

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

January 27, 1989

NRC INFORMATION NOTICE NO. 89-10: UNDETECTED INSTALLATION ERRORS IN MAIN
STEAM LINE PIPE TUNNEL DIFFERENTIAL
TEMPERATURE-SENSING ELEMENTS AT
BOILING WATER REACTORS

Addressees:

All holders of operating licenses or construction permits for boiling water reactors (BWRs).

Purpose:

This information notice is being provided to alert addressees to potential problems from undetected installation errors in main steam line (MSL) pipe tunnel differential temperature-sensing elements at BWRs. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On July 27, 1988, Pennsylvania Power and Light Company (PP&L) declared all of the differential temperature (DT) instruments in both Units 1 and 2, used for the detection of leaks in the MSL pipe tunnel at the Susquehanna Steam Electric Station (SSES) inoperable. In both units the inlet and outlet temperature detector (thermocouple) locations were found reversed such that the follower DT instrumentation modules would sense a zero or negative DT in the event of a steam line leak. In Unit 2, the temperature detectors were found not only reversed, but installed in the wrong location. The Unit 2 detectors were found in the vicinity of the air cooler units, a location that would have substantially reduced (non-conservatively) the available signal to the follower DT modules. As a result of these deficiencies, none of the DT protective instrumentation would have detected a steam line leak, and thus they would have been unable to perform their design function.

On June 24, 1987, Niagara Mohawk Power Corporation declared two of four channels of the main steam tunnel DT instrumentation at Nine Mile Point (NMP) Unit 2 inoperable. The temperature-sensing elements (thermocouples) were improperly located such that the cold leg thermocouples, which are supposed to monitor steam tunnel ventilation inlet air temperature were actually sensing steam tunnel ambient air temperature. Operations personnel detected this problem

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while the reactor was at less than 2 percent power. They observed significant differences in the DT indications for the four channels. Two channels with properly located thermocouples indicated approximately 15°F DT and the other two channels with improperly located thermocouples indicated approximately 0 DT.

Discussion:

In both the SSES and NMP-2 plants, the steam tunnel is equipped with temperature detectors that are used to initiate steam line isolation upon detection of a steam leak, based on either a rise in steam tunnel ambient air temperature or an increase in the temperature differential between the tunnel ventilation inlet and outlet. These steam tunnel differential temperature and ambient temperature instruments provide redundant methods for detecting leaks and isolating the MSLs. The installation errors described above reduced the designed redundancy of the MSL leak detection system.

PP&L attributes the root cause of DT thermocouple location errors in both units to vague initial system descriptions and design-basis documents that did not clearly establish locations for the DT thermocouples. As a consequence, the installation documents for both units inappropriately specified the connection of the thermocouples to the DT instruments in such a manner that the inlet and outlet device locations were interchanged. This reversal caused the follower DT instruments to always read zero and downscale when in fact they should have read above zero and upscale for both normal power operation and in the event of a leak. The SSES-2 problem was further compounded by the fact that the thermocouples for sensing inlet air temperature were not located in the air inlet but rather in the fan cooler room for the steam tunnel cooling system. As a consequence, even if the thermocouples were connected properly, the increase in DT in the event of a steam leak would have been substantially less than the instrumentation trip set value. The scope of the PP&L start-up and surveillance tests was too narrow to identify the location errors. Although these tests verified that the instrumentation would respond to temperature and DT, neither test verified that the inputs were of the proper magnitude for a given steam leak or detected that they were reversed. During these tests and during years of routine surveillance, neither the technicians nor the operators recognized the zero or negative DT reading as being abnormal.

Niagara Mohawk attributes the root cause of the DT thermocouple location errors for two channels to a design deficiency. The two mislocated thermocouples were installed away from the inlet air stream, and therefore they sensed steam tunnel ambient air temperature instead of ventilation inlet air temperature. This reading provided a non-conservative input into the steam tunnel differential temperature isolation logic.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi
Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: Carl H. Woodard, RI
(215) 337-5261

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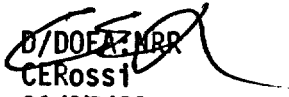
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