7590-01 (P)

NUCLEAR REGULATORY COMMISSION

Proposed Generic Communication

Loss of Reactor Coolant Inventory and Associated Potential for Loss of Emergency Mitigation Functions While in a Shutdown Condition (M92635)

AGENCY: Nuclear Regulatory Commission

ACTION: Notice of opportunity for public comment

SUMMARY: The Nuclear Regulatory Commission (NRC) is proposing to issue a generic letter that will request addressees to (1) assess the susceptibility of their emergency core cooling system (ECCS) to common-cause failure as a result of reactor coolant system (RCS) draindown while in a shutdown condition, and (2) submit certain information, pursuant to Section 50.54(f) of Title 10 of the *Code of Federal Regulations* (10 CFR 50.54(f)), concerning their findings regarding potential pathways for inadvertent RCS drain-down and the suitability of configuration control and operating practices during reactor shutdown cooling. This information will enable NRC staff to verify whether addressees comply and conform with NRC regulatory and license requirements; i.e., are adequately maintaining the residual heat removal safety function to transfer fission product decay heat and other residual heat from the reactor core (General Design Criterion (GDC) 34 of Appendix A to 10 CFR 50), and the ECCS to provide abundant emergency core cooling when required (GDC 35 Of Appendix A to 10 CFR 50). The NRC is seeking comment from interested parties regarding both the technical and regulatory aspects of the proposed generic letter presented under the Supplementary Information heading.

The proposed generic letter has been endorsed by the Committee to Review

9702120324 970210
PDR I&E
MISC PDR

Generic Requirements (CRGR). The relevant information that was sent to the CRGR will be placed in the NRC Public Document Room. The NRC will consider comments received from interested parties in the final evaluation of the proposed generic letter. The NRC's final evaluation will include a review of the technical position and, as appropriate, an analysis of the value/impact on licensees. Should this generic letter be issued by the NRC, it will become available for public inspection in the NRC Public Document Room.

DATES: Comment period expires **[30 days after FRN is published]**. Comments submitted after this date will be considered if it is practical to do so, but assurance of consideration cannot be given except for comments received on or before this date.

ADDRESSEES: Submit written comments to Chief, Rules Review and Directives Branch, U.S. Nuclear Regulatory Commission, Mail Stop T-6D-69, Washington, DC 20555-0001. Written comments may also be delivered to 11545 Rockville Pike, Rockville, Maryland, from 7:30 am to 4:15 pm, Federal workdays. Copies of written comments received may be examined at the NRC Public Document Room, 2120 L Street, N.W. (Lower Level), Washington, D.C.

FOR FURTHER INFORMATION CONTACT: Muhammad M. Razzaque (301) 415-2882.

SUPPLEMENTARY INFORMATION:

NRC GENERIC LETTER 97-xx: LOSS OF REACTOR COOLANT INVENTORY AND ASSOCIATED POTENTIAL FOR LOSS OF EMERGENCY MITIGATION FUNCTIONS WHILE IN A SHUTDOWN CONDITION

Addressees

All holders of operating licenses for pressurized-water reactors (PWRs).

except those that have certified to the permanent cessation of operations.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter to request that addressees (1) assess the susceptibility of their emergency core cooling systems (ECCSs) to common-cause failure as a result of reactor coolant system (RCS) draindown while in a shutdown condition, and (2) submit certain information, pursuant to Section 50.54(f) of Title 10 of the *Code of Federal Regulations* (10 CFR 50.54(f)), concerning their findings regarding potential pathways for inadvertent RCS drain-down and the suitability of configuration control and operating practices during reactor shutdown cooling. This information will enable NRC staff to verify whether addressees comply and conform with NRC regulatory and license requirements; i.e., are adequately maintaining the RHR safety function to transfer fission product decay heat and other residual heat from the reactor core (General Design Criterion (GDC) 34 of Appendix A to 10 CFR 50), and the ECCS to provide abundant emergency core cooling when required (GDC 35 of Appendix A to 10 CFR 50).

Background

The NRC issued Information Notice (IN) 95-03, "Loss of Reactor Coolant Inventory and Potential Loss of Emergency Mitigation Functions While in a Shutdown Condition," on January 12, 1995, to alert addressees to an incident at the Wolf Creek Plant involving the loss of reactor coolant inventory while the reactor was in a shutdown condition. In that event, operators were attempting to reborate residual heat removal (RHR) train B, while at the same

time maintenance personnel were repacking a RHR train A-to-train B crossover isolation valve. Train B is reborated by recirculating water through a loop that contains the RHR system piping, the refueling water storage tank (RWST), a containment spray pump, a manual RWST isolation valve, and a RHR system crossover line. When the RWST isolation valve was opened for the reboration process and the train A-to-train B crossover isolation valve was opened for stroke testing, a drain-down path was inadvertently created from the reactor coolant system (RCS) to the RWST. This drain-down path included a suction header common to all ECCS pumps.

Events of this nature are considered particularly significant because they can result in loss of emergency core cooling capability and involve the potential for containment bypass. On March 25, 1996, the staff issued a supplement to IN 95-03 that further analyzed the event. The NRC has also issued a number of other communications describing events at reactor facilities involving inadvertent loss of reactor coolant inventory while the reactor was in a shutdown condition. The Office for Analysis and Evaluation of Operational Data (AEOD) published AEOD/E704, "Discharge of Primary Coolant Outside of Containment at PWRs While on RHR Cooling," in March 1987, which documented six events involving RCS backflow into the RWST. In Generic Letter 88-17, "Loss of Decay Heat Removal (DHR) 10 CFR 50.54(f)," dated October 17, 1988, the NRC requested several actions to address loss-of-DHR events that occurred while reactors were in a shutdown condition. In IN 91-42, "Plant Outage Events Involving Poor Coordination Between Operations and Maintenance Personnel During Valve Testing and Manipulations," dated June 27, 1991, the NRC discussed inadvertent loss-of-inventory events.

Discussion

At Wolf Creek, all ECCS pump suction lines are tied into a common suction header. When the draindown event occurred at Wolf Creek, hot RCS water was introduced into this common suction header between the RWST and the ECCS pumps. This hot water flashed to steam, resulting in a steam/water mixture in the header. In the event of an ECCS actuation, this mixture would have been introduced into the suction of the ECCS pumps. If operators had not been able to terminate the event, the hot water in the RWST suction piping might have led to steam binding, which could have affected all pumps in both ECCS trains. In addition, water flashing to steam in the header and the RWST could have caused serious mechanical damage to the RHR piping and the RWST as a result of water hammer. Finally, steaming through the RWST establishes a containment bypass path.

The licensee estimated (using actual plant conditions) that for an unmitigated event, the reactor vessel water level could have drained to the bottom of the hot leg within 5 minutes and, as a consequence, RHR pump A would have lost suction, cavitated, and failed. Shortly thereafter, the common ECCS suction header could have reached a 90-percent steam/water ratio. The licensee also estimated that continued boil-off could have caused the pressure vessel water level to drop to the point of core uncovery in less than 1 hour.

The AEOD report "Reactor Coolant System Blowdown at Wolf Creek on September 17, 1994," (AEOD/S95-01), dated March 1995, noted 19 events in which RCS water was transferred to the RWST. On the basis of this history and the potential for containment bypass, the staff has concluded that additional information is

required to confirm the adequacy of existing ECCS configuration control and operating practices regarding residual heat removal.

Requested Actions

Addressees are requested to determine whether their ECCSs are susceptible to common-cause failure, e.g., as a result of events similar to the Wolf Creek RCS drain-down event of September 17, 1994.

If ECCSs are found to be susceptible to common-cause failure, addressees are expected to take corrective action, as appropriate, in accordance with the requirements stated in Section XVI of Appendix B to 10 CFR Part 50, to ensure compliance with NRC regulatory and license requirements.

Requested Information

Within 120 days of the date of this generic letter, addressees are requested to submit a written summary report that includes a description of the evaluation conducted and the conclusions reached concerning the susceptibility of the RCS to drain-down events with a potential for consequential common-cause ECCS failure, and the corrective actions that were taken, or that are planned to be taken, if any, in response to the above requested actions. If the RCS is found to be susceptible to drain-down events, describe each potential drain-down flow path (include piping sizes, identify flow path valves and their normal positions, and identify valve interlocks and provisions for valve position indication in the control room), describe potential valve testing manipulations or uses, and describe any administrative

controls that are intended to be used to control valve manipulations to preclude RCS drain-down events.

Required Response

Within 30 days of the date of this generic letter, addressees are required to submit a written response indicating (1) whether or not the requested actions will be taken, (2) whether or not the requested information will be submitted, and (3) whether or not the requested information will be submitted within the requested time period. Addressees who choose not to complete the requested actions, or choose not to submit the requested information, or are unable to satisfy the requested completion date must describe in their response any alternative course of action that is proposed to be taken, including the basis for establishing the acceptability of the proposed alternative course of action and the basis for continued operability of affected systems and components, as applicable.

Address the required written responses to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, under oath or affirmation under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). In addition, submit a copy to the appropriate regional administrator.

Backfit Discussion

The actions requested in this generic letter, if required, would be backfits in accordance with NRC procedures and are necessary to ensure that addressees

are in compliance with existing NRC rules and regulations. Specifically, 10 CFR 50.46 requires that the ECCS be designed to provide adequate flow capability to maintain the core temperature at an acceptably low value and to remove decay heat for the extended period of time required by the long-lived radioactivity remaining in the core. The Wolf Creek event has demonstrated that the adequacy of ECCS configuration control and operating practices regarding residual heat removal can adversely impact ECCS performance and could prevent the ECCS from performing its safety function following events at reactor facilities involving inadvertent loss of reactor coolant inventory while the reactor is shut down. Therefore, this generic letter is being issued as if the requested actions were compliance backfits under the terms of 10 CFR 50.109(a)(4)(i). A full backfit analysis was not performed. However, in accordance with NRC procedures, an evaluation was prepared stating the objectives of and the reasons for the requested actions and the basis for invoking the compliance exception if the requested actions were to be required. A copy of this evaluation will be made available in the NRC Public Document Room.

Dated at Rockville, Maryland, this 10th day of February 1997.

FOR THE NUCLEAR REGULATORY COMMISSION

Thomas T. Martin, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation