

ENTERGY OPERATIONS, INC.  
WATERFORD STEAM ELECTRIC STATION  
UNIT NO. 3

BASEMAT MONITORING PROGRAM  
REPORT NO. 5

May 1993

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ENERGY OPERATIONS, INC.  
WATERFORD STEAM ELECTRIC STATION  
UNIT NO. 3

BASEMAT MONITORING PROGRAM  
REPORT NO. 5

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ENERGY OPERATIONS, INC.  
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## 1.0 PURPOSE

The Nuclear Plant Island Structure (NPIS) Common Foundation Basemat Monitoring Program required by Waterford 3 Technical Specification Section 6.8.4.e has been established to provide continuing assurance of basemat integrity and to ensure that conditions within the basemat do not change significantly. The monitoring program is being implemented according to Entergy Operations, Inc. Surveillance Procedures PE-005-033, NPIS Common Foundation Basemat Integrity Check, and CE-002-100, Chemistry Technical Specification Surveillance Performance Coordination. This is the fifth Basemat Monitoring Program Report prepared for the U.S. Nuclear Regulatory Commission.

## 2.0 SCOPE

This report documents the results of the NPIS Common Foundation Basemat Monitoring Program for the period of September 1991 to May 1993. During this period, one basemat survey and crack width surveillance was performed in August 1992. This was the second of the three annual basemat surveillances required done at Waterford 3.

The groundwater chloride content and elevation measurements are done on a quarterly basis; therefore, seven measurements were taken this period.

### Requirements

Technical Specification Section 6.8.4.e states that the program will monitor the settlement of the basemat, changes in ground water chemistry that could effect corrosion of reinforcing steel, changes in crack width, and seasonal variation in ground water levels.

### Acceptance Criteria

The measurements taken to comply with the technical specifications are compared with the acceptance criteria and requirements stated in Reference 5. The acceptance criteria include the following:

- a. an action limit of one inch for the difference between the baseline differential settlement based on July 84 readings and the calculated differential settlement for a surveillance;
- b. an action limit of 250 ppm for the measurement of chloride content in the groundwater; and

## 2.0 SCOPE (CONTINUED)

- c. an action limit of 15 mils (0.015 inch) for the difference between the baseline and measured crack widths.

No acceptance criteria is associated with seasonal variation in groundwater levels. It is tracked to determine if there is a correlation with this level and the basemat settlement and movement.

## 3.0 CONCLUSIONS

All of the acceptance criteria stated in Section 2 have been met for this reporting period. The reported data for all the surveillances since the beginning of the basemat program have consistently been well below the action limits.

## 4.0 RESULTS AND DISCUSSIONS

The data obtained for the basemat elevations, crack width measurements, chloride content in groundwater, and groundwater elevations can be found in the Work Authorizations listed in Section 5.0, References.

### Differential Settlement

Differential settlement is defined as the settlement between a monitoring point at the basemat center near the shield building and a monitoring point at the boundary of the NPIS.

The differential settlements for all eight sets of points were well below the action limit of one inch. Table 1 lists all the differential settlements since the beginning of the program through August 1992. The highest calculated differential settlement for this reporting period was 0.372 inches.

Waterford 3 has also tracked the settlement of 27 additional points on the basemat. Reference 1 lists the elevations for all 37 points. Figure 1 (Attachment 10.2 of Procedure PE-005-033 Revision 5) shows the locations of all the points. No action limit is associated with these measurements. They are tracked to monitor the overall flexural behavior of the foundation mat. No unusual behavior was observed this period.

#### 4.0 RESULTS AND DISCUSSIONS (CONTINUED)

##### Chloride Content

The chloride content in the groundwater remains far below the action limit of 250 ppm. The highest level for this reporting period was 56.40 ppm, measured in the east well on May 19, 1992. Table 2 shows the seven measurements taken during the past reporting period and the measurements taken since the start of the program. Figure 3 shows the locations of the east and west well.

##### Crack Width Measurements

Table 3 and 4 lists the crack width measurements with and without temperature correction, respectively, from the start of the program to August 1992. All the measurements for the August 1992 surveillance are well below the action limit of 15 mils. Figure 2 (Attachment 10.8 of Procedure PE-005-033 Revision 5) shows the locations of all the cracks.

##### Groundwater Elevation

The groundwater elevation in the east and west well fluctuated less than 1.5 feet between each reading from September 1991 to May 1993. The levels in the wells have been similar at each reading. The groundwater elevation in the two wells from the start of the program through May 1993 are listed in Table 5. Figure 3 shows the locations of both wells.

## 5.0 REFERENCES

1. Work Authorization #01098410, Survey of Basemat.
2. Work Authorization #01098412, Survey of SBM-A and SBM-B.
3. Work Authorization #01098411, Crack Width Measurements.
4. Work Authorizations #01086437, #01089938, #01092511, #01098211, #01101257, #01104472, and #01108610, Verify Chlorides and Ground Water Elevation.
5. Letter W3P87-1123, K. W. Cook to NRC, Basemat Surveillance Program, dated June 26, 1987.
6. Entergy Report, "Basemat Monitoring Program Report No. 4," January, 1992.
7. Entergy Operations Surveillance Procedure, "NPIS Common Foundation Basemat Integrity Check," PE-005-033, Revision 5.
8. Entergy Operations Surveillance Procedure, "Chemistry Technical Specifications Surveillance Performance Coordination," CE-002-100, Revision 7.



TABLE 1

ENTERGY OPERATIONS, INC.  
WATERFORD STEAM ELECTRIC STATION  
UNIT NO. 3

BASEMAT MONITORING PROGRAM  
REPORT NO. 5

SETTLEMENT POINTS DIFFERENTIAL RELATIVE  
TO JULY, 1984 BASELINE (a)  
(INCH)

(Action Limit =  $\pm$  1.0 Inch)

MONITORING POINTS	DEC 85	JUL 86	DEC 86	JUN 87	SEP 87	DEC 87	MAR 88	AUG 88	NOV 88	FEB 89	MAY 89	AUG 89	MAR 90	AUG 90	FEB 91	AUG 91	(b) AUG 92
E5-M9	0.156	0.180	0.192	0.168	0.168	0.348	0.324	0.132	0.336	0.336	0.276	0.264	0.360	0.216	0.420	0.264	0.216
E5-E13					0.120	0.276	0.324	0.114	0.252	0.192	0.288	0.300	0.288	0.216	0.300	0.240	0.132
E5-E14					0.096	0.300	0.324	0.091	0.192	0.156	0.264	0.288	0.240	0.168	0.228	0.216	0.036
E5-F	0.540	0.228	0.084	0.480	0.408	0.468	0.456	0.310	0.288	0.468	0.276	0.420	0.360	0.300	0.492	0.384	0.372
M11A-M10	0.228	0.168	0.288	0.084	0.216	0.312	0.348	0.215	0.408	0.300	0.264	0.252	0.324	0.180	0.408	0.336	0.228
M11A-M13	0.036	0.060	0.060	0.084	0.108	0.156	0.144	0.145	0.192	0.132	0.096	0.156	0.132	0.132	0.180	0.168	0.132
M11A-A	-0.024	-0.156	-0.024	0.036	0.420	0.036	0.420	0.102	0.096	-0.060	-0.024	0.036	-0.060	-0.060	0.240	0.312	0.108
M11A-D	-0.060	-0.120	-0.024	0.000	0.396	0.060	0.384	0.024	0.108	-0.024	-0.036	0.000	-0.024	-0.096	0.252	0.300	0.120

## NOTE:

- (a) Differentials are calculated as "Baseline Differential" minus "Actual Differential."  
Sign convention: A (+) differential indicates settlement, whereas, a (-) differential indicates heaving of the Basemat.
- (b) New data calculated during this report period.

TABLE 2

ENTERGY OPERATIONS, INC.  
WATERFORD STEAM ELECTRIC STATION  
UNIT NO. 3

BASEMAT MONITORING PROGRAM  
REPORT NO. 5

NUCLEAR PLANT ISLAND STRUCTURE  
GROUNDWATER CHLORIDE CONTENT (ppm)

(Action Limit = 250 ppm)

<u>DATE</u>	<u>LOCATION</u>	
	<u>EAST WELL</u>	<u>WEST WELL</u>
08/29/84	22.00	17.50
11/29/84	35.00	28.50
03/04/85	37.00	25.00
06/13/85	35.00	22.00
09/21/85	23.00	14.40
11/25/85	46.00	18.00
03/06/86	35.00	16.00
06/02/86	33.00	15.00
09/05/86	33.00	20.00
11/20/86	31.00	20.00
02/26/87	38.00	15.00
06/09/87	48.00	7.80
09/03/87	22.00	5.00
12/14/87	36.00	7.70
03/15/88	22.50	24.80
06/14/88	29.80	10.10
08/15/88	21.00	6.10
11/17/88	17.00	4.8
02/20/89	21.00	5.60
05/15/89	15.90	5.20
08/15/89	12.70	5.00
11/14/89	43.20	15.00
02/23/90	19.50	16.70
05/16/90	15.50	14.50
08/29/90	32.59	16.42
11/16/90	49.10	18.20
02/18/91	21.70	11.30
05/31/91	5.23	56.10
08/28/91	19.90	8.70
11/22/91	24.40	6.80
02/18/92	12.10	1.50
05/19/92	56.40	1.40
08/03/92	20.60	9.00
11/08/92	4.40	0.35
02/04/93	16.60	1.58
05/20/93	45.30	3.70

NOTE:

The seven measurements taken 11/22/91 through 05/20/93 were taken during this report period.

TABLE 3

ENTERGY OPERATIONS, INC.  
WATERFORD STEAM ELECTRIC STATION  
UNIT NO. 3

BASEMAT MONITORING PROGRAM  
REPORT NO. 5

CRACK WIDTH MONITORING  
CHANGE IN CRACK WIDTH IN MILS (0.001 INCH)  
WITH TEMPERATURE CORRECTION

(ACTION LIMIT = 15 MILS (0.015 INCH))

CRACK NUMBER	NOV 86	FEB 87	MAY 87	SEPT 87	DEC 87	MAR 88	JUNE 88	AUG 88	NOV 88	FEB 89	MAY 89	AUG 89	MAR 90	AUG 90	FEB 91	AUG 91	(a) AUG 92
1				-0.35	-0.20	0.45	0.20	0.10	-0.05	0.30	1.25	1.30	0.90	0.90	0.95	-1.20	-1.65
2				-0.65	1.30	1.10	0.90	-0.55	-0.10	0.65	0.25	-1.10	1.10	1.05	1.80	0.40	1.85
3	-0.50	0.20	-0.30	-0.20	-0.40	1.05	0.15	0.20	0.45	0.50	0.20	0.10	0.45	0.60	-3.45	1.00	-4.50
4				-0.55	2.35	3.15	-0.60	-0.65	0.30	2.00	0.25	0.30	1.80	1.90	3.00	0.75	2.75
5	0.00	0.40	-0.50	-0.35	1.10	0.00	0.35	0.00	0.80	0.20	0.50	3.00	-0.30	-1.05	0.45	-1.50	3.35
6				-0.35	-0.70	-0.55	-0.65	-0.65	-0.60	-0.40	-0.55	-0.10	0.20	1.15	-1.00	-0.10	1.05
7				-0.30	0.50	0.20	-0.75	-0.55	-0.40	-0.95	-0.25	-0.80	0.55	1.15	0.55	-0.20	-0.55
8				-0.20	-1.15	0.45	-0.90	-0.75	-1.60	-1.00	-1.00	-0.85	-0.45	-0.35	-0.40	-0.85	-0.40
9				0.25	-0.15	-0.25	0.00	0.15	0.55	0.80	0.20	-0.05	0.55	0.55	1.05	0.55	0.30
10				0.75	0.25	1.40	1.15	0.40	0.35	0.20	0.00	0.15	0.50	0.35	0.70	-0.20	2.60
11	-0.50	0.10	-0.50	-0.35	0.50	0.05	1.95	-0.15	0.50	0.45	0.75	0.35	0.65	-0.60	0.10	2.35	-1.35
12	1.20	3.70	1.00	0.10	1.90	4.65	2.80	1.55	1.05	4.45	-0.50	1.25	1.85	0.25	2.15	3.00	1.60
13				0.20	1.00	2.40	-0.15	0.15	0.75	2.50	0.45	0.15	1.05	0.95	2.35	1.65	0.20
14				-0.80	0.55	1.95	0.05	-0.90	-0.65	0.80	-0.10	-0.40	0.40	-1.45	1.80	-1.10	1.10
15				0.70	1.05	1.75	0.50	1.20	1.75	1.35	1.30	1.55	1.45	1.15	2.10	1.95	4.30

Note: (a) New data calculated during this report period.

TABLE 4

ENTERGY OPERATIONS, INC.  
WATERFORD STEAM ELECTRIC STATION  
UNIT NO. 3

BASEMAT MONITORING PROGRAM  
REPORT NO. 5

CRACK WIDTH MONITORING  
CHANGE IN CRACK WIDTH IN MILS (0.001 INCH)  
WITHOUT TEMPERATURE CORRECTION

(ACTION LIMIT = 15 MILS (0.015 INCH))

CRACK NUMBER	NOV 86	FEB 87	MAY 87	SEPT 87	DEC 87	MAR 88	JUN 88	AUG 88	NOV 88	FEB 89	MAY 89	AUG 89	MAR 90	AUG 90	FEB 91	AUG 91	(a) AUG 92
1				0.45	1.40	1.85	0.90	0.50	0.45	1.30	-0.65	-1.30	-1.50	-1.30	-1.85	-3.60	-2.85
2				0.15	1.00	1.70	0.40	0.25	0.90	1.05	-2.05	-1.90	-0.70	-0.75	-1.10	-0.50	-0.15
3	-0.40	-0.20	-0.20	-0.20	-0.10	1.35	0.05	0.00	0.25	1.20	-2.50	-2.80	-1.75	-1.30	-3.15	-2.00	-4.40
4				0.05	3.15	3.35	0.60	0.05	0.90	2.70	-1.25	-2.00	-0.20	-0.20	1.50	-1.75	-1.65
5	-0.10	0.00	-0.50	-0.05	1.20	1.10	0.65	0.00	0.70	0.70	-1.60	0.30	-1.70	-2.05	-0.15	-2.50	-0.95
6				-0.15	-0.50	0.15	-0.25	-0.45	-0.20	0.00	-2.85	-2.60	-2.30	-2.25	-2.30	-1.60	-3.15
7				0.40	0.90	0.80	0.15	0.05	0.10	0.15	-2.35	-2.30	-1.55	-1.05	-1.65	-1.90	-2.75
8				0.50	0.35	1.25	0.20	0.05	-0.20	0.20	-2.50	-2.55	-2.05	-2.25	-1.50	-2.25	-2.00
9				0.45	0.15	0.25	0.80	0.35	0.45	1.10	-2.30	-2.25	-1.75	-2.05	-0.85	-1.85	-1.60
10				0.65	0.75	2.00	0.65	0.30	0.85	1.20	-1.90	-1.85	-0.80	-1.25	-0.40	-1.70	-2.10
11	-0.10	1.50	-0.60	0.35	0.70	1.65	0.55	0.35	0.80	1.05	-1.95	-1.85	-0.95	-1.80	-1.00	-0.05	-5.45
12	1.30	3.50	0.70	0.10	1.30	3.95	2.30	1.25	1.15	5.35	0.50	-1.15	2.45	-1.45	4.65	1.90	-0.50
13				0.20	1.10	3.40	-0.05	0.45	0.85	1.90	-1.75	-1.95	-0.75	-0.85	-0.45	-1.65	-3.80
14				0.00	0.55	2.15	0.45	0.10	0.65	2.20	-1.70	-1.50	-1.40	-2.15	0.03	-2.00	-1.70
15				0.80	0.95	1.65	0.40	0.90	1.05	1.45	-1.90	-1.75	-1.85	-1.75	-1.00	-1.65	-3.50

Note: (a) New data calculated during this report period.

TABLE 5

ENTERGY OPERATIONS, INC.  
 WATERFORD STEAM ELECTRIC STATION  
 UNIT NO. 3

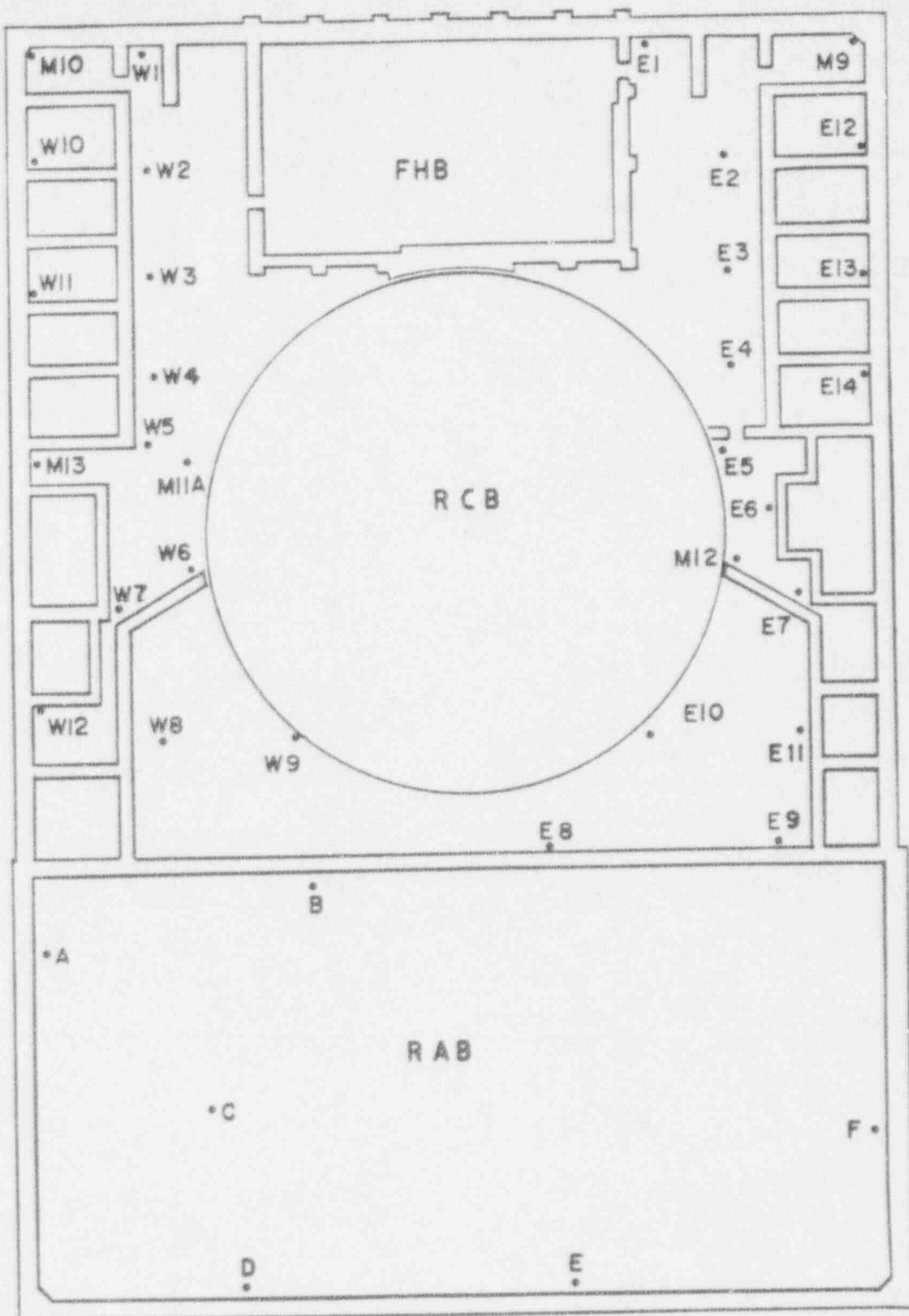
BASEMAT MONITORING PROGRAM  
 REPORT NO. 5

NUCLEAR PLANT ISLAND STRUCTURE  
GROUNDWATER ELEVATION (FEET)

(No Action Limit)

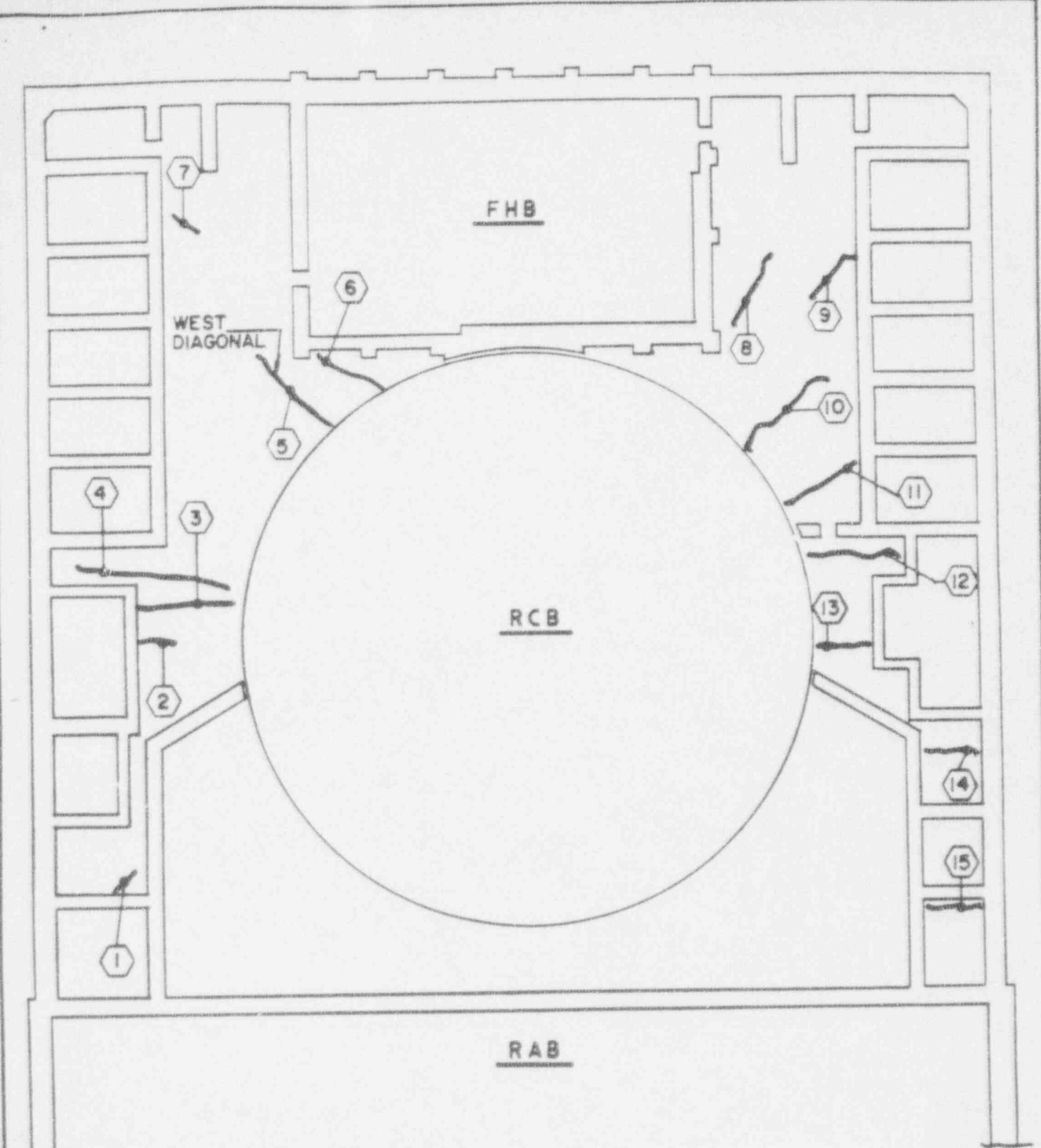
<u>DATE</u>	<u>LOCATION</u>	
	<u>EAST WELL</u>	<u>WEST WELL</u>
06/13/85	11.50	11.50
09/21/85	10.70	10.97
11/25/85	11.65	11.52
03/06/86	11.57	11.70
06/02/86	11.67	11.80
09/05/86	11.75	11.91
11/20/86	11.90	12.11
02/26/87	12.00	12.01
06/09/87	12.05	12.35
09/03/87	11.90	12.11
12/14/87	11.36	11.18
03/15/88	12.00	12.16
06/14/88	11.92	12.13
08/18/88	12.23	12.26
11/17/88	11.65	11.81
02/20/89	11.60	11.61
05/15/89	12.15	12.02
08/15/89	12.15	12.39
11/14/89	12.10	11.85
02/23/90	12.90	13.00
05/16/90	12.23	12.21
08/29/90	11.45	11.55
11/16/90	11.45	11.36
02/18/91	13.05	12.86
05/31/91	13.04	13.51
08/28/91	10.80	12.11
11/22/91	11.40	11.51
02/18/92	12.00	11.90
05/19/92	11.50	11.61
08/03/92	12.20	12.36
11/08/92	12.15	12.35
02/04/93	12.10	11.50
05/20/93	12.82	12.82



NOTE: The seven measurements taken 11/22/91 through 05/20/93 were taken during this report period.



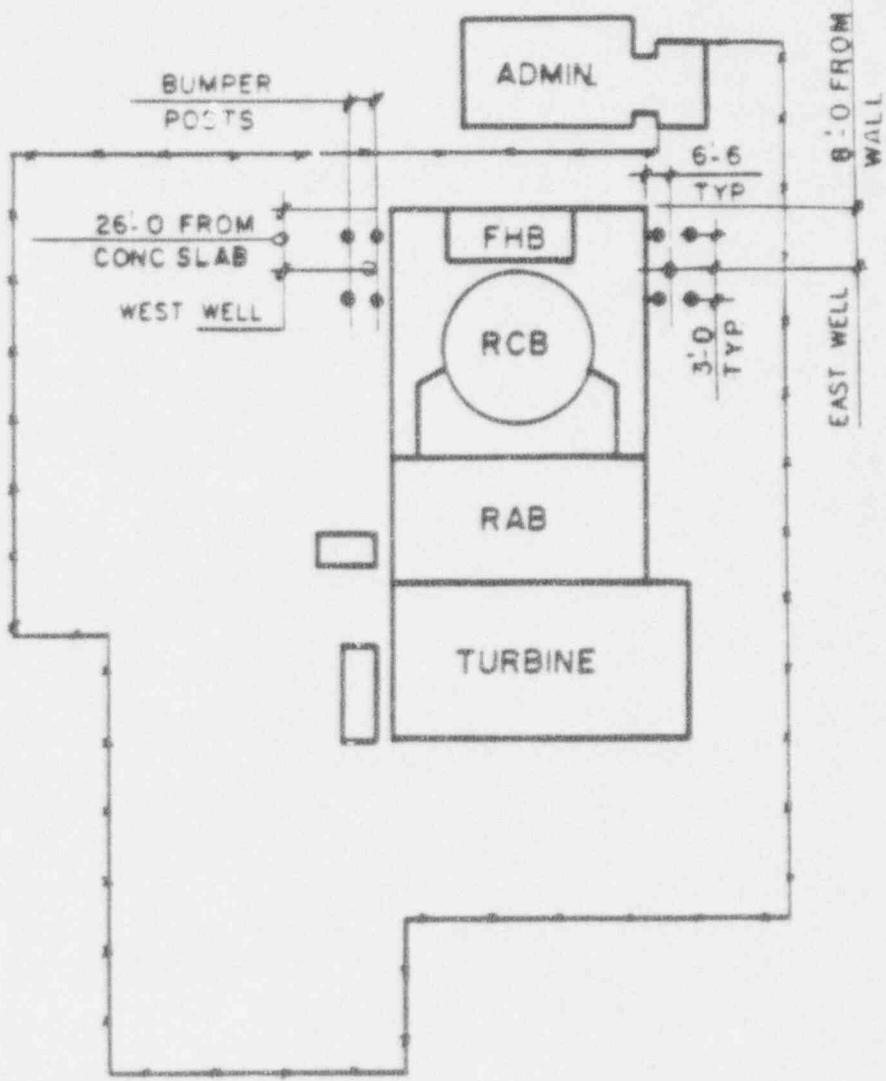
ENERGY OPERATIONS  
Waterford Steam Electric Station # 3

SETTLEMENT  
MONITORING POINTS  
FIGURE 1



 CRACK IN BASE MAT  
 MONITORING STATION

**ENERGY OPERATIONS**  
 Waterford Steam Electric Station # 3  
**CRACK WIDTH MONITORING STATIONS**  
**FIGURE 2**



PLAN

<p>ENERGY OPERATIONS Waterford Steam Electric Station #3</p>
<p>GROUNDWATER SAMPLING WELLS FIGURE 3</p>



BASEMAT MONITORING PROGRAM REPORT NO. 5  
Administrative Revision Summary

CHLORIDE CONTENT

Table 3, Groundwater Chloride Content, of Basemat Monitoring Report No. 4 contains a typo for the measurement of the chloride content for the west well on August 28, 1991. The chloride content is listed as 6.70 ppm, the actual content was 8.70 ppm. Table 2 of Report No. 5 has the correct content.

GROUNDWATER ELEVATION

Table 4, Groundwater Elevation, in Basemat Monitoring Program Report No. 4 list the sounding tape readings instead of the elevations of the groundwater for the August 28, 1991, measurements. The correct groundwater elevations for the east and west wells are 10.80 feet and 12.11 feet, respectively, Table 5 of Report No. 5 contains the correct elevation.

REPORT CHANGES

Since the basemat program has been in existence, four reports have been written to summarize the data collected during each reporting period. Each report contained the historical data, background information, and graphs presenting the data. Since this reporting period only contains one extra set of data from the August, 1992, basemat survey and crack surveillance and seven sets of data for the chloride content and groundwater elevation, this fifth report concentrates on stating the findings of the current surveillances and relating them to the acceptance criteria stated in Letter W3P87-1123. Consequently, the historical data, background information, and graphic presentation of data is omitted from this report.