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A Unit of PECO Energy

PECO Energy Company
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

October 25, 1996

Docket Nos. 50-277
50-278
50-352
50-353

License Nos. DPR-44
DPR-56
NPF-39
NPF-85

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

Subject: Peach Bottom Atomic Power Station, Units 2 and 3
Limerick Generating Station, Units 1 and 2
Response to Generic Letter 96-04, "Boraflex Degradation
In Spent Fuel Pool Storage Racks"

Dear Sir:

Attached is our response to the "Requested Information" section of the subject Generic Letter
(GL) 96-04, dated June 26, 1996 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and
3. This GL concerns the use of Boraflex in the spent fuel storage racks. As discussed in the
GL, only those licensees that use Boraflex are required to respond. Limerick Generating Station
(LGS), Units 1 and 2 exclusively uses BORAL as the neutron poison material in its spent fuel
racks. Therefore, LGS, Units 1 and 2 are not required to respond.

If you have any questions, please contact us.

Very truly yours,

G. A. Hunger, Jr.
Director - Licensing

Attachment, Affidavit

cc: H. J. Martin, Administrator, Region I, USNRC (w/ attachment)
W. L. Schmidt, USNRC Senior Resident Inspector, PBAPS (w/ attachment)
N. S. Perry, USNRC Senior Resident Inspector, LGS (w/attachment)

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COMMONWEALTH OF PENNSYLVANIA   :

                                       :   ss.

COUNTY OF CHESTER   :

        D. B. Fetters, being first duly sworn, deposes and says:
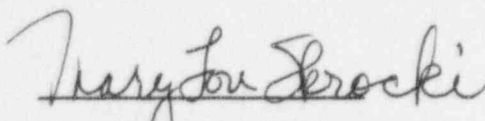

        That he is Vice President of PECO Energy Company; that he has read the enclosed

response to Generic Letter 96-04 dated June 26, 1996, for Peach Bottom Facility Operating

Licenses DPR-44 and DPR-56, and knows the contents thereof; and that the statements and

matters set forth therein are true and correct to the best of his knowledge, information and

belief.

                                                    _____
                                                              Vice President

Subscribed and sworn to

before me this 25ᵗʰ day

of October 1996.

_____

Notary Public

ATTACHMENT 1

Response to Generic Letter 96-04

Peach Bottom Atomic Power Station, Units 2 and 3

Background

In 1986, the spent fuel storage racks at Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 were replaced with Westinghouse-designed, high-density storage racks which contained BORAFLEX as the neutron poison material. This modification was approved by the NRC in Amendment Numbers 116 and 120, dated February 19, 1986. Because of this modification to the spent fuel storage pools, each pool has a storage capacity of 3819 Boiling Water Reactor (BWR) fuel assemblies. See Figures 1 and 2 for the spent fuel storage rack arrangement for PBAPS Units 2 and 3 respectively.

The BORAFLEX was manufactured by Brand Industrial Services and is required to have a minimum B^{10} areal density of 0.021 gm/cm^2 as discussed in Section 10.3 of the PBAPS Updated Final Safety Analysis Report (UFSAR). Each BORAFLEX panel is a continuous sheet centered on the length of the as-stored active fuel. The number of BORAFLEX panels associated with each storage cell depends on the location of the storage cell in the rack. Most cells (located within the interior of the spent fuel storage rack) have BORAFLEX on all four sides. Cells on the periphery have BORAFLEX panels on three sides. Cells on the corner of the spent fuel storage rack have BORAFLEX panels on two sides. (The objective is to maintain a BORAFLEX poison panel between each fuel assembly stored in the racks.) The BORAFLEX panels are each enclosed by a stainless steel wrapper plate. The wrapper plates are attached to the outside of the storage cell enclosure by intermediate spot welds along the entire length of the wrapper. This forms a capsule for the BORAFLEX panel. This capsule does not form a watertight seal isolating the BORAFLEX panel from the spent fuel pool coolant. See Figures 3 and 4 for the configuration of BORAFLEX panel and wrapper plate.

PECO Energy is an active participant with the Electric Power Research Institute (EPRI) efforts concerning BORAFLEX. PECO Energy participation has taken the form of:

1. Contributing pool silica data to the EPRI database;

2. Funding for EPRI research and development including the understanding of the BORAFLEX degradation phenomenon and mitigation measures;

3. Hosting the Boron Areal Density Gage for Evaluating Racks (BADGER) test device hot demonstration;

4. Utilization of the RACKLIFE BORAFLEX performance computer model.

Assessment of PBAPS BORAFLEX Physical Condition

The BORAFLEX panels at PBAPS have been in service since 1986. A review of the silica data shows no adverse trends that may be indicative of significant BORAFLEX degradation. The wrapper plate as designed, limits the free flowing access of the spent fuel pool coolant

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water to the enclosed BORAFLEX panels. This is substantiated by a BADGER test performed by EPRI in the PBAPS Unit 2 spent fuel pool during the week of April 8, 1996. A total of 13 in-service BORAFLEX panels were measured by the BADGER. The 13 panels represent a range of gamma exposures from essentially zero to approximately 4.3×10^9 rads. The test population was selected by a review of the results of a RACKLIFE computer model that was developed for PBAPS Unit 2 by PECO Energy and EPRI. A further limit to the selection process was that spent fuel was not to be moved in order to reduce the likelihood of fuel handling accidents.

Evaluation of B^{10} Areal Test Results

The following are the results of the BADGER measurements of the 13 BORAFLEX panels:

1. **Panel scans that represent the majority of spent fuel storage rack cells**
   Ten spent fuel pool storage rack BORAFLEX panels were measured by the BADGER. All ten of these panels exceeded the minimum B^{10} areal density described in the UFSAR. The impact of the scans show that all panels that have not been reworked or damaged are in compliance with the applicable Technical Specifications. See Table 1 for summary of test results.

2. **Panel scans that represent reworked spent fuel storage rack cells**
   Two spent fuel pool storage rack BORAFLEX panels in storage cell MM-30, that was re-worked during the assembly of the spent fuel racks, were measured by the BADGER. These panels were shown to have slightly less than the requisite minimum B^{10} areal density as described in the UFSAR (0.020 and 0.0207 g/cm^2 versus 0.021 g/cm^2 respectively). See Table 2 for a summary of the test results. As a result of this discovery, a records search was performed for the PBAPS Unit 2 spent fuel pool to identify additional reworked cells. This search identified cells MM-30, A-40, DD-46, EE-51, NN-07, and BBB-25. These reworked cells are currently empty, or contain fuel with low reactivity. the cells have been evaluated to ensure that the reactivity remains below .95 K-effective. Additionally, an analysis was performed to justify the continued operation of the PBAPS Unit 2 spent fuel pool. This analysis is discussed in the analysis section of this response. This analysis has determined that considerable margin exists to .95 K-effective. Due to the similarity in design, fuel bundle exposure, rack age, operating history, and pool environment, to PBAPS Unit 2, it was evaluated that no safety concern exists for the PBAPS Unit 3 spent fuel pool.

3. **Panel scan that represents a potentially damaged wrapper plate**
   One spent fuel pool storage rack BORAFLEX panel (JJ-30 East) is suspected to have a damaged BORAFLEX panel wrapper plate.

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This is indicated by several factors:

1. The BADGER probe was unable to complete a full length scan. It was stopped from reaching the bottom of the storage cell. Data acquisition was thus incomplete regarding the whole panel.

2. The B^{10} areal density of the accessible portion of the suspected panel was measured to be 0.0189 g/cm^2 by the BADGER which could be indicative of accelerated BORAFLEX dissolution.

3. An adjacent BORAFLEX panel of similar gamma dose (JJ-30 South) had a measured B^{10} areal density of 0.0244 g/cm^2. This indicates that this wrapper plate was intact and the suspected BORAFLEX dissolution was limited to one panel.

4. For JJ-30 South, the BADGER could come closer to performing a complete stroke of panel measurement but was stopped approximately 8 inches from the bottom of a complete scan; indicating some obstruction or binding.

See Table 3 for a summary of the test results.

In the interim, the cell associated with location JJ-30 has been declared unusable and no fuel is currently in this cell.

Results of Post-Operational Tests

As noted earlier, PECO Energy pioneered the use of the BADGER to obtain the most information regarding the condition of in-service BORAFLEX panels during a spent fuel pool assessment campaign. With the exception of the limited gaping measured by the BADGER, the measured B^{10} areal density exceeds that required by the PBAPS UFSAR for non-reworked and undamaged storage cell locations. The measured BORAFLEX gaping is randomly distributed thus reducing considerably the reactivity effect. Also, BORAFLEX gaping is due to radiation-induced crosslinking of the polymer which causes the BORAFLEX panel to shrink and thus form gaps. This gap formation thus represents no loss of boron from the system. The gap phenomenon merely results in a redistribution of the neutron absorber material to a slightly less than optimum configuration. Thus, the reactivity effect due to BORAFLEX gaps may be considered negligible.

Analysis Performed as a result of the B^{10} Areal Density Test Results

An analysis was performed to support continued spent fuel storage. The analysis used a bounding representative fuel assembly currently stored in the spent fuel pool storage racks. The results of the analysis indicate that the spent fuel currently residing in the storage racks

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have considerable margin to 0.95 K-effective. Fuel having an in-core cold K-infinity of up to 1.155 can be stored in the spent fuel pools and maintain a minimum 5% margin to criticality with up to 95% BORAFLEX dissolution. Gaps in the BORAFLEX panels were detected but were limited in size to approximately 3 inches or approximately 2.4% of the total panel length (see Table 1 for details). Given the data and similarity of design and duty between the PBAPS Unit 2 and 3 spent fuel pools, sufficient margin exists to ensure spent fuel pool subcriticality in accordance with PBAPS Units 2 and 3 Technical Specification 4.3.1.b which states:

> The spent fuel storage racks are designed and shall be maintained with K-effective less than or equal to 0.95 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 10.3 of the UFSAR.

Future Actions to be Performed as a Consequence of the BADGER Test

(As a result of the BADGER Test results, a Nonconformance Report was generated to provide a tracking mechanism for actions/analyses performed.)

1. Perform a video scan of the PBAPS Unit 2 spent fuel storage cell wrapper plates associated with locations JJ-30 and MM-30 to characterize the nature of the differences between damaged and reworked storage cells and normal cells by September 1, 1997. The final disposition of JJ-30 and the reworked storage cells (MM-30, A-40, DD-46, EE-51, NN-07 and BBB-25) shall be based on the results of the video examination.

2. Perform a records search to identify all PBAPS Unit 3 reworked storage cells for disposition by Reactor Engineering in a manner similar to the reworked storage cells associated with Unit 2 by February 28, 1997.

3. An analysis is currently being performed for the design-reference bundle which represents the highest reactivity that would be expected in the spent fuel pool. This design-reference analyses will bound all fuel that will be placed in the spent fuel pool. This analyses will consider gaping and uniform BORAFLEX degradation. This analysis will be completed by January 30, 1997. Future actions for criticality margin maintenance and mitigation measures will be based on this analysis. The UFSAR will be revised following completion of this analysis to reflect this design-reference evaluation and to reflect the B^{10} areal density test results and implied changes to BORAFLEX Panel B^{10} areal density and continuity.

Description of Further Proposed Actions

PECO Energy will continue to monitor spent fuel pool coolant silica for concentration increases that may be indicative of accelerated BORAFLEX degradation.

PECO Energy expects to enhance the RACKLIFE computer model for PBAPS Unit 2 and fully develop the RACKLIFE computer model for Unit 3. The RACKLIFE models will be maintained as a strategic planning tool to determine the appropriate time for additional B^{10} areal density measurements, blackness testing, or other monitoring/surveillance or when mitigation measures would be required.

PECO Energy has committed to continue support of the BORAFLEX Users Group Phase II activities. These activities include PECO Energy participation and/or review in the following activities: continued maintenance of the industry-wide BORAFLEX database, continuation of BORAFLEX special surveillance projects, RACKLIFE technical support, and BORAFLEX mitigation measures research and development.

PECO Energy plans to evaluate BORAFLEX degradation mitigation measures such as burnup credit, selective spent fuel storage rack loading patterns (e.g. checkerboarding) and supplementary poison inserts or attachments. The implementation of these measures will be balanced against BORAFLEX degradation indications provided by industry experience, research, pool silica concentration trends, PBAPS surveillance test results and the PBAPS RACKLIFE pool performance computer model output. Therefore, BORAFLEX degradation management is an ongoing process.

PECO Energy will also evaluate the emerging results of EPRI research and development regarding spent fuel pool low concentration zinc injection which has been noted to significantly diminish BORAFLEX dissolution in the laboratory. This effort is expected to continue through 1997.

Spent Fuel Pool Silica Trends

As requested by the Generic Letter, Table 4 provides spent fuel pool silica data for PBAPS Units 2 and 3 respectively, from June, 1986 to July, 1996. The tables are organized in the following manner for each Unit:

Sample Date   The day on which the spent fuel pool coolant sample was analyzed

MODES   The operational condition of the associated reactor. The noted reactor conditions are Power Operation, Startup, Hot Shutdown, Cold Shutdown and Refueling as defined in Table 1.1-1 of PBAPS Technical Specifications.

Silica   The concentration of spent fuel pool coolant reactive silica (SiO_2) in parts per billion.

Silica concentrations in the spent fuel pool vary with time. This can be attributed to factors noted previously:

1. Seasonal variation of service water - cooler ambient temperatures tend to lead to cooler pool operating temperatures resulting in a reduction in BORAFLEX dissolution.

2. Refueling - the addition and mixing of Reactor Water Storage Tank and reactor coolant water tend to dilute the measured silica in the spent fuel pool.

A gradual increasing trend of silica levels in the spent fuel pool has been observed over the course of several years. A sustained increasing trend in pool silica concentrations inconsistent with previous seasonal/refueling changes would elicit further actions by PBAPS plant staff. Further actions may include (but not limited to) the following:

1. Estimation of potentially accelerated BORAFLEX degradation using the RACKLIFE pool computer model;

2. Review of design bases and evaluation of adequacy of subcriticality margin;

3. Increased frequency of poison panel surveillance testing;

4. Reconfiguration and/or re-analysis of spent fuel storage;

5. Hardware mitigation such as insertable poison fixtures or re-racking.

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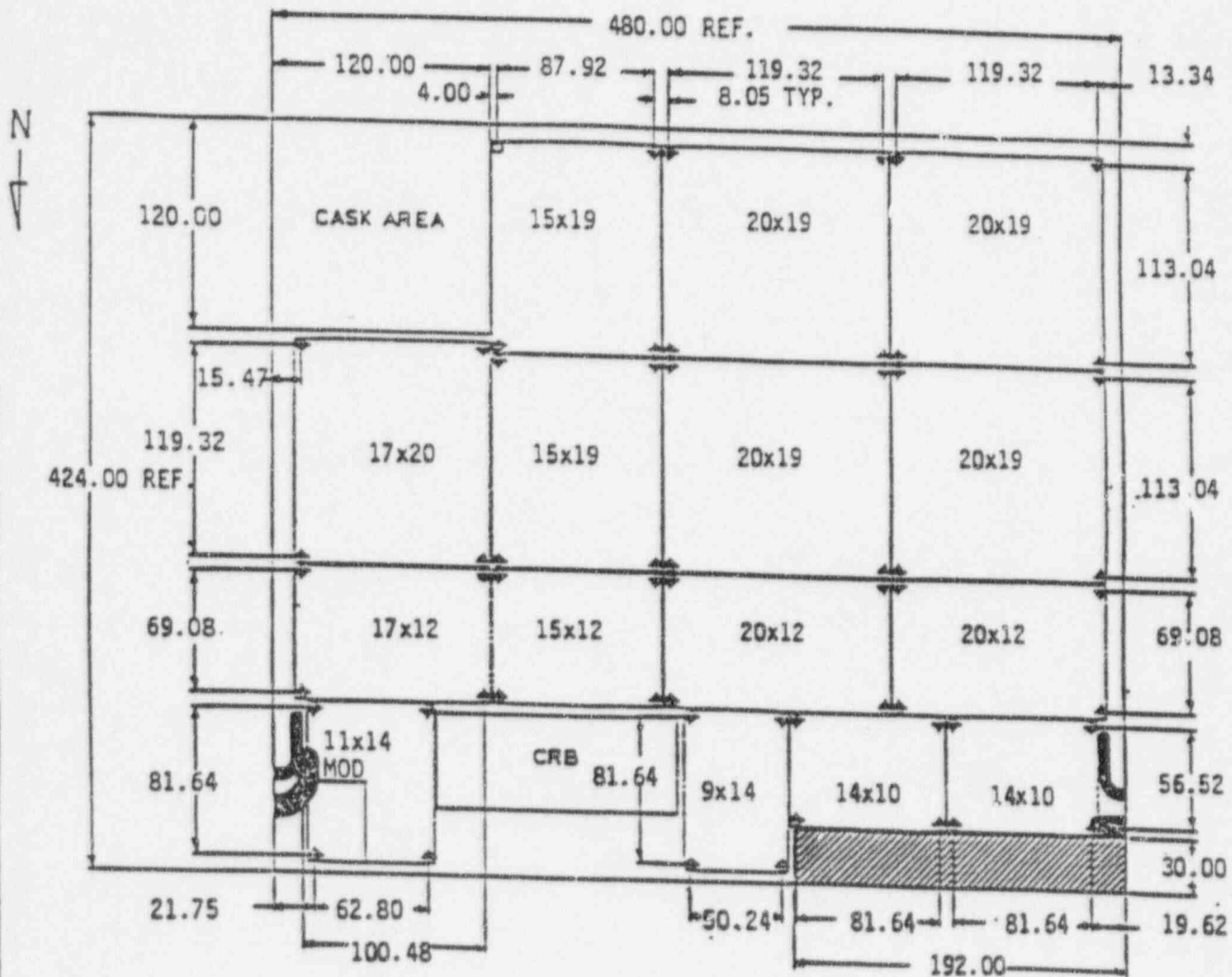
TOTAL LOCATIONS • 3819

Figure 1
PBAPS Unit 2 Spent Fuel Storage Rack Arrangement
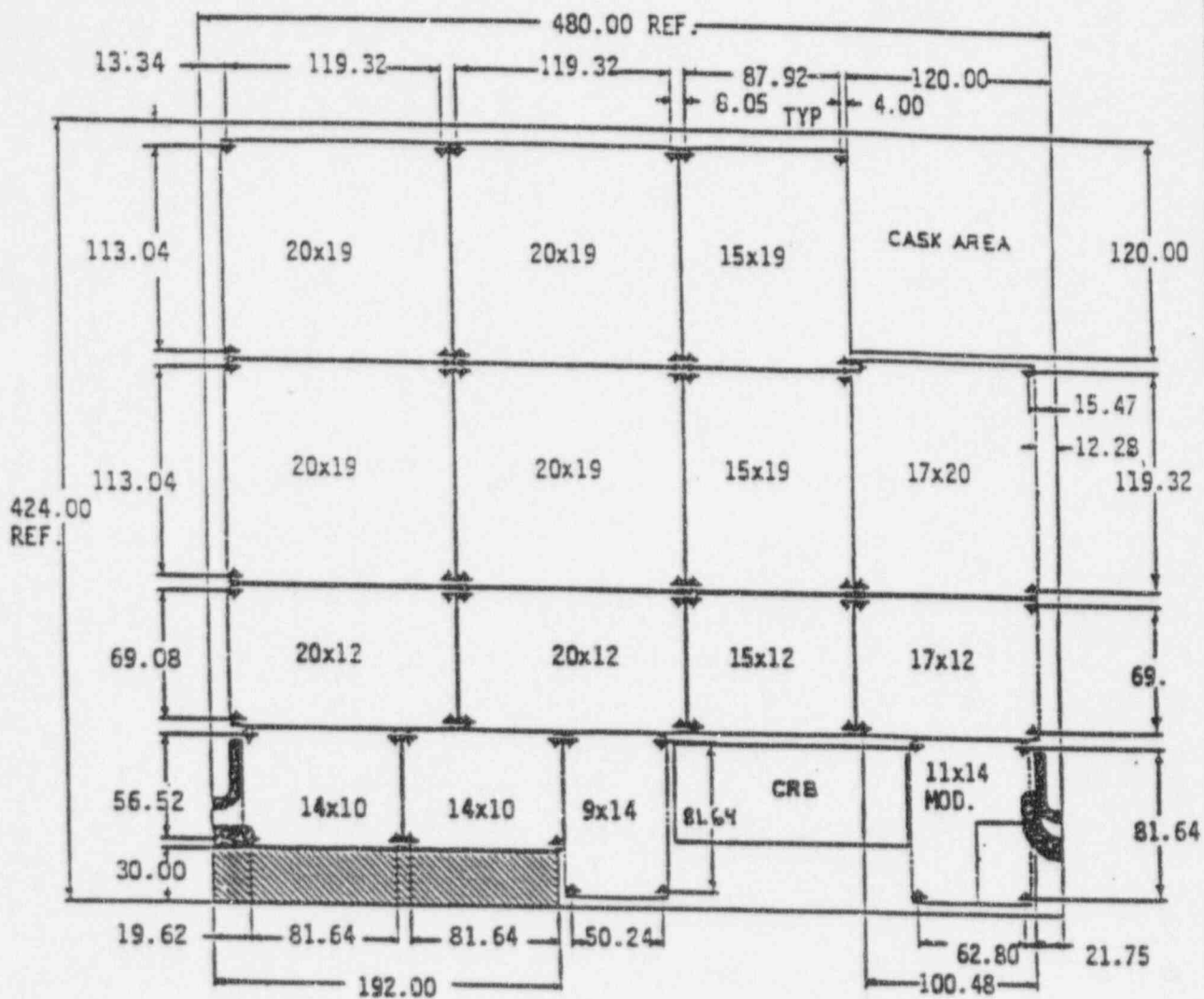
TOTAL LOCATIONS • 3819

Figure 2
PBAPS Unit 3 Spent Fuel Storage Rack Arrangement
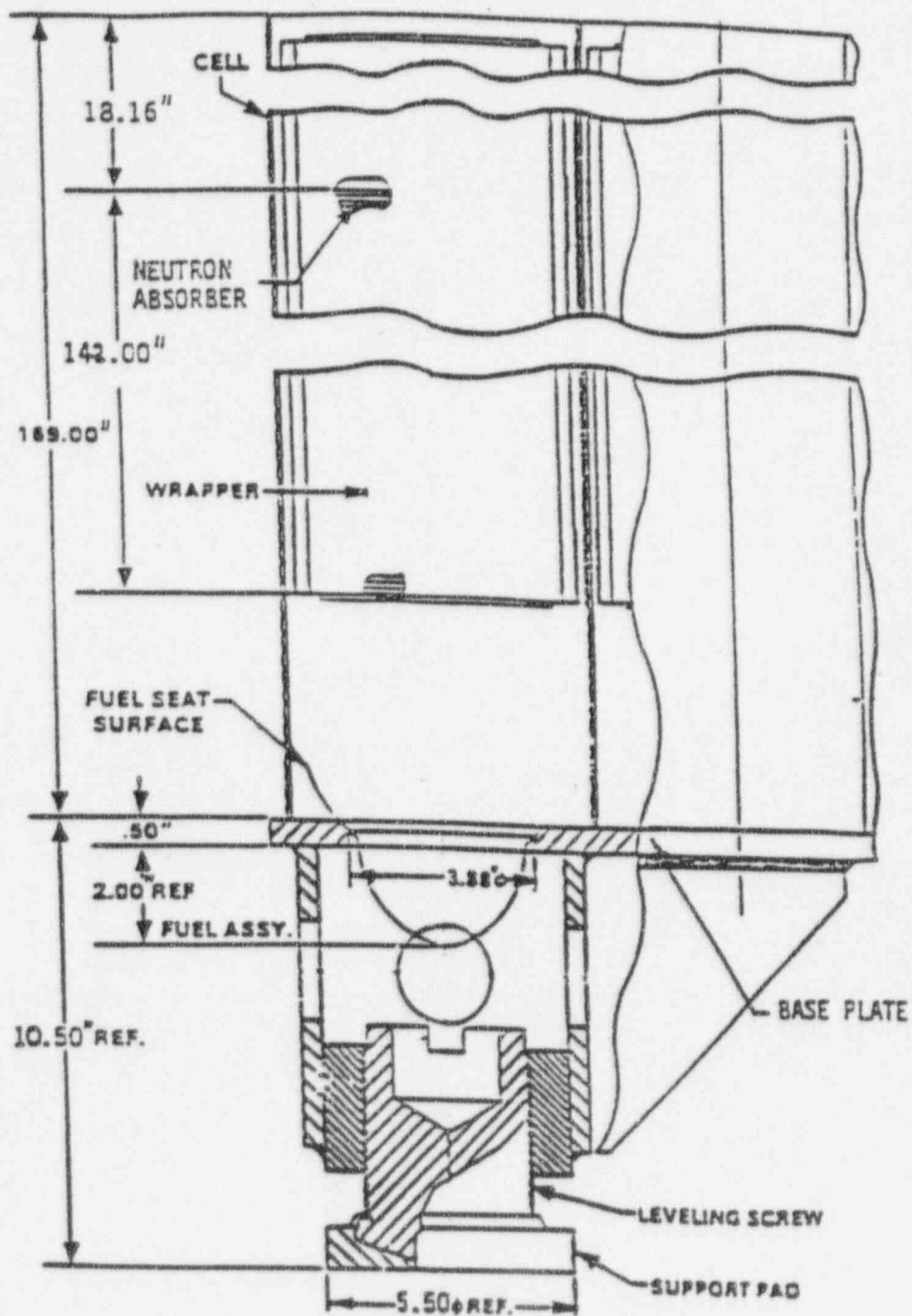
Figure 3
Boraflex/Wrapper Configuration - Elevation

6.280"

6.280"

UNIT CELL OF
INFINITE ARRAY

4.900" BORAFLEX

6.070"

DETAIL "A"

6.120"

0.090" Gap

0.075" Inner Cell Wall

0.081" Boraflex

0.020" Wrapper

DETAIL "A"
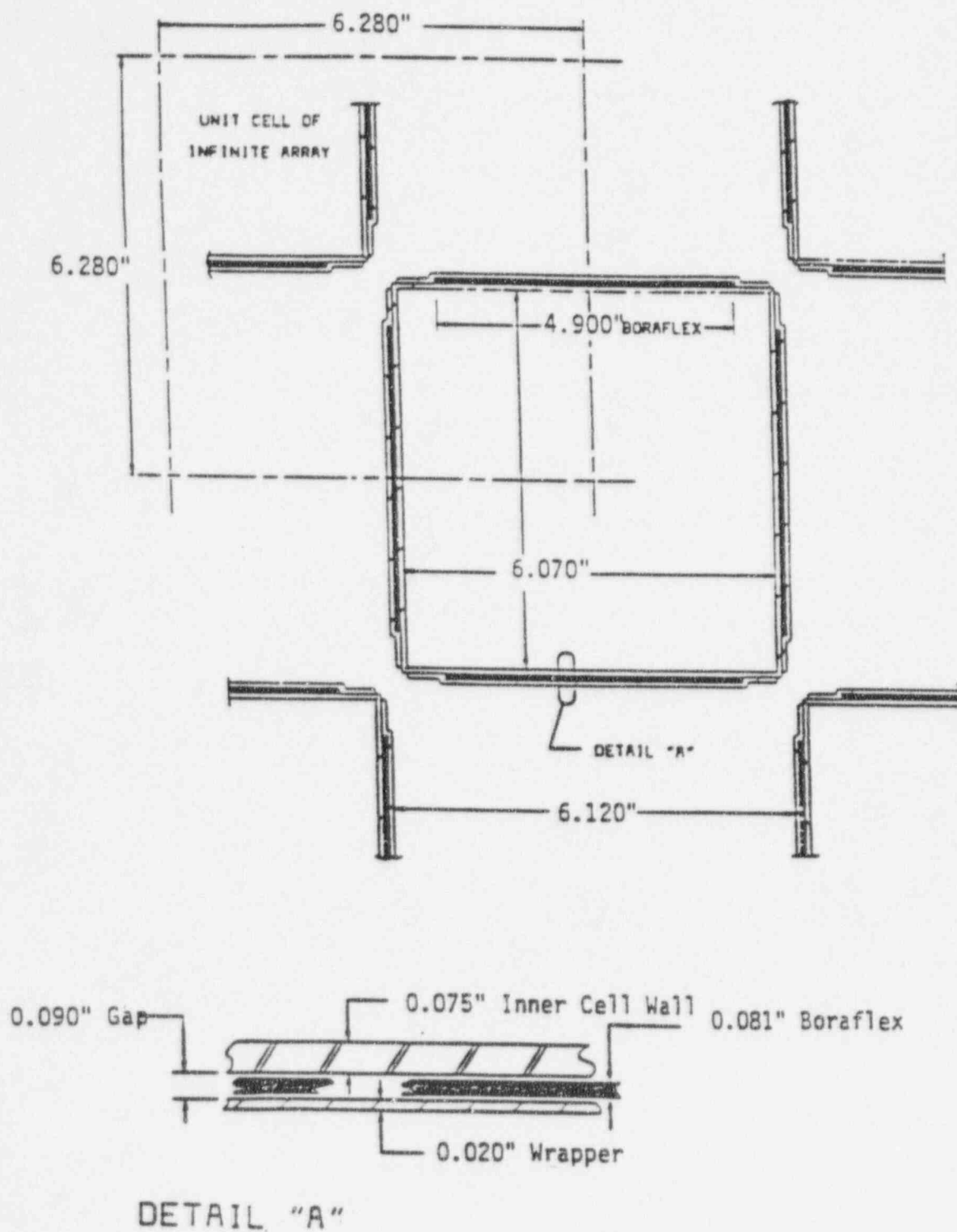
Figure 4
Boraflex/Wrapper Configuration - Plan

Table 1
PBAPS Unit 2 Boraflex BADGER Test Data
[Undamaged/Unreworked Cells]

Panel ID (*)	Dose (Rads)	Areal Den. (gm/cm^2)	Scan Depth (in. from top)	Gaps–size/location (in./in. from top)
OO34S	1.30E+09	0.0252	140	2.1/7.5
OO34E	1.30E+09	0.0253	139	2.3/8
JJ30S	4.00E+09	0.0244	132	2.5/106.5
DD30E	3.50E+09	0.0261	145	1.9/49, 0.9/102
II33S	4.30E+09	0.0267	142	3.4/27.5
II33E	2.80E+09	0.0267	143	1.8/48.5, 1.0/125
KK33W	3.80E+09	0.0269	139	0.6/25.5, 0.5/64.5, <0.5/80.5, 0.6/90.5
EE31S	3.10E+09	0.0249	145	<0.5/32.5, <0.5/50.5, 0.6/55.5, <0.5/86.5, <0.5/105.5
Y35N	0.00E+00	0.0239	140	
Y35W	0.00E+00	0.024		

* X, Y coordinate followed by compass orientation

Table 2
PBAPS Unit 2 Boraflex BADGER Test Data
[Reworked Cells]

Panel ID (*)	Dose (Rads)	Areal Den. (gm/cm^2)	Scan Depth (in. from top)	Gaps-size/location (in./in. from top)
MM30N	4.00E+09	0.0207	132	
MM30W	3.90E+09	0.02	133	

* X, Y coordinate followed by compass orientation

Table 3
PBAPS Unit 2 Boraflex BADGER Test Data
[Damaged Wrapper Plate Suspect]

Panel ID (*)	Dose (Rads)	Areal Den. (gm/cm^2)	Scan Depth (in. from top)	Gaps–size/location (in./in. from top)
JJ30E	3.60E+09	0.0189	104	1.0/2.5

* X, Y coordinate followed by compass orientation

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
05–Jun–86	Power Ops	125	Power Ops	120
12–Jun–86	Power Ops	120	Power Ops	110
19–Jun–86	Cold SD	138	Power Ops	128
26–Jun–86	Cold SD	160	Power Ops	130
04–Jul–86	Power Ops	140	Power Ops	130
09–Jul–86	Power Ops	170	Power Ops	140
16–Jul–86	Power Ops	170	Power Ops	140
24–Jul–86	Power Ops	108	Cold SD	104
31–Jul–86	Power Ops	175	Cold SD	140
06–Aug–86	Power Ops	180	Power Ops	153
21–Aug–86	Cold SD	210	Cold SD	130
28–Aug–86	Cold SD	210	Cold SD	140
10–Sep–86	Power Ops	220	Power Ops	150
18–Sep–86	Power Ops	230	Cold SD	140
25–Sep–86	Power Ops	240	Power Ops	130
02–Oct–86	Cold SD	280	Power Ops	150
09–Oct–86	Startup	300	Startup	150
16–Oct–86	Startup	350	Power Ops	150
23–Oct–86	Power Ops	300	Power Ops	140
30–Oct–86	Power Ops	335	Power Ops	142
05–Nov–86	Power Ops	300	Cold SD	130
12–Nov–86	Power Ops	350	Power Ops	150
20–Nov–86	Power Ops	360	Power Ops	135
04–Dec–86	Power Ops	410	Power Ops	105
10–Dec–86	Power Ops	425	Power Ops	120
17–Dec–86	Power Ops	440	Power Ops	100
24–Dec–86	Power Ops	600	Power Ops	115
01–Jan–87	Power Ops	440	Cold SD	120
08–Jan–87	Power Ops	500	Startup	130
15–Jan–87	Power Ops	330	Power Ops	86
22–Jan–87	Power Ops	410	Power Ops	112
29–Jan–87	Power Ops	115	Power Ops	96
12–Feb–87	Power Ops	420	Power Ops	110
19–Feb–87	Power Ops	800	Power Ops	100
26–Feb–87	Power Ops	440	Power Ops	100
04–Mar–87	Power Ops	400	Power Ops	110
12–Mar–87	Power Ops	400	Startup	80
18–Mar–87	Refueling	325	Cold SD	80
25–Mar–87	Refueling	135	Cold SD	105
01–Apr–87	Refueling	162	Cold SD	122
08–Apr–87	Refueling	200	Cold SD	95
22–Apr–87	Refueling	120	Cold SD	50
29–Apr–87	Refueling	295	Cold SD	112
06–May–87	Refueling	340	Cold SD	
13–May–87	Refueling	360	Cold SD	115
20–May–87	Refueling	500	Cold SD	120
26–May–87	Refueling	445	Cold SD	90
03–Jun–87	Refueling	510	Cold SD	132

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
10–Jun–87	Refueling	520	Cold SD	135
17–Jun–87	Refueling	600	Cold SD	140
24–Jun–87	Refueling	330	Cold SD	150
29–Jun–87	Refueling	340	Cold SD	
07–Jul–87	Refueling	320	Cold SD	150
14–Jul–87	Refueling	350	Cold SD	180
29–Jul–87	Refueling	340	Cold SD	200
03–Aug–87	Refueling	470	Cold SD	230
11–Aug–87	Refueling	450	Cold SD	210
18–Aug–87	Refueling	482	Cold SD	220
25–Aug–87	Refueling	500	Cold SD	225
02–Sep–87	Refueling	500	Cold SD	250
08–Sep–87	Refueling	610	Cold SD	270
15–Sep–87	Refueling	540	Cold SD	190
23–Sep–87	Refueling	750	Cold SD	245
29–Sep–87	Refueling	520	Cold SD	230
07–Oct–87	Refueling	800	Cold SD	230
12–Oct–87	Refueling	1070	Refueling	155
20–Oct–87	Refueling	730	Cold SD	135
27–Oct–87	Refueling	1090	Refueling	155
04–Nov–87	Refueling	620	Refueling	160
11–Nov–87	Refueling	1000	Refueling	175
16–Nov–87	Refueling	780	Refueling	155
29–Nov–87	Refueling	760	Refueling	155
09–Dec–87	Refueling	800	Refueling	185
16–Dec–87	Refueling	1050	Refueling	160
29–Dec–87	Refueling	750	Refueling	175
04–Jan–88	Refueling	720	Refueling	170
12–Jan–88	Refueling	800	Refueling	200
18–Jan–88	Refueling	1000	Refueling	210
27–Jan–88	Refueling	850	Refueling	190
03–Feb–88	Refueling	700	Refueling	125
08–Feb–88	Refueling	1000	Refueling	170
16–Feb–88	Refueling	1060	Refueling	156
24–Feb–88	Refueling	1050	Refueling	195
02–Mar–88	Refueling	800	Refueling	200
10–Mar–88	Refueling	920	Refueling	260
17–Mar–88	Refueling	720	Refueling	250
22–Mar–88	Refueling	700	Refueling	230
29–Mar–88	Refueling	700	Refueling	250
06–Apr–88	Refueling	760	Refueling	270
13–Apr–88	Refueling	840	Refueling	280
20–Apr–88	Refueling	800	Refueling	250
27–Apr–88	Refueling	820	Refueling	230
04–May–88	Refueling	760	Refueling	280
11–May–88	Refueling	970	Refueling	360
18–May–88	Refueling	780	Refueling	330
25–May–88	Refueling	420	Refueling	320

Table 4 - Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
01-Jun-88	Refueling	420	Refueling	340
09-Jun-88	Refueling	400	Refueling	400
16-Jun-88	Refueling	420	Refueling	370
23-Jun-88	Refueling	440	Refueling	370
30-Jun-88	Refueling	480	Refueling	350
06-Jul-88	Refueling	480	Refueling	400
13-Jul-88	Refueling	460	Refueling	420
20-Jul-88	Refueling	530	Refueling	380
27-Jul-88	Refueling	600	Refueling	500
03-Aug-88	Refueling	610	Refueling	350
09-Aug-88	Refueling	620	Refueling	350
16-Aug-88	Refueling	700	Refueling	325
22-Aug-88	Refueling	710	Refueling	350
29-Aug-88	Refueling	320	Refueling	900
06-Sep-88	Refueling	580	Refueling	350
12-Sep-88	Refueling	740	Refueling	310
20-Sep-88	Refueling	740	Refueling	340
27-Sep-88	Refueling	780	Refueling	320
05-Oct-88	Refueling	600	Refueling	200
12-Oct-88	Refueling	560	Refueling	350
20-Oct-88	Refueling	800	Refueling	330
26-Oct-88	Refueling	740	Refueling	300
02-Nov-88	Refueling	660	Refueling	290
08-Nov-88	Refueling	720	Refueling	330
15-Nov-88	Refueling	720	Refueling	300
23-Nov-88	Refueling	700	Refueling	350
30-Nov-88	Refueling	760	Refueling	340
07-Dec-88	Refueling	620	Refueling	350
14-Dec-88	Refueling	740	Refueling	380
22-Dec-88	Refueling	680	Refueling	340
29-Dec-88	Refueling	750	Refueling	350
06-Jan-89	Refueling	565	Refueling	290
11-Jan-89	Refueling	725	Refueling	375
19-Jan-89	Refueling	710	Refueling	360
27-Jan-89	Refueling	710	Refueling	360
03-Feb-89	Refueling	730	Refueling	375
11-Feb-89	Refueling	760	Refueling	340
19-Feb-89	Refueling	710	Refueling	340
26-Feb-89	Refueling	740	Refueling	320
06-Mar-89	Refueling	710	Refueling	320
13-Mar-89	Refueling	810	Refueling	325
17-Mar-89	Refueling	840	Refueling	340
23-Mar-89	Refueling	800	Refueling	340
30-Mar-89	Refueling	675	Refueling	340
07-Apr-89	Refueling	685	Refueling	340
14-Apr-89	Refueling	730	Refueling	340
21-Apr-89	Refueling	680	Refueling	330
28-Apr-89	Refueling	720	Refueling	340

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
06-May-89	Startup	710	Refueling	330
15-May-89	Startup	640	Refueling	310
22-May-89	Startup	710	Refueling	360
30-May-89	Power Ops	695	Refueling	400
07-Jun-89	Power Ops	640	Refueling	360
14-Jun-89	Power Ops	740	Refueling	360
21-Jun-89	Power Ops	720	Refueling	350
29-Jun-89	Power Ops	750	Refueling	325
07-Jul-89	Power Ops	900	Refueling	340
13-Jul-89	Power Ops	610	Refueling	315
21-Jul-89	Power Ops	840	Refueling	310
28-Jul-89	Startup	740	Refueling	335
04-Aug-89	Power Ops	800	Refueling	285
10-Aug-89	Power Ops	840	Refueling	300
17-Aug-89	Power Ops	980	Refueling	300
25-Aug-89	Power Ops	850	Refueling	180
01-Sep-89	Power Ops	960	Refueling	185
08-Sep-89	Power Ops	775	Refueling	220
13-Sep-89	Power Ops	770	Refueling	215
21-Sep-89	Power Ops	875	Refueling	200
27-Sep-89	Power Ops	940	Refueling	190
04-Oct-89	Power Ops	1000	Refueling	960
11-Oct-89	Startup	980	Refueling	185
18-Oct-89	Power Ops	850	Refueling	190
25-Oct-89	Power Ops	1060	Refueling	170
01-Nov-89	Power Ops	840	Refueling	200
08-Nov-89	Power Ops	960	Refueling	180
15-Nov-89	Power Ops	800	Refueling	140
22-Nov-89	Power Ops	990	Refueling	185
28-Nov-89	Cold SD	935	Startup	185
06-Dec-89	Power Ops	869	Cold SD	205
15-Dec-89	Power Ops	860	Power Ops	143
22-Dec-89	Cold SD	898	Power Ops	208
27-Dec-89	Power Ops	905	Power Ops	164
03-Jan-90	Power Ops	864	Power Ops	147
10-Jan-90	Power Ops	901	Power Ops	155
15-Jan-90	Power Ops	890	Power Ops	164
22-Jan-90	Power Ops	866	Power Ops	149
29-Jan-90	Startup	883	Power Ops	186
05-Feb-90	Power Ops	804	Power Ops	186
12-Feb-90	Power Ops	886	Power Ops	173
19-Feb-90	Power Ops	896	Power Ops	201
26-Feb-90	Power Ops	935	Power Ops	217
07-Mar-90	Cold SD	871	Power Ops	199
14-Mar-90	Refueling	319	Power Ops	159
21-Mar-90	Refueling	887	Power Ops	200
28-Mar-90	Cold SD	856	Power Ops	197
04-Apr-90	Cold SD	863	Power Ops	178

Table 4 - Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCCN	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
11-Apr-90	Cold SD	852	Power Ops	183
18-Apr-90	Cold SD	756	Power Ops	171
25-Apr-90	Cold SD	631	Power Ops	189
02-May-90	Power Ops	889	Power Ops	188
11-May-90	Power Ops	750	Power Ops	121
18-May-90	Power Ops	780	Power Ops	130
25-May-90	Power Ops	881	Power Ops	187
01-Jun-90	Power Ops	884	Power Ops	183
08-Jun-90	Power Ops	880	Power Ops	226
15-Jun-90	Power Ops	901	Power Ops	183
22-Jun-90	Power Ops	646	Power Ops	146
29-Jun-90	Power Ops	924	Power Ops	187
06-Jul-90	Power Ops	865	Power Ops	555
13-Jul-90	Power Ops	938	Power Ops	189
20-Jul-90	Power Ops	686	Power Ops	201
27-Jul-90	Power Ops	973	Power Ops	202
03-Aug-90	Power Ops	820	Startup	186
10-Aug-90	Power Ops	987	Power Ops	151
17-Aug-90	Power Ops	1044	Power Ops	211
24-Aug-90	Power Ops	1044	Power Ops	229
31-Aug-90	Power Ops	1035	Power Ops	234
07-Sep-90	Startup	1000	Power Ops	236
14-Sep-90	Power Ops	993	Power Ops	247
21-Sep-90	Power Ops	1072	Power Ops	240
28-Sep-90	Power Ops	1048	Power Ops	236
05-Oct-90	Power Ops	1087	Power Ops	257
12-Oct-90	Power Ops	1010	Power Ops	283
19-Oct-90	Power Ops	1096	Power Ops	265
25-Oct-90	Power Ops	1074	Power Ops	354
31-Oct-90	Power Ops	1023	Refueling	269
07-Nov-90	Power Ops	844	Refueling	276
14-Nov-90	Power Ops	1020	Cold SD	270
21-Nov-90	Cold SD	971	Cold SD	223
28-Nov-90	Power Ops	742	Power Ops	251
06-Dec-90	Power Ops	995	Power Ops	264
14-Dec-90	Power Ops	970	Power Ops	261
21-Dec-90	Power Ops	1050	Power Ops	303
28-Dec-90	Power Ops	1084	Power Ops	316
03-Jan-91	Power Ops	851	Power Ops	261
10-Jan-91	Power Ops	997	Power Ops	299
17-Jan-91	Refueling	872	Power Ops	294
24-Jan-91	Refueling	455	Cold SD	298
31-Jan-91	Refueling	495	Power Ops	333
06-Feb-91	Refueling	521	Power Ops	223
13-Feb-91	Refueling	405	Power Ops	
20-Feb-91	Refueling	428	Power Ops	346
27-Feb-91	Refueling	437	Power Ops	400
06-Mar-91	Refueling	385	Power Ops	462

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
13-Mar-91	Refueling	400	Power Ops	430
20-Mar-91	Refueling	403	Power Ops	465
26-Mar-91	Refueling	388	Power Ops	529
01-Apr-91	Refueling	393	Power Ops	432
08-Apr-91	Refueling	427	Power Ops	481
16-Apr-91	Refueling	420	Power Ops	484
24-Apr-91	Startup	402	Power Ops	476
01-May-91	Power Ops	496	Power Ops	430
08-May-91	Cold SD	397	Cold SD	555
15-May-91	Cold SD	479	Cold SD	634
22-May-91	Startup	501	Cold SD	630
29-May-91	Power Ops	493	Startup	602
05-Jun-91	Power Ops	653	Power Ops	701
12-Jun-91	Cold SD	590	Power Ops	700
19-Jun-91	Power Ops	640	Power Ops	790
26-Jun-91	Power Ops	681	Power Ops	807
03-Jul-91	Power Ops	746	Power Ops	855
10-Jul-91	Power Ops	682	Hot SD	862
17-Jul-91	Power Ops	770	Power Ops	918
24-Jul-91	Power Ops	750	Power Ops	884
31-Jul-91	Power Ops	784	Power Ops	946
07-Aug-91	Cold SD	816	Power Ops	827
14-Aug-91	Power Ops	802	Power Ops	979
21-Aug-91	Power Ops	858	Power Ops	1113
28-Aug-91	Power Ops	869	Power Ops	1134
04-Sep-91	Power Ops	882	Power Ops	1127
11-Sep-91	Power Ops	903	Power Ops	1029
19-Sep-91	Power Ops	875	Refueling	1483
25-Sep-91	Power Ops	774	Refueling	1071
01-Oct-91	Power Ops	933	Refueling	432
09-Oct-91	Power Ops	971	Refueling	432
21-Oct-91	Cold SD	974	Refueling	387
28-Oct-91	Power Ops	938	Refueling	363
04-Nov-91	Power Ops	835	Refueling	358
13-Nov-91	Power Ops	973	Refueling	362
20-Nov-91	Power Ops	960	Refueling	253
27-Nov-91	Power Ops	955	Refueling	206
03-Dec-91	Power Ops	975	Refueling	192
11-Dec-91	Cold SD	950	Refueling	126
18-Dec-91	Cold SD	900	Refueling	171
26-Dec-91	Power Ops	832	Refueling	168
03-Jan-92	Power Ops	807	Refueling	154
10-Jan-92	Power Ops	709	Startup	167
17-Jan-92	Power Ops	655	Power Ops	141
24-Jan-92	Power Ops	657	Power Ops	161
03-Feb-92	Power Ops	695	Power Ops	193
10-Feb-92	Power Ops	686	Power Ops	195
17-Feb-92	Power Ops	695	Power Ops	209

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
24-Feb-92	Power Ops	615	Power Ops	166
03-Mar-92	Power Ops	571	Power Ops	148
09-Mar-92	Power Ops	671	Power Ops	235
16-Mar-92	Power Ops	507	Power Ops	220
22-Mar-92	Power Ops	625	Power Ops	248
29-Mar-92	Cold SD	649	Power Ops	236
06-Apr-92	Startup	767	Power Ops	327
13-Apr-92	Power Ops	611	Power Ops	273
20-Apr-92	Power Ops	655	Power Ops	293
27-Apr-92	Power Ops	615	Power Ops	170
04-May-92	Power Ops	717	Power Ops	364
11-May-92	Power Ops	680	Power Ops	339
18-May-92	Power Ops	700	Power Ops	413
25-May-92	Cold SD	680	Power Ops	381
01-Jun-92	Power Ops	727	Power Ops	356
08-Jun-92	Power Ops	672	Power Ops	381
15-Jun-92	Power Ops	490	Power Ops	725
24-Jun-92	Power Ops	732	Power Ops	541
01-Jul-92	Power Ops	769	Power Ops	266
08-Jul-92	Power Ops	831	Hot SD	598
15-Jul-92	Power Ops	822	Hot SD	649
22-Jul-92	Cold SD	823	Cold SD	696
29-Jul-92	Startup	830	Power Ops	716
05-Aug-92	Power Ops	881	Power Ops	776
12-Aug-92	Power Ops	925	Power Ops	776
19-Aug-92	Power Ops	933	Power Ops	830
26-Aug-92	Power Ops	916	Power Ops	858
02-Sep-92	Power Ops	929	Power Ops	894
09-Sep-92	Power Ops	978	Power Ops	780
16-Sep-92	Refueling	891	Power Ops	955
23-Sep-92	Refueling	317	Power Ops	981
30-Sep-92	Refueling	306	Power Ops	984
07-Oct-92	Refueling	296	Power Ops	984
14-Oct-92	Refueling	269	Power Ops	1021
21-Oct-92	Refueling	291	Cold SD	996
28-Oct-92	Refueling	292	Cold SD	974
04-Nov-92	Refueling	325	Cold SD	1013
11-Nov-92	Refueling	218	Cold SD	972
18-Nov-92	Refueling	267	Power Ops	1003
25-Nov-92	Refueling	302	Power Ops	1014
01-Dec-92	Refueling	305	Power Ops	1036
09-Dec-92	Refueling	305	Power Ops	996
16-Dec-92	Power Ops	203	Power Ops	908
23-Dec-92	Power Ops	348	Power Ops	1037
30-Dec-92	Power Ops	362	Power Ops	1045
06-Jan-93	Cold SD	368	Power Ops	900
13-Jan-93	Cold SD	352	Power Ops	1085
20-Jan-93	Power Ops	377	Power Ops	999

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
27-Jan-93	Power Ops	411	Power Ops	1032
03-Feb-93	Power Ops	409	Power Ops	1015
10-Feb-93	Power Ops	408	Power Ops	984
17-Feb-93	Power Ops	442	Power Ops	1020
24-Feb-93	Power Ops	459	Power Ops	1021
03-Mar-93	Cold SD	340	Power Ops	1042
10-Mar-93	Cold SD	456	Cold SD	992
17-Mar-93	Power Ops	436	Startup	1010
24-Mar-93	Power Ops	465	Power Ops	1037
31-Mar-93	Power Ops	479	Power Ops	1025
07-Apr-93	Power Ops	502	Power Ops	1063
14-Apr-93	Power Ops	502	Power Ops	1034
21-Apr-93	Power Ops	513	Power Ops	969
28-Apr-93	Startup	478	Power Ops	985
05-May-93	Power Ops	518	Power Ops	960
12-May-93	Power Ops	517	Power Ops	976
19-May-93	Power Ops	601	Power Ops	1073
26-May-93	Power Ops	593	Power Ops	1056
02-Jun-93	Power Ops	628	Power Ops	1327
09-Jun-93	Power Ops	586	Power Ops	860
16-Jun-93	Power Ops	674	Power Ops	1153
23-Jun-93	Power Ops	720	Power Ops	1144
30-Jun-93	Power Ops	731	Power Ops	1145
07-Jul-93	Power Ops	713	Refueling	1075
14-Jul-93	Power Ops	508	Refueling	331
21-Jul-93	Power Ops	805	Power Ops	453
28-Jul-93	Power Ops	698	Power Ops	411
04-Aug-93	Power Ops	862	Power Ops	456
11-Aug-93	Power Ops	570	Power Ops	400
18-Aug-93	Startup	659	Power Ops	409
25-Aug-93	Power Ops	756	Power Ops	452
01-Sep-93	Power Ops	1181	Power Ops	449
08-Sep-93	Power Ops	1186	Power Ops	513
15-Sep-93	Power Ops	821	Power Ops	440
22-Sep-93	Power Ops	1222	Refueling	211
29-Sep-93	Power Ops	1188	Refueling	206
06-Oct-93	Cold SD	852	Refueling	214
13-Oct-93	Power Ops	1080	Refueling	230
20-Oct-93	Power Ops	1203	Refueling	228
27-Oct-93	Power Ops	1143	Refueling	209
03-Nov-93	Power Ops	1198	Refueling	272
10-Nov-93	Power Ops	1235	Refueling	285
17-Nov-93	Power Ops	1297	Power Ops	284
24-Nov-93	Power Ops	1007	Power Ops	285
01-Dec-93	Power Ops	1232	Power Ops	477
08-Dec-93	Power Ops	1096	Cold SD	535
15-Dec-93	Power Ops	1116	Startup	627
22-Dec-93	Power Ops		Power Ops	746

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
29-Dec-93	Power Ops	1194	Power Ops	
05-Jan-94	Power Ops	950	Power Ops	853
12-Jan-94	Power Ops	1130	Power Ops	610
19-Jan-94	Power Ops	1115	Power Ops	876
26-Jan-94	Power Ops	1155	Power Ops	805
02-Feb-94	Power Ops	1118	Power Ops	836
09-Feb-94	Power Ops	924	Power Ops	
16-Feb-94	Power Ops	999	Power Ops	822
23-Feb-94	Power Ops	974	Power Ops	801
02-Mar-94	Power Ops	1026	Power Ops	869
09-Mar-94	Power Ops	1039	Power Ops	911
16-Mar-94	Power Ops	1116	Power Ops	900
23-Mar-94	Power Ops	1068	Power Ops	988
30-Mar-94	Power Ops	1056	Power Ops	1016
06-Apr-94	Power Ops	958	Power Ops	933
13-Apr-94	Power Ops	1026	Power Ops	960
20-Apr-94	Power Ops	1040	Power Ops	999
27-Apr-94	Power Ops	996	Power Ops	950
04-May-94	Power Ops	1033	Power Ops	1033
11-May-94	Power Ops	1018	Power Ops	964
18-May-94	Cold SD	1051	Power Ops	997
25-May-94	Power Ops	1012	Power Ops	968
01-Jun-94	Power Ops	1017	Power Ops	961
08-Jun-94	Power Ops	1068	Power Ops	1004
15-Jun-94	Power Ops	1047	Power Ops	991
22-Jun-94	Power Ops	1100	Power Ops	1040
29-Jun-94	Power Ops	1100	Power Ops	1030
06-Jul-94	Power Ops	1102	Power Ops	1069
13-Jul-94	Power Ops	902	Power Ops	934
21-Jul-94	Power Ops	1148	Power Ops	1077
29-Jul-94	Power Ops	1038	Power Ops	964
05-Aug-94	Power Ops	1467	Power Ops	1102
12-Aug-94	Power Ops	1242	Power Ops	1167
19-Aug-94	Power Ops	1224	Power Ops	1110
26-Aug-94	Power Ops	1247	Power Ops	1124
02-Sep-94	Power Ops	1221	Power Ops	1182
09-Sep-94	Power Ops	1137	Power Ops	1019
16-Sep-94	Power Ops	1153	Power Ops	1019
23-Sep-94	Refueling		Power Ops	1105
30-Sep-94	Refueling		Power Ops	1134
07-Oct-94	Refueling		Power Ops	965
14-Oct-94	Refueling	229	Cold SD	1072
21-Oct-94	Refueling	275	Power Ops	1136
28-Oct-94	Power Ops	382	Power Ops	1168
04-Nov-94	Power Ops	298	Power Ops	990
11-Nov-94	Power Ops	336	Power Ops	1018
18-Nov-94	Power Ops	391	Power Ops	1112
25-Nov-94	Power Ops	355	Power Ops	1010

Table 4 – Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
02-Dec-94	Power Ops	551	Power Ops	1082
09-Dec-94	Power Ops	327	Power Ops	897
16-Dec-94	Power Ops	493	Power Ops	1025
22-Dec-94	Power Ops	532	Power Ops	1042
30-Dec-94	Power Ops	489	Power Ops	882
06-Jan-95	Power Ops	510	Power Ops	981
13-Jan-95	Power Ops	545	Power Ops	931
20-Jan-95	Power Ops	553	Power Ops	861
27-Jan-95	Power Ops	616	Power Ops	854
03-Feb-95	Power Ops	627	Power Ops	887
10-Feb-95	Power Ops	673	Power Ops	961
17-Feb-95	Power Ops	715	Power Ops	919
24-Feb-95	Power Ops	666	Power Ops	771
03-Mar-95	Power Ops	713	Power Ops	805
10-Mar-95	Power Ops	673	Power Ops	710
17-Mar-95	Power Ops	694	Power Ops	737
24-Mar-95	Power Ops	729	Hot SD	751
31-Mar-95	Power Ops	836	Power Ops	833
07-Apr-95	Power Ops	558	Power Ops	728
14-Apr-95	Power Ops	779	Power Ops	782
21-Apr-95	Power Ops	850	Power Ops	804
28-Apr-95	Power Ops	803	Power Ops	767
05-May-95	Power Ops	803	Power Ops	760
12-May-95	Power Ops	835	Power Ops	767
19-May-95	Power Ops	578	Power Ops	771
26-May-95	Power Ops	880	Power Ops	802
02-Jun-95	Power Ops	905	Power Ops	810
09-Jun-95	Power Ops	982	Power Ops	898
16-Jun-95	Power Ops	904	Power Ops	650
23-Jun-95	Power Ops	916	Power Ops	809
30-Jun-95	Power Ops	904	Power Ops	798
07-Jul-95	Power Ops	979	Power Ops	820
14-Jul-95	Power Ops	1031	Power Ops	858
21-Jul-95	Power Ops	912	Power Ops	649
28-Jul-95	Power Ops	1135	Power Ops	787
04-Aug-95	Power Ops	1020	Power Ops	765
11-Aug-95	Power Ops	1216	Power Ops	888
18-Aug-95	Power Ops	1110	Power Ops	815
25-Aug-95	Power Ops	1133	Power Ops	795
01-Sep-95	Power Ops	1203	Power Ops	903
08-Sep-95	Power Ops	1245	Power Ops	915
15-Sep-95	Power Ops	1268	Power Ops	650
22-Sep-95	Power Ops	1227	Power Ops	899
29-Sep-95	Power Ops	1244	Refueling	343
06-Oct-95	Power Ops	1172	Refueling	265
13-Oct-95	Power Ops	864	Refueling	249
20-Oct-95	Power Ops	1252	Startup	262
27-Oct-95	Power Ops	1240	Power Ops	348

Table 4 - Peach Bottom Fuel Pool Silica

Sample Date	PBAPS 2 OPCON	Silica (ppb)	PBAPS 3 OPCON	Silica (ppb)
03-Nov-95	Power Ops	1254	Power Ops	351
10-Nov-95	Power Ops	1219	Power Ops	324
17-Nov-95	Power Ops	1315	Power Ops	400
24-Nov-95	Power Ops	1296	Power Ops	445
01-Dec-95	Power Ops	1210	Power Ops	358
08-Dec-95	Startup	1126	Power Ops	418
15-Dec-95	Power Ops	1443	Power Ops	487
26-Dec-95	Power Ops	1251	Power Ops	459
01-Jan-96	Power Ops	1062	Power Ops	396
08-Jan-96	Power Ops	1210	Power Ops	440
15-Jan-96	Power Ops	1200	Power Ops	444
22-Jan-96	Power Ops	1200	Power Ops	463
30-Jan-96	Power Ops	1137	Power Ops	492
07-Feb-96	Power Ops	904	Power Ops	441
14-Feb-96	Power Ops	1195	Power Ops	449
21-Feb-96	Power Ops	1160	Power Ops	434
28-Feb-96	Power Ops	1201	Power Ops	475
06-Mar-96	Power Ops	931	Power Ops	513
13-Mar-96	Power Ops	915	Power Ops	315
20-Mar-96	Power Ops	1142	Power Ops	397
27-Mar-96	Power Ops	1367	Power Ops	547
03-Apr-96	Power Ops	1298	Power Ops	502
10-Apr-96	Power Ops	1221	Power Ops	487
17-Apr-96	Power Ops	1274	Power Ops	541
24-Apr-96	Power Ops	1409	Power Ops	584
01-May-96	Power Ops	1077	Power Ops	469
10-May-96	Power Ops	1258	Power Ops	421
17-May-96	Power Ops	1085	Power Ops	470
24-May-96	Power Ops	1220	Power Ops	548
31-May-96	Power Ops	1248	Power Ops	580
07-Jun-96	Power Ops	1279	Power Ops	590
14-Jun-96	Power Ops	1252	Power Ops	580
21-Jun-96	Power Ops	1300	Power Ops	524
28-Jun-96	Power Ops	1270	Startup	665
08-Jul-96	Power Ops	1187	Power Ops	510
15-Jul-96	Power Ops	1380	Power Ops	710