

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

August 16, 1994

NRC INFORMATION NOTICE 94-58: REACTOR COOLANT PUMP LUBE OIL FIRE

Addressees

All holders of operating licenses or construction permits for pressurized-water reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a problem that may exist with the oil collection system for the lube oil system components of reactor coolant pumps. 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

Haddam Neck Plant

On July 11, 1994, while operating at 100 percent power, the licensee for the Haddam Neck Plant received a low oil level alarm for the upper lube oil reservoir of reactor coolant pump No. 3. The licensee later observed that the upper bearing temperature for reactor coolant pump No. 3 had been increasing for approximately 6 hours prior to receiving the low oil level alarm and reached 82 °C [180 °F]. The licensee began a controlled power reduction to bring the plant to a power level condition which would allow the reactor coolant pump to be taken out of service. Simultaneously, a maintenance crew was entering containment to fill the oil reservoir. Upon entering containment, the maintenance crew observed smoke just inside the airlock. At this time, the upper bearing temperature reached nearly 93 °C [200 °F], and the licensee manually tripped the reactor from approximately 50 percent power. The heat detectors installed above the reactor coolant pump went into alarm approximately 50 minutes later. At about the same time, the fire brigade entered containment and reported a fire in the insulation around the pump casing and nearby piping of reactor coolant pump No. 3. The fire brigade removed insulation and extinguished the fire using portable dry chemical fire extinguishers. A relief crew later observed a reflash on the remaining insulation, removed this insulation, and extinguished the second fire.

The licensee determined that the oil leak and subsequent fire resulted from a crack in a 1-inch diameter, schedule 80, threaded PVC fitting in the pump lube oil system. The PVC fitting was installed between the reactor coolant pump

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oil reservoir and the oil lift pump to electrically isolate the oil lift pump from the reactor coolant pump motor. The oil leaking from the crack was not properly collected and routed away from high velocity cooling air, which blew the oil onto the insulation on the pump casing and pipe. The cooling air came from the reactor coolant pump motor and the area ventilation system. The high temperature of the reactor coolant system (approximately 282 °C [540 °F]) ignited the oil-soaked insulation. (The flash point of the lube oil is approximately 204 °C [400 °F].) The reservoir retained about 455 liters [120 gallons] of the approximately 755 liters [200 gallons] of oil originally in the reservoir. About about 150 liters [40 gallons] of oil was collected by the oil collection system, and 150 liters [40 gallons] leaked onto the insulation and the containment floor.

#### Millstone Nuclear Power Station, Unit 2

On July 27, 1994, the lube oil low flow alarm for the 'A' reactor coolant pump annunciated at Millstone Unit 2. Plant operators began reducing reactor power in accordance with plant procedures. Licensee personnel inspected all of the reactor coolant pumps and found that oil had dripped from the tops of the 'A' and 'D' pump motors, coating the outside of the motors. Most of the oil was contained by the oil collection drip pans; however, some of the oil that leaked from the 'A' pump motor was not contained. Based on the observed fire hazard in containment, the licensee shut down the plant.

After the plant was shut down, an NRC inspector examined the lube oil collection system and the area around the reactor coolant pumps. There were a number of small oil leaks on each pump motor although there was more leakage from the 'A' pump motor. The inspector observed that various equipment around the 'A' reactor coolant pump was coated with a film of oil and he estimated that several gallons of oil had collected in various areas outside the oil collection system. The inspector also noted that portions of the lube oil system were outside the oil collection system and that the collection system piping did not appear to be large enough to accommodate the largest potential oil leak.

#### Discussion

In pressurized-water reactors, each reactor coolant pump motor typically contains between 530 and 830 liters [140 and 220 gallons] of oil. Oil leaking from the lube oil system may come in contact with either (1) surfaces that are hot enough to ignite the oil, or (2) an electrical source of ignition. Appendix R to Part 50 of Title 10 of the *Code of Federal Regulations* requires the installation of an oil collection system to collect oil from all potential pressurized and unpressurized leakage sites. An adequately designed, installed, and maintained oil collection system is necessary to contain any oil released because of leakage or failure of the lubrication system and to minimize fire hazards by draining the oil to a safe location.

There are a number of differences between the reactor coolant pump motors and their associated lube oil systems at Millstone Unit 2 and Haddam Neck. For example, the Millstone Unit 2 motors do not use PVC or other synthetic couplings in the lube oil system. The Millstone Unit 2 reactor coolant pump

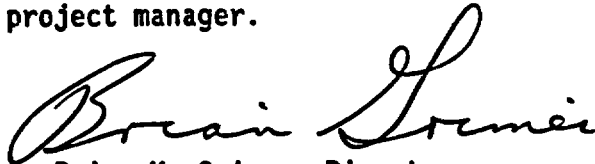
motors are manufactured by General Electric Company while the motors at Haddam Neck are manufactured by Westinghouse Electric Corporation. However, the oil collection systems at the two plants are similar.

The Haddam Neck oil collection system is intended to collect lube oil from all potential leakage sites and to drain it to a vented, closed container to prevent a fire during normal conditions or design basis accident conditions. However, in this event the catch pan design, which relied on an unshielded vertical flow of oil, was not adequate. This design allowed the air flow around the motor to affect the vertical movement of the dripping oil and allowed it to escape the collection system. To a lesser extent, the ventilation system also created air currents in the vicinity of the pump, which prevented some of the oil from being collected.

The licensee is installing a steel dielectric union on each reactor coolant pump motor at Haddam Neck to replace the PVC fitting which failed and caused the leak in this event. The licensee is also modifying the oil collection system to account for air currents near the reactor coolant pumps.

The ventilation system for the Millstone Unit 2 containment does not contribute to the air flow around the reactor coolant pump motors. The only air flow in this area is caused by the motor itself. In addition, Millstone Unit 2 has installed mirror insulation on some of the piping in the vicinity of the reactor coolant pumps. This type of insulation would prevent oil from coming in contact with and igniting on the high temperature piping it insulates. These factors reduce, but do not eliminate, the likelihood of leaking lube oil reaching an ignition source. However, the design of the existing oil collection system was inadequate to contain existing and potential oil leakage paths. The licensee is evaluating modifications that can be installed during the current forced outage to ensure that the lube oil collection system for the reactor coolant pump motors meets the requirements of Appendix R.

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 (NRR) project manager.



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

Technical contacts: Edward A. Connell, NRR  
(301) 504-2838

Ralph J. Paolino, RI  
(610) 337-5285

Attachment:  
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-57	Debris in Containment and the Residual Heat Removal System	08/12/94	All holders of OLs or CPs for nuclear power reactors.
94-56	Inaccuracy of Safety Valve Set Pressure Determinations Using Assist Devices	08/11/94	All holders of OLs or CPs for nuclear power reactors.
94-55	Problems with Copes-Vulcan Pressurizer Power-Operated Relief Valves	08/04/94	All holders of OLs or CPs for nuclear power reactors.
91-79, Supp. 1	Deficiencies Found in Thermo-Lag Fire Barrier Installation	08/04/94	All holders of OLs or CPs for nuclear power reactors.
94-54	Failures of General Electric Magne-Blast Circuit Breakers to Latch Closed	08/01/94	All holders of OLs or CPs for nuclear power reactors.
91-45, Supp. 1	Possible Malfunction of Westinghouse ARD, BFD, and Nbfd Relays, and A200 DC and DPC 250 Magnetic Contactors	07/29/94	All holders of OLs or CPs for nuclear power reactors.
94-42, Supp. 1	Cracking in the Lower Region of the Core Shroud in Boiling-Water Reactors	07/19/94	All holders of OLs or CPs for boiling water reactors (BWRs).
94-53	Hydrogen Gas Burn Inside Pressurizer During Welding	07/18/94	All holders of OLs or CPs for nuclear power reactors.
94-52	Inadvertent Containment Spray and Reactor Vessel Draindown at Millstone Unit 1	07/15/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
CP = Construction Permit

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Original signed by  
Brian K. Grimes

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*Enclosure:  
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EAConnell  
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\*DRS:RI  
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07/21/94

\*OGCB:DORS  
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CEMcCRACKEN  
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MJVirgilio  
07/25/94

\*C/OEAB:DORS  
AEChaffee  
07/26/94

\*AC/OGCB:DORS  
ELDoolittle  
07/28/94

*[Signature]*  
D/DORS  
BKGrimes  
08/10/94

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DOCUMENT NAME: 94-58.IN

NOTES:

- The PM was informed of the development of this Infor. Notice.
- The licensee was consulted with the technical content of this Infor. Notice, and its comments were incorporated. Subsequently, the final version was shown to R. Paolino (RI) and P. Madden (SPLB). They have no further comments.
- This version also addressed OEAB's comments.

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DOCUMENT NAME: HADMNECK.IN

NOTES:

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*Peter Wen 7/28/94*

The licensee is considering flanged connections to replace the PVC fittings. The licensee is also modifying the oil collection system to account for the air currents near the RCPs.

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07/21/94

C/SPLB:DSSA  
CEMcCRACKEN  
07/24/94 #11  
SFA

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07/25/94

C/OGCB:DORS  
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07/26/94 *see comment*

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PCWen *PCW*  
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