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May 22, 1991

Report Required by
10 CFR Part 50, Section 50.73

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Inadequate Control Rod Drive Cap Screw Design
Resulting in Stress Corrosion Cracking Indications

The Licensee Event Report for this occurrence is attached.

This event was reported via the Emergency Notification System in accordance with 10 CFR Part 50, Section 50.72 on April 22, 1991.

Thomas M. Parker

for Thomas M Parker
Manager
Nuclear Support Services

c: Regional Administrator - III NRC
Sr Resident Inspector, NRC
NRR Project Manager, NRC
MPCA

Attn: Dr J W Ferman

Attachment

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LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (8)			PAGE (3)	
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*TEXT (if more space is required, use additional NRC Form 366A 1/ (17)

DESCRIPTION

On April 22, 1991, while changing out Control Rod Drives during a refueling outage, Quality Control personnel discovered indications of cracking on 37 of 72 Control Rod Drive housing flange cap screws just below the cap screw head. The indications were discovered as a result of nondestructive examination of the cap screws during drive change out. Cap screw examination was included in the Control Rod Drive change out procedure as recommended in General Electric Service Information Letter 483, "CRD Cap Screw Crack Indications." It is not known when during the life of the cap screws the crack indications first appeared. This condition was reportable under 10CFR Part 50, Section 50.12(b)(2)(i) since it represents a degradation of the Reactor coolant pressure boundary.

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CAUSE

In May 1988, General Electric issued a notification (RICSIL 019) of shallow linear indications that were observed in Control Rod Drive housing cap screws at an operating boiling water reactor. The indications were detected during the required ASME Code visual in-service examination of the cap screws. General Electric indicated that there was no safety significance to the event. The cracking was attributed to stress corrosion initiating at the bottom of corrosion pits. It is likely that the cracking is aggravated by the presence of manganese sulfide inclusions in the cap screw material. In March 1989, General Electric issued a follow-up document on this subject (Service Information Letter 483) which confirmed the previous failure assessment of RICSIL 019.

The root cause of the Control Rod Drive cap screw cracking is attributed to inadequate design of the screws. The cap screws are made of material susceptible to stress corrosion cracking in the under vessel environment. Additional destructive testing is being performed to verify the cause and extent of the indications. A supplemental Licensee Event Report will be submitted when the results have been evaluated.

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

ANALYSIS

Service Information Letter 483 states Control Rod Drive loads can be supported by three uniformly distributed uncracked cap screws within the stress limits set forth in ASME codes and the probability of structurally significant cracks occurring in five or more screws on a single Control Rod Drive housing flange is extremely low. If, however, any such failure were to have occurred, the Control Rod Drive support structure would have allowed the Control Rod Drive to drop only one inch or less. An evaluation of the loss of one Control Rod Drive has been considered in the Updated Safety Analysis Report.

At the time of discovery of the crack indications there was no danger of the cap screws on a housing flange breaking because the vessel was at atmospheric pressure and there was no driving force to rapidly eject a drive housing. Furthermore, there was no danger of a reactivity addition caused by an ejected rod since fuel had been removed from the vessel. Fuel was not reloaded until the safety impact of the cracked cap screws had been addressed by Safety Review Item 91-016.

Subsequent reactor operation is permissible and poses no health or safety risk to the public since four bolts on each Control Rod Drive housing flange have been replaced with new, uncracked cap screws. This ensures separation of the Control Rod Drive mounting flange from the vessel flange will not occur since Control Rod Drive loads can be supported within the stress limits set forth in ASME codes by as few as three uniformly distributed uncracked cap screws.

Replacing four cap screws on each flange with original design equipment is acceptable because the General Electric investigation of the problem has shown that crack growth is very slow or self arresting. This is further evidenced by the Monticello cap screws, which have been in service since original plant startup with no failures.

CORRECTIVE ACTION

Completed Corrective Actions:

1. Safety Review Item 91-016, Cracked Cap Screws, was prepared to address the safety concerns associated with refueling, the cap screw change out, and operation with four possibly cracked cap screws.

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

2. Four new, original equipment cap screws were installed on each Control Rod Drive.
3. A reactor vessel hydro was performed to ensure Control Rod Drive housing flange integrity prior to reactor start up.

Planned Corrective Actions:

1. Destructive testing on a sample of cracked screws will be performed to verify the mode of failure.
2. General Electric is developing a new design cap screw that is expected to be available in August of 1991. If available, new design cap screws will be installed at the next refueling outage as deemed necessary to ensure continued pressure boundary integrity.

ADDITIONAL INFORMATION

Failed Component Identification:

The cap screws are SA-193 B7, made of low alloy, high strength, AISI 4140 material. General Electric part No. 117C4515P002

Previous Similar Events: None