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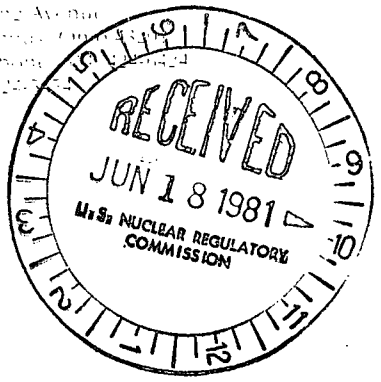
CT-1336

Battelle
Columbus Laboratories



April 30, 1981

Mr. E. Igne
Staff Engineer
U.S. Nuclear Regulatory Commission
Advisory Committee on Reactor Safeguards
Washington, D.C. 20555

Dear El:

Subject: SER on Indian Point 2, Pressure Vessel Flooding, Your Memo to Kerr and Shewmon Dated 4/13/81

The EG&G report, "Stress Analysis of Indian Point 2 Reactor Vessel for River Quench Condition", indicates a usage factor of:

6.75×10^{-5} for the vessel other than at the penetration tubes
6.7×10^{-3} at the penetration tubes.

These usage factors are for a single stress cycle caused by a gradual rise of the cold water outside the vessel to a height of 9 feet above the bottom of the hemispherical head, followed by a slow cooling of the vessel to ambient temperature.

My rough check indicates that the usage factor for the vessel is significantly less than 0.01. For the penetration tubes, my rough check indicates a usage factor of about 0.05 as compared to EG&G 0.0067. I concur with the EG&G conclusion that the single cycle of cooling water quenching would cause negligible fatigue damage.

In the unusual condition of this hot vessel sitting in cold water, the exact conditions at the water line could be significant. Conceivably, there could be some turbulent mixing of hot and cold water, producing many thousands of thermal cycles on the outside surface of the vessel. I am gratified to note that the licensee performed a magnetic particle/liquid penetrant inspection, finding no relevant indications and that this was repeated by an outside inspection firm contracted by NRC, again with no relevant indications.

The aspect that would concern me most is the possibility of chloride contamination of the stainless steel tube penetrations. The description of the evaluation of this concern reads as follows:

ACRS

Incore Instrument Stub-Tube-to-Reactor
Vessel Weld Failure Consequences

Even though water containing chlorides contacted the bottom head of the vessel, this water could not penetrate the clearance between the stub-tubes and the shell because the metal temperature, especially near the welds, was much above the boiling temperature of the water and prevented the deposition of chloride at the weld location. Thus, contaminants in the water are not a cause for concern regarding corrosion and/or crack initiation in the weld region.

Stress analysis for this region performed by EG&G and by Westinghouse indicate that these welds were not jeopardized by the October, 1980 flooding event. A fracture mechanics analysis performed by the staff led to the same conclusion. Nevertheless, in the unlikely event that cracks were to initiate in this region in the future, we conclude that it is very unlikely that they would unite and propagate as a cylindrical crack of the same diameter as the stub-tubes because of the stress field at these locations. Thus, detectable leaks would result rather than tube ejection.

The first paragraph may be entirely correct. However, without knowing the details of the construction, the claim that chloride deposition did not occur in the crevice and at the weld is not entirely convincing to me. I would be more convinced if they had flushed the tube penetration areas with demineralized water and checked the water around the penetrations for chlorides. However, I concur with the second paragraph; that detectable leaks would result rather than tube ejection.

The modifications planned by the licensee appear to be adequate to assure that this kind of incident will not happen again at Indian Point 2.

I concur with the SER conclusion that this flooding incident does not constitute an unreviewed safety question regarding the integrity of the partially submerged vessel and the stainless steel penetration tubes in the bottom head of the vessel.

Yours very truly,

E. C. Rodabaugh
Stress Analysis and Fraction Section

ECR:lt