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

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
R.E. Ginna Nuclear Power Plant	05000244	1 OF 7

TITLE (4)

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
02	09	98	1998	001	00	03	11	98	FACILITY NAME	DOCKET NUMBER

		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
OPERATING MODE (9)	1	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
POWER LEVEL (10)	100	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)	X OTHER-Part 21
		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)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
John T. St. Martin - Technical Assistant	(716) 771-3641

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	DA	RK	B386	N						

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 15 single-spaced typewritten lines) (16)

On February 9, 1998, the plant was in Mode 1 at approximately 100% steady state reactor power. It was discovered that Boraflex degradation in the Spent Fuel Pool, greater than was assumed in the criticality analysis, had occurred. This is reportable under 10 CFR 50.73 and 10 CFR 21.

Interim corrective action included removing spent fuel assemblies from selected degraded storage rack cells and maintaining a high concentration of soluble boron in the Spent Fuel Pool.

The cause of the Boraflex degradation was high cumulative gamma radiation exposure and the subsequent dissolution of the boron from the Boraflex matrix.

Corrective action to prevent recurrence is outlined in Section V.B.

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
R.E. Ginna Nuclear Power Plant	05000244	1998	-- 001 --	00	2 OF 7

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

I. PRE-EVENT PLANT CONDITIONS:

On February 4, 1998, the plant was in Mode 1 at approximately 100% steady state reactor power. In activities unrelated to plant conditions, RG&E and contractor personnel began performing "Boron-10 Areal Density Gauge for Evaluating Racks" ("BADGER") testing for spent fuel storage racks containing Boraflex panels.

Each cell of the Ginna Station Region 2 spent fuel storage racks contains two Boraflex sheets (panels). Each cell can store one fuel assembly. These Boraflex panels are 144 inches in length and are positioned adjacent to the stored fuel assemblies, sandwiched between stainless steel sheets. The design is such that water exchange may occur both at the panel edges and up through the Boraflex region of the rack assembly.

NRC Generic Letter (GL) 96-04 (Boraflex Degradation in Spent Fuel Pool Storage Racks) was issued June 26, 1996. GL 96-04 requested that licensees assess the capability of the Boraflex to maintain a 5-percent subcriticality margin and submit to the NRC a plan describing its proposed actions if this subcriticality margin cannot be maintained by Boraflex material because of current or projected future Boraflex degradation. As stated in the Generic Letter, Boraflex dissolution appears to be a gradual and localized effect forewarned by relatively high silica levels in the pool water.

Rochester Gas and Electric (RG&E) responded to this GL in a letter dated October 24, 1996. (Refer to Ginna Docket No. 50-244, letter dated October 24, 1996, from R.C. Mecredy (RG&E) to USNRC, "Response to NRC Generic Letter 96-04".) In this response, RG&E committed to perform blackness testing on selected Boraflex panels to obtain data on the physical condition of the Boraflex panels in 1997. RG&E subsequently revised the commitment date to the first quarter of 1998, in a letter dated December 22, 1997. This was done primarily due to the availability of personnel and equipment from Northeast Technology Corporation (NETCO), who were contracted to perform the more rigorous "BADGER" testing, which RG&E felt was more appropriate than blackness testing. (Refer to Ginna Docket No. 50-244, letter dated December 22, 1997 from R.C. Mecredy to USNRC, "Revision to Blackness Testing Schedule Per GL 96-04".)

RG&E contracted with NETCO to perform "BADGER" testing, and determined which 24 Boraflex panels to perform this "BADGER" testing on. These panels were selected based on a representative cumulative gamma radiation exposure, ranging from a low of 9.9 E+8 rads to a high of 4.19 E+9 rads. Testing started on February 4, 1998. Initial results were reported to RG&E on February 9, 1998.

II. DESCRIPTION OF EVENT:

A. DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES:

- February 9, 1998: Event date.
- February 9, 1998, 1445 EST: Discovery date and time.
- February 9, 1998, 1528 EST: NRC is notified of this condition per 10CFR50.72 (b) (1) (ii) (B).

B. EVENT:

On February 9, 1998, the plant was in Mode 1 at approximately 100% steady state reactor power. In activities unrelated to plant conditions, the preliminary results of "BADGER" testing were reported to RG&E personnel.

During Spent Fuel Pool "BADGER" testing, degradation beyond the four (4) inch gap assumption of the criticality analysis was noted on selected boraflex panels. This data indicates that some panels have undergone dissolution beyond expected levels. One panel had experienced up to 100 inches of dissolution. This is considerably more than was previously identified by other plants.

The Ginna Station Updated Final Safety Analysis Report (UFSAR), Section 9.1.2.1.12, states: "Fuel storage racks using nuclear poisons additional to those inherent in the structural materials shall be designed and fabricated in a manner to prevent inadvertent removal of the additional poison by mechanical or chemical action."

Specific results of the "BADGER" testing were as follows:

- 16 panels with cumulative gamma exposures greater than or equal to 2.47 E+9 rads had different degrees of degradation. 11 of these panels showed small degrees of dissolution around gaps and panel edges. Two other panels showed edge dissolution in the lower 60 inches of the panel. The remaining three panels had gaps and dissolution ranging from 20 inches to 100 inches, which exceeded the assumptions of the criticality analysis of record.

- Eight panels had cumulative gamma exposures lower than 2.47 E+9 rads. These panels showed either uniform boron content or had only slight dissolution along the edges.

- Preliminary assessment indicates that up to 184 storage rack cells may have one or more adjacent panels with cumulative gamma exposures above 2.4 E+9 rads.

The Plant Operations Review Committee (PORC) met on February 10, 1998, to review these results. PORC directed that administrative controls be established to maintain a high concentration of soluble boron in the Spent Fuel Pool (SFP).

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

None

D. OTHER SYSTEMS OR SECONDARY FUNCTIONS AFFECTED:

None

E. METHOD OF DISCOVERY:

This event was self-identified by RG&E personnel after review of the initial data from the "BADGER" testing, as provided by NETCO.

F. OPERATOR ACTION:

Primary Systems Engineering personnel notified Operations supervision, who notified the Control Room operators. The NRC Senior Resident was notified at this time. At approximately 1445 EST on February 9, 1998, plant staff determined that a non-emergency one hour notification, per 10CFR50.72 (b) (1) (ii) (B), should be made to the NRC Operations Center. The Shift Supervisor made this notification at approximately 1528 EST on February 9, 1998.

G. SAFETY SYSTEM RESPONSES:

None

III. CAUSE OF EVENT:

A. IMMEDIATE CAUSE:

The immediate cause of the plant being in an unanalyzed condition was the Boraflex degradation identified by the "BADGER" testing.

B. INTERMEDIATE CAUSE:

The intermediate cause of the Boraflex degradation was dissolution of the boron from the Boraflex matrix.

C. ROOT CAUSE:

The underlying cause of the dissolution of boron from the Boraflex matrix is attributed to a high cumulative gamma radiation exposure, aggravated by washout-accelerated dissolution of the Boraflex, caused by pool water flow through the panel enclosures.

When Boraflex is subjected to gamma radiation in the pool aqueous environment, the silicon polymer matrix becomes degraded and silica filler and boron carbide are released. Since irradiated Boraflex typically contains 46 percent of crystalline silica and 50 percent of boron carbide, in a 4 percent silicone rubber matrix (polydimethyl siloxane polymer), the presence of silica in the pool indicates the likely depletion of boron carbide from Boraflex. The loss of boron carbide is characterized by slow dissolution of the Boraflex matrix from the surface of the Boraflex and a gradual thinning of the material.

The rate of silica release from Boraflex is influenced by the water exchange to and around the Boraflex panels. The rate of dissolution also increases with higher pool temperature and gamma exposure. Experimental data indicates that once silica reaches an equilibrium value, the rate of dissolution is dramatically reduced. An increase in pool water flow past the Boraflex panels can disturb any localized silica equilibria.

This event is NUREG-1022 Cause Code (B), "Design, Manufacturing, Construction / Installation".

IV. ANALYSIS OF EVENT:

This event is reportable in accordance with 10 CFR 21 and in accordance with 10 CFR 50.73, Licensee Event Report System, item (a) (2) (ii) (A), which requires a report of, "Any event or condition ... that resulted in the nuclear power plant being ... In an unanalyzed condition that significantly compromised plant safety". The amount of Boraflex degradation is greater than that assumed in the criticality analysis, which placed the SFP in an unanalyzed condition.

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

There were no operational or safety consequences or implications attributed to the Boraflex degradation because:

- RG&E had been maintaining a high concentration, greater than 2300 parts per million (PPM), of soluble boron in the Spent Fuel Pool (SFP). This value is being monitored weekly.
- Calculations show that 1450 PPM of soluble boron is required to compensate for a complete absence of Boraflex in all the panels in Region 2, while maintaining the reactivity condition $K_{eff} < 0.95$ under all postulated off-normal conditions (i.e., fuel misload accident).
- There are no credible sources of boron dilution that would be expected to decrease SFP boron concentration below the required 1450 PPM.

- RG&E is developing strategies to minimize or eliminate the need to credit Boraflex in Region 2 of the SFP. There are several possible options being considered or implemented:

  a. Region 1 of the SFP will be re-racked with new storage racks that incorporate borated stainless steel. This work is scheduled for completion prior to the 1999 refueling outage. The Region 1 storage racks do not contain Boraflex, and the re-rack will provide additional storage space in non-Boraflex rack cells.

  b. Licensing actions to obtain credit for soluble boron in the SFP may be pursued in accordance with NRC-accepted methodology. This credit could justify analyses to assure that the fuel would remain subcritical, even if this boron were replaced with pure water. If pursued, this will require a separate license amendment.

  c. Licensing actions to obtain credit for neutron absorber material (control rods, absorber rodlets, and/or absorber panels) may be pursued. Such absorber material could be strategically placed in Region 2 locations to support the criteria outlined above. If pursued, this would also require a license amendment request.

  d. More restrictive storage patterns can be utilized in Region 2. If pursued, this would also require a license amendment request.

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:

- Procedures have been changed to ensure administrative controls are in place to verify at least 2300 PPM of soluble boron is maintained in the SFP.
- Spent fuel assemblies were removed from selected degraded storage rack cells, so that for Boraflex panels with cumulative gamma radiation exposure greater than 2.47 E+9 rads, the configuration is bounded by the current criticality analysis of record.

B. ACTION TAKEN OR PLANNED TO PREVENT RECURRENCE:

- Administrative controls will be established to prevent storage of spent fuel assemblies in designated cells, as determined by the Reactor Engineer or designee, to ensure the configuration is bounded by the criticality analysis.
- Long term strategies will be pursued that do not credit Boraflex in Region 2 of the SFP.

VI. ADDITIONAL INFORMATION:

A. FAILED COMPONENTS:

The Boraflex panels in the Ginna Station SFP were manufactured by Brand Industrial Services Corporation (BISCO), and have been in the SFP since 1984.

B. PREVIOUS LERs ON SIMILAR EVENTS:

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

C. SPECIAL COMMENTS:

Due to the amount of Boraflex degradation, the industry will be notified of this event via Nuclear NETWORK.