

DMB 016

AUG 23 1984

Docket No. 50-289

Mr. Henry D. Hukill, Vice President  
and Director - TMI-1  
GPU Nuclear Corporation  
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Dear Mr. Hukill:

The staff has completed its review of the seismic capability of the backup incore thermocouple display system (restart certification item 113). The review considered information provided in your letters of December 22, 1983 and May 31, 1984 and obtained during a January 4, 1984 on-site audit and on August 6, 1984 audit at your corporate headquarters. Based upon this review, we conclude there is reasonable assurance that the TMI-1 backup incore thermocouple display system, as augmented by the alternate means of obtaining backup incore thermocouple readings in the control room, would remain functional following an SSE. We therefore consider restart certification item 113 resolved. Our Safety Evaluation is enclosed.

Please note that this review relates only to restart certification item 113 and does not constitute staff review of your compliance with NUREG-0737, Item II.F.2, "Instrumentation for Detection of Inadequate Core Cooling." That review is continuing.

Sincerely,

"ORIGINAL SIGNED BY  
JOHN F. STOLZ"

John F. Stolz, Chief  
Operating Reactors Branch #4  
Division of Licensing

Enclosure:  
Safety Evaluation

cc w/enclosure:  
See next page

ORB#4:DL  
JVan Vliet;cf  
8/23/84

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*RGJ for*  
*ICG review is continuing*  
*Please note this comment on page 4. (incorporated in check)*

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

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

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-289

BACKGROUND

One of the conditions emanating from the Licensing Board decisions in the TMI-1 restart proceeding was that the licensee was to install a backup incore thermocouple display system prior to operation above five percent power. (See ASLB PID dated 12/14/81, paragraphs 867 and 914 and NUREG-0752, Supplement 1 pages 10-12). The staff had, within the context of the TMI-1 restart certification program, previously verified the installation of such a system under restart certification item 113. (See Region 1 inspection reports 81-10, 81-28, 82-14, 82-15, 82-26 and 83-32).

Upon review of the Licensing Board decisions, the Appeal Board, in its decision on design issues (ALAB-729), assumed, based upon a licensee submittal, that the backup incore thermocouple display system was "safety-grade except for environmental qualification." (See ALAB-729, page 176). This decision assumed seismic qualification of the backup incore thermocouple display system and thus required that the staff expand the scope of restart certification item 113 to include seismic qualification. However, by letter dated September 8, 1983, counsel for licensee indicated that, contrary to the Appeal Board assumption, the backup incore thermocouple display system was not currently seismically qualified, but would be upgraded to a fully safety-grade status, including seismic qualification, at the first refueling (Cycle 6 refueling outage).

By subsequent letter dated December 22, 1983, the licensee advised that, based on analysis, it considered the system to be seismically qualified with the exception of the digital indicators, which it considered unqualified. To compensate for the unqualified indicators until such time as it could locate, procure and install qualified indicators, the licensee proposed an alternate method of obtaining backup incore thermocouple readings in the control room. The alternate method consists of a portable measuring instrument (Voltmeter) which together with a conversion table would allow a control room operator to convert thermocouple voltages to temperature.

The purpose of the staff's review has been to determine whether there is reasonable assurance that the existing backup incore thermocouple display system, as augmented by the alternate method of obtaining thermocouple readings, will function following the occurrence of a design basis seismic event. The two aspects of the review have been (1) the seismic resistance of the system from the reactor vessel to the point at which the voltage readings would be taken, and (2) the acceptability of the alternate method of obtaining readings.

In this regard, the staff performed an on-site audit of the TMI-1 backup incore thermocouple display system on January 4, 1984. This audit included: (1) a review of GPUN Document #C1101-625-5320-001, validated on 12-27-83, addressing seismic capability of the cables inside containment; (2) a review of polaroid pictures of cables inside containment; (3) a walk-down and review of the backup incore thermocouple system cabinet at elevation 326 ft. (approx.) in the control building; and (4) a briefing by the licensee regarding the layout and status of qualification of various system components. The staff also reviewed the licensee letter #82-007 dated February 2, 1982 which responded to NUREG-0737, Item II.F.2.

By letter dated April 25, 1984 the staff provided its audit findings to the licensee. The staff findings were that the system, as augmented by the alternate method of obtaining thermocouple readings, would be acceptable provided that six specifically identified issues could be resolved. Licensee subsequently responded to each of the six unresolved issues in its letter of May 31, 1984. The staff's review of the May 31, 1984 letter follows.

## EVALUATION

### Incore Instrument Channel Tubing

The staff's April 25, 1984 letter questioned the seismic resistance of the incore instrument channel tubing because of apparently conflicting statements between the licensee's February 2, 1982 letter and the TMI-1 FSAR. The licensee's May 31, 1984 response subsequently indicated that the subject incore instrument channel tubing was analyzed for a safe shutdown earthquake (SSE) in response to IE Bulletin 79-14. The analyses showed that the maximum stresses due to a postulated SSE, in combination with dead weight and pressure loadings, are well within allowable limits specified in TMI-1 FSAR Section 5-1. The staff finds this response acceptable and concludes that the incore instrument channel tubing is capable of withstanding an SSE.

### Connectors, Cables, and Electrical Penetration Assemblies

During the on-site audit, licensee personnel indicated that certain system wiring inside containment was routed through non-safety grade electrical penetration assemblies (EPAs). Additionally, there was some uncertainty regarding the safety grade status of system connectors and cables. However, the licensee clarified the issue in its May 31, 1984 submittal by referencing documentation indicating that the EPAs, cables and connectors in question are safety-grade and therefore capable of withstanding an SSE.

### Signal Conditioning Cabinet

During the on-site audit, the licensee provided no detailed information regarding the seismic qualification of the signal conditioning cabinet and its internal components. However, in the May 31, 1984 submittal, the licensee subsequently provided reference to and excerpts from a seismic qualification test report concerning the signal conditioning cabinet and also provided an analysis of the seismic response of the as-installed signal conditioning cabinet. The licensee concludes, based on this information, that the signal conditioning cabinet is seismically qualified and should maintain its structural integrity and remain functional during and following an SSE.

The staff reviewed the information provided by the licensee, but could not draw any conclusions regarding seismic qualification. However, during an August 6, 1984 audit at the licensee's corporate headquarters, the staff and a consultant reviewed seismic qualification test reports, quality assurance documentation establishing similarity, cabinet prints, and calculations demonstrating that the installed configuration is bounded by the seismic test configuration (including installed modules). Based upon this review the staff concludes (1) that similarity between the installed and tested cabinets has been established, and (2) the test configuration bounds the installed configuration for seismic response. The staff concludes, therefore, that licensee has adequately demonstrated the seismic qualification of the signal conditioning cabinet.

### Thermocouple Lead Cable Sleeves

In its April 25, 1984 letter, the staff provided comments on the seismic analysis for the thermocouple lead cable sleeves (GPUN document #C-1101-625-5320-001). The comments focused on (1) including a copy of the applicable floor response spectrum (FRS) in the analysis, and (2) performing an analysis of the cable sleeve to seal plate welds. The licensee's May 31, 1984 letter indicated that it had included the FRS in the analysis and also included an additional stress calculation demonstrating that the seal plate welds stresses during an SSE would be well within acceptable limits.

### Availability of Backup Display Channel

The staff's April 25, 1984 letter raised a concern regarding compliance with item (8) of NUREG-0737, Item II.F.2 which indicates that the system should have a 99% availability. The licensee provided a response in its May 31, 1984 letter. However, this issue falls beyond the scope of the instant review, but will be addressed during the staff's review of NUREG-0737 item II.F.2.

### Calibration of Thermocouple Voltage Into Temp

Item (3) of II.F.2, NUREG-0737 requires the capability to read temperatures ranging from 200° to 2300°F. Recent research results indicate that the metals in the thermocouples are subject to an irreversible decalibration if they are subject to accident heat for a prolonged period. Virtual junctions can

form in which a reading is given from a hot spot on the thermocouple cable, and the instruments exhibit nonuniformities at steep temperature gradients. Thus, the licensee's proposal in the December 22, 1983 letter to use a portable measuring instrument (voltmeter) which together with a conversion table would produce the core temperature reading is not likely to be very reliable. At the upper temperature range and in the range of nonuniform behavior it is very important to correlate incore temperature readings between the primary system computer readout and the alternative temperature reading method for the backup system using portable voltmeters. Thus a test should be conducted to assure the acceptability of the alternative reading method. Such a test will allow verification and adjustment of the voltage to temperature conversion table. In the letter of May 21, 1984, the licensee has committed to perform such a test. The staff finds this acceptable.

#### CONCLUSION

Based upon the information provided in the licensee's letters of December 22, 1983 and May 31, 1984 and obtained during the January 4 and August 6, 1984 audits, the staff concludes there is reasonable assurance for reasons set forth herein, that the TMI-1 backup incore thermocouple display, as augmented by the alternate method of obtaining thermocouple readings, would remain viable following an SSE until the upgrading of the backup incore thermocouple display system to a fully safety-grade system at the first refueling outage (Cycle 6 refueling outage). This resolves the outstanding issues of restart certification item 113.

Dated: August 23, 1984