UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 16, 1990

Docket No. 50-416

LICENSEE: Entergy Operations, Inc.

FACILITY: Grand Gulf Nuclear Station, Unit 1

SUBJECT: SUMMARY OF APRIL 16 AND 17, 1990 MEETING WITH ENTERGY OPERATIONS, INC. REGARDING BUILDING SETTLEMENT MONITORING

The NRR Structural and Geosciences Branch of the NRC met with the licensee and toured the Grand Gulf facility to observe the condition of foundations of Category I structures, settlement markers, seismic gaps and groundwater monitoring wells and to discuss settlement monitoring. The NRC Resident Inspector and J. Lenahan, an NRC Region II Inspector, participated in the meeting and tour. Enclosure 1 lists attendees at the April 16, 1990 meeting. Enclosure 2 lists participants in the April 17, 1990 facility tour and exit meeting. Enclosure 3 is a table giving allowable and measured settlement information for pipes. Enclosure 4 is an agenda, draft NRC requests for additional information and a handout prepared by the licensee.

In the afternoon of April 16, 1990, a technical meeting was held between the NRC staff and the licensee's personnel. The following is a brief summary of the licensee's presentation. Licensee's slides are given in Enclosure 4.

1. Although settlement monitoring is not included in the plant Technical Specifications, the licensee has performed settlement monitoring in accordance with its Final Safety Analysis Report (FSAR) commitment. After Bechtel Corporation turned over the settlement monitoring task to the licensee in April 1982, the licensee's staff measured building settlements every 6 months for 5 years following the completion of construction of structures and annually thereafter. Following each set of measurements, settlement data were evaluated to determine the total settlement and tilt of the structures, and differential settlement between structures. The FSAR was updated by incorporating the latest "settlement vs. time" information as well as "measured vs. predicted settlement."

2. The licensee's staff discussed its proposed responses to the NRC staff's draft request for additional information (Enclosure 4, Sheet 1A), and stated that the plant structures were behaving as expected without any settlement concerns. The licensee's staff further explained that the slight oscillations in settlement measurements that were recently noticed in differential settlements could be attributed to three factors: (1) survey tolerance, (2) temperature fluctuations, and (3) changing live loads.

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3. Regarding the ground water level monitoring, the licensee's staff stated that water level has generally been in the estimated range in all areas with the only exceedance being noted in the dewatering well, DW-8. The level in DW-8 has exceeded the design basis value for .09 ft. by less than 3 ft. This is not a concern since the stability of all structures has been evaluated with ground water level up to El. 114.5 MSL.

On April 17, 1990, NRC staff toured the plant examining the condition of the foundations of Category-1 Structures, the setttlement markers and ground water monitoring wells. The staff particularly looked for any signs of tilting of Category-1 Structures due to differential settlement by examining the seismic gap at various locations between the Category-1 structures. The observations of seismic gaps did not indicate differential movement of structures.

The staff observed minor vertical cracks in the outside concrete wall of the Auxiliary Building from El. 139 to about El. 166 and above, near settlement marker No. P-9a. There were also several minor cracks on the east wall of the Unit 1 Turbine Building. The Resident Inspector, J. Mathis, pointed out that the missile shield structure near the SSW pumphouse and valve room had settled down some time ago and stated that this had been dealt with by a Material Non-conformance Report.

At the exit meeting in the afternoon of April 17, the NRC staff provided the following recommendations and action items:

1. The seismic gaps between the Category-1 Structures should be monitored as part of the settlement monitoring program.

2. The licensee's surveying procedures should be improved to obtain consistently accurate measurements. In the case of those measurements where large fluctuations have been noticed recently, the licensee should perform an analysis and approximately apportion numerical values to the three factors it attributes to the fluctuations.

3. The minor cracks in the outer walls of the Auxiliary Building and Turbine Building should be watched to see if they develop further, and if they are settlement-related.

4. The licensee should adhere to its FSAR commitments regarding settlement monitoring and measure the settlements at the specified intervals.

5. The licensee should provide drawings showing the longitudinal sections of pipes buried in soil that penetrate through the walls and furnish to the NRC staff sample calculations showing the differential settlements of penetrations in the buildings.

After the exit meeting the NRC staff was shown a table (Enclosure 3) showing the allowable and measured differential settlements of pipes 4 inches and greater and for pipes with less than 1/2 inch allowable differential settlements. It was noticed from that table that, at two penetrations, i.e.,

(1) No. 27 for the line 14" - HBB-32, and (2) No. DP-44A for the line 6" - HBC-404 the actual differential settlements had reached 80 percent of the allowable values. In the case of eight other penetrations given in that table, the ratios of the actual to allowable differential settlements ranged from 4 percent to 56 percent. The licensee should perform an engineering analysis of the causes and effects of the excessive amounts of differential settlements in those two penetrations.

J. J. Lenahan, NRC Inspector, Region II, has reported (NRC Inspection Report No. 50 - 416/90-07 dated May 9, 1990), that he examined the licensee's survey equipment used in settlement monitoring, and found that it did not meet the requirement for first order leveling recommended by the General Specification of Geodetic Survey published by the U.S. Dept. of Commerce. This report also indicates that the licensee's engineers have agreed to review their field procedures and equipment needs to comply with the first order leveling requirements.

A request for additonal information regarding settlement of Category I structures will be sent to the licensee separately and will include a request for a report describing improvements in surveying procedures as described in this meeting summary.

Original signed by:

Lester L. Kintner, Senior Project Manager
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Enclosures:
As stated

DISTRIBUTION

Docket File	J. Lenahan	L. Kintner	OGC MS15B18
NRC PDR	T. Quay	PD4-1 Reading	E. Jordan MNBB3701
Local PDR	L. Berry	B. Boger MS13E4	ACRS (10) MS P-315
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C	:PD4-1/LA	:PD4-1/PM	:PD4-1/D	:	:	:
ME	:LBerry	:LKintner	:TQuay	:	:	:
TE	:08/14/90	:08/15/90	:08/16/90	:	:	:

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Enclosure 1

Entergy Operations - NRC
Meeting April 16, 1990
Attendees

Name	Title	Affiliation
J. Summers	Compliance Coordiator	SERI*
D. Austin	Civil Engineer	SERI
M. R. Lewis	Engineering Supt.	Bechtel
W. Mashburn	Principle Civil	SERI
R. L. Blodnikor	Hydrogeoligist	Bechtel
J. Sutterfield	Eng Asst. II	SERI
Steve Benartt	Lic Proj. Supv	SERI
Jim Barker	Supv. Engineering Services	SERI
Dan Pace	Mgr. Nuclear Design	SERI
Raman Pichumani	Geotechnical Engr.	NRC/NRR
Goutam Bagchi	Branch Chief, ESGB	NRC/NRR
Joe Lenahan	Civil Engineer	NRC/Region II
J. Mathis	Resident Inspector	NRC/Region II
L. Kintner	Project Manager	NRC/NRR

*Licnesee for Grand Gulf Nuclear Station was System Energy Resources, Inc. (SERI) before June 6, 1990 and Entergy Operations, Inc. (Entergy Operations) on and after June 6, 1990.

Enclosure 2

Entergy Operations - NRC
Meeting April 17, 1990
Attendees

Name	Title	Affiliation
J. Summers	Compliance Coordinator	SERI*
Johnny L. Mathis	Resident Inspector	NRC
Les Kintner	Project Manager	NRC
Joe Lenahan	Civil Engineer	NRC/RII
Goutam Bagchi	Branch Chief, ESGB	NRC/NRR
Raman Pichumani	Geotechnical Engineer	NRC/NRR
Dan Pace	Mgr.-Nuclear Design	SERI
Lonnie Daughtery	Compliance Supv.	SERI
Steven Bennett	Supv. Licensing Projects	SERI
J. G. Cesare	Director, Nuclear Licensing	SERI
W. F. Mashburn	Principal Civil Engineer	SERI
J. Sutterfield	Civil Eng. Asst.	SERI
D. R. Austin	Civil Eng.	SERI
R. L. Blodnikar	Hydrogeologist	Bechtel
M. R. Lewis	Engineering Supt.	Bechtel

*Licensee for Grand Gulf Nuclear Station was System Energy Resources, Inc. (SERI) before June 6, 1990 and Entergy Operations, Inc. (Entergy Operations) on and after June 6, 1990.

ALLOWABLE AND MEASURED DIFFERENTIAL SETTLEMENT FOR PIPE 4" IN DIAMETER AND GREATER AND FOR PIPES WITH LESS THAN 1/2" ALLOWABLE DIFFERENTIAL SETTLEMENT

PENE NO.	LINE	SYSTEM	ELEV FT	DATE INSTALLED	FROM STRUCTURE TO STRUCTURE	ALLOWABLE DIFFERENTIAL SETTLEMENT INCHES	ACTUAL DIFFERENTIAL SETTLEMENT SINCE INSTALLATION INCHES	RATIO OF ACTUAL TO ALLOWABLE DIFFERENTIAL SETTLEMENT
9	24"-DBA-13	FW	143'-1 1/2"	11/80	CTMT TO AUX	0.41	0.12	.29
10	24"-DBA-13	FW	143'-1 1/2"	07/80	CTMT TO AUX	0.43	0.24	.56
26	14"-DBA-5	HPCS	130'-6"	12/80	CTMT TO AUX	0.42	0.06	.14
27	14"-HBB-32	HPCS	117'	05/80	CTMT TO AUX	0.42	0.34	.81
38	4"-HBB-44	CHDWTR	157'-6"	03/80	CTMT TO AUX	0.35	0.06	.17
49	4"-HBE-152	RWCU	134'-6"	05/81	CTMT TO AUX	0.43	0.04	.09
56	6"-HBB-34	DEMIN WTR	148'-6"	07/80	CTMT TO AUX	0.23	0.07	.30
57	8"-HBB-7	FPCU	202'-6"	09/80	CTMT TO AUX	0.42	0.13	.31
83	6"-DBB-104	RWCU	145'-4"	09/80	CTMT TO AUX	0.48	0.02	.04
DP-44A	6"-HBC-404	CHDWTR	172'	11/80	DG TO AUX	0.40	0.32	.80

Enclosure 4

Agenda for Grand Gulf Site Visit

April 16, 1990

2:30 p.m to 4:00 p.m — 1. Site Meeting with Licensee's Staff

(a) Licensee's Presentation on
  (i) Settlement Monitoring (i/c Surveying Procedures)
  (ii) Groundwater monitoring and permanent dewatering system
  (iii) Impact of Unit 2 cancellation on Unit 1 structures, systems, etc. (FSAR Revision)

(b) Discuss draft RAI and Licensee's proposed responses to RAI (Enclosure)

April 17, 1990

8:30 a.m to 12:00 p.m — 2. Site Visit

(a) Tour of settlement monitoring and Groundwater monitoring elements (e.g. settlement markers, permanent benchmarks on site and off site, piezometers, wells, etc.)
(b) General inspection of foundations of Category 1 structures
(c) Slopes and embankments, Cooling Towers, Standby S. W. Basin

12:00 p.m to 1:00 p.m — Lunch

1:30 p.m to 2:30 p.m — 3. Exit meeting (proceeded by NRC staff caucus)

(1)

DRAFT

Enclosure

GRAND GULF NUCLEAR STATION
REQUEST FOR ADDITIONAL INFORMATION (RAI)
STRUCTURAL & GEOSCIENCES BRANCH/DET/NRR
(REVIEWER: RAMAN PICHUMANI)

1.a) Provide a comparison of measured total and differential settlements with i) predicted and ii) allowable settlements for all Category 1 structures, along with explanations for differences, if any, between the predicted and measured settlements for each Category 1 structure.

b) Explain the consequences, if any, of the measured settlements that may exceed the allowable settlements for each Category 1 structure.

c) In addition to evaluating the differential settlement between adjacent structures, determine the tilting of each structure due to differential settlement of individual structure. For example, according to Fig. 2.5.4-75, in the updated FSAR, there appears to be a difference in settlement of about 0.6 inches. between the markers P-9 and P-15 located in the Auxiliary Building - one on either side of the Containment, Unit 1.

Discuss the safety significance of this differential settlement of the Auxiliary Building.

2.a) Explain the reasons for the destruction of settlement markers and for the unavailability of settlement data for extended periods of time in the case of some Category 1 structures as noted from FSAR Fig. 2.5.4-75.

b) Describe the surveying procedures used to reestablish the destroyed settlement markers, paying special attention to:
i) the quality assurance aspects of accurately transferring the settlement data from the destroyed markers to the new markers, and
ii) the proper maintenance and assurance of the accuracy of permanent benchmarks used in settlement monitoring.

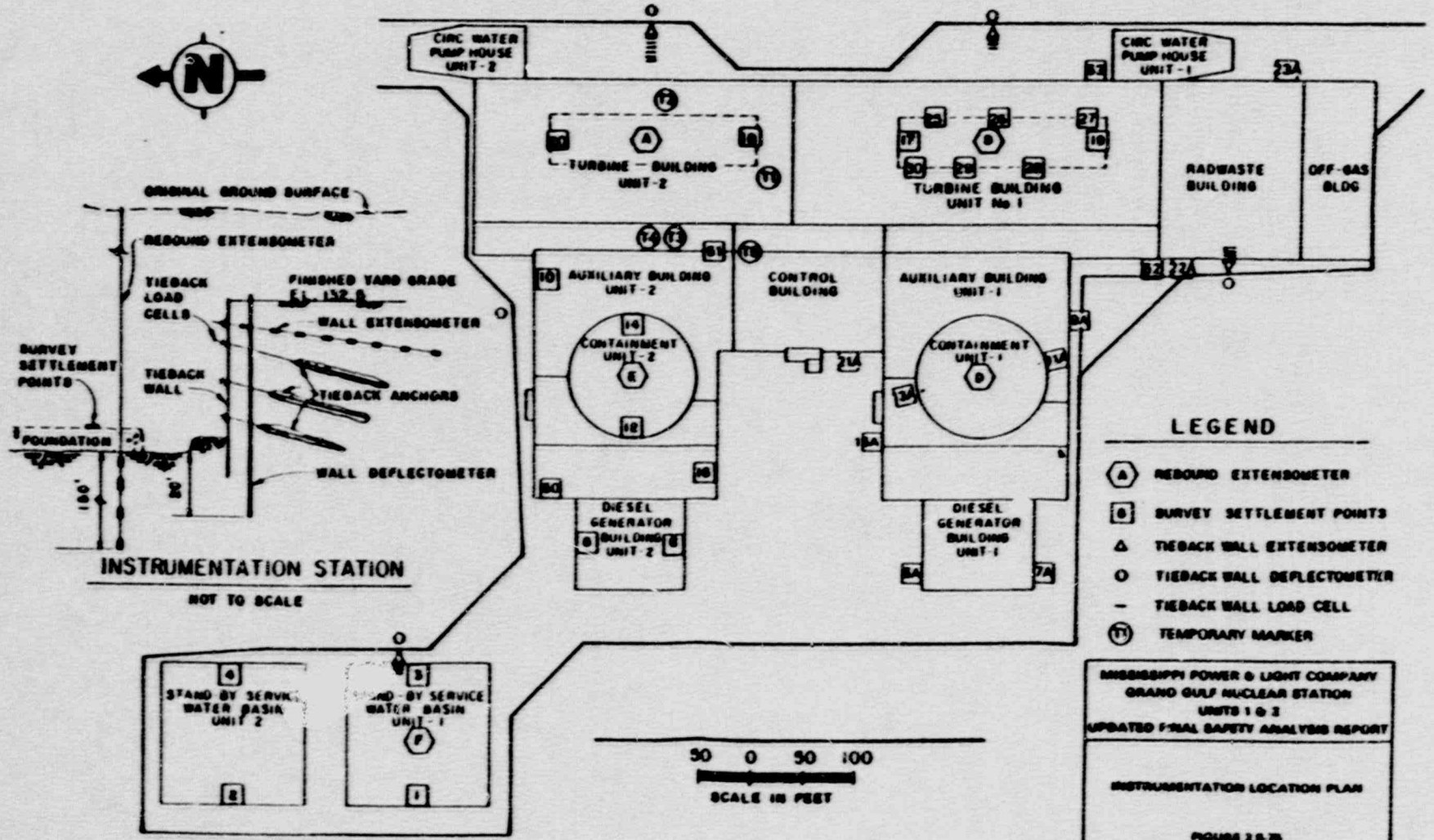
3. Discuss the results of groundwater monitoring at the site and provide an evaluation of the effects of fluctuation in groundwater levels, if any, on the stability and settlement of structures.

4. Provide draft amendments to the relevant FSAR Sections incorporating your responses to the questions above.

(1A)

SETTLEMENT MONITORING PROGRAM
UNIT 1

- Performed monthly by Bechtel per Spec. 9645-C-195.0 until turnover in April, 1982.
- Performed by SERI every 6 months for 5 years following structure completion and annually thereafter.
- Initiated by Plant Operations Surveillance Procedure Task Card
- Survey performed per Spec. SERI-C-395.0
  - 3 wire level method
  - Instructions for establishing new and relocating marks
  - 1st order leveling
  - Assessments made for inaccessible points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CIRC WATER PUMP HOUSE UNIT-2
CIRC WATER PUMP HOUSE UNIT-1
TURBINE BUILDING UNIT-2
TURBINE BUILDING UNIT No 1
RADWASTE BUILDING
OFF-GAS BLDG
AUXILIARY BUILDING UNIT-2
CONTROL BUILDING
AUXILIARY BUILDING UNIT-1
CONTAINMENT UNIT-2
CONTAINMENT UNIT-1
DIESEL GENERATOR BUILDING UNIT-2
DIESEL GENERATOR BUILDING UNIT-1
STAND BY SERVICE WATER BASIN UNIT 2
STAND BY SERVICE WATER BASIN UNIT-1
ORIGINAL GROUND SURFACE
REBOUND EXTENSOMETER
TIEBACK LOAD CELLS
FINISHED YARD GRADE
WALL EXTENSOMETER
SURVEY SETTLEMENT POINTS
TIEBACK WALL
TIEBACK ANCHORS
FOUNDATION
WALL DEFLECTOMETER
INSTRUMENTATION STATION
NOT TO SCALE
50 0 50 100
SCALE IN FEET
LEGEND
REBOUND EXTENSOMETER
SURVEY SETTLEMENT POINTS
TIEBACK WALL EXTENSOMETER
TIEBACK WALL DEFLECTOMETER
TIEBACK WALL LOAD CELL
TEMPORARY MARKER
MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
UPDATED FINAL SAFETY ANALYSIS REPORT
INSTRUMENTATION LOCATION PLAN
FIGURE 2.5-75

- **FSAR updated for:**
  - **Settlement vs time**
  - **Measured vs Predicted**
- **Data Evaluated to FSAR Criteria for:**
  - **Tilt of Structures**
  - **Total Settlement**
  - **Differential Settlement**

1.a) Provide a comparison of measured total and differential settlements with i) predicted and ii) allowable settlements for all Category 1 structures, along with explanations for differences, if any, between the predicted and measured settlements for each Category 1 structure.

(5)

TOTAL SETTLEMENT

- Current total settlement for all structures is less than 1½".
- Predicted values of total settlement agree well with measured values.
- Total settlement has essentially remained unchanged since 1981
- Ratio of measured total settlement to exceedance values given in FSAR is less than 40% for all major structures.

TABLE 2.5-10
(MODIFIED)

PREDICTED VS MEASURED TOTAL SETTLEMENT VALUES
(Based on Data at the end of November 1981
for Unit 2 and to December 1989 for Unit 1)

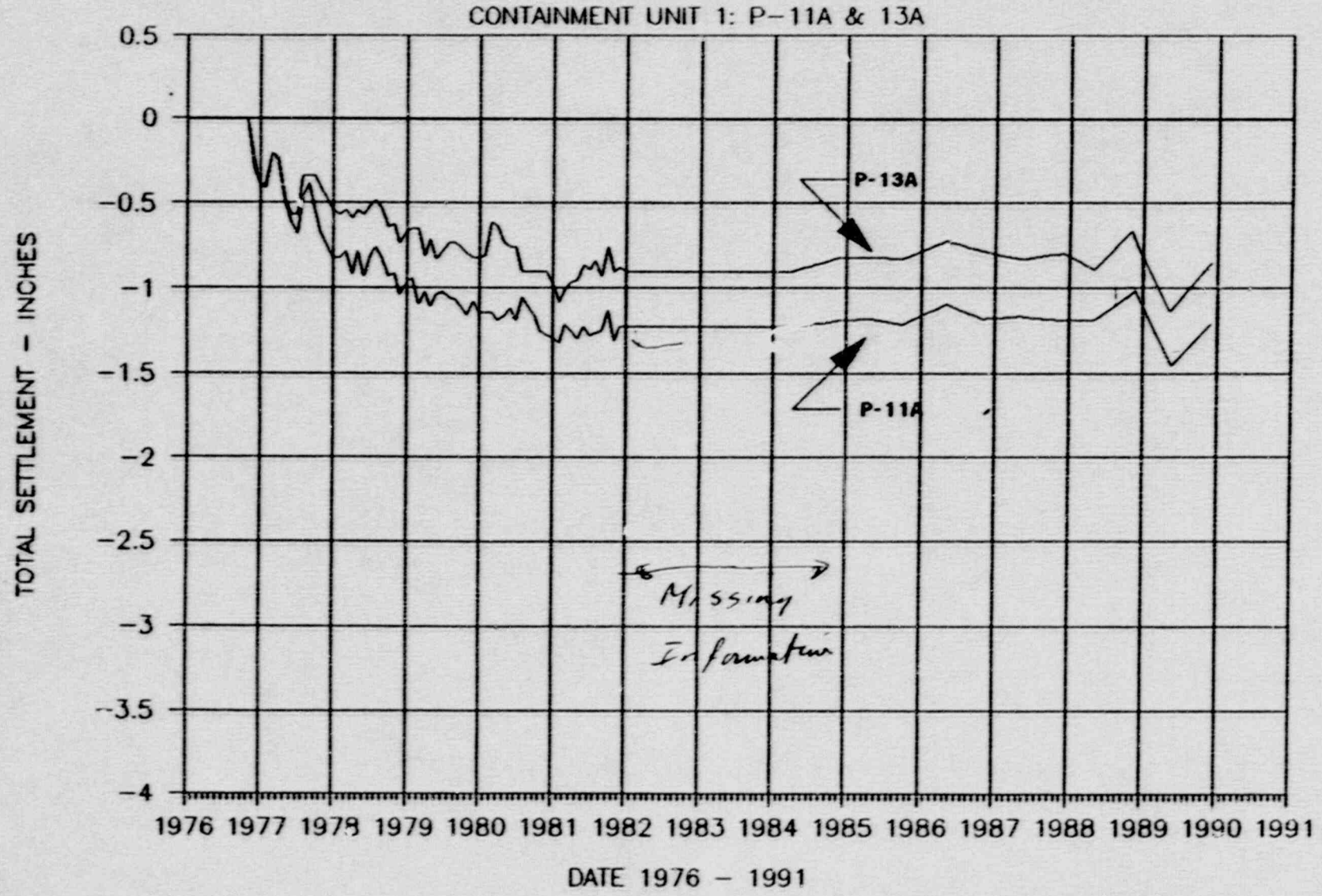
	Settlement			Percent of Dead Load Completed
	Maximum *Predicted (in.)	Current **Measured (in.)		
Containment - Unit 1	0.8	1.0	(1.2)	100***
Containment - Unit 2	0.8	1.0	(1.0)	40
Auxiliary Bldg - Unit 1	1.0	1.0	(1.4)	100
Auxiliary Bldg - Unit 2	1.0	0.6	(0.6)	10
Radwaste Bldg	0.8	0.5	(0.6)	100
Control Bldg	0.5	0.7		96
SSW Basin - Basin A	0.7	0.3	(0.4)	100% water***
SSW Basin - Basin B	0.7	0.4	(0.5)	100% water***
Diesel Gen. Bldg - Unit 1	0.8	0.2	(0.2)	100

* Based on elastic modulus values as determined from rebound measurements. Refer to Figure 2.5-90 for predicted total settlements for different assumed groundwater levels. (These values are 40-year predictions.)

** Values given are average of two settlement markers except for control building where there is only one marker. Values in parentheses are for the marker with greater settlement.

*** Intermittent filling and emptying of water from the Containment Building and SSW Basin can produce coincident fluctuations in the measured settlement values.

GRAND GULF NUCLEAR STATION



STRUCTURE	TOTAL SETTLEMENT - INCHES EXCEEDANCE VALUE	MAXIMUM 12/89	RATIO OF CURRENT MAXIMUM TO EXCEEDANCE
Containment - 1	3.5	1.2	0.3
Auxiliary - 1	3.5	1.4	0.4
Radwaste	3	0.6	0.2
Control	3	0.7	0.2
Diesel Generator	3	0.2	0.1

TABLE 2

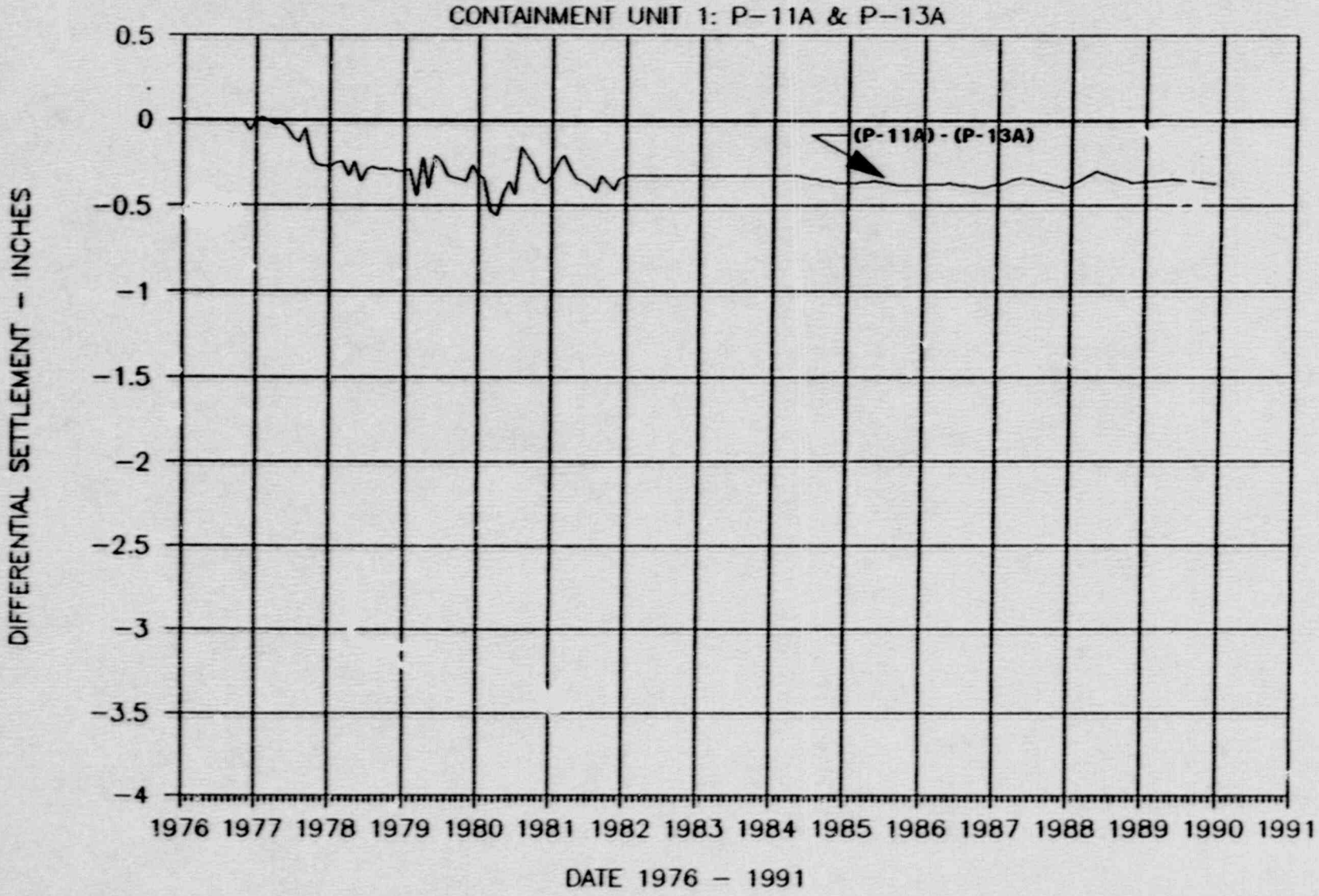
DIFFERENTIAL SETTLEMENT

- Differential settlement has remained essentially unchanged since 1981.

- Differential settlement for the Unit 1 Containment and Auxiliary Buildings since the foundations were constructed is well below the FSAR established allowable values.

- Since the installation of the majority of Auxiliary Building piping support systems in 1978-1980, the differential settlement between major structures is equal to or less than 1/4".

GRAND GULF NUCLEAR STATION



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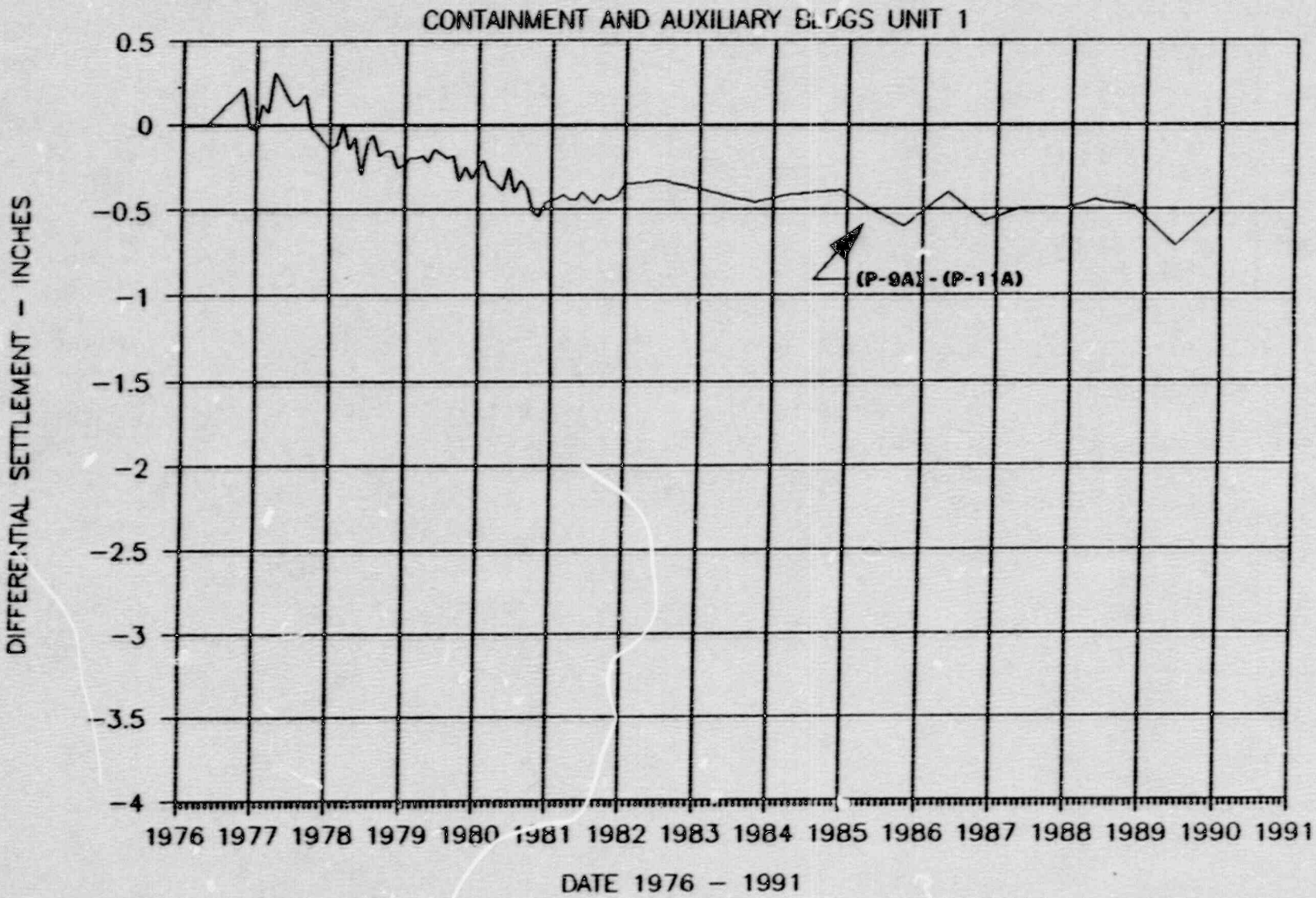


STRUCTURE	MARKERS	DIFFERENTIAL SETTLEMENT - INCHES		RATIO OF CUR. TO ALL.
		CURRENT 12/89	ALLOWABLE	
Containment-1	11 & 13	0.37	0.6	0.6
Auxiliary -1	9 & 15	0.67	1.15	0.6

TABLE 3

STRUCTURE	MARKERS	SETTLEMENT 12/78	SETTLEMENT CURRENT	SETTLEMENT INCHES
Auxiliary Containment	9 - 11	0.25	0.50	0.25
Auxiliary Containment	13 - 15	0.65	0.54	0.11
Auxiliary Control Building	15 - 21	0.56	0.64	0.07

TABLE 4

EXPLANATION FOR ANY DIFFERENCES

- Correlation of predicted versus measured settlement is excellent.
- For structures bearing on Catahoula, the average ratio of current total settlement to predicted total settlement is 0.9.
- Differential settlements are all well below the established allowables.
- The small differences shown can be attributed to:
  1. Survey tolerance
  2. Temperature fluctuations
  3. Changing live loads (outage vs. non-outage)

SUMMARY OF SETTLEMENT

- All total settlements are well below exceedance values given in UFSAR.

- Differential settlements between major structures is equal to or less than 50% of expected differential settlement since 1981.

- Differential settlements for the Containment and Auxiliary Building since 1976 is 60% of the allowable values given in the FSAR.

- Conclusion: Plant is behaving as expected with no settlement concerns.

1.b) Explain the consequences, if any, of the measured settlements that may exceed the allowable settlements for each Category 1 structure.

1.c) In addition to evaluating the differential settlement between adjacent structures, determine the tilting of each structure due to differential settlement of individual structure. For example, according to Fig. 2.5.4-75, in the updated FSAR, there appears to be a difference in settlement of about 0.6 inches between the markers P-9 and P-15 located in the Auxiliary Building - one on either side of the Containment, Unit 1.

Discuss the safety significance of this differential settlement of the Auxiliary Building.

STRUCTURE TILTING

- Structure tilting becomes significant when the possibility exists of the structures touching during a seismic event.

- Tilting therefore becomes significant once the shell of the structures has been completed.

- For the two critical structures, Auxiliary and Containment structures, the shell completion date is approximately 1978.

- To date, tilt values are far below the established FSAR allowables of 1.15 inches for the Auxiliary Building and 0.6 inches for the Containment.

- The gap between the Auxiliary Building and Containment is 2″. To date the two structures have moved towards one another 0.07 inches.

- Ratio of measured tilt to allowable tilt since 1978 for Auxiliary Building and Containment is less than 0.1.

- Conclusion: Tilt values are far below allowables and should not increase.

STRUCTURE	MARKERS	DIFFERENTIAL SETTLEMENT - INCHES		RATIO OF CUR. TO ALL.
		CURRENT 12/89	ALLOWABLE	
Containment-1	11 & 13	0.37	0.6	0.6
Auxiliary -1	9 & 15	0.67	1.15	0.6

TABLE 3

STRUCTURE TILTING SUMMARY

STRUCTURE	REFERENCE DATE	SETTLEMENT MARKER	SETTLEMENT - IN. REF. DATE	SETTLEMENT - IN. 12/89	DIFFERENCES INCHES	DELTA TILT INCHES	RATIO OF MEA. TILT TO ALL.
Auxiliary-1	12/78	9	-0.78	-0.71	+0.07		
						0.07	0.06
Auxiliary-1	12/78	15	-1.38	-1.38	0		
Containment-1	12/78	11	-0.73	-0.84	-0.18		
						0.07	0.1
Containment-1	12/78	13	-0.73	-0.84	-0.11		
Turbine-1	4/84	52	0	+0.12	+0.12		
						0.25	-
Turbine-1	4/84	53	0	+0.37	+0.37		
Diesel Gen.-1	11/78	5	-0.24	-0.23	+0.01		
						0.01	-
Diesel Gen.-1	11/78	7	-0.19	-0.19	0.00		

Note: 1. Reference Dates indicate time when shell of structures was essentially complete, except for the Turbine Bldg. where reference date indicates establishment of settlement marker.

2. Negative numbers indicate settlement, positive number indicate heave.

OVERALL SUMMARY

- Settlement plots demonstrate the structures are not settling and have not been settling for about 8 to 10 years.

- In every case measured total settlement is less than the exceedance values.

- Differential settlements have essentially remained unchanged for 8 to 10 years.

- The slight variations that have taken place can be attributed to survey error and temperature fluctuations.

- The results demonstrate the adequacy of the bearing stratum and that it is behaving as expected.

- In summary, no additional settlement is expected.

UNIT 2 SETTLEMENT

- Surveyed every month until structures complete
- Last concrete pour for Unit 2 approximately Spring 1985
- Bechtel turnover of Unit 2 Survey to NPE effective September 1, 1989
- January 20, 1989 - Spec. C-395.0 revised to give frequency of survey for Unit 2 (6 months) (same criteria applies)
- FSAR changes are being prepared to be submitted with other Unit 2 demobilization FSAR changes
- Unit 2 settlement should be of less concern since Unit 2 load will not increase

2.a) Explain the reasons for the destruction of settlement markers and for the unavailability of settlement data for extended periods of time in the case of some Category 1 structures as noted from FSAR Fig. 2.5.4-75.

UNAVAILABILITY OF DATA

- Destroyed
- Accessibility
- Under Water

EXTENDED PERIODS WITH NO DATA

- February 1982 thru October 1983
  - No FSAR guidance on post construction required survey.
  - Survey was performed once per year except for P-7, P-11, P-13, P-52, and P-53.
- P-7 - Diesel Generator Building
  - Missed on 8/82 survey due to inaccessibility
  - Relocated in 4/84.
  - Tied back to existing point.

CONTAINMENT POINTS P-11 & P-13

- Missed between 1/82 - 4/84
- Points are not accessible due to location.
- 4/84 - Re-established in an accessible location.
- Tied back in using other accessible points in the Auxiliary Building.
- Very minimal change in Auxiliary Building elevations in this time period.

TURBINE BUILDING POINTS P-52 & P-53

- Not established until April 1984.
- Established to provide additional data points.

2.b) Describe the surveying procedures used to re-establish the destroyed settlement markers, paying special attention to:

i) the quality assurance aspects of accurately transferring the settlement data from the destroyed markers to the new markers, and

ii) the proper maintenance and assurance of the accuracy of permanent benchmarks used in settlement monitoring.

RE-ESTABLISHING DESTROYED MARKERS

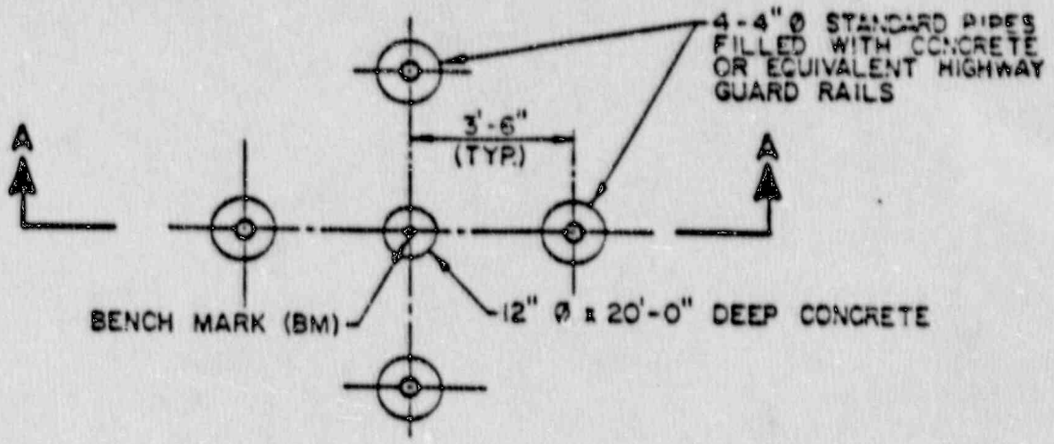
- Bechtel Construction
  - Work performed per Specification 9645-C-195.0 per Bechtel Construction Program
  - 3 Wire Leveling
  - Calibrated Equipment
  - First Order Leveling
- SERI
  - Documented on nonconformance reports
  - Work performed per SERI-C-395.0
  - Calibrated Equipment
  - First Order Leveling
  - Installed per controlled design change program with QP inspection

MAINTENANCE AND ASSURANCE OF BENCHMARKS

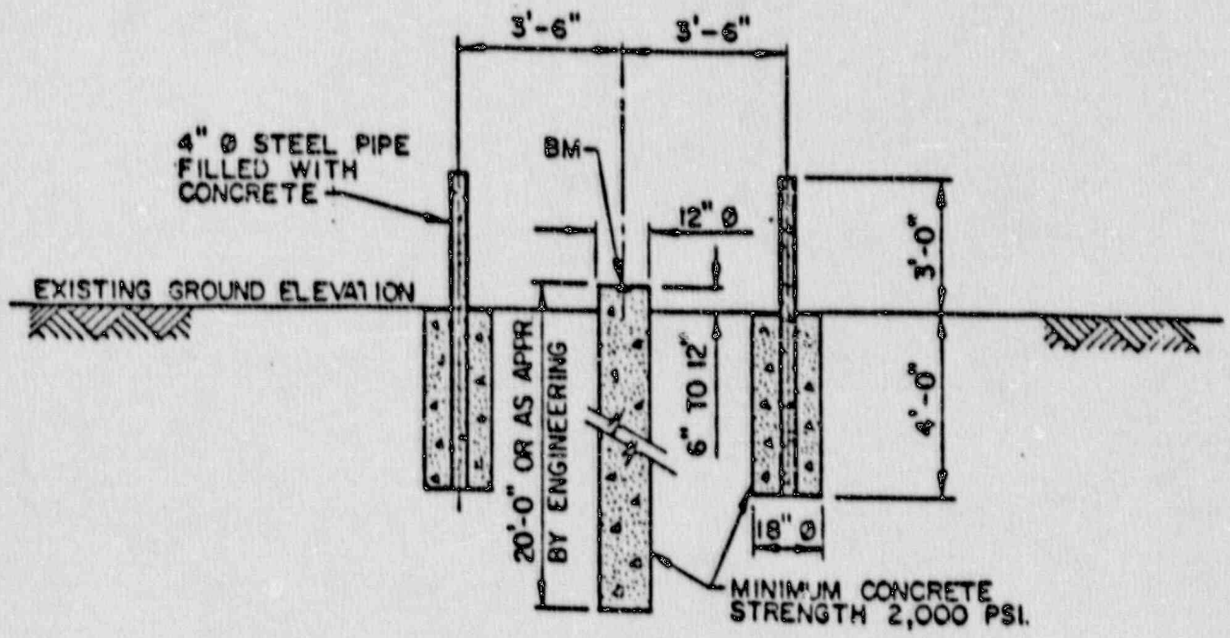
- Outside the powerblock/fill area not subject to settlement

- BM1 located inside the two security boundary fences. (No guard post due to location).

- BM2 located northeast of the Unit 2 turbine building and guarded by 4 steel post, per Specification SERI-C-395.0.



PLAN



SECTION A-A

SPEC. C-395.0

3. **Discuss the results of groundwater monitoring at the site and provide an evaluation of the affects of fluctuation in groundwater levels, if any, on the stability and settlement of structures.**

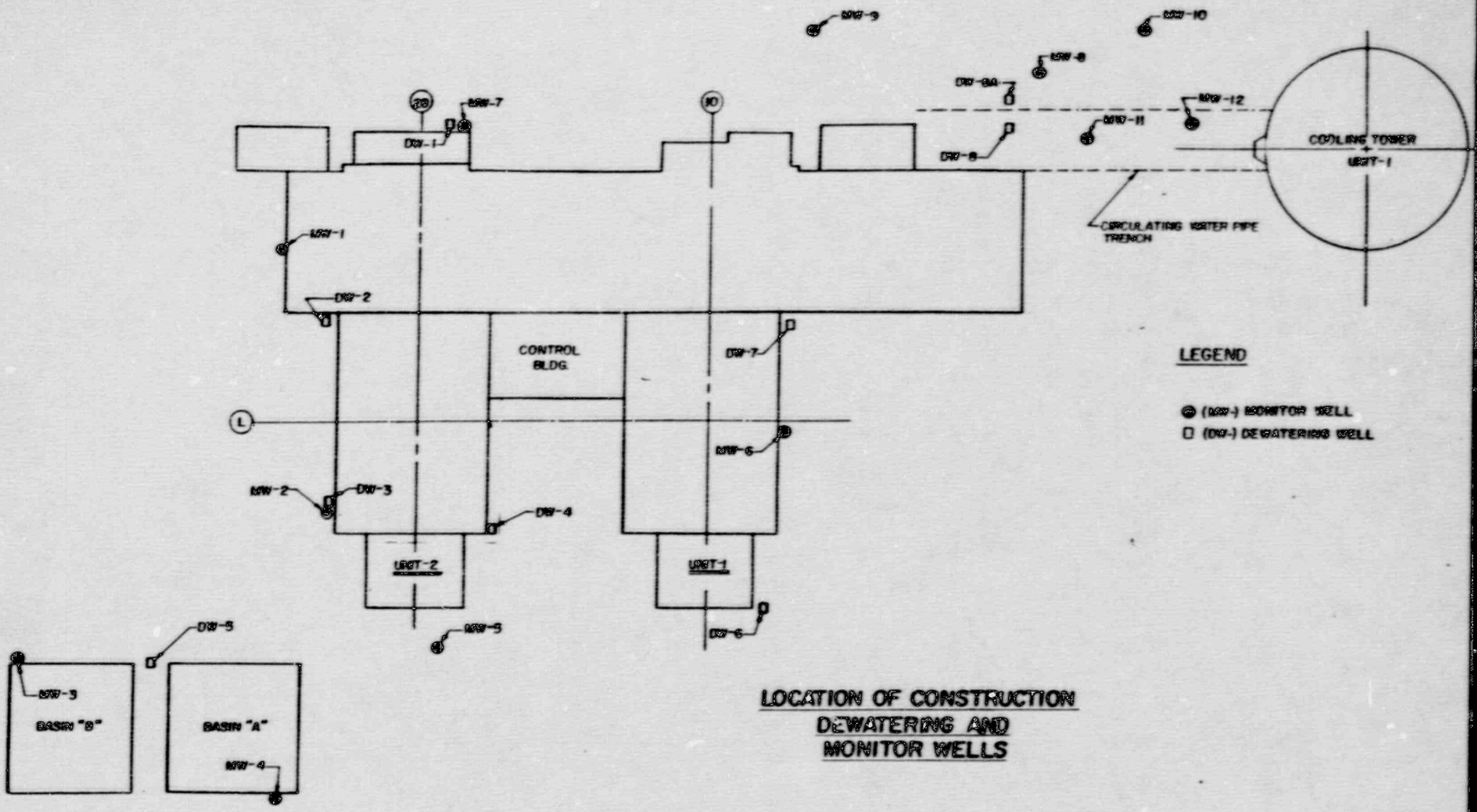
- Two elevations were considered for settlement prediction.
  - Elevation 78′ MSL
  - Elevation 109′ MSL
  - Shown in FSAR Figure 2.5-90
- Actual settlement vs predicted settlement is close, as discussed earlier.
- Water level has generally been in the estimated range in all areas with the only exceedance being in DW-8.
- DW-8 has exceeded 109 by less than 3 feet
- Seismic stability has been evaluated for all structures up to Elevation 114.5′ MSL
- Conclusion: Minor Fluctuation has negligible affect on settlement.

STRUCTURE	WATER ELEVATION 78'	WATER ELEVATION 109'
Containment	0.8	0.6
Auxiliary Building	1.0	0.9
Radwaste Building	0.8	0.6
Control Building	0.5	0.4
S.S.W Building	0.7	0.5
Diesel Gen. Building	0.8	0.8

Calculated Total Settlement - Inches

GROUNDWATER MONITORING

- Per FSAR and SER maximum groundwater level established at Elevation 109.0 MSL
- Level for Unit 1 monitored at 1 month intervals
- January 1983 level exceeded Elevation 109 MSL
- December 1983 - Performed a Study of exceedance
- February 1985 - submitted study to NRC, with exceedance attributed to:
  - Excessive precipitation at the site
  - Lack of completion of U2 structure
  - Lack of completion of clay seal
  - General yard area grading not completed
  - Increased infiltration from natural causes
- Analysis shows high groundwater acceptable up to Elevation 114.5 for all buildings.



LOCATION OF CONSTRUCTION DEWATERING AND MONITOR WELLS

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- August 1985 - SER concludes
  - Levels up to 114.5 feet MSL will not compromise safety related structures.
  - Requests reporting of any groundwater levels above 109 feet MSL.
  - Request resolution by December, 1990 or provide status and schedule for resolution.

CURRENT MONITORING PROGRAM

- At present, regional wells read in accordance with NSAP 5.7, Rev. 2
  - Level taken on two week intervals
  - Results submitted in the annual environmental operating report
- The perched wells are read in accordance with NSAP SP-N-6, Rev. 5
  - Level taken on monthly intervals
  - Level equal to or greater than 109.0 MSL reported to Supervisor Environmental Services and Unit 1 Shift Superintendent and subsequently to the NRC via AECM

CURRENT STUDY - IN PROGRESS

- Nature and causes of high groundwater level
- Adequacy of current design groundwater level
- Program completion schedule for end of 1990 to recommend long term solution.
- Based on study recommendations, other pertinent actions may be required.
- Results of study with planned actions by end of 1990.

4. **Provide draft amendments to the relevant FSAR Sections incorporating your response to the question above.**