

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

January 23, 1990

NRC INFORMATION NOTICE NO. 90-03: MALFUNCTION OF BORG-WARNER BOLTED BONNET  
CHECK VALVES CAUSED BY FAILURE OF THE  
SWING ARM

Addressees:

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

Purpose:

This information notice is being provided to alert addressees to the potential malfunctioning of Borg-Warner bolted bonnet check valves caused by failure of the swing arm. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On May 31, 1989, a 4-inch 150 lb Borg-Warner bolted bonnet swing check valve installed in the service water system at the Comanche Peak Steam Electric Station (CPSES), Unit 1, exhibited excessive backleakage. This resulted from separation of the disk from the swing arm which connects the disc and stud assembly to the clevis. The swing arm's collar, which surrounds the disc stud, fractured radially in two places. Indications of surface flaws were also found in two other swing arms. The swing arms in question were produced from a 17-4PH alloy in accordance with Aerospace Materials Specification 5398A and were required to be heat treated to an H1100 condition per Military Specification MIL-H-6875.

Discussion:

The licensee for CPSES, Texas Utilities Electric Company (TU Electric), and consultants performed evaluations of six swing arms removed from service; these evaluations included visual examination and fractography, chemical analysis, metallography, the effects of heat treatment, and non-destructive examination. It was concluded that the failure of the swing arm was caused by surface defects formed during the fabrication process. Other deficiencies identified as contributing factors of the failure were inadequate heat treatment, weld repairs, high residual stresses, and the high chloride environment of the service water system.

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Concurrence

The failure mechanism was defined as preexisting surface and subsurface casting defects which propagated under the influence of raw water and residual stresses during normal operating conditions. TU Electric's consultants concluded that the swing arm castings were of poor quality; they exhibited hot cracks, porosity, weld repair, and inadequate heat treatment. When some of these swing arms were solution annealed and aged to produce the H1100 condition, the swing arms exhibited lower hardness. If the swing arms had been properly heat treated, little or no change in hardness would have been expected. As a result of these problems, TU Electric is purchasing replacement swing arms produced from investment castings, rather than sand castings. The consultants also recommended that additional examinations be performed on the remaining swing arms, including a 10X visual examination, dimensional inspection, liquid penetrant test, and replication. Using these inspection and testing methods, 17 of 91 swing arms examined by TU Electric were rejected.

An NRC inspection of BW/IP International, Incorporated, Vernon, California, (formerly Borg-Warner Nuclear Valve Division of Van Nuys, California) was performed from September 11-14, 1989. During the inspection, BW/IP could not produce documentation to support the placing of companies on the list of qualified suppliers for manufacture of the swing arms used in safety-related check valves. Records reviewed indicated that the swing arm that failed in service was manufactured by the Industrial Pattern and Casting Company and was subsequently heat treated by the Valley Heat Treating Company. During the inspection, it was determined that Valley Heat Treating Company was not on the list of approved suppliers. In addition, the inspectors could not determine from the records whether the failed swing arms were properly solution annealed or heat treated, nor were the swing arms serialized for traceability.

The inspectors also reviewed the replacement swing arms ordered by TU Electric. TU Electric had imposed Appendix B of 10 CFR Part 50 and 10 CFR Part 21 in the purchase order for the replacement swing arms and required a certificate of conformance. During the inspection, it was determined that eight swing arms sold as replacements to TU Electric had been transferred in 1986 from the Van Nuys plant to the Vernon plant. During this transfer the records associated with the swing arms were apparently lost. Because BW/IP did not have documentation to support this inventory as meeting safety-related requirements, BW/IP decided to dedicate the swing arms for use by performing a material identity check, and a visual and dimensional verification. However, the NRC inspectors determined that BW/IP's dedication was inadequate because the swing arms' primary critical characteristics (mechanical and chemical properties) were not verified by BW/IP. The method used by BW/IP was only capable of sorting generic alloy groups such as austenitic and martensitic stainless steels, but could not distinguish between the four typical martensitic specifications used by BW/IP. In addition, the results of the visual inspection performed on the arms were not documented.

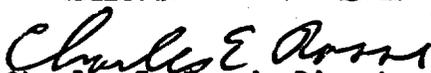
The NRC concluded that Borg-Warner and BW/IP classified non-pressure boundary valve internals as exempt under requirements of Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, failed

to recognize that Appendix B to 10 CFR Part 50 was imposed and applicable to the valve internals, and as a result did not impose nuclear quality assurance requirements on the manufacturer of these parts. The swing arm failure at the CPSES raises concerns about the quality of non-pressure boundary items supplied by BW/IP for use in safety-related applications.

Documentation reviewed during the BW/IP inspection identified additional weaknesses such as the placement of vendors on the approved vendors list without an adequate basis and the use of ASME Quality System Certificate holders without any evaluation of the suppliers' or manufacturers' quality assurance program by BW/IP. This practice was contrary to BW/IP's procedures. In one example, there was no documented basis to support qualification of ACME Castings, Incorporated, which is currently furnishing cast swing arms to BW/IP.

The subject of qualification and oversight of vendors and procurement of non-pressure boundary parts has been discussed in NRC Information Notice (IN) 88-95, "Inadequate Procurement Requirements Imposed By Licensees On Vendors," and IN 86-21, "Recognition of ASME Accreditation Program For N Stamp Holders."

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 NRR project manager.

  
Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Technical Contacts: R. L. Pettis, NRR  
(301) 492-3214

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(301) 492-0978

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-02	Potential Degradation of Secondary Containment	1/22/90	All holders of OLS or CPs for BWRs.
90-01	Importance of Proper Response to Self-Identified Violations by Licensees	1/12/90	All holders of NRC materials licenses.
89-90	Pressurizer Safety Valve Lift Setpoint Shift	12/28/89	All holders of OLS or CPs for PWRs.
89-89	Event Notification Worksheets	12/26/89	All holders of OLS or CPs for nuclear power reactors.
89-88	Recent NRC-Sponsored Testing of Motor-Operated Valves	12/26/89	All holders of OLS or CPs for nuclear power reactors.
89-87	Disabling of Emergency Diesel Generators by Their Neutral Ground-Fault Protection Circuitry	12/19/89	All holders of OLS or CPs for nuclear power reactors.
89-45, Supp. 2	Metalclad, Low-Voltage Power Circuit Breakers Refurbished with Substandard Parts	12/15/89	All holders of OLS or CPs for nuclear power reactors.
89-86	Type HK Circuit Breakers Missing Close Latch Anti-Shock Springs.	12/15/89	All holders of OLS or CPs for nuclear power reactors.
89-85	EPA's Interim Final Rule on Medical Waste Tracking and Management	12/15/89	All medical, academic, industrial, waste broker, and waste disposal site licensees.

OL = Operating License  
CP = Construction Permit

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Documentation reviewed during the BW/IP inspection identified additional weaknesses such as the placement of vendors on the approved vendors list without an adequate basis and the use of ASME Quality System Certificate holders without any evaluation of the suppliers' or manufacturers' quality assurance program by BW/IP. This practice was contrary to BW/IP's procedures. In one example, there was no documented basis to support qualification of ACME Castings, Incorporated, which is currently furnishing cast swing arms to BW/IP.

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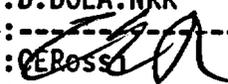
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\*See previous concurrence

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NAME	:MSnodderly*:nrp	:RLPettis*	:ETBaker*	:EWBrach* :	:BKGrimes* :
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Documentation reviewed during the BW/IP inspection identified additional weaknesses such as the placement of vendors on the approved vendors list without an adequate basis and the use of ASME Quality System Certificate holders without any evaluation of the suppliers' or manufacturers' quality assurance program by BW/IP. This practice was contrary to BW/IP's procedures. In one example, there was no documented basis to support qualification of ACME Castings, Incorporated, which is currently furnishing cast swing arms to BW/IP.

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Documentation reviewed during the BW/IP inspection identified additional weaknesses which included vendors currently placed on the approved vendors list without an adequate basis and ASME Quality System Certificate holders used without BW/IP performing any evaluation of the suppliers' or manufacturers' quality assurance program which was contrary to BW/IP's procedures. In one example, there was no documented basis to support qualification of ACME Castings, Incorporated, who is currently furnishing cast swing arms to BW/IP.

If licensees decide to evaluate this issue and determine that it is necessary to replace existing swing arms, the problems discussed above concerning BW/IP's methods of qualifying and overseeing their subcontractors should be considered. The subject of qualification and oversight of vendors and procurement of non-pressure boundary parts has been discussed in NRC Information Notice (IN) 88-95, "Inadequate Procurement Requirements Imposed By Licensees On Vendors," and IN 86-21, "Recognition of ASME Accreditation Program For N Stamp Holders."

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