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August 26, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Safety Parameter Display System
Response to Request for Additional Information
NRC Dockets Nos. 50-237, 50-249, 50-254 and 50-265

References (a): D. M. Crutchfield letter to D. L. Farrar dated June 22, 1984.

(b): B. Rybak letter to H. R. Denton dated October 17, 1984.

Dear Mr. Denton:

Reference (a) requested additional information on the SPDS design; our response was provided in Reference (b). Upon review of our submittal, members of your Staff verbally requested additional clarifications on the maximum credible faults for which the SPDS isolators are qualified.

Our response is enclosed as an Attachment to this letter. If you have any further questions regarding this matter, please contact this office.

One signed original and forty (40) copies of this transmittal is provided for your use.

Very truly yours

J. R. Wojnarowski
Nuclear Licensing Administrator

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Attachment

cc: R. Gilbert - NRR
R. Bevan - NRR
Quad Cities Resident Inspector
Dresden Resident Inspector

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SAFETY PARAMETER DISPLAY SYSTEM RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION EFFECTS OF MAXIMUM CREDIBLE FAULTS ON SIGNAL ISOLATORS USED

NRC Request for Information (Item 2b)

Data to verify that the maximum credible faults applied during the test were the maximum voltage/current to which the device could be exposed, and define how the maximum voltage/current was determined.

Response (Item 2b)

The maximum credible voltage/current that could be applied to the output of an isolation device was determined by the maximum voltage that could be imposed on the output and power supply cables anywhere in their routings between the isolation device and the computer, or between the power source and the isolator card cage. As the output cables are all routed in seperate conduits or designated instrument raceways, cables adjacent to them would all be for instrumentation and generally less than 5 Vdc with a maximum expected voltage of approximately 50 volts.

In addition to the isolator outputs, the 120 Vac power supply was also considered in the fault analysis. Each Acromag card cage contains one 120 Vac power supply module. It supplies 15 Vdc and/or 24 Vdc to each card with overvoltage and overcurrent protection. The power supply module is seperately fused to make certain damage does not occur to any of the modules it powers. For additional protection the card cage is also fused. In the light of the above, and multiple voltage regulators that are incorporated in the power supply design, there is no single credible failure that could result in greater than 50 volts being imposed at the power supply terminals.

The cables used for the inputs and outputs of the signal isolators are shielded instrument cables, grounded at one end. In view of the extensive plant grounding system and the use of this type of cable, the adverse effects of a main generator phase to ground fault are considered to be negligible. Therefore, the highest voltage that could be applied to the input or output of the signal isolators during any credible fault would be 50 volts.

Each isolation device is designed and generically tested to maintain electrical isolation between the input, output and power circuits for DC common mode voltages up to 100 volts continuously, or 1000 Vac for 1 minute.

Per discussions with Acromag Engineering personnel the worst case scenario would be to impose a reverse polarity voltage across the output terminals. A reverse polarity of just several volts would destroy the output filter capacitor(s). However, although the circuitry itself would fail, the isolation function of the circuitry would remain intact. Ensuing discussions with Acromag revealed that they have never tested for the effects of a reverse polarity voltage across the output terminals. However,

it is expected that voltages higher than 50 V would be required in order to physically damage the electrical components such that the isolation function of the component would be degraded.

NRC Request For Information (Item 2c)

Data to verify that the maximum credible fault was applied to the output of the device in the transverse mode (between signal and return) and other faults were considered (i.e., open and short circuits).

RESPONSE

The technique of DC isolation used with the Acromag 700 series isolation devices is to convert the DC input signal to AC and feed it to an isolation transformer. Acromag Engineering has evaluated every type of credible failure that could occur on the output side of the module including short circuit or open circuit loads, and has determined that the input will not be adversely affected. The generic 1000 Vac hi-pot test is applied, at a minimum, between the input and output of each CSA device. In all cases, the input is completely isolated from the output and power supply.

As noted previously, the maximum credible fault (50 V) has never been applied to the output terminals in the normal or transverse mode. The devices have been generally tested for common mode voltages only.

All signal isolators used on safety-related SPDS inputs are in a current loop as the current flows through the resistor.

NRC Request for Information (Item 2d)

Define the pass/fail acceptance criteria for each type of device.

Response (Item 2d)

The design basis acceptance criteria for each device is to maintain input/output electrical isolation at all times, regardless of the operability of the isolation device's signal conditioning circuitry.

The generic 1000 Vac hi-pot test is performed to ensure the isulation breakdwon strength is adequate. The pass/fail acceptance criteria for each hi-pot test requires that a 1000 Vac be imposed between the input and output terminals for one minute. The insulation breakdown strength is considered inadequate and the device is failed if more than 1 mA of current flows during the test.