UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

March 12, 1997

NRC INFORMATION NOTICE 97-09: INADEQUATE MAIN STEAM SAFETY VALVE (MSSV) SETPOINTS AND PERFORMANCE ISSUES ASSOCIATED WITH LONG MSSV INLET PIPING

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert licensees to the recent staff findings related to improper main steam safety valve (MSSV) setpoints and MSSV performance issues associated with long inlet piping. 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 are not NRC requirements, therefore, no specific action or written response is required.

Description of Circumstances

The licensee for Millstone Unit 2, a Combustion Engineering pressurized-water reactor (PWR), reviewed the calculations used to determine MSSV setpoints to assure that peak main steamline pressure did not exceed the allowable pressure. The licensee determined that the calculations may be inadequate because the dynamic pressure loss between the main steamline and the MSSVs was not modeled. This stretch of piping is not modeled in the licensee's design-basis event transient analysis. The consideration of the dynamic pressure drop in the piping would reduce the relieving capacity of the MSSVs. Therefore, the omission resulted in an underprediction of the peak main steamline pressure by a relatively significant amount and also resulted in the potential for the calculated peak pressure to exceed 110 percent of the design pressure for the main steam system. In addition, significant dynamic pressure drops resulting from long inlet piping could cause unstable MSSV performance.

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Discussion

The peak main steam pressure for PWRs generally occurs when a main steam isolation valve closure or a turbine trip is postulated. Typically, as much as 100 percent of the full main steam flow can be relieved through the MSSVs following one of these events. These high flowrates can create significant dynamic (i.e., frictional and acoustic) pressure drops.

At Millstone Unit 2, 8 individual code safety relief valves are attached to each of the 2 main steamlines with approximately 6.1 m [20 feet] of 15.24-cm [6-inch] piping. The full-flow pressure drop through this 6.1 m [20 ft] of piping could be as high as 689 kPa [100 psi]. As a result of not modeling the stretch of piping for each MSSV, the actual discharge capacity of the MSSVs was overpredicted and the peak main steamline pressure was underpredicted. The relatively long stretch (approximately 6.1 m [20 feet]) of relatively small (15.24-cm [6-inch]) piping between the main steamlines and the MSSVs contributed to the magnitude of the underprediction of the peak pressure; however, the dynamic pressure loss from all stretches of piping should be accounted for in the analysis. For plants that do not have long stretches of narrow piping or have a large manifold, the MSSVs will not have as large a pressure drop, however, the calculations may still be affected significantly depending on the actual piping configuration in the plant.

In addition, long MSSV inlet piping may also affect the stability of the MSSVs. If dynamic pressure drops are great enough, the valve disks may chatter because (after the valves open) the valve inlet pressures will immediately drop below the valve reseating pressures. Because significant excess system pressure has not been relieved, the valves reopen and the chattering cycle would continue.

Depending on the specific plant, this analysis can be performed by the architect engineer, the nuclear steam supply system vendor, the fuel vendor, or the licensee. For example, the fuel vendor may supply the transient analysis; however, the system pressure losses that are inputs to the transient analysis are frequently provided by the architect engineer. As a result, it is important that controls are in place such that data communication across organizational interfaces include all pressure losses in the transient analysis.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Wayne Lanning for

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97-07	Problems Identified During Generic Letter 89-10 Closeout ınspections	03/06/97	All holders of OLs or CPs for nuclear power reactors
97-06	Weaknesses in Plant-Specific Emergency Operating Procedures for Refilling the Secondary Side of Dry Once-Through Steam Generators	03/04/97	All holders of OLs or CPs for nuclear power reactors with with once-through steam generators
91-85, Rev. 1	Potential Failures of Thermostatic Control Valves or Diesel Generator Jacket Cooling Water	02/27/97	All holders of OLs or CPs for nuclear power reactors
97-05	Offsite Notification Capabilities	02/27/97	All holders of OLs or CPs for nuclear power reactors and test and research reactors
97-04	Implementation of a New Constraint on Radioactive Air Effluents	02/24/97	All materials, fuel cycle, and non-power reactor licensees

OL = Operating License
CP = Construction Permit

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original signed by M.M. Slosson

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At Millstone Unit 2, 8 individual code safety relief valves are attached to each of the 2 main steamlines with approximately 6.1 m [20 feet] of 15.24-cm [6-inch] piping. The full-flow pressure drop through this 6.1 m [20 ft] of piping could be as high as 689 kPa [100 psi]. As a result of not modeling the stretch of piping for each MSSV, the actual discharge capacity of the MSSVs was overpredicted and the peak main steamline pressure was underpredicted. The relatively long stretch (approximately 6.1 m [20 feet]) of relatively small (15.24-cm [6-inch]) piping between the main steamlines and the MSSVs contributed to the magnitude of the underprediction of the peak pressure; however, the dynamic pressure loss from all stretches of piping should be accounted for in the analysis. For plants that do not have long stretches of narrow piping or have a large manifold, the MSSVs will not have as large a pressure drop, however, the calculations may still be affected significantly depending on the actual piping configuration in the plant.

In addition, long MSSV inlet piping may also affect the stability of the MSSVs. If dynamic pressure drops are great enough, the valve disks may chatter because (after the valves open) the valve inlet pressures will immediately drop below the valve reseating pressures. Because significant excess system pressure has not been relieved, the valves reopen and the chattering cycle would continue.

Depending on the specific plant, this analysis can be performed by the architect engineer, the nuclear steam supply system vendor, the fuel vendor, or the licensee. For example, the fuel vendor may supply the transient analysis; however, the system pressure losses that are inputs to the transient analysis are frequently provided by the architect engineer. As a result, it is important that controls are in place such that data communication across organizational interfaces include all pressure losses in the transient analysis.

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At Millstone Unit 2, 8 individual code safety relief valves are attached to each of the 2 main steamlines with approximately 20 feet of 6-inch piping. The full-flow pressure drop through this 20 feet of piping could be as high as 100 psi. As a result of not modeling the stretch of piping for each MSSV, the actual discharge capacity of the MSSVs was overpredicted and the peak main steamline pressure was underpredicted. The relatively long stretch (approximately 20 feet) of relatively small (6-inch) piping between the main steamlines and the MSSVs contributed to the magnitude of the underprediction of the peak pressure; however, the dynamic pressure loss from all stretches of piping should be accounted for in the analysis. For plants that do not have long stretches of narrow piping or have a large manifold, the MSSVs will not have as large a pressure drop, however, the calculations may still be affected significantly depending on the actual piping configuration in the plant.

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At Millstone Unit 2, the transient analysis is currently performed by Siemens. Depending on the specific plant, this analysis can be performed by the architect engineer, the nuclear steam supply system vendor, the fuel vendor, or the licensee. For example, the fuel vendor may supply the transient analysis; however, the system pressure losses that are inputs to the transient analysis are frequently provided by the architect engineer. As a result, it is important that controls are in place such that data communication across organizational interfaces include all pressure losses in the transient analysis.

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