions for informing the NRC when neither channel is operable and for initiating immediate corrective action to return at least one channel to operable status as soon as possible. The Technical Specifications also provide for periodic (weekly) channel check of the void fraction portion of the system and periodic calibration of the entire system. Although GPU Nuclear did not specifically propose language in the Technical Specifications regarding alternate methods of monitoring reactor vessel inventory in the event of RCITS failure, the staff expects this information to be in the report submitted informing us of the failure. The report would also be expected to contain details regarding plans to fully restore RCITS to operation during the refueling shutdown subsequent to the failure if repairs were not feasible without shutting down.

Because discussion between the staff and the B&W owners group on the issue of actions following complete RCITS inoperability continues on an ongoing basis and to give the licensee confidence in the reliability of this system, the staff is approving the Technical Specification as proposed by GPUN for TMI-1 only to the end of fuel Cycle 8 at which time a Technical Specification consistent with the generic staff position at that time must be proposed.

During the staff's review it was noted that none of GPU Nuclear's submittals on RCITS define what constitutes a channel even though it is described as a two-channel system. For the purpose of compliance with the Technical Specifications, the staff hereby defines one channel as the hot leg differential pressure (dp) detector, the reactor vessel head dp detector and the two pump power monitors associated with a given loop. Further, for a channel to be considered operable, the two dp detectors and at least one of the pump power monitors must be operable. However, other combinations may be considered on a case basis with agreement by the NRC staff.

We conclude that the proposed Technical Specifications provide reasonable assurance that the RCITS information will be available to the operator to enhance the operator's ability to understand and manage transients and events when needed.

ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational exposure. The staff has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

CONCLUSION

We have concluded, based of the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: December 13, 1988

Principal Contributor: Ronald W. Hernan

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

Enclosure 3

FINAL

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO INSTRUMENTATION TO DETECT INADEQUATE CORE COOLING

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

METROPOLITAN EDISON COMPANY
JERSEY CENTRAL POWER & LIGHT COMPANY
PENNSYLVANIA ELECTRIC COMPANY
GPU NUCLEAR CORPORATION

DOCKET NO. 50-289

1.0 INTRODUCTION

In response to the USNRC Order for Modification of License, "Inadequate Core Cooling Instrumentation Systems," dated December 10, 1982, General Public Utility Nuclear Corporation (GPUNC) has proposed for the Three Mile Island Nuclear Station, Unit 1 (TMI-1) a system for detecting and monitoring inadequate core cooling (ICC) conditions including: 1) subcooling margin monitoring (SMM); 2) core exit thermocouples (CET); and 3) a reactor coolant inventory tracking system (RCITS) consisting of a wide range hot leg level monitoring system and a reactor vessel head level monitor to monitor reactor coolant level under natural circulation conditions and a reactor coolant pump motor current monitor to trend void content of the primary coolant system with the pumps operating. This staff review incorporates significant technical input prepared by the staff's consultants at Oak Ridge National Laboratory (ORNL) under Technical Assistance Contract FIN B-0779.

8812190081 881213
PDR ADOCK 05000289
P PDC

2.0 EVALUATION

2.1 Subcooling Margin Monitor (SMM)

Two redundant channels of subcooling margin monitoring are provided. The pressure measurements are obtained from two seismically and environmentally qualified sensors. The two measurements of reactor coolant temperature are control grade, but seismically qualified and physically and electrically separated. The pressure and temperature signals are isolated at the signal inputs with suitable devices. The output signals to annunciators and the plant computer are also isolated. The redundant channels are powered from separate Class IE power sources. Continuous digital display of the margin between actual RCS temperature and saturation temperature for the existing RCS pressure is provided in the control room on the back panel (PCL). Trending and additional Delta Tsat is -100F to +400F which is adequate for both normal and accident conditions. The equipment is accessible and on-line testing and maintenance can be performed without affecting other reactor systems.

2.2 Core Exit Thermocouples (CET)

The core exit thermocouple system consists of 52 thermocouples. Thirty-six of these are identified as the primary system and are connected through a common multiplexer to the plant computers. The backup system is composed of 16 selected CETs, including 4 per core quadrant, which are routed directly to the qualified digital backup displays through selector switches. Signals from the 16 backup CETs are fed back to the primary display system via the single input multiplexer. The primary and backup display channels

are electrically independent, and energized from independent power supplies. The primary channel utilizes the dual plant computers for display, one of which is energized from a battery backed power source and the other from a source backed by an on-site diesel generator. Neither of these is a qualified class 1E source. The single backup display channel is energized from a qualified class 1E source.

The CET system inside containment has been completely qualified environmentally and seismically by a combination of testing, analysis and replacement of non-conforming components such as connectors. Outside of containment, all cabling and hardware associated with the backup system is environmentally and seismically qualified. Electrical isolation devices are provided at all interfaces between the backup system and the non-qualified portions of the primary display system (plant computers), as reported in Reference 14. The functional capabilities of the CET system conform to the requirements of II.F.2.

2.3 Reactor Coolant Inventory Tracking System

The coolant level measurement system consists of differential pressure transmitters measuring the water level from bottom to

the top of each coolant loop hot leg piping and from the bottom of the hot leg piping to the top of the vessel head. The hot leg transmitters are installed from an upper connection at the top of each steam generator hot leg and a lower connection upstream of the decay heat drain line isolation valve. The vessel measurement transmitters (two redundant channels) are installed between an upper connection at the reactor vessel head vent valves and a lower connection on the decay heat drain line. The upper connection for each transmitter is equipped with a condensate pot which provides a water column reference leg for the transmitter. Density compensation for the reference legs is provided by resistance temperature detectors which sense the temperature of the water in each of the hot leg reference legs. The same detectors are used for both the hot leg and the vessel head reference lines as they are routed together in the same environment. Compensation for reactor coolant system density changes is provided by thermocouples mounted in existing incore detector instrument structures sensing core exit temperature. Cold junction reference temperature is provided by resistance temperature detectors. Each of the two thermocouples provides compensation for both a hot leg and a vessel head measurement.

The water level measurement is located within the Reactor Building and the Control Building. System piping and tubing, including the dp transmitters, is totally within the Reactor Building. Piping and tubing are routed from the reactor vessel head area and inside the

D-rings to instruments on racks located outside the secondary shield wall. Electrical cabling transmits signals from the instruments located inside the Reactor Building to the Control Building. The Foxboro Spec. 200 signal processing equipment is located in the Control Building. The processed signals from all channels of level measurements are then passed through a single multiplexer to the plant process computers for display. No qualified or alternate displays of level information are provided.

Calculations were made to estimate the expected measurement error of the level system under both normal and small-LOCA accident conditions. The estimates, summarized below, represent three-sigma values. (From reference 3).

Reactor Vessel Level Instrument Error:

Non-Accident = +/-6.76% or +/-9.46" level

Accident = +/-13.88% or +/- 19.44" level

Hot Leg Level Instrument Error:

Non-Accident =+/-6.16% or +/-40.56" level

Accident = +/-13.88% or +/-83.28" level

A revised discussion of uncertainities associated with the Reactor Coolant Inventory Trending System was provided in Reference 16. The differential pressure coolant level measurement system is useful only when the reactor coolant pumps (RCPs) are not in operation. Void fraction trending during pump operation is provided by pump power signals

are converted to void fractions via an empirical algorithm utilizing RCP power, pump status and RCS cold leg temperature data. The void fraction trending system is not considered a class 1E system, but is classified as "Important to Safety."

The RCITS is said to be designed so that a single active failure, other than the plant computer, will not prevent trend displays of the reactor coolant void fraction or water level for at least one hot leg level measurement, one reactor vessel head level measurement, and one void fraction measurement. The lower connections for all the level transmitters are connected to a single tap on the decay heat drain line. The electrical and mechanical components of the level measurement system are class 1E and environmentally and seismically qualified to the applicable requirements. However, the computer and associated wiring is non-class 1E.

3.0 STAFF POSITION

GPU has contended, both in written submittals and in telephone conference calls, that their system conforms to the requirements of NUREG-0737, II.F.2. The staff concurs that their system meets the absolute minimum requirements since II.F.2 part (8) states that the single-failure criteria need not apply to the channel beyond the isolation device if it is designed to provide 99% availability as set forth in NUREG-0737. However, this system appears to be somewhat less reliable than the types of systems installed at many other plants in the United States.

In reference 1 and 2 GPU contends that the availability of the plant computer, including the single input multiplexer, is better than 99% and that the system meets the letter of the requirements of NUREG-0737. We note from the data presented that neither of the two computers alone provides 99% availability. Only the combined availability of the two computers, which assumes that they are completely redundant with respect to the necessary ICC information, exceeds the minimum requirement of 99% availability. The combined availability figure assumes 100% availability of the input multiplexer which is common to both computers. It is stated that the multiplexer had some relay modules fail during the year but that these failures did not affect the level and CET information. This cannot be construed to imply that the necessary information will continue to be 100% available. The realistic overall availability of the multiplexer must be factored into the determination. Since the multiplexer is common to both computers, it may be the determining factor in overall availability and no data is presented for this vital link.

In response to the staff's concern regarding multiplexer reliability, GPU committed to calibrate the voltage signal input to the multiplexer to the corresponding reactor coolant inventory value and provide the operator with an unambiguous and timely method for determining reactor coolant inventory should the multiplexer fail (Reference 17). This action has been completed and provisions for monitoring level under these condition have been incorporated in plant procedures.

4.0 CONCLUSION

The staff concludes that, although the TMI-1 system for detecting ICC has some design vulnerabilities as noted above, the system meets the intent of the December 10, 1982 Order for Modification and NUREG-0737 Item II.F.2.

5.0 REFERENCES

1. Letter from GPU to USNRC dated February 18, 1987, 5211-87-2037, (RCITS and CET displays).

2. Letter from GPU to USNRC dated January 5, 1987, 5211-86-2184, (RCITS display and CET redundancy).

3. Letter from GPU to USNRC dated December 31, 1985, 5211-85-2206, (Response to questions).

4. Letter from USNRC to GPU dated September 5, 1985, (Evaluation and reouest for additional information).

5. Letter from GPU to USNRC dated June 28, 1985, 5211-85-2121, (CET qualification).

6. Letter from GPU to USNRC dated May 21, 1985, 5211-85-2100. (CET readout).

7. Letter from GPU to USNRC dated February 6, 1985, 5211-85-2020, (Revision to SDD).

8. Letter from USNRC to GPU dated August 23, 1984, (Safety evaluation of CET).

9. Letter from GPU to USNRC dated July 6, 1984, 5211-84-2173, (Final SDD).

10. Letter from GPU to USNRC dated January 31, 1984, 5211-83-379, (Intermediate SDD).

11. Letter from GPU to USNRC dated August 25, 1983, 5211-83-230, (Description of SMM).

12. Letter from USNRC to GPU dated May 10, 1983, (Request for additional information).

13. Letter from GPU to USNRC dated March 10, 1983, 5211-83-071, (ICC evaluation).

14. Letter from GPU to USNRC dated February 2, 1982, 82-007, (CET Display).

15. Letter from GPU to USNRC dated November 13, 1981, L1L 324, (Description of HLLIS).

16. Letter from GPU to USNRC dated March 11, 1987, 5211-87-2052, (Implementation Letter).

17. Letter from GPU to USNRC dated March 19, 1987, 5211-87-2065.