NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

# LICENSEE EVENT REPORT (LER)



FACILITY NAME (1): R.E. Ginna Nuclear Power Plant

DOCKET NUMBER (2): 0 5 0 0 0 2 4 4



TITLE (4): During Planned Maintenance, Failures of Safeguard Service Water System Were Discovered

| EVENT DATE (5) MONTH | DAY | YEAR | LER NUMBER (6) YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | REPORT DATE (7) MONTH | DAY | YEAR | OTHER FACILITIES INVOLVED (8) FACILITY NAMES | DOCKET NUMBER(S) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 3 | 2 8 | 9 3 | 9 3 | 0 0 3 | 0 0 | 0 7 | 0 9 | 9 3 | | 0 5 0 0 0 |
| | | | | | | | | | | 0 5 0 0 0 |

OPERATING MODE (9): N

POWER LEVEL (10): 0 0 0

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

| | | | |
|---|---|---|---|
| 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) | X OTHER *(Specify in Abstract below and in Text, NRC Form 366A)* |
| 20.405(a)(1)(iii) | 50.73(a)(2)(i) | 50.73(a)(2)(viii)(A) | Voluntary Report |
| 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: Wesley H. Backus
Technical Assistant to the Operations Manager

TELEPHONE NUMBER: AREA CODE 3 1 5 | 5 2 4 - 4 4 4 6

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 | B I | I S V | C 6 8 4 | Y | | | | | |
| | | | | | | | | | |

SUPPLEMENTAL REPORT EXPECTED (14)

YES *(If yes, complete EXPECTED SUBMISSION DATE)*   X NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

On March 28, 1993 at approximately 1200 EST, with the reactor in the defueled condition, the Maintenance Department, during valve improvement program maintenance, discovered that two manually operated Service Water System Valves, that were required to be open during normal operation, were failed in the closed position, and some isolation valves had excessive seat leakage.

No immediate operator action was necessary because the failures were identified on out of service sections of the Service Water System.

The cause of these events was determined to be partly due to design and partly due to the operating environment. (This event is NUREG-1022 (B) and (X) cause codes).

Corrective action taken was to replace the affected valves with qualified spares. Corrective actions to prevent recurrence are discussed in section (V) (B) of this report.

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

## I. PRE-EVENT PLANT CONDITIONS

The plant was in the Cold/Refueling Shutdown mode with the reactor in the defueled condition. Phase Five (5) of the Valve Improvement Program (VIP) was in progress with major emphasis on the Service Water System valves. Normal valve degradation had been observed in the previous 4 phases of the VIP. During Phase Five, a more serious degraded condition was discovered for Crane Model 101XU valves. The following is a listing of the recent problems experienced with these Crane Model 101XU valves:

- May 1990: First failure of a Crane Model 101XU valve was identified. This failure was in a non-safety related application, and was documented on Work Request/Trouble Report (WR/TR) #9000910 for Service Water System valve 4675 (Service Water Inlet Isolation Valve to Main Generator Hydrogen Side and Air Side Seal Oil Coolers).

- April 1991: Indication of a possible second failure of a Crane Model 101XU valve was identified. This possible failure, also in a non-safety related application, was documented on WR/TR #9100754 for Service Water System valve 4690 (Service Water Inlet Block Valve to Turbine Lube Oil Cooler "B").

- September 1991: After several troubleshooting efforts as followup to WR/TR #9100754, radiography of valve 4690, documented on WR/TR #9122140, confirms failure of valve 4690.

- April 1992: During disassembly and repair of valve 4690, the failure mode is determined to be the same failure mode as for valve 4675.

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## II. DESCRIPTION OF EVENT

### A. DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES:

- March 28, 1993, 1200 EST: Event date and time.
- March 28, 1993, 1200 EST: Discovery date and time.

### B. EVENT:

On March 28, 1993 at approximately 1200 EST, with the reactor in the defueled condition, the Maintenance Department was performing Phase Five (5) of the VIP. As included in the 1993 VIP, Service Water System valve 4669 (Service Water Inlet to Emergency Diesel Generators "A" and "B" Crosstie) (safety related) was to be refurbished and Service Water valve 4738 (Service Water Loop "B" Root Valve to Auxiliary Building Motor Coolers) (safety related) was to be replaced. Valve 4738 was planned for replacement, vice refurbishment, due to unavailability of repair parts. When the internals of the valves were exposed, the existing conditions revealed that the valve disk had separated from its valve stem. Both valve disks were found in the closed position with their stems separated from the disk and fully retracted. This failure mode is undetectable under normal operation and with existing routine periodic testing, due to parallel flow paths. (The normal at power condition for these valves is "locked open").

Also during Phase Five (5) of the VIP, special performance tests identified other Service Water System valves with unexpectedly high leakage past the valve seat with the valve in the closed position. These valves perform an isolation function, and this leakage degraded their isolation capabilities.

C. INOPERABLE STRUCTURES, COMPONENTS, OR SYSTEMS THAT CONTRIBUTED TO THE EVENT:

None.

D. OTHER SYSTEMS OR SECONDARY FUNCTIONS AFFECTED:

Crane Model 101XU valves are also installed in the Component Cooling Water (CCW) and Auxiliary Feedwater Systems. See Section (V)(B) for more detail on valves in these systems.

E. METHOD OF DISCOVERY:

These events were discovered during planned VIP maintenance for the 1993 Annual Outage.

F. OPERATOR ACTION:

As these were component failures identified on out of service sections of the Service Water System, no immediate operator action was necessary.

G. SAFETY SYSTEM RESPONSES:

None.

III. <u>CAUSE OF EVENT</u>

A. IMMEDIATE CAUSE:

The immediate cause of valves 4738 and 4669 being unknowingly in the closed position was due to a separation of the valve disk from the valve stem.

The immediate cause of excessive leakage was due to the general deterioration of isolation valves.

B. **INTERMEDIATE CAUSE:**

The stem and disk of valves 4738 and 4669 had separated due to a variety of corrosion effects.

Isolation valve deterioration was due to a variety of factors, including corrosion, wastage, and environmental conditions, resulting in valves not fully isolating.

C. **ROOT CAUSE:**

The underlying cause of the corrosion effects on valves 4738 and 4669 was due to the use of dissimilar metals in the manufacture of the stem and disk, combined with prolonged exposure to raw service water and differential aeration cell (concentration cell) corrosion due to stagnant conditions surrounding the tee slot area in the valve bonnet.

The underlying cause of the valves not fully isolating was due to prolonged exposure to the erosive and corrosive effects of raw service water.

## IV. ANALYSIS OF EVENT

These events are being voluntarily reported using the guidance of NUREG-1022 (Licensee Event Report System), and Supplement 1 to NUREG-1022. While the safety significance of these specific events does not require submittal of a Licensee Event Report, these types of degradation could be safety-significant at other plants, depending on the valve applications. This report is intended to alert other utilities and the NRC of problems in applications where corrosion can occur between the valve stem and disk, in raw water applications, and of the potential for degradation of isolation capabilities due to valve deterioration. These events are related to, but do not meet, the reporting requirements of 10 CFR 50.73, item (s)(2)(v) and (a)(2)(vi); which requires reporting of conditions, "that alone could have prevented the fulfillment of the safety function", but where, "individual component failures need not be reported".

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

An assessment was performed considering both the safety consequences and implications of this event with the following results and conclusions:

As part of this assessment, an evaluation was performed concerning the Service Water System operability, prior to the 1993 Annual Outage, due to the effects of Service Water System valve leakage from the valves designed to isolate the non-essential service water during an accident with loss of offsite power and due to the effects of the two failed close essential service water cross tie valves. The evaluation considered 3 accidents (i.e. Containment Integrity, Loss Of Coolant Accident (LOCA) and LOCA Recirculation) using the following assumptions:

- o Total service water isolation valve leakage of approximately 1100 gpm, based on a detailed results of special performance tests conducted during the 1993 outage.
- o One service water pump operating.
- o Single failure of the "A" Emergency Diesel Generator.
- o Loss of offsite power.

Based on the above assumptions the main thrust of the evaluation was to investigate whether the identified valve failures and leakage could have adversely impacted nuclear safety due to changing the service water flow to the critical components for required accident cooling. The critical components considered were the Emergency Diesel Generator Coolers, the Containment Recirculation Fan Cooling Coils, the Containment Recirculation Fan Motor Coolers and during the recirculation phase of the accident, the Component Cooling Water heat exchangers.

Conclusions from the above evaluation indicate that all critical component flows were acceptable.

The potential for interruption of Service Water flow to the Safety Injection (SI) pump thrust bearings was evaluated. This evaluation determined that flow from the redundant Service Water line to the SI pumps was adequate using the assumption outlined above.

Based on the above, it can be concluded that the public's health and safety was assured at all times.

## V. CORRECTIVE ACTION

### A. ACTION TAKEN TO RETURN AFFECTED SYSTEMS TO PRE-EVENT NORMAL STATUS:

The failed Crane Model 101XU Service Water valves were replaced with qualified spares of a different design and material composition, were tested satisfactorily and were returned to service. Other degraded Service Water valves were also replaced with qualified spares.

### B. ACTION TAKEN OR PLANNED TO PREVENT RECURRENCE:

As part of the VIP and to prevent recurrence of the Service Water System valve failures, all other Crane Model 101XU valves in the Service Water system were assessed for functionality and those valve warranting replacement were replaced during the 1993 Annual Outage. In addition, selected Crane Model 101XU valves in the CCW and Auxiliary Feedwater Systems were inspected, with satisfactory results.

As part of the VIP and to prevent recurrence of the Service Water System valve type failures, all remaining Crane Model 101XU valves in the Service Water System are scheduled to be refurbished or replaced during the 1994 Annual Outage. In addition, remaining Crane Model 101XU valves in the CCW and Auxiliary Feedwater Systems will be inspected in 1994. If the inspection results warrant refurbishment or replacement, the valves will be replaced.

As a result of tests performed on the Service Water System, the scope of maintenance was increased, and other Service Water System valves were also inspected during the 1993 Outage. Valves found to be excessively deteriorated were replaced, and other valves were refurbished, if warranted. Inspection/refurbishment/replacement will continue during the 1994 and 1995 Annual Outages.

Based on the results of the VIP inspection/refurbishment/replacement, a preventative maintenance frequency, for valves in the Service Water System, will be established as part of the Reliability Centered Maintenance process.

## VI. ADDITIONAL INFORMATION

### A. FAILED COMPONENTS:

The failed Crane Model 101XU valves were manufactured by Crane Company.

### B. PREVIOUS LERs ON SIMILAR EVENTS:

A similar LER event historical search was conducted with the following results: No documentation of similar LER events with the same root cause at Ginna Nuclear Power Plant could be identified.

C. SPECIAL COMMENTS:

The industry was informed of these failures via Nuclear Network on April 8, 1993. A report of component failures will be submitted to the NPRDS System.

These failures may also be undetectable at other plants, under normal operation and with existing routine periodic testing, due to parallel flow paths. Failures at Ginna were only detected during valve disassembly and/or replacement, or as a result of special performance tests. Other utilities may want to consider the benefits of enhanced testing or maintenance evaluations to detect these types of failures.