SCE&G
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RC-96-0258

Document Control Desk
U.S Nuclear Regulatory Commission
Washington, DC 20555

Ladies and Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
GENERIC LETTER 96-04: BORAFLEX DEGRADATION IN SPENT FUEL POOL STORAGE RACKS

South Carolina Electric & Gas Company (SCE&G) submits the following response to Generic Letter 96-04: Boraflex Degradation in Spent Fuel Pool Storage Racks. This information is being submitted to provide assurance that the onsite storage of spent fuel is in compliance with GDC 62 for the prevention of criticality in spent fuel storage and handling and with the 5 percent subcriticality margin position of the NRC staff. This response is being submitted under oath of affirmation.

VCSNS has installed spent fuel pool storage racks containing the neutron absorber Boraflex. This material was installed prior to initial use of the spent fuel pool. In accordance with the generic letter, the following items are provided:

NRC Request:

(1) "Provide an assessment of the physical condition of the Boraflex, including any deterioration, on the basis of current accumulated gamma exposure and possible water ingress to the Boraflex and state whether a subcritical margin of 5 percent can be maintained for the racks in unborated water.

Monitoring programs or calculational models in effect or being developed, or an estimation of anticipated concerns based on the specific rack design are considered an appropriate basis for this response."

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V. C. Summer Nuclear Station Response:

SCE&G initiated two formal monitoring programs, blackness testing campaigns and coupon surveillances, aimed at verifying the physical integrity and the neutron absorption properties of the Boraflex material for design bases compliance. Additionally, a third means of assessing the condition of the Boraflex panels is through periodic surveillance of the silica concentration in the spent fuel pool.

Based on the latest blackness test, the largest gap observed is 7 inches wide with the average of all gaps being 0.8 inches. The largest cumulative gap in any one panel was observed to be 2.86 inches, representing ~2.1% shrinkage.

The most recent coupon surveillance data exhibits ~3.4% shrinkage. This data corresponds to the expected shrinkage at end of rack life. Rack cell doses have not been specifically determined; however, based upon the results from the accelerated portion of the irradiated coupon surveillance program, VCSNS is assuming that for the expected point of Boraflex deterioration, sufficient irradiation has occurred in the majority of the cells.

Although the specific rack design at VCSNS allows for venting and wetting of the Boraflex panels, it is not an anticipated concern at VCSNS since direct access for possible localized flow induced erosion is not provided. Based upon the trend of reactive silica in the spent fuel pool, some degradation of the Boraflex has occurred.

To conservatively bound the current observed condition of the Boraflex panels and to allow for future development of additional shrinkage and gap formation, a rack criticality analysis has been performed with the following assumptions:

1. All absorber panels have been modeled with a 4% width shrinkage.

2. All absorber panels have been modeled with a 4% length shrinkage (5.56 inches) which was assumed to accrue either uniformly (where the panel remains intact over the entire length) or non-uniformly (where a conservative, single 4 inch gap develops somewhere along the panel length).

3. For those panels which are modeled with a gap, the remainder of the 4% length shrinkage not accounted for by the single 4 inch gap has been conservatively applied as bottom end shrinkage.

4. Gaps have been distributed randomly with respect to axial position for the absorber panels which are modeled with gaps.

5. All absorber material which is lost to shrinkage and gaps has been conservatively removed from the model.

With these as assumptions to the spent fuel pool rack criticality analysis, SCE&G has demonstrated that .95 Keff limit can be maintained for enrichments up to and including 5.0 w/o U235 by employing credit for Integral Fuel Burnable Absorbers (IFBA) and accumulated fuel assembly burnup.

NRC Request:

(2) "Submit to the NRC a description of any actions to monitor or confirm that this 5-percent subcriticality margin can be maintained for the lifetime of the storage racks and describe what corrective actions could be taken in the event it cannot be maintained."

V. C. Summer Nuclear Station Response:

VCSNS will continue the Boraflex coupon surveillance program. Utilizing the results of the coupon surveillance, the 5-percent subcriticality margin will be confirmed. Reactive silica in the spent fuel pool will continue to be trended.

In the event it is determined that the 5-percent subcriticality margin cannot be maintained for the lifetime of the storage racks, VCSNS will utilize any reasonable combination of corrective actions to ensure adequate margin. These possible corrective actions include, but are not limited to:

a) Technical Specification change request action to credit soluble boron in the spent fuel pool,

b) Technical Specification change request action to implement a suitable 'checkerboarding' pattern,

c) utilizing fixed neutron absorbing inserts, or

d) conducting additional testing to confirm the 5-percent subcriticality margin.

NRC Request:

(3) "Describe the results from any previous post operational blackness tests and state whether blackness testing, or other in-situ tests or measurements, will be periodically performed."

V. C. Summer Nuclear Station Response:

Three blackness test campaigns have been performed:

1st Campaign - April 1988 following Refuel 3
2nd Campaign - November 1989 following Refuel 4
3rd Campaign - December 1990 following Refuel 5.

Table 1 provides a summary of the Boraflex panels tested during the three campaigns. Most of the gaps are relatively small (average of all gaps is 0.8 inches). The largest gaps observed were 2 inches wide. The largest cumulative gap in any one panel was observed to be 2.86 inches, representing ~2.1% shrinkage.

There was a substantial increase in the size and number of gaps between the first and second campaigns. The third campaign, however, indicated a smaller increase, suggesting that the gap formation (and shrinkage) in the Boraflex is approaching saturation, with little further increase in size expected for the largest gaps. In the panels yet to achieve saturation shrinkage, it is likely that a greater number of small gaps may appear and that the existing small gaps may increase in size.

VCSNS does not plan to conduct any additional periodic blackness testing. VCSNS will continue the Boraflex coupon surveillance program. Reactive silica in the spent fuel pool will also continue to be trended.

NRC Request:

(4) "Chronological trends of pool reactive silica levels, along with the timing of significant events such as refuelings, pool silica cleanups, etc., should be provided.

Implications of how these pool silica levels relate to Boraflex performance should be described."

V. C. Summer Nuclear Station Response:

Reactive silica concentration in the VCSNS spent fuel pool is monitored on a weekly basis. Figure 1 illustrates the reactive silica concentrations observed since 1985. Silica concentrations have increased from <1 ppm to ~3.7 ppm.

During this period, several refueling outages have taken place:

Refuel Outage	Start Date	End Date
2	10/ 5/85	12/14/85
3	3/ 6/87	6/ 6/87
4	9/16/88	12/29/88
5	3/23/90	5/24/90
6	9/21/91	11/18/91
7	3/ 5/93	5/ 3/93
8	9/ 9/94	12/16/94
9	4/16/96	5/23/96

Also, a Reverse Osmosis (RO) plant was installed and operated in the spent fuel pool during October 1990 for several weeks as a demonstration program.

The trend shown by these pool silica levels does indicate that some Boraflex degradation has occurred in the VCSNS spent fuel pools. VCSNS does not believe that accurate correlations can be made as to the actual amount of Boraflex degradation that has occurred relative to silica content of the spent fuel pool.

In conclusion, the absence of direct access for possible localized flow induced erosion, the conservative analyses for rack criticality, and the coupon surveillance data results support VCSNS's position that the 5-percent subcriticality margin will be maintained throughout the lifetime of the spent fuel pool racks.

Should you have any questions, please call Mr. Michael J. Zaccone at (803) 345-4328.

Very truly yours

Gary J. Taylor

MJZ/GJT/nkk
Attachment (2)

c.	J. L. Skolds	NRC Resident Inspector
	W. F. Conway	J. B. Knotts, Jr.
	R. R. Mahan	NSRC
	R. J. White	RTS (LTR 960004)
	S. D. Ebneter	DMS (RC-96-0258)
	A. R. Johnson	File (815.14)

STATE OF SOUTH CAROLINA :
: **TO WIT** :
COUNTY OF FAIRFIELD :

I hereby certify that on the 24th day of October 1996, before me, the subscriber, a Notary Public of the State of South Carolina personally appeared Gary J. Taylor, being duly sworn, and states that he is Vice President, Nuclear Operations of the South Carolina Electric & Gas Company, a corporation of the State of South Carolina, that he provides the foregoing response for the purposes therein set forth, that the statements made are true and correct to the best of his knowledge, information, and belief, and that he was authorized to provide the response on behalf of said Corporation.

WITNESS my Hand and Notarial Seal

Michael J. Boccone
Notary Public

My Commission Expires

My Commission Expires July 13, 2005
Date

TABLE 1
VCSNS BLACKNESS TESTING SUMMARY

REGION 1 RESULTS

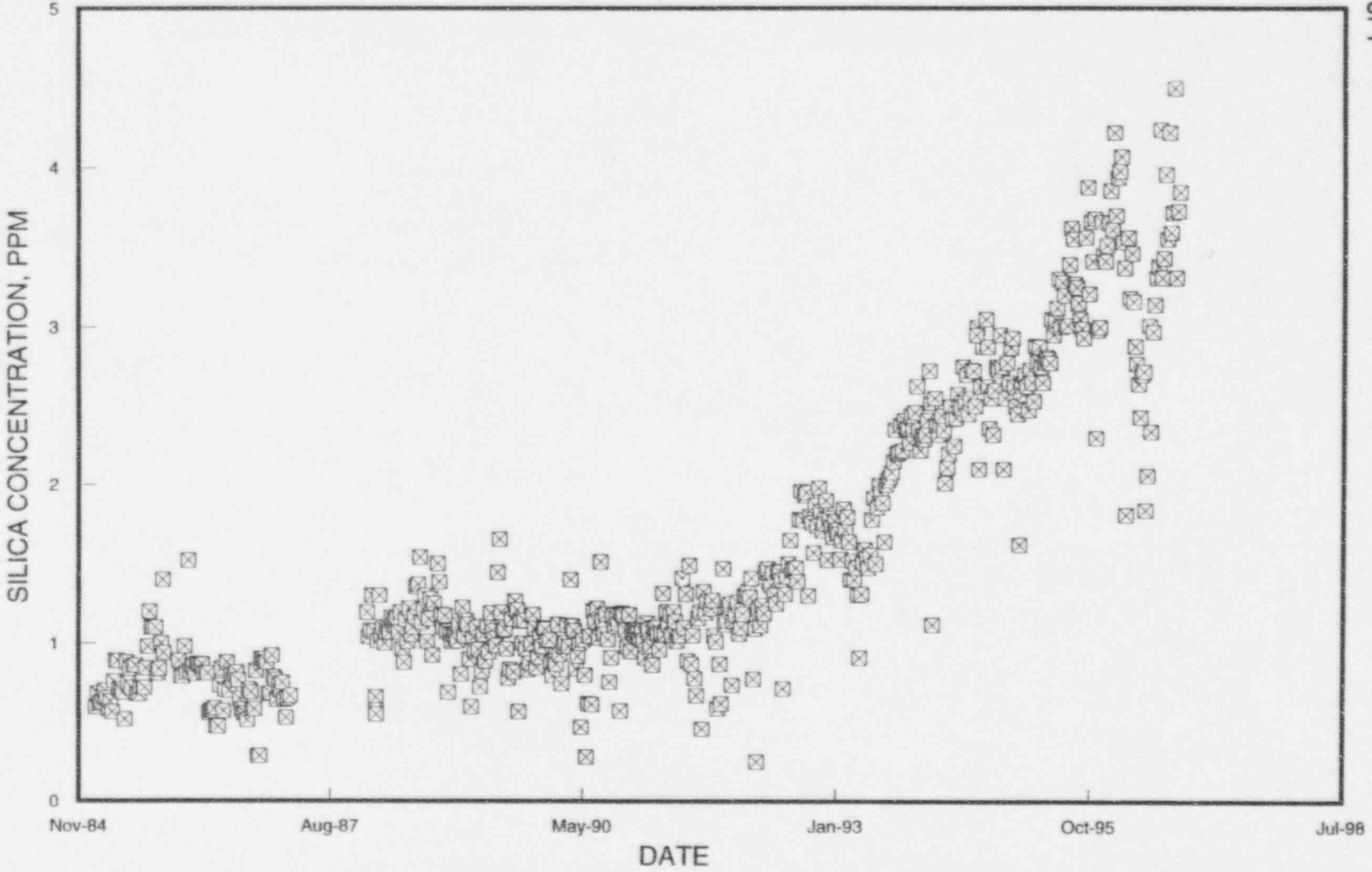
	1st Campaign	2nd Campaign	3rd Campaign
Number of Cells Examined	46	46	52
Number of Panels with Gaps	40	130	150
Number of Panels without Gaps	144	49	58
Total Panels	184	179	208
Number of Gaps	40	176	210
Maximum Gap Size	1.2 inch	1.7 inch	2.0 inch
Average Gap Size	0.6 inch	0.6 inch	0.8 inch

REGION 2 RESULTS

	1st Campaign	2nd Campaign	3rd Campaign
Number of Cells Examined	6	18	N/A
Number of Panels with Gaps	0	3	---
Number of Panels without Gaps	24	69	---
Total Panels	24	72	---
Number of Gaps	None	3	---
Maximum Gap Size	0.0 inch	<1.0 inch	---
Average Gap Size	0.0 inch	<1.0 inch	---

FIGURE1 - SPENT FUEL POOL SILICA CONCENTRATION

1985 TO PRESENT



NFM
10/22/96