



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
OF PLANT OPERATION WITH DEGRADED PIPING
AND OF A REQUEST FOR RELIEF FROM ASME CODE REPAIR REQUIREMENTS
FOR ASME CODE CLASS 3 PIPING
VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNIT 1
DOCKET NO. 50-338

1.0 BACKGROUND

In its letters of August 26, and September 2, 1992, Virginia Electric and Power Company (VEPCO or the licensee) requested relief from Code repair requirements of certain Code Class 3 piping at North Anna 1. The licensee found a pinhole steam leak in a 3-inch drain pipe connected to the main steam system. The leaking piping is classified as a high energy system. The leak is downstream of the main steam drain header and upstream of valve 1-MS-TV-109. The licensee attributed the leak to wall thinning from erosion. Under 10 CFR 50.55a(g)(5)(iii), the licensee submitted information to show that conforming with Code requirements is impractical. The leak in the drain line is not isolable and a Code repair would be impractical without bringing the plant to a cold shutdown.

Structural Integrity Requirements

The Code of Federal Regulations at 10 CFR 50.55a(g)(4) requires that throughout the service life of a boiling or pressurized water-cooled nuclear power facility, components, including supports, classified as ASME Code Class 1, 2, and 3, shall meet the requirements, except the design and access provisions and preservice examination requirements, of Section XI of the ASME Boiler and Pressure Vessel Code and Addenda to the extent practical within the limitations of design, geometry and materials of construction of the components.

When a licensee finds a degraded component it must promptly determine its operability. For piping, this is done by assessing its structural integrity in accordance with ASME XI flaw evaluation criteria. North Anna 1 is committed to ASME Boiler and Pressure Vessel Code, Section XI, 1983 Edition, and Summer 1983 Addendum, for its inservice inspection (ISI) program. The Code edition provides rules for evaluation of indications in Table IWB-3514-1.

Later Code editions and Code cases limit flaw depths for both planar and non-planar indications to 70% of the wall thickness. From a regulatory perspective and according to ASME Section XI flaw evaluation criteria, the degraded piping at North Anna 1 is considered inoperable since ASME XI flaw evaluation criteria and 10 CFR 50.55a(g)(4) are not met.

2.0 EVALUATION OF LICENSEE'S SUBMITTAL REGARDING OPERATION WITH DEGRADED PIPING

Though operability is not strictly satisfied in this case, the licensee's submittals show that operating the plant with the degraded piping will not adversely affect overall plant safety.

Catastrophic failure of the degraded piping is not expected. The licensee, not being able to measure wall thinning at the flaw location to characterize it, conservatively postulated a large through wall flaw. It analyzed the pipe section with the postulated flaw subjected to a resultant moment and an axial force due to pressure, deadweight, thermal, and design basis earthquake loading. Results showed that the pipe would not experience a double ended rupture under the postulated loads. A margin of at least two against a catastrophic failure was calculated.

The effects of the leakage from the large postulated flaw upon nearby equipment were not significant. The licensee found the effects of flooding, pipe whip, jet impingement, and spraying of steam would be minimal because of the location of the leak and because adjacent equipment is qualified to operate in a steam environment.

The licensee is monitoring the leak. Operators monitor the condition of the pipe and affected system more than once per each 12-hour shift.

The system is isolated most of the time or will automatically isolate if a break occurs. There are six steam traps on each of the main steam lines. One trap is upstream of the main steam isolation valve (MSIV) and five are downstream for a total of 18 for all three main steam lines. The steam supply line for the auxiliary feedwater pump also has two traps. To isolate the leak, the traps upstream of the MSIVs and those associated with the auxiliary feedwater pump have been manually isolated. The manually isolated drains for the steam supply to the auxiliary feedwater pump are opened once a shift to drain the lines. Effects of a break in the drain header are discussed in the following paragraph. Isolating the upstream traps has an insignificant effect on drainage of the line since traps are installed directly downstream of each MSIV and the MSIV is open. The 15 valves downstream of the MSIVs are open during plant operation. If a small loss of coolant accident (LOCA) occurs at the leak or in the steam line, the 15 valves would automatically isolate the system.

There is no significant safety hazard to personnel. For a short period of time, each shift operator is required to drain accumulated moisture from the steam supply piping to the auxiliary feed pump manually. The operator is

safely shielded from the leaking piping by a wall and the time required for the operator to blowdown the system is short (2-5 minutes.) If the degraded header should rupture during this time the operator could safely isolate the two drain lines.

3.0 EVALUATION OF LICENSEE'S SUBMITTAL REGARDING REQUEST FOR RELIEF

Temporary Non-Code Repairs

The Code of Federal Regulations at 10 CFR 50.55a(g) requires nuclear power facility piping and components to meet the applicable requirements of Section XI of the ASME Boiler and Pressure Vessel Code (hereafter called the Code). Section XI of the Code specifies Code-acceptable repair methods for flaws that exceed Code acceptance limits in piping that is in service. A Code repair is required to restore the structural integrity of flawed Code piping, independent of the operational mode of the plant when the flaw is detected. Those repairs not in compliance with Section XI of the Code are non-Code repairs. However, the required Code repair may be impractical for a flaw detected during plant operation unless the facility is shut down. Under 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations of impracticability and may grant relief and may impose alternative requirements.

Component Identification

The affected line is 3-inch SHPD-5-601-Q3 and is designated ASME Class 3 in the ASME Section XI program. The leak is downstream of the main steam drain header and upstream of valve 1-MS-TV-109.

Code Requirement

Articles IWA-4000 and IWD-4000 of Section XI of the Code, 1983 Edition, Summer 1983 Addendum, describes the Code repair requirements. A Code repair would require removal of the flaw and subsequent weld repair. This repair weld is also subject to post-repair nondestructive examination and pressure testing.

Code Relief Request

Relief is requested from performing a Code repair/replacement of the degraded piping while the plant is in operation. The Code Class 3 piping is described in the component identification section above.

Basis for Relief

Code repair requirements are impractical unless the facility is shut down.

Proposed Alternative

The licensee proposed a temporary repair consisting of an engineered mechanical clamp sealed with a liquid compound. The engineered clamp is designed to ASME Code Section VIII requirements to maintain the pressure

integrity of the steam drain line. It is designed for operating conditions of a pressure of 1205 psi and a temperature of 545 °F. The design addresses the through-wall leak. The effects of the proposed repair were analyzed and found to not adversely affect the structural integrity of the piping system and its supports during normal operating and seismic conditions. Analysis of the piping system showed that one pipe support anchor was overloaded independent of the proposed mechanical clamp. A spring hanger is being added to relieve the overstress condition.

The licensee intends to monitor the repair by performing weekly visual inspections. It will perform a permanent repair during the next refueling outage scheduled for January 1993.

The staff finds Code repair requirements in this case are impractical. Repairing the pipe in conformance with Code requirements would require a plant shutdown. This could cause unnecessary cycling of the plant safety systems and components without a significant compensating gain in safety and reliability. The licensee has demonstrated that, until the next outage, the proposed temporary mechanical clamp will maintain the structural integrity of the system on which it is installed when subjected to design basis loading conditions and that the public health and safety will be protected.

4.0 CONCLUSIONS

The staff concludes that operation with the pipe in the degraded condition until the repair can be made is acceptable and does not adversely affect safety for the following reasons: (1) The system is isolated most of the time. (2) The leak is being monitored. (3) If the eroded pipe should break, the system can be readily isolated without presenting a safety hazard to personnel.

The staff also concludes that the licensee has met both the criteria of 10 CFR 50.55a(a)(3) and has shown that the proposed alternative would provide an acceptable level of quality and safety and that compliance with the Code requirement would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety. The NRC staff recognizes that circumstances may justify taking temporary corrective measures for such systems that cannot be isolated without a plant being shut down. Accordingly, the staff concludes that granting relief where Code requirements are impractical and imposing alternative requirements are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest, given due consideration to the burden upon the licensee and facility that could result if the Code requirements were imposed on the facility. Under 10 CFR 50.55a(g)(6)(i) relief is granted until the next outage of the facility but no later than the next scheduled refueling outage. The flawed pipe must then be repaired or replaced in accordance with the Code.

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