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SUBJECT: Interim Part 21 rept re possible surge line flooding when large pressurizer vent used to support reduced inventory operations,per Generic Ltr 88-17.Westinghouse performing analysis.Evaluation to be completed by 920717.

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May 11, 1992

U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Interim 10 CFR Part 21 Report Regarding Surge Line Flooding

References: 1) Letter from G. Goldberg (Westinghouse) to M.L. Marchi (WPSC) received 3-12-92.

2) NRC Generic Letter 88-17, "Loss of Decay Heat Removal," October 17, 1988.

Wisconsin Public Service Corporation (WPSC) received notification of a possible 10 CFR Part 21 (part 21) defect from Westinghouse Electric Corporation on March 12, 1992. The subject of the Westinghouse letter is a phenomena termed surge line flooding which may occur when a large pressurizer vent is used to support reduced inventory operations. An excerpt from reference 1 providing a complete description of the surge line flooding issue and the concerns associated with it is included as an attachment to this letter. The complexity of this issue has not made it possible for WPSC to determine if surge line flooding represents a substantial safety hazard for the Kewaunee Nuclear Power Plant (KNPP). Therefore, this letter is serving as the 60 day interim reporting requirement of part 21.

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Currently, Westinghouse is performing an analysis for WPSC to determine the impact, if any, on the analyses that they performed for WPSC in response to Generic Letter 88-17 (reference 2). Westinghouse has estimated that this analysis will be completed in 4 to 6 weeks. WPSC has reviewed applicable operating procedures and identified those that will need to be changed if the Westinghouse analysis determines that surge line flooding is a safety hazard at the KNPP. WPSC will complete the evaluation as to whether surge line flooding represents a substantial safety hazard by July 17, 1992, and will then complete the reporting requirements of part 21. If there are any questions, please contact a member of my staff.

Sincerely,

C. A. Schrock

C. A. Schrock
Manager - Nuclear Engineering

PMF/jms

Attach.

cc - US NRC - Region III
Mr. Patrick Castleman, US NRC

LIC\NRC\N30.WP

ATTACHMENT

To

Letter from C. A. Schrock (WPSC)

To

Document Control Desk (NRC)

Dated

May 11, 1992

The following information is taken from reference 1 in order to provide the staff with a summary of the surge line flooding issue.

Issue Description

It is sometimes necessary or desirable during an outage to create large openings in the RCS to allow for various maintenance or inspection activities. Frequently, a large hot side vent is provided by removal of the pressurizer manway or by removal of the pressurizer safety valves. A large hot leg side vent would be provided, for example, to limit the pressure on the steam generator nozzle dams, to prevent a rapid loss of RCS inventory through potential cold side openings, and/or to allow some capability to gravity feed from the RWST. Per Generic Letter 88-17, these would all be valid reasons for using a large hot leg side vent.

If the pressurizer has a large vent, then steam generated in the RCS during a loss of RHR cooling event would be relieved through the pressurizer surge line and out the opening(s) near the top of the pressurizer. If the decay heat is high, it is possible that the steam velocity through the surge line would be high enough to cause water to be held up in the pressurizer. This water held up in the pressurizer could have been initially forced into the pressurizer because of swelling following the onset of boiling, or entrainment with the boil-off steam, or the RCS may have been initially filled to some level in the pressurizer. This process of surge line flooding and water hold-up in the pressurizer could continue even if the core is being uncovered.

In a report prepared for the NRC, EG&G calculated that surge line flooding in a typical 4-loop Westinghouse plant (14 inch diameter surge line) would occur at atmospheric pressure if more than 3 MWt went into generating steam traveling through the surge line (reference 2). With less than 3 MW, surge line flooding was calculated not to occur. Higher pressures would permit a higher decay heat. Uncertainty exists in the calculation, as it depends upon the correlation used. (EG&G used the Kutateladze correlation.) Considering the beneficial effect of even small pressure increases above atmospheric, and other heat losses in the RCS, Westinghouse suggests that surge line flooding should be considered as a possibility at all times prior to core refueling. (Note that after refueling and 30 days after shutdown, decay heat for a typical 4-loop plant should not exceed 4 MW.)

Safety Significance

The phenomenon of surge line flooding introduces the following three concerns:

1. Calculations previously performed to determine the limiting times to core uncovery would be non-conservative (too long) if these calculations have taken credit for the water held up in the pressurizer.

2. With the water hold-up and/or high steam flow, some RCS level indication systems would read erroneously high.

3. With water hold-up in the pressurizer and high steam flow in the surge line, the RCS pressure in the loops could be high enough to prevent gravity feed from the RWST, depending on the elevation of the RWST.

For the first concern, without water hold-up in the pressurizer, one might expect that a large hot side vent path located near the top of the pressurizer would allow a longer time to core uncovery than that expected if the vent path is located near the top of the hot leg (e.g., an open hot side steam generator manway). For the pressurizer vent case, it might be assumed that any initial water in the pressurizer would not be lost, nor would water be lost from the RCS piping due to spilling (due to swelling and entrainment) after the reactor coolant starts to boil. However, if surge line flooding occurs, the time to core uncovery for the pressurizer vent case would be reduced due to water hold-up and the resulting time to core uncovery would become more comparable to the time to core uncovery for the open hot side steam generator manway case. Note that if boiling occurs, a larger initial water inventory in the RCS (above mid-loop) may not significantly lengthen the time to core uncovery -- more water may be simply transferred to the pressurizer and either spilled or held up there.

For the second concern noted, water in the pressurizer or even significant flow up the surge line will cause an erroneously high reading on some reactor vessel level instrumentation systems, particularly those having an upper tap in the pressurizer. Thus, an operator could be misled into believed he had a full reactor vessel, as well as water in the pressurizer, even though water level in the reactor vessel could be below the bottom of the nozzles. With this false indication, the operator may not add water when he should.

Regarding the third concern, a vent at the top of the pressurizer may not support gravity feed from the RWST as an alternate for sustained decay heat removal once the RCS starts to boil. Gravity feed from the RWST is sometimes considered as a passive alternate to the RHR System for decay heat removal since it is independent of ac power. As noted above, high steam flow in the surge line and/or substantial water hold-up in the pressurizer will increase the RCS pressure in the loops, thereby reducing the capability to gravity feed from the RWST. Therefore, gravity feed from the RWST could be limited to a "one-shot" addition of coolant, dependent upon the initial RCS inventory and the RWST level. (Note that in some plants, the water level in the RWST is below the vent at the top of the pressurizer. This would make it impossible to drain water from the RWST into the RCS if the pressurizer is nearly full. On other plants, the RWST is high enough that gravity feed could be effective for long-term heat removal even with high decay heat and after RCS boiling.)

References:

1. Letter from G. Goldberg (Westinghouse) to M. L. Marchi (WPSC) received March 12, 1992.

2. Fletcher, C.D., at el, Thermal-Hydraulic Processes Involved in Loss of Residual Heat Removal During Reduced Inventory Operation, EGG-EAST-9337, Rev., 1, February 1991.