

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

April 10, 2008

NRC INFORMATION NOTICE 2008-06: INSTRUMENT AIR SYSTEM FAILURE RESULTING
IN MANUAL REACTOR TRIP

ADDRESSEES

All holders of operating licenses or construction permits for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees of an event involving an instrument air system failure that resulted in a manual reactor trip. The NRC expects that recipients will review this information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions in this information notice are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

On June 20, 2007, San Onofre Nuclear Generating Station Unit 2 (SONGS-2) was operating at about 96 percent power when a line in the instrument air system separated at a soldered connection. The resulting loss of instrument air pressure caused a loss of control of the steam generator feedwater regulating valves. The water level in one of the steam generators rose in an uncontrolled manner necessitating action by the control room operators to trip the reactor manually. Subsequently, the operators tripped the main feedwater pumps to stop excess feedwater to the steam generators and actuated the auxiliary feedwater system. The loss of air also prevented the use of the steam dumps to the main condenser (i.e., the normal heat removal method) and; therefore, operators controlled the steam generator pressure and decay heat removal using the steam generator atmospheric dump valves. As designed, a loss of instrument air system pressure will cause the isolation of cooling water to the normal containment coolers; therefore, the operators manually started the containment emergency cooling units as a conservative measure.

The licensee at SONGS-2 reported this occurrence in Licensee Event Report (LER) 50-361/2007-001-01, dated August 24, 2007 (Agencywide Documents Access Management System (ADAMS) Accession No. ML072400033). The LER stated that the cause of this event was the loss of instrument air system pressure when the instrument air system separated at a soldered connection in a section of 3-inch diameter piping. The connection failed because of a weak solder joint and corrosion of the solder joint. This section of pipe with the failed solder joint was installed in about 1980 during original plant construction. The solder connection was

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weak because the gap between the tube and the coupling was too large. The larger gap did not allow for the capillary action necessary to provide an even distribution of the melted solder and the solder pooled at the bottom of the coupling. The larger gap also allowed solder flux to remain in the solder, which led to slow-acting corrosion of the solder joint. When corrosion had sufficiently reduced the solder joint strength, the connection separated.

As corrective actions, the licensee inspected the instrument air piping and replaced the instrument air line solder joint that had separated and the leaking joint adjoining it. The licensee also inspected all soldered joints in the instrument air system on piping with a diameter greater than 1 inch and installed pipe clamps to strengthen pipe joints, where needed, to supply additional margin.

At SONGS-2, the instrument air system is a shared, nonsafety-related system. However, the system is equipped with certain protective features (e.g., excess flow check valves) to ensure that a failure in the piping system on one unit does not significantly affect instrument air pressure on the other unit. In this incident, the SONGS-2 instrument air pressure dropped significantly from 110 psig to about 43 psig while the back-up system and check valves sustained service to Unit 3 until the break could be isolated. The loss of instrument air pressure caused the feedwater control valves to stop functioning and the water level in the steam generators increased in an uncontrolled manner necessitating a manual trip of the reactor by the control room operators. The licensee has assessed the safety significance of the event and performed a risk assessment based on the reported actual component unavailability, system alignments, and operating conditions. The assessment of the conditional core damage probability and conditional large early release probability found the safety significance of this event to be very low.

Based on the conditions reported in the LER, as supported by the licensee's risk analysis, the NRC staff found that although this event challenged plant operations, it did not affect the health and safety of either plant personnel or the public.

DISCUSSION

Although no specific requirements or standards were unmet, the failure of the instrument air system at SONGS-2 illustrates the importance of understanding the potential failure mechanisms associated with the fabrication/installation process, monitoring the fabrication/installation of the systems, and performing inspections that check for potential failure mechanisms.

CONTACT

This information notice does not require any specific action or written response. Please direct any questions about this matter to the technical contact listed below.

/RA/

Michael J. Case, Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Technical Contact: Edward Smith, NRR/DSS/SBPB
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Email: ets1@nrc.gov

Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

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