DCR 016

September 28, 1984

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Docket No. 50-289

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

Your letter of August 31, 1984 provided the NRC staff with new analyses reflecting changes in the Saturation Margin Monitor Loop Error Analysis for TMI-1. The staff has reviewed your submittal and determined that more information is required to complete the review. Enclosed are the questions which need to be answered. We feel that a meeting would be helpful in resolving some of the issues which have come up due to this submittal. Please indicate to the Project Manager the earliest date for such a meeting to discuss the additional information requested.

Sincerely,

/S/

John F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

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REQUEST FOR ADDITIONAL INFORMATION ON THE TMI-1 SATURATION MARGIN MONITOR LOOP ERROR ANALYSIS

1. Sheet 2 of the loop error analysis discusses the error allowance for the steam line break and small break LOCA conditions. For the purpose of determining the error allowance, the manufacturer's test results for more severe accident conditions were divided by a factor of three. It is the staff's concern that this may be nonconservative. Manufacturer's tests are typically one-time tests that yield a single curve or data point. In lieu of requiring that several tests be performed with a statistical evaluation of the results, the staff has accepted a single curve or data point provided there is conservatism in the temperature and radiation levels. Accordingly, we request that additional information be provided to support this proposed method of estimating the environmental error allowance.

2. Sheet 2 of the loop error analysis states that the more conservative temperature effects of a harsh environment were considered and the radiation effects were ignored in the calculations. This is shown in the calculations on Sheet 13. We request that the basis for ignoring the radiation induced errors be provided.

3. Sheet 13 of the loop error analysis provides the calculations for alarm loop error under accident conditions. In considering the loop error associated with the harsh environment, the accuracy, stability and temperature effect allowances were subtracted and a

new term representing the error associated with the harsh environment's temperature was statistically added to the alarm loop error. It is the staff's concern that this may be a nonconservative method. Statistical methods of summing errors may not be appropriate when the errors are induced by harsh environmental conditions. These errors are not random in nature as, for example, are stability errors. They represent a bias (systematic error) that should be treated algebraically in the error equations. Further, the errors induced by the harsh environment are typically considered in addition to those random errors associated with accuracy, stability, temperature effects and calibration. Accordingly, we request that you provide the basis for statistically summing the accident induced errors and subtracting the random errors.

4. Table 3 on Sheet 5 of the loop error analysis provides the total alarm loop uncertainty. The discussion preceeding Table 5 states that the total positive (nonconservative) error is the positive random error alone. We request that you provide the basis for neglecting the systematic error associated with the characterizer curve, and provide the equations for calculating the values shown on the Table.

5. The loop error analysis has not included an error allowance associated with the RTD's process measurement accuracy (i.e., the difference between the temperature of the fluid at the point of measurement as compared with the mixed mean fluid temperature). For similar temperature measurement instrument loops, this error has been calculated to be 1.0 percent span at full loop flow conditions. This error would be nonconservative in the calculated saturation margin if the measured temperature is lower than the average temperature. We request that you provide the basis for neglecting this factor in the loop error methodology.

6. Notes 1 and 2 on Sheet 6 of the loop error analysis provide qualitative bases for the use of statistically less conservative error allowances for temperature effects and power supply effects. We request that you provide test results or analyses to confirm the linear relationship between error and power supply/temperature variation.

7. Note 5 on Sheet 7 of the loop error analysis states that the pressure transmitter error values are not applicable for calibration error calculations. As shown on Sheets 21, 22 and 23, the allowable calibration error is calculated by subtracting the error associated with pressure transmitter from the total loop error for the non-accident condition. It is the staff's concern that this may not be

an appropriate method for considering calibration error. Typically, calibration error is considered in addition to the error specified by the manufacturer for accuracy, stability and temperature effects. Calibration error may be from a number of sources including the inaccuracy of the calibration equipment and the ability of the technician to precisely read the calibration equipment or set an instrument, or procedural guidelines on how precisely to set an instrument. Where digital calibration equipment or precision type gauges are utilized, neglecting the human factor in reading calibration instruments may be appropriate.

Calibration errors act in combination with component drift (stability error) and tend to work together as a single error component in their effects on the input/output relationship of a transmitter. When summing these errors statistically they should be added into one unit, and total error may then be used in a statistical summation. If, for example, the square root of the sum of the squares method is used, the following would be an appropriate method to consider the variables associated with calibration and stability: [(transmitter stability error + human factor calibration considerations + calibration equipment inaccuracy + error band allowed by procedure)^2 + (transmitter accuracy)^2 + (transmitter temperature effects)^2 + $(x)^2$

+ $(y)^2 + (z)^2]^{1/2}$. In this equation x, y, and z represent the independent error contributions to the total loop error associated with other components in the loop. Accordingly, we recommend that the instrument loop error be recalculated utilizing the methods described above or other appropriate methods to treat the errors associated with calibration accuracy.

8. Sheet 21 of the loop error analysis states that calibration error associated with the RTD was considered negligible and, therefore, excluded from consideration. We request that you provide the quantitative basis for excluding the calibration error associated with the RTD, the alarm module (setpoint) and the indicator.

9. Sheet 10 of the loop error analysis states that the errors for modules 9 and 10 must be multiplied by the slope of the saturation temperature/pressure curve (dT/dP). Over the pressure range of interest, the multiplication factor is less than one, reducing the error associated with modules 9 and 10 by a factor of 14 at the upper range. As discussed in Enclosure 1 to the letter dated August 31, 1984, from H.D. Hukill (GPU) to J.F. Stolz (NRC), this multiplication factor is necessary to correct for the amplifier gain in the function generator. From a review of the information provided, it is not clear why the uncorrected error values for modules 9 and 10 are nonconservative, and how you determined that dT/dP was the appropriate correction

factor. Accordingly, we request that you provide additional information to support the use of the dT/dP correction factor in computing error.

10. Sheet 10 of the loop error analysis includes a discussion on the methods used to normalize the range of each loop component to the range of the final elements in the loop. For example, the range of modules 9 and 10, 2500 psi (corrected for gain errors), was divided by 500°F to provide a 5.0 psi/°F correction factor. It is the staff's concern that this method may not be appropriate. Typically, normalization is achieved by summing the signal errors (mA or mV) rather than creating an psi/°F unit in an equation that sums error in percent span. Accordingly, we request that you supply additional information to support the use of this method.

11. The error in the subcooling margin monitor loop increases with decreasing reactor system pressure. Based on operating procedures and LOCA analyses, we request that you identify the lowest reactor system pressure that the high pressure injection flow would be throttled.