Consumers Power

POWERING MICHIGAN'S PROGRESS

Big Rock Point Nuclear Plant, 10269 US-31 North, Charlevoix, MI 49720

Patrick M Donnelly
Plant Manager

December 9, 1996

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 - BIG ROCK POINT PLANT - LICENSEE EVENT REPORT 96-003: REACTOR DEPRESSURIZATION SYSTEM "B" TRAIN FOUND INOPERABLE DURING REFUELING OUTAGE SURVEILLANCE TESTING - REVISION 1

Licensee Event Report 96-003: **REACTOR DEPRESSURIZATION SYSTEM "B" TRAIN FOUND INOPERABLE DURING REFUELING OUTAGE SURVEILLANCE TESTING - REVISION 1**, is attached. The revisions are shaded. This event was reportable to the Nuclear Regulatory Commission in accordance with 10 CFR 50.73(a)(2)(i)(B); 10 CFR 50.73(a)(2)(ii)(B) and 10 CFR 50.73(a)(2)(vii)(A)(D).

Patrick M Donnelly
Plant Manager

CC: Administrator, Region III, USNRC
NRC Resident Inspector - Big Rock Point

ATTACHMENT

NRC FORM 366 (4-95) — U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)
RDS "B" Train Found Inoperable During Refueling Outage Surveillance Testing - Revision 1.

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	18	96	96	003	01	12	09	96	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9): N
POWER LEVEL (10): 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.36(c)(2)	X	50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (INCLUDE AREA CODE)
Michael D. Bourassa, Licensing Supervisor	1-616-547-8244

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B		ISV	K085	N					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On January 15, 1996, an as-found surveillance test was being performed on the Reactor Depressurization System (RDS) "B" train pilot assembly during a scheduled refueling outage. At 2200, Maintenance concluded that the "pop test" had failed, due to mechanical binding since there was evidence that the solenoid valve was "picking up". On January 18, 1996, an investigation concluded that the disc of the lower of the two pilot isolation valves was stuck in its seat. The isolation valves are normally open during power operation; and should have been demonstrated open by the surveillance test. An unusual black coating, suspected to be stellite corrosion, was noted on the valve disc. Engineering could not ascertain if the valve had been closed for the entire operating cycle; however management decided to consider the valve closed and the RDS "B" train inoperable for the entire operating cycle.

Corrective actions included cleaning the disc and seat, inspecting remaining seven kerotest valves on the RDS trains, revising maintenance and operations procedures and investigating other valve designs for RDS application. During disassembly of the RDS pilot valve, difficulty was experienced due to the presence of corrosion products in the main pilot disc. The main disc of the pilot valve had become rusted in place, and also may not have operated during plant operation.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

IDENTIFICATION OF EVENT

This event is reportable to the Nuclear Regulatory Commission pursuant to:

1) 10 CFR 50.73(a)(2)(i)(B) - "Any operation prohibited by the plant's Technical Specifications" - Exceeded the 7 day Limiting Condition of Operation allowed outage time and shutdown requirement.

In addition, the following condition requires consideration:

Following a subsequent review, it was determined that RDS "C" train had been removed from service for 12 hours during the operating cycle to replace a leaking pilot valve. Therefore, during Cycle 28, "B" and "C" RDS trains were inoperable at the same time, resulting in 2 out of 4 trains being inoperable. For this condition, Technical Specifications require that should two or more RDS valve trains become inoperable, the plant shall be brought to the SHUTDOWN condition within 12 hours and to the COLD SHUTDOWN condition within the following 24 hours; and:

2) 10 CFR 50.73(a)(2)(ii)(B) - "Any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded; or that resulted in the nuclear power plant being:

(A) In an unanalyzed condition that significantly compromised plant safety;
(B) In a condition that was outside the design basis of the plant; or
(C) In a condition not covered by the plant's operating and emergency procedures.

3) 10 CFR 50.73(a)(2)(vii)(A)(D) - "Any event where a single cause or condition caused at least one independent train or channel to become inoperable in multiple systems or two independent trains or channels to become inoperable in a single system designed to:

(A) Shutdown the reactor and maintain it in a safe shutdown condition:
(B) Remove residual heat;
(C) Control the release of radioactive material; or
(D) Mitigate the consequences of an accident."

Note: The RDS is a SINGLE system comprised of four independent trains. This condition was reportable because two out of the four RDS trains were inoperable for 12 hours.

On January 16, 1996, at 0027, a four hour non-emergency report was called in by the Big Rock Point Staff. The Reactor Depressurization System "B" train pilot valve had failed to open during a routine maintenance test. "B" train was declared inoperable. (The Reactor Depressurization System provides for both manual and automatic depressurization of the primary system to allow injection of the core spray following a small break in the primary

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system. This allows core cooling with the objective of preventing excessive fuel clad temperatures). The nuclear plant was determined to be in an unanalyzed condition or experienced a serious degradation of the plant or principal safety barriers. (10 CFR 50.72(b)(2)(i)).

After further review, the condition reported did not meet the criteria for reportability. The nuclear plant was never in an unanalyzed condition or experienced a serious degradation of the plant or principal safety barriers. (10 CFR 50.72(b)(2)(i)). Each blowdown path is designed to pass 144lb/sec of steam at 1350 psig which is a third of the total flow rate. Therefore, failure of one flow path to open upon actuation did not preclude achieving the required rate of depressurization. "A", "C" and "D" train were scheduled to be tested, and were assumed to be operable at this time.

In accordance with NUREG 1022, an ENS notification was not required. The four hour report would only be required if one of the conditions, [(50.72(b)(1)(ii)(B), outside the design basis] had been discovered during operation, or if the condition was classified as unanalyzed.

REFERENCES

C-BRP-96-088; Failure of 86R-4 Pilot Valve - RDS "B" Train.

C-BRP-96-129; Disc Stuck in Seat of Isolation Valve Upstream of "B" Train Pilot Valve.

NUREG 1022 - Event Reporting Guidelines

C-BRP-96-729; Spare RDS Model 86R Pilot Valve Internals Found Rusted in Place.

DESCRIPTION OF EVENT

Big Rock Point Technical Specifications require that "the Reactor Depressurization System (RDS) shall be operable during POWER OPERATION. Should one RDS train become inoperable in the closed position, the reactor [RCT] may remain in POWER OPERATION for a period not to exceed 7 days. If not returned to operable status, a normal orderly shutdown shall be initiated within one hour...". In addition, should two or more RDS valve trains...become inoperable the plant shall be brought to the SHUTDOWN condition within 12 hours and to the COLD SHUTDOWN condition within the following 24 hours.

On January 15, 1996, an as-found surveillance test was being performed on the RDS "B" train pilot assembly during a scheduled refueling outage. The RDS system is not required to be operable in the COLD SHUTDOWN condition. At 2200, Maintenance concluded that the "pop test" had failed, due to mechanical binding since there was evidence that the solenoid valve [FSV] was "picking up".

On January 18, 1996, an investigation concluded that the disc of the lower of the two pilot isolation valves was stuck in its seat. The isolation valves [ISV] are normally

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open during power operation; and should have been demonstrated open by the surveillance test. An unusual black coating, suspected to be stellite corrosion, was noted on the valve disc. Engineering could not ascertain if the valve had been closed for the entire operating cycle; however management has decided to consider the valve closed and the RDS "B" train inoperable for the entire operating cycle.

Addendum

During the disassembly of the RDS pilot valve, difficulty was experienced due to the presence of corrosion in and around the main pilot disc. "Hand" force was exerted to the solenoid core in an attempt to lift the pilot disc assembly from the valve body. Additional force, great enough to shear the main pilot disc pin, failed to move the disc from its "as found" position. The main disc was eventually driven out with a punch and mallet.

ROOT CAUSE

Two issues were investigated with respect to this failure.

- What mechanism caused the isolation valve to remain in the closed position?

- Why was the isolation valve closed when it should have been open?

An unusual black coating and general discoloration was noted on the valve disc. The disc stem was decontaminated and the disc sent to Consumers Power Company Laboratory Services Group for analysis. Preliminary findings indicate that the grey-black substance was a product of stellite corrosion.

Evidence indicates that the valve was closed or near closed since the 1994 refueling outage. The mechanisms evaluated that could place the disc in a permanently closed position while giving a "false open" indication have been disproved by either testing or analysis.

A common cause failure exists for the series 9915 Kerotest valves in this application, but the root cause could not be definitely determined.

The corrosion observed on the valve and disc is the most probable cause of the valve remaining in its seat after removal of the bonnet and diaphragms. This is a common occurrence throughout the industry whose valves are similar in design but are typically maintained in a closed versus open application.

Discussion

The 9900 series Kerotest packless metal diaphragm globe valve utilizes independent stem and disc assemblies separated by a series of pressure retaining diaphragms. The diaphragms provide a 100% isolation of the stem and outside environment from the fluid side of the

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valve. The stem is threaded to the valve bonnet and the disc follows the stem motion due to being spring loaded to open. Rotating the stem handwheel about 1 turn clockwise compresses the spring and closes the valve. Total travel, close to open is less than 1/4 inch. The valve is fabricated from stainless steel and has an integral stellited #6 seat. The disc is fabricated from 316 stainless steel but has an overlaid stellite #6 seating surface. Stellite is a high cobalt alloy.

Addendum

The failure of the "B" Train RDS pilot valve, 86R-4, had been identified as a blockage of the pressure sensing line to the pilot, and was attributed to VRDS-157B being stuck in the closed position. Additional testing of the "B" train components was not performed since the entire train had already been declared inoperable.

The corrosion products observed on the upstream pilot isolation valve (VRDS-157B) were not from the same process. The corrosion found on VRDS-157B was glossy black in nature and attributed to stellite corrosion occurring at high temperatures in a moist, oxygen rich environment. Because the pilot isolation valve was believed to be shut throughout the course of the 1995 fuel cycle, the RDS pilot 86-R would have been isolated from the high pressures and temperatures of the steam drum. Slight steam leakage past the small pilot valve was evident but not enough to generate high tail piece temperatures. This fact establishes that the "corroded" pilot valve was above ambient temperature, in a moist, oxygenated environment as well an environment that supports corrosion. Traces of black corrosion product were found on one of the fractured surfaces of the tooth. An insignificant amount of stainless steel corrosion products and/or pitting was found on the sleeve or other valve internal components.

Two failure mechanisms were identified in the course of the root cause evaluation.The first failure mechanism was due to the corrosion products found throughout the upper regions of the valve disc assembly. The corrosion was determined to be from a foreign material introduced during reassembly or testing of the valve. During disassembly of the valve, the corrosion products circumvented removal of the disc, which eventually had to be forcefully removed.

The second was a sleeve that was cracked in the shape of a tooth. The piece of the "tooth" that was dislocated from the sleeve was found within the thread relief area of the valve body and most probably would not have caused the valve to malfunction. The root cause of the cracking in the sleeves of the model 86R pilot valves is not fully understood. Material in conjunction with environmental conditions, per the metallurgical report, are stated to be precursors for the failure seen.

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CORRECTIVE ACTION

Discussion

The unusual black coating and general discoloration was noted on the valve disc. The disc stem was decontaminated and the disc sent to Consumers Power Company Laboratory Services Group for analysis. The old disc and seat have been cleaned, and dimensional checks of the valve have been performed.

The following actions have been completed for the Kerotest isolation valve:

- VRDS-157 series valves on the tops installed in the RDS trains A,B,C, and D were inspected during the 1996 refueling outage prior to performing the post maintenance/preoperational tests.

- TR-101, RDS Depressurization Valve Test, was revised to:

a. Ensure the SV-4984/5/6/7 are tested in the truly "as-found" condition, and after a successful "lift", the pilot valves are to remain in the open position

b. Disassemble, inspect and clean all the lower pilot isolation valves prior to returning the valve(s) to service.

- The reliability of the existing locking mechanism has been improved. The old style locking collars were replaced by locking rings and pinned in place.

- "Operation-Maintenance Instruction "Y" Type Globe Valve, Manual #MG-004, Rev 5, January 19, 1981" has been revised to include critical dimensions of valve internals and lapping tools. The use of Neolube has been eliminated and replaced with an approved lubricant (i.e., Felpro-N5000).

- Based on industry experience, a placard has been posted near the isolation valves warning to "Only operate by Hand"

- A new verification method for valve position on VNS-0210 (another Kerotest valve application) was determined to be unnecessary. However, a note has been added to O-TGS-1, A-1, Valve Check List for NSSS, to inform the user that the valve(s) only require 1-2 turns for full stroke.

- Radiographic examination of the pilot isolation valves during power operation is feasible for B, C, and D, trains. The exception is A train. Due to valve orientation relative to the respective blowdown valve's position indication, the film cassette, with insulation, cannot be set in place for an exposure.

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- Provided industry notification via NETWORK or other appropriate vehicle for this issue.

- Periodic and Predetermined Activity Change (PPAC) XTR101 and MRDS-13, "Remove and/or Install RDS Target Rock Valves" have been revised to include expanded as-found examination of the pilot isolation valves (preserves "as - found"/"as left" conditions).

Addendum

The following corrective actions will be also be taken for the pilot isolation valve:

1) Ensure adequate material conditions (eg., properties) are evaluated for the sleeves purchased for the 86R style pilot valves (lot sample)

This action will be complete January 30, 1997.

2) Revise MRDS-9 and TR-101 to direct "as-found" testing of a pilot valve if removed from the system due to leakage or if an "as found" test of the main RDS valve fails.

This action will be complete June 30, 1997.

3) Improve foreign material exclusion controls in RDS pilot valve rebuild and testing procedures (eg., MRDS-6A and 6B).

This action will be complete June 30, 1997.

4) Replace sleeves in all 86R style pilot valves as they become available for rebuild.

This action will be complete August 1, 1997

SAFETY SIGNIFICANCE

The reactor depressurization system serves three functions during anticipated transients. The primary function is to provide rapid depressurization of the primary system [AD] to permit operation of the low-pressure core spray system [BM] when normal high-pressure makeup sources [BG] fail to provide adequate flow to maintain core coverage. As a secondary function, the system is employed for manual primary system pressure control to precluded safety valve actuations for accidents in which primary system heat sinks (i.e.. the main and emergency condenser) are unavailable. As a tertiary function, the system is operated to prevent primary system over-pressurization in accidents where the safety relief valves fail to open.

System success criteria are dependent on the operational mode of the system. For automatic or manual depressurization, success requires three of four valve trains. Each valve train is initially capable of releasing steam at a rate of 144 lb/sec, which is equivalent to one-third of the full steam flow. When manual venting through one RDS valve train to control primary system pressure, success requires the air operated valve to be open and

opening of one of the four depressurization valves. Flow through the bypass valve CV-4184 is approximately 6 to 7 lb/sec. These success criteria are summarized below:

EVENT	SUCCESS CRITERIA
Very small steam line break inside containment	Automatic actuation of 3 out of 4 RDS trains
Small steam line break outside of containment	Automatic or manual actuation of 3 out of 4 RDS trains
High-pressure transients caused by failure of the main condenser and the emergency condenser	Manual venting of the PCS through CV-4184 and one depressurization valve to prevent safety valve cycling
Small LOCAs above and below core	Automatic actuation of 2 out of 4 RDS trains causing rapid depressurization of the PCS
Very high-pressure transients caused by failure to control pressure by venting the PCS and RDS or by safety valve cycling	Manual actuation of all 4 trains of RDS valves to prevent over pressurization of the PCS
Station blackout without power restoration	Manual actuation of 3 out of 4 valve trains from the computer room. In this scenario, power to RDS control panel C-40 is unavailable

During operation, the RDS system is tested weekly, and each of the four actuation cabinets are tested monthly. Therefore, there were occurrences when 2 out of 4 trains were inoperable due to testing and the configuration of "B" Train; however if an event would have required depressurization, the train/cabinet being tested could have been actuated manually because they had only been placed in a bypass mode for testing.

When the "C" RDS train was removed from service to replace the leaking pilot valve, only 2 out of 4 RDS trains would have been available for automatic depressurization. Manual operation would not have been possible. However, since the "C" train was removed for 12 hours, the contribution to core damage frequency is negligible.