



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION II  
230 PEACHTREE STREET, N.W. SUITE 1217  
ATLANTA, GEORGIA 30303

MAY 25 1978

*Central file*  
*50-390*  
*391*

In Reply Refer To:

RII:JPO

50-438, 50-439

50-327, 50-328

50-390, 50-391


50-566, 50-567

Tennessee Valley Authority  
Attn: Mr. N. B. Hughes  
Manager of Power  
830 Power Building  
Chattanooga, Tennessee 37401

Gentlemen:

The enclosed IE Circular No. 7805, is forwarded to you for information. No written response is required. Should you have any questions related to your understanding of this matter, please contact this office.

Sincerely,

  
James P. O'Reilly  
Director

Enclosures:

1. IE Circular No. 78-05
2. List of IE Circulars  
Issued in 1978

*AD 2*  
*60*

MAY 25 1978

Tennessee Valley Authority

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cc w/encl:

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
WASHINGTON, D.C. 20555

May 25, 1978

IE Circular 78-05

INADVERTENT SAFETY INJECTION DURING COOLDOWN

Salem-1, a four-loop Westinghouse PWR, was being cooled from Mode 3 (hot standby) to Mode 5 (cold shutdown) on January 23, 1978. With one reactor cooling pump operating, the atmospheric relief valves on all four steam generators were used to remove heat from the reactor coolant system. When reactor coolant pressure and average temperature were at 1500 psig and 403 degrees fahrenheit, an inadvertent safety injection occurred due to low pressure in the steamline from one of the steam generators. Water at 61 degrees fahrenheit was transferred from the refueling water storage tank to the reactor coolant system resulting in thermal shock to the safety injection nozzles. Operator action limited the duration of the safety injection to 2 to 4 1/2 minutes.

The nuclear steam system supplier had informed the licensee that 50 safety injections using refueling water at 40 degrees fahrenheit would not result in excessive stress at the safety injection nozzle. Because Salem-1 has had an unexpectedly large number of inadvertent safety injections, the licensee is taking action to reduce the frequency with which they occur.

There are a number of contributing factors which lead to inadvertent safety injection when the reactor is being cooled from Mode 3 to Mode 5. These factors include: (1) operation of a single reactor coolant pump instead of reactor coolant pumps in opposed cooling loops, (2) lack of pressure recording instruments for the steamlines, and (3) use of atmospheric relief valves instead of steam dump valves.

The reactor vessel inlet nozzles for the four reactor cooling loops are not equally spaced on the circumference of the reactor vessel. Two pairs of inlet nozzles are located on opposite sides of the vessel. The azimuthal separation between the inlet nozzles of each pair is approximately 45 degrees. With one reactor coolant pump in operation, backflow occurs in the other three cooling loops and is expected to be greatest in the loop with the nearest adjacent inlet nozzle. Because of the different flow rates in the four cooling loops, the task of controlling the cooling rate in each steam generator is difficult. If the atmospheric relief valves on each steam generator are positioned alike, the cooling rate will

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be greatest in the steam generator receiving the least reactor coolant flow and thus the least heat. Therefore, the saturation pressure in that steam generator falls more rapidly than in the other steam generators. When the pressure in any steamline is 100 psi less than the pressure in any two of the other three steamlines, a safety injection occurs.

So that the flow rates will be more nearly equal in the four reactor cooling loops, the licensee has changed the procedure for cooling from Mode 3 to Mode 5. The revised procedure requires that two reactor coolant pumps in opposing reactor cooling loops be in operation when available.

While cooling from Mode 3 to Mode 5, the Salem-1 operator monitors the pressure in each steamline and adjusts the position of each atmospheric relief valve as necessary to maintain an equal rate of pressure decrease. The operator's task is more difficult than necessary because steam generator pressures are indicated but not recorded on the control panel.

The steam generators can also be cooled using the steam dump valves when the condenser is available. The steam dump valves are in steamlines connecting the mixing bottle to the condenser. The mixing bottle is a large diameter manifold which receives steam from all four steam generators. Use of the steam dump valves and the mixing bottle, instead of the atmospheric relief valves, causes heat transfer in each steam generator to be essentially self regulating and to tend to maintain the same pressure in each steamline. For this reason the licensee has changed the procedure for cooling from Mode 3 to Mode 5 to require that the steam dump valves be used when the condenser is available.

Holder's of Operating Licenses for PWRs which have experienced problems with inadvertent safety injections during cooldown and holders of construction permits for PWRs should consider actions which would minimize the frequency of those occurrences.

No written response to this circular is required. If additional information is needed regarding this matter, please contact the Director of your NRC Regional Office.

LISTING OF IE CIRCULARS ISSUED IN 1978

Circular No.	Subject	Date of Issue	Issued To
78-01	Loss of Well Logging Source	4/5/78	All Holders of Well Logging Source Licenses
78-02	Proper Lubricating Oil for Terry Turbines	4/20/78	All Holders of Reactor Operating Licenses (OL) or Construction Permit (CP)
78-03	Packaging Greater Than Type A Quantities of Few Specific Activity Radioactive Material for Transport	5/12/78	All Holders of Reactor Operating Licenses (OL), Construction Permits (CP), Fuel Cycle, Priority I Material and Waste Disposal Licenses
78-04	Installation Error That Could Prevent Closing of Fire Doors	5/15/78	All Holder of an NRC Operating License (OL) or Construction Permit (CP)