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

June 16, 1994

NRC INFORMATION NOTICE 94-44: MAIN STEAM ISOLATION VALVE FAILURE TO CLOSE ON DEMAND BECAUSE OF INADEQUATE MAINTENANCE AND TESTING

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 addressees to the failure of two main steam isolation valves at McGuire Nuclear Station to close fully on demand. 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

On December 27, 1993, at McGuire Nuclear Station, Unit 2, the 'B' main steam isolation valve (MSIV) failed to close on demand, resulting in a dryout condition of the associated steam generator during an event initiated by a loss of offsite power followed by a safety injection. MSIV 'B' closed fully after the event when a technician working on the valve loosened one of the yoke rod guides. In addition, analysis of transient data after the event indicated that MSIV 'A' had failed to close fully at the onset of the event and had leaked excessively. MSIV 'A' completed closure during the event as it cooled down, and the steam generator associated with this MSIV did not reach a dryout condition.

McGuire Nuclear Station Unit 2 is a four-loop pressurized-water reactor designed by Westinghouse with nominal 34-inch Atwood & Morrill air-operated "wye" type globe MSIVs, with the actuators mounted horizontally. The valve actuator is constructed as follows (see attached Figures 1 and 2). The four springs that provide the motive force for closure encase the yoke rods and rest on a bottom spring seat. The stem of the valve passes through and is attached to the bottom spring seat. The four yoke rods penetrate the bottom spring seat in the corners and attach to the valve bonnet. The springs are attached at the top to the top spring seat. As the valve is opened, the bottom spring seat rises and compresses the springs between the bottom spring seat and the top spring seat. Yoke rod guides are provided as part of the

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seismic qualification of the valves to minimize lateral movement of the bottom spring seat. The guides are brass bolts that screw into the sides of the bottom spring seat. The bolts are aligned to the centerline of the holes on the bottom spring seat through which the yoke rods pass. Four guides prevent deflection of the bottom spring seat along the axis of the main steam line (vertical), and two guides prevent deflection along an axis perpendicular to the main steam line (see Figure 2). Failure of the two MSIVs to close as designed is attributed to inadequate setting of clearances between yoke rod guides and yoke rods and to inadequate testing. According to the manufacturer, clearances between the yoke rod guides and the yoke rods for a valve should be set when the valve is closed and heated to normal operating temperature. Also, the manufacturer indicated that the valve should be tested at normal operating temperature. Licensee procedures specified that clearances be set while the valve was at ambient temperature, and all testing was done under cold conditions.

When the valve is cold, the yoke rods are essentially parallel to each other. However, when the valve is hot, the bonnet of the valve expands slightly and causes the lower section of the yoke rods to move laterally outward from the centerline, forming a tapered shape. The yoke rods had formed a tapered shape (wide at the bottom) and caused the clearance between the yoke rods and the yoke rod guides to close. Lack of control over the yoke rod guide clearances can cause binding in at least two ways. First, the clearances between the yoke rod guides and the yoke rods can close completely and cause the bottom spring seat to bind on the yoke rods. Second, when properly set (with the valve hot), the upper yoke rod guides do not have any clearance and should just touch the yoke rods. However, excessive torquing of these guides causes misalignment of the bottom spring seat so that it moves the attached valve stem off its proper line of travel, causing it to bind on the valve packing as the valve attempts to stroke.

Discussion

The valve described in this information notice is used in safety-related applications at both boiling-water and pressurized-water reactors. One such application is as an MSIV. At McGuire and other domestic pressurized-water reactors, MSIVs are required to close and remain closed after a design-basis accident. Failure to properly set the clearances between the yoke rod guides and the yoke rods can cause a common mode failure that will defeat the safety function of these valves.

After the failure at McGuire, a similar failure of an MSIV was detected at the Sequoyah Nuclear Plant during a shutdown testing program. In addition, MSIV binding was experienced at the H. B. Robinson facility when stroke testing was performed at normal operating temperature, even though these valves were of a different design, i.e., check valves with air actuators.

Inservice testing (IST) for measuring the full stroke times of the MSIVs at McGuire is performed during cold shutdown. The requirements for IST do not

include performing testing at the operating conditions that would exist at the time a valve would be required to perform its design-basis function. The current IST requirements, rather, are intended to establish a monitoring program for identifying degrading trends in the operation of the tested components. The event at McGuire illustrates an example where IST alone could not be relied upon to ensure operability of the MSIV. The licensee determined that additional testing, supplemental to that required by the IST program, is necessary to verify that the valves are capable of performing their design-basis function. One of the corrective actions taken at the Sequoyah Nuclear Plant is to test the MSIV at approximately 286 degrees C [547 degrees F] until an adjustment method that is not temperature dependent can be developed. These events highlight the importance of vendor recommendations and adequate testing programs to ensure that safety-related equipment is capable of performing its safety function.

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 project manager.

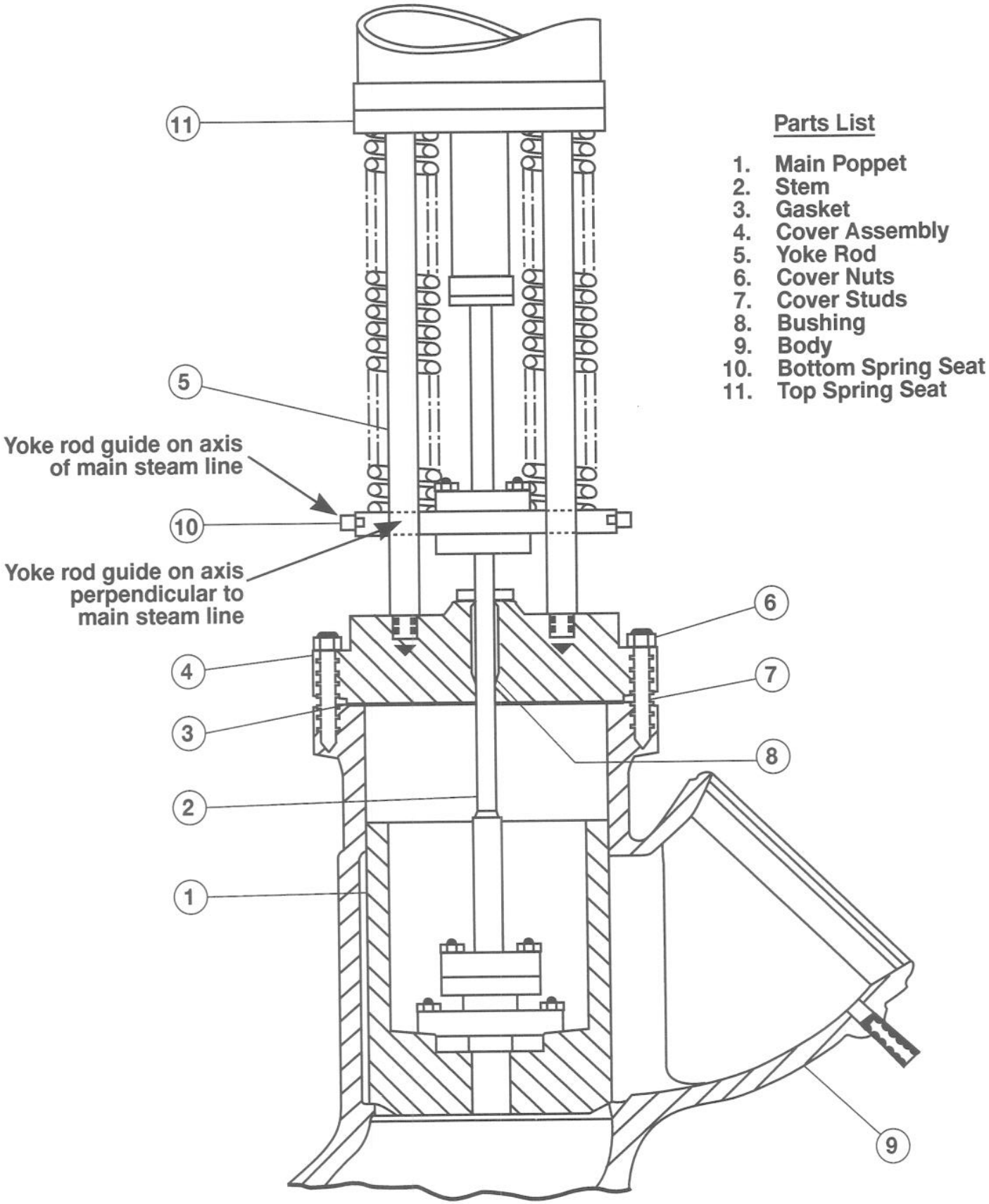
Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Jim Moorman, RII
(404) 331-5593

Eric Benner, NRR
(301) 504-1171

Attachments:
1. Figure 1 - Atwood & Morrill 34 Inch, "Wye" Type MSIV (Valve Parts)
2. Figure 2 - Atwood & Morrill 34 Inch, "Wye" Type MSIV (Bottom Spring Seat)
3. List of Recently Issued NRC Information Notices

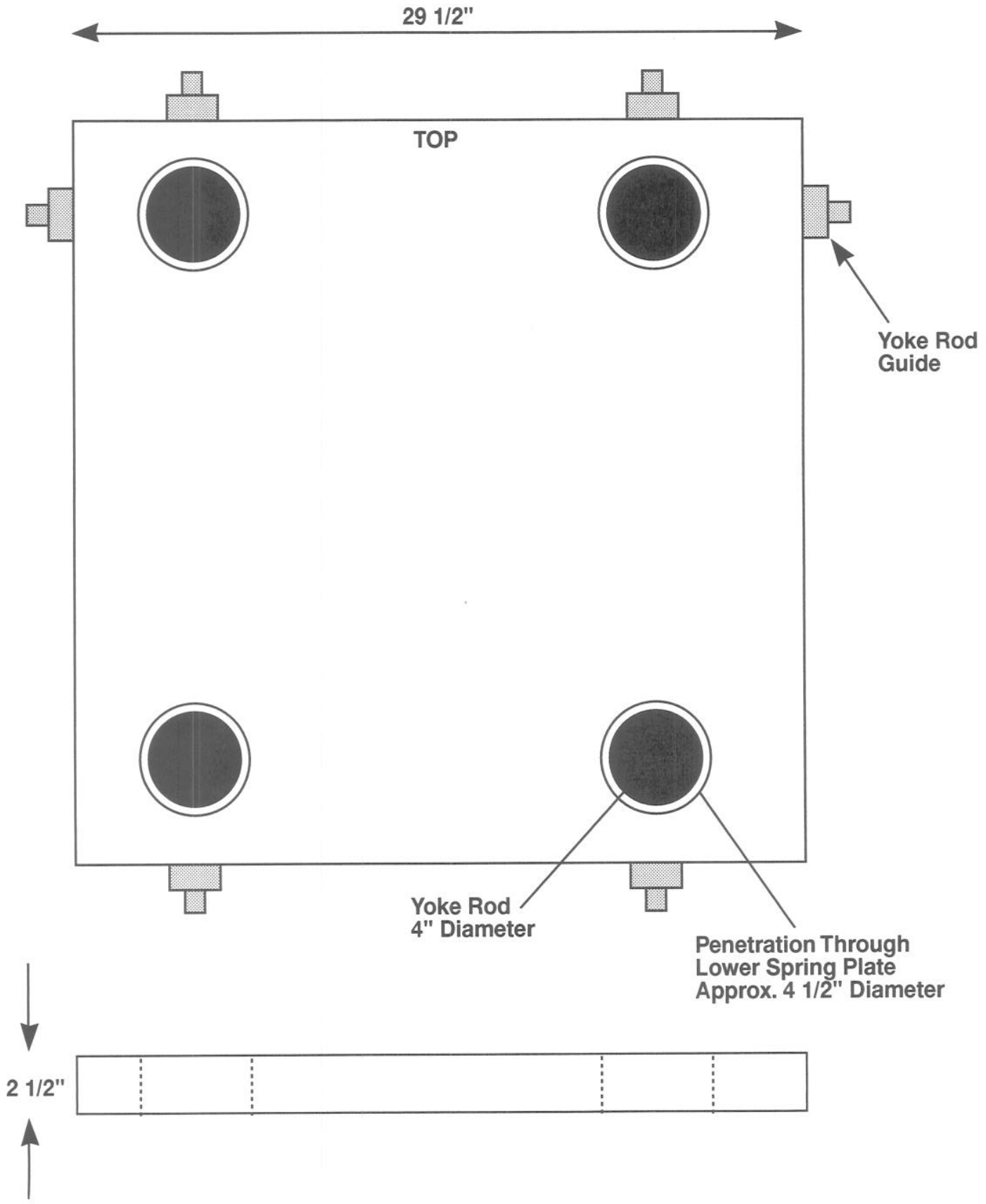
Atwood and Morrill
34 Inch "Wye" Type
Main Steam Isolation Valve
(Valve Parts & Actuator)



Parts List

1. Main Poppet
2. Stem
3. Gasket
4. Cover Assembly
5. Yoke Rod
6. Cover Nuts
7. Cover Studs
8. Bushing
9. Body
10. Bottom Spring Seat
11. Top Spring Seat

Atwood and Morrill
34 Inch "Wye" Type
Main Steam Isolation Valve
(Bottom Spring Seat)



LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-43	Determination of Primary-to-Secondary Steam Generator Leak Rate	06/10/94	All holders of OLs or CPs for pressurized water reactors.
94-42	Cracking in the Lower Region of the Core Shroud in Boiling-Water Reactors	06/07/94	All holders of OLs or CPs for boiling-water reactors (BWRs).
94-41	Problems with General Electric Type CR124 Overload Relay Ambient Compensation	06/07/94	All holders of OLs or CPs for nuclear power reactors.
94-40	Failure of a Rod Control Cluster Assembly to Fully Insert Following a Reactor Trip at Braidwood Unit 2	05/26/94	All holders of OLs or CPs for pressurized-water reactors (PWRs).
94-39	Identified Problems in Gamma Stereotactic Radiosurgery	05/31/94	All U.S. Nuclear Regulatory Commission Teletherapy Medical Licensees.
94-38	Results of a Special NRC Inspection at Dresden Nuclear Power Station Unit 1 Following a Rupture of Service Water Inside Containment	05/27/94	All holders of OLs or CPs for NPRs and all fuel cycle and materials licensees authorized to possess spent fuel.
94-37	Misadministration Caused by a Bent Interstitial Needle during Brachy-therapy Procedure	05/27/94	All U.S. Nuclear Regulatory Commission Medical Licensees authorized to use brachy-therapy sources in high-, medium-, and pulsed-dose-rate remote afterloaders.
94-36	Undetected Accumulation of Gas in Reactor Coolant System	05/24/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit