Consumers Power

POWERING MICHIGAN'S PROGRESS

Palisades Nuclear Plant: 27780 Blue Star Memorial Highway, Covert, MI 49043

David W. Rogers
Plant Safety and Licensing Director

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Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
LICENSEE EVENT REPORT 94-006 - PLANT SHUTDOWN IN ACCORDANCE WITH PLANT TECHNICAL SPECIFICATIONS BECAUSE OF A LEAK ON AN ASME, SECTION XI, CLASS 2, SAFETY-RELATED CHECK VALVE

Licensee Event Report (LER) 94-006 is attached. This event is reportable in accordance with 10CFR50.73(a)(2)(i)(A) as the completion of a nuclear plant shutdown required by the plant's technical specifications.

David W. Rogers

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Plant Safety and Licensing Director

CC Administrator, Region III, USNRC
NRC Resident Inspector - Palisades

Attachment

IE22

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

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TITLE (4) PLANT SHUTDOWN IN ACCORDANCE WITH PLANT TECHNICAL SPECIFICATIONS BECAUSE OF A LEAK ON AN ASME, SECTION XI, CLASS 2 SAFETY-RELATED CHECK VALVE

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 NAMES	
0 2	1 7	9 4	9 4	- 0 0 6	- 0 0		0 3	2 1	9 4	N/A	0 5 0 0 0
										N/A	0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Barry N. Young, Staff Licensing Engineer	AREA CODE 6 1 6 7 6 4 - 8 9 1 3

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	

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

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

On February 17, 1994, at 1538 hours, with the plant operating at 100% power, an accumulation of boric acid on the valve body of check valve CK-ES3166 was confirmed to be caused by a through wall defect. The 24-inch austenitic stainless steel check valve is located between the containment sump and the suction piping for one train of Engineered Safeguards System (ESS) pumps. The check valve is considered an ASME, Class 2 component in the Section XI program. The valve was declared inoperable. A Plant shutdown was initiated at 1634, February 17, 1994 and the plant was taken to cold shutdown.

Inspection of the comparable check valve in the other ESS train, CK-ES3181, identified indications of a similar nature in the casting of that valve.

The cause of this event was a through wall defect in the body of an ASME, Class 2, check valve, CK-ES3166, due to preferential corrosion at the grain boundaries in a weld repaired region of the valve casting. The code does not allow operation of an ASME Class 2 component with a through wall leak.

Corrective action for this event will be the repair of both check valves, CK-ES3166 and CK-ES3181.

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EVENT DESCRIPTION

On February 17, 1994, at 1538 hours, with the plant operating at 100% power, an accumulation of boric acid on the valve body of check valve CK-ES3166 [BQ;ISV] was confirmed to be caused by a through wall defect. The 24-inch austenitic stainless steel check valve is located between the containment sump [BP;ISV] and the suction piping for one train of Engineered Safeguards System (ESS) pumps. The check valve is considered an ASME, Class 2 component in the Section XI program. The valve was declared inoperable because the Code does not allow operation of a Class 2 component with a through wall leak. A Plant shutdown was initiated at 1634, February 17, 1994 and the plant was taken to cold shutdown.

Inspection of the comparable check valve in the other ESS train, CK-ES3181, identified indications of a similar nature in the casting of that valve.

This event is reportable to the NRC in accordance with 10CFR50.73(a)(2)(i)(A) as the completion of a nuclear plant shutdown required by the plant's technical specifications.

CAUSE OF THE EVENT

The cause of this event was a through wall defect in the body of an ASME, Class 2, check valve, CK-ES3166, due to preferential corrosion at the grain boundary in a weld repaired region of the valve casting. The valve body material in the area of the defect had been extensively sensitized as it is in the heat affected zone of a number of welding operations that have been performed on the valve. This sensitization at the grain boundary followed by intergranular corrosion caused the leak to surface. A possible contributor to the leak going through wall was that it could have traveled along an existing defect to go entirely through wall.

ANALYSIS OF THE EVENT

CK-ES3166 and CK-ES3181 are Chapman A351-CF8M 316 Cast Stainless Steel 24-inch tilting disk check valves. They are located in the West and East Engineered Safeguards Rooms, respectively. The valves are part of the Engineered Safeguards Systems (ESS) pumps suction header. The valve inlet flow is from the containment sump, and thus the outlet supplies the ESS pumps following a Containment Sump Recirculation Actuation Signal. The inlets have bolted flanges and the outlets are butt welded to the ESS pump suction piping.

On Monday, February 14, 1994, a dry boric acid deposit was identified on the CK-ES3166 outlet weld. After numerous inspections a boric acid spot about the size of a pen tip was observed on Thursday, February 17, 1994. The spot was roughly 3/4-inch from the toe

of the butt weld and was located on the check valve body. Dye penetrant examination results were inconclusive until light hand filing was performed on the suspected area which resulted in positive identification of a 3/32-inch long defect. The check valve was declared inoperable and plant shutdown was commenced.

The through wall flaw was in a heat affected zone created by casting weld repairs and the adjacent butt weld. The existence of the repair welds was determined during the surface replication and macro etching activities.

Additional inspection of the same area on the second containment sump check valve, CK-ES3181, has revealed subsurface indications that we have conservatively decided to repair.

The history of the valves is that both check valves were originally welded into place, but during initial plant startup test (circa 1969) seat leakage problems were identified and the valves were cut out and sent back to the manufacturer for repairs. While at the manufacturer, the internals of the check valves were repaired and weld repairs were made to the buttweld ends of the valves.

The check valves were returned to the plant and welded into place. The through wall leak on CK-ES3166 and additional NDE determined that indications were present in an area where the valve body had seen significant prior heat input. Casting weld repairs by the vendor, and two butt weld operations to install the valve (original and following valve removal for seat leakage repairs), created a highly sensitized heat altered zone on CK-ES3166. The continuously sensitized grain boundaries near the buttweld pipe connection and valve casting weld repair areas were observed via several surface replications performed on CK-ES3166.

The leak mechanism was determined by non-destructive examination (NDE) and surface replication metallography. Interpretation of the results indicated that inter-granular corrosion attack was occurring in sensitized weld heat affected zones initiating on the valve inside diameter.

SAFETY SIGNIFICANCE

Analysis, based on the methodology of Appendix C of the 1989 ASME, Section XI, code and the proposed Standard Review Plan 3.6.3, "Leak Before Break Procedures," performed after the flaw had been characterized determined that adequate margin between the Allowable Stress Index (SI) and the Applied Stress Index (ASI_n and ASI_e), such that failure of the valve would not occur during a safe shutdown earthquake event. The presence of the through wall defect, although not allowed by code requirements, had no impact on safety.

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CORRECTIVE ACTION

Near Term Actions:

Corrective action for this event continues, with the weld repair or replacement of both check valves, CK-ES3166 and CK-ES3181. The ASME Code Case N-504-1, "Alternate Rules For Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," is being used to repair the valves. We have requested and received approval for the use of this Code Case from the NRC.

VT-2 examinations on both containment sump outlet valves and both SIRW tank outlet valves revealed no additional boric acid deposits or leaks of the pressure boundary material.

VT-2 examinations were also completed on 18 similar cast stainless steel butt welded valves in the ESS system to determine the existence of any similar boric acid buildup on welded ends. No additional indications were observed.

Longer Term Actions:

Review the importance of reporting observed conditions which could indicate through wall leakage of components with those personnel who perform system walkdowns.

Assess existing welding practices to ensure that controls exist to minimize sensitization of stainless steel components and the resulting long term intergranular corrosion.

Revise the Palisades Augmented Inspection Program to include periodic examinations required for code case N-504-1 repairs on valves CK-ES3166 and CK-ES3181.

Develop a ranked list of valves with similar intergranular corrosion (IGC) susceptible welds and develop actions to inspect and evaluate higher risk components for existence of IGC defects.

If CK-ES3166 or CK-ES3181 is removed during the 1995 REFOUT, perform further metallurgical examinations of weld areas to further characterize the through wall flaw and other nondestructive examination indications.

Perform destructive examinations on similarly susceptible valves that are removed for replacement in 1994 or 1995 to determine further existence of intergranular attack in heat affected zones.

Use the results of planned inspections on CK-ES3181 and CK-ES3166 and other IGC inspections on Palisades' valves to develop a programmatic control mechanism to prevent excessive repairs on components that could lead to excessive sensitization.

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ADDITIONAL INFORMATION

The details of the valve defects, the associated analyses, and a root cause analysis are contained in a March 6, 1994 Consumers Power Company letter to the NRC entitled, "Code Case N-504-1 Update Approval For Leak Repair of Containment Sump Check Valves."