UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
HOUSTON LIGHTING & POWER COMPANY, ET AL.	)	Docket Nos. 50-498 OL 50-499 OL
	)	
(South Texas Project, Units 1 and 2)	)	

APPLICANTS' SUGGESTED SPECIFICATION OF ISSUE RELATING TO SOILS

In the Board's March 29, 1985 Memorandum and Order (Denying Proposed Contention on Soil Stability but Directing Hearing on Certain Soils Questions) (Order) it put the parties on notice that it regarded "the matter of the Applicants' current organization, procedures and activities in soils areas as likely warranting further exploration in the Phase II hearings." (Order, p. 8.) It tentatively identified aspects of the "soils and foundation area" in which it was interested. (Id., pp. 9-10.) It indicated that the degree of attention to be given to this topic "depends, in part, on the soils work (if any) remaining to be undertaken," and that this subject will be explored at the April 30, 1985 prehearing conference. (Id., p. 10, n.5.)

The amount of Category I backfill that remains to be placed at the South Texas Project (STP) is very limited. A total of 2,300,900 cubic yards was required for Unit 1, Unit 2 and Balance

of Plant. Of that total, 1,978,300 cubic yards were placed by Brown & Root and 216,000 cubic yards have been placed by Ebasco as of March 24, 1985. Accordingly, as of that date only 106,600 cubic yards remained to be placed, or less than 5% of the total.

The remaining backfill work is made up of numerous areas requiring only small amounts of backfill. There is no single area where the remaining backfill work is likely to exceed 5000 cubic yards and no Category I backfill operations remain to be performed under any major structures of the powerblock. Such remaining work can be generally categorized as of a miscellaneous nature involving areas such as backfill operations around manholes and duct banks and local areas of the ECW pipe trench.

These facts suggest that limited attention should be given at the forthcoming hearing to the Applicants' organization and procedures for the remaining backfill activities. Perhaps the Board's principal interest lies in the adequacy of the backfill placed by Ebasco in light of the two violations referred to in I&E Report 83-26 and the two findings (findings 23 and 24) in the programmatic audit submitted by HL&P on May 25, 1984, as alluded to at page 9 of the Order.

Accordingly, Applicants suggest that the issue to be heard in Phase II concerning the soils and foundation area be specified as follows:

> "G. Is there reasonable assurance that the backfill placed at STP by Ebasco is in conformity with the construction permits and the provisions of Commission regulations in light of the two violations in the area of 'soils

> and foundation' discussed in I&E Rept. 83-26 (dated April 20, 1984) and findings 23 and 24 in the programmatic audit filed by HL&P on May 25, 1984 (ST-HL-AE-1095)"?

In suggesting this specific issue, we have noted that the Board pointed out that "the material before us does not reflect monitoring requirements (if any) employed to detect future excessive differential settlement, but it raises certain questions concerning the adequacy of base line data (see, e.g., programmatic audit, at pp. 8-9, findings 23 and 24)." (Order, p. 9.) To the extent that the Board may have had in mind a concern as to the adequacy of the backfill, such concern is explicitly addressed in our suggested Issue G.

However, the placement of backfill has no relationship to the monitoring for differential settlement nor to the "adequacy of base line data" for such monitoring referred to in the Order. This was the reason why information pertaining to such subjects was not found in the materials cited by the Board. The "Evaluation and Location Base Line Control" and the "Settlement Monitoring Program" for STP are discussed in Sections 2.5.C.2 and 2.5.C.4, respectively, of Appendix 2.5.C of the FSAR; the locations of horizontal and vertical baseline and control monuments are shown on Figure 2.5.C-1, and permanent structural benchmark locations are shown on Figure 2.5.C-3. Copies of each of these materials are enclosed for the Board's convenience. Since the monitoring program and the adequacy of baseline data for such monitoring are not affected by the placement of backfill, they are not brought into question by the NRC and HL&P reports which the

Board has reviewed and there appears to be no reason to take up such matters at the Phase II hearings.

Moreover, consideration of monitoring for differential settlement in the absence of any new information would be particularly inappropriate since the subject of criteria for differential settlement, and monitoring thereof, was raised and resolved to the Licensing Board's satisfaction at the construction permit hearing. See LBP-75-46, 2 AEC 271 at 315 (1975); LBP-75-71, 2 AEC 894 at 907 (1975).

Accordingly, Applicants respectfully suggest that the Board adopt Issue G, as formulated above, as the specification of the issue in the "soils and foundation area" to be heard in Phase II of this proceeding.

Respectfully submitted,

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APPENDIX 2.5.C

GEOTECHNICAL MONITORING

2.5.C.1 Introduction

A comprehensive geotechnical instrumentation monitoring program has been established to measure the settlement of facility structures, to measure regional ground surface subsidence, to measure lateral movement of excavation slopes (slope stability), and to monitor the performance of the construction dewatering systems. These monitoring programs were designed to provide basic data for verification of predicted plant foundation performance. Evaluation of the monitoring data pertaining to slope stability and dewatering enhances the safety of the project during construction by giving advance warning of any potentially adverse events. The geotechnical instrumentation monitoring program was implemented in conjunction with the foundation verification program (see Section 2.5.4.5 and Appendix 2.5.A) and a geological mapping program (see Section 2.5.1 and Appendix 2.5.B) to provide a complete evaluation of the supporting stratification and the performance of the foundations of the facility structures.

The settlement portion of the geotechnical instrumentation monitoring program consists of an array of borehole heave points, extensometers, and structural bench marks together with piezometers and pore pressure cells for groundwater observations in the plant area. The regional ground surface subsidence monitoring program consists of an array of shallow and deep aquifer open standpipe piezometers, a network of vertical and horizontal ground control bench marks, and a deep reference bench mark with continuous subsidence monitoring instrumentation. These monitoring programs and resulting data accumulation and evaluations are discussed in detail in this appendix. The data and evaluations for lateral movement of excavation slopes and dewatering are addressed in Sections 2.5.4.5 and 2.5.4.6, respectively. The geotechnical instruments used for lateral movement and dewatering system monitoring and their methods of installation are, however, described in this appendix.

2.5.C.2 Elevation and Location Base Line Control

Base line control for vertical and horizontal datum were established at the STP site during 1973 for the various site explorations and property surveys. The vertical datum was established by a first-order-level loop from a National Geodetic Survey (NGS) monument near Wadsworth, Texas. This monument had earlier (1973) been resurveyed (reestablished) by the NGS by their own first-order-level loop from a monument established in bedrock near Austin, Texas. Therefore, the vertical control used at the STP for explorations, construction, and monitoring is 1973 datum.

The horizontal base line control was established at the STP site during 1973 by a first-order traverse between various NGS horizontal control monuments. This traverse was subsequently used to establish horizontal positions for site explorations and the grid system for plant construction. The STP horizontal control network utilizes the Texas State Plane Coordinate System (Southern Zone), which is a Lambert conformal projection system.

The locations of the horizontal and vertical base line monuments for the plant area are provided on Figure 2.5.C-1 together with the regional subsidence monuments. Figure 2.5.C-1 identifies several of the vertical control monuments as primary reference bench marks as well as a secondary bench mark used for geotechnical monitoring. The primary bench marks were used to establish vertical datum, as subsequently discussed for each monitoring system. The secondary bench marks were used as vertical reference points for interim periods and periodically (biweekly) verified or adjusted by a second-order-level loop to a primary bench mark (datum). Temporary bench marks (not shown on Figure 2.5.C-1) were used on a daily basis as vertical points of reference in the plant area and were verified or adjusted by a second-order-level loop to a secondary bench mark on a daily basis.

2.5.C.3 Data Accumulation, Processing, and Storage

The measurement data from the settlement, subsidence, and construction dewatering monitoring systems are reduced and stored, and can be retrieved in tabular or graphical format by the computer data processing system, GEMIS. 44
This processing system has the capabilities to store all base line information, reduce field data to actual elevations (ft mean sea level [MSL]) of the observation points, calculate differential movement between the field measurements and base line data, print field data in tabular format together with reference point elevations and differential movements, and generate time-history plots of observation points. The time-history plots can be superimposed or stacked allowing concurrent observations from several instruments or different observation points within an instrument to be depicted.

In March 1982 GEMIS was superseded by GEMP-Geotechnical Engineering Monitoring Program (Ref. 2.5.C-2). GEMP has the same capabilities, performs the same functions and produces the same output as described for the GEMIS program. 35
All project data previously stored in GEMIS has been transcribed into GEMP storage. Monitoring data acquired after March 1982 is compatible with previously filed information.

2.5.C.4 Settlement Monitoring Program

The settlement analysis performed during the design phase is addressed in Section 2.5.4.10.3. Geotechnical parameters and criteria described in that section are those applied in the preconstruction analysis. An extensive settlement monitoring system has been implemented during construction as described in this appendix. The details of the settlement monitoring system and the evaluation of the data are described in the following sections. 35

2.5.C.4.1 Settlement Monitoring System Description. The settlement monitoring program is capable of monitoring heave and settlement of individual soil layers during construction as well as the actual heave or settlement of plant structures. This was accomplished by the installation of 19 borehole heave points (BHPs) in the plant area, 4 BHPs for the Essential Cooling Water Structure, 12 BHPs and 4 settlement plates for the essential cooling water 44
piping, 14 Sonde extensometers (Sondex), and in excess of 100 structural bench marks. The locations of Sondex and BHP instruments are shown on Figure 2.5.C-2, and the locations of permanent structural bench marks are shown on Figure 2.5.C-3. The piezometer and pore pressure cell data used to monitor the effectiveness of the dewatering system (see Section 2.5.4.6) were also

used to evaluate the effects of dewatering on soil deformation during construction. In addition, a record of events and foundation loads which affect the stress conditions in the STP plant area was maintained to document the actual construction stress history of the foundation soils.

To isolate the heave and settlement deformations resulting from plant construction from the deformations (regional subsidence) resulting from regional groundwater withdrawals, a primary reference bench mark (denoted "VP" on Figure 2.5.C-1) was established in near-surface soils outside the range of influence (heave/settlement effects) of the plant construction. The establishment of this bench mark as datum from the settlement monitoring program and the maintenance of this datum unchanged (although the bench mark was subject to regional subsidence effects) allowed effective isolation of the two phenomena.

2.5.C.4.1.1 Subsoil Instrumentation: Sonde extensometers (Sondex) were installed to depths of 230 ft and 300 ft below the ground surface. The Sondex consists of horizontally corrugated plastic tubing with gaging rings fixed at selected increments (typically 5-ft spacing) throughout the depth of the installation. The flexible nature of the Sondex tubing, which permits the gaging rings to move vertically as the soil expands and/or compresses during construction, allowed an accurate determination of the movement of individual soil layers in the depth range of the Sondex.

Borehole heave points were installed below the final excavation bottom. The BHPs are deep bench mark monuments that permit periodic monitoring of heave and/or settlement of the soil at the level of the BHP anchor. The BHPs allowed measurement of the total accumulated heave and/or settlement of the soil below the anchor elevation.

At several locations the BHP and Sondex instruments were installed adjacent to each other, as shown on Figure 2.5.C-2. This redundancy permitted a check of the observations by direct comparison of the observed deformations at corresponding elevations. The designs of the Sondex and BHP instruments are shown on Figure 2.5.C-4.

2.5.C.4.1.2 Structural Bench Marks: Structural bench marks have been installed on plant structures as plant foundation and substructure construction proceeded to allow monitoring of heave and/or settlement both during construction and plant operation. The locations of the permanent structural bench marks are shown on Figure 2.5.C-3. During initial foundation construction, temporary structural bench marks were established in proximity to the permanent installations so that there could be continuity of measurements until the permanent structural bench marks were installed.

2.5.C.4.2 Instrument and Installation Description.

2.5.C.4.2.1 Sonde Extensometer: The Sonde extensometer (Sondex) consists of 3-in. (nominal) inside diameter (ID) corrugated plastic tubing with metal wire gaging rings affixed at approximately 5-ft intervals as shown on Figure 2.5.C-4, detail A. A 2-1/2-in. (nominal) diameter polyvinyl chloride (PVC) pipe mandrel was places inside the corrugated tubing to facilitate installation, to provide added support for the tubing, and to guide the sensor probe. The corrugated plastic tubing and mandrel were installed in 8-3/4-in.-diameter, rotary-drilled boreholes stabilized by 6-in.-diameter steel casing during the Sondex installation.

To facilitate installation, the Sondex corrugated plastic tubing and PVC pipe mandrel were divided into segments and spliced together when lowered into the borehole. Drainholes were cut in the bottom segment, and it was weighted to overcome the hydrostatic pressure of the drilling fluid in the borehole. The annular space between the corrugated Sondex tubing and the soil of the borehole wall was backfilled with pea gravel as the steel casing was extracted. The pea gravel functioned as a medium to transmit vertical strains from the soil to the corrugated plastic Sondex tubing. The upper portions of the Sondex were dismantled in short segments as the excavation exposed them and the mandrels were subsequently spliced together in short segments as the 5
backfill was placed. The Sondex was extended through the concrete foundations to allow continued monitoring during plant construction until the piezometric levels in the ground (and hence through the Sondex) increased because of dewatering system shutdown to the point that further measurements were impractical because of upward flow of water.

The Sonde extensometers are monitored by lowering an electronic probe with a steel surveyor's tape through the PVC pipe mandrel; the probe produces a signal by inductance as it passes the metal wire gaging rings. The probe is connected by cable to a sensitive readout device. When the readout device indicates that the probe is adjacent to a metal wire gaging ring, the location of a 1-ft marker on the surveyor's tape is recorded relative to the scale mounted on the tripod. The elevation of this scale is established by surveying to an accuracy of 0.01 ft before and after each set of measurements is obtained. The actual depth readings to the gaging rings are likewise obtained to an accuracy of 0.01 ft. The readings are obtained from the bottom of the instrument moving up. The recorded data include the surveyed elevation of the scale and the depth measurements to each gaging ring.

2.5.C.4.2.2 Borehole Heave Points: The BHP consists of a lower, 2-in.-diameter steel pipe anchor unit and an upper, detachable steel riser pipe of the same diameter. A 1-1/2-in.-ID inner pipe sleeve is welded to the anchor and extends into the riser pipe, but is free to move vertically relative to the riser pipe. Details of this instrument are shown on Figure 2.5.C-4.

The BHPs were installed in an 8-3/4-in.-diameter, rotary-drilled hole penetrating 10 ft below the excavation bottom. The hole was stabilized with drilling mud which was flushed out before the anchor was placed. The anchor was grouted in place and the riser pipe lifted about 1 ft 3 in. above the top of the anchor to permit unencumbered movement of the anchor. A packer was placed around the riser pipe about 11 ft above the bottom of the anchor to assure adequate space for free movement, and the remainder of the hole was backfilled with pea gravel.

The equipment used to obtain measurements of BHPs consists of a mechanical torpedo with spring-loaded pawls connected to a steel measuring tape. The torpedo is lowered with the pawls extended, and the pawls catch the lower edge of the 1-1/2-in. pipe sleeve in the anchor unit, which is the observation point (see Figure 2.5.C-4 Detail B). The distance from the top of the riser pipe to the observation point is then recorded. The elevation of the top of 5
the riser pipe is determined by surveying each time a measurement is obtained.

2.5.C.4.2.3 Structural Bench Marks: The structural bench marks consist of 2-1/2-in.-diameter brass markers with a convex head anchored in the concrete by a 2-in.-long ribbed shaft. The elevations of structural bench marks are established by conventional survey techniques.

2.5.C.4.3 Frequency of Observation. The heave/settlement monitoring instrumentation is observed on a weekly, bimonthly, or monthly basis, depending upon the rate of the imposed construction loads, the instrument type, and the accessibility of the instrument. The minimum observation frequencies are given in Table 2.5.C-1. In general, during the heave cycle (resulting from plant area excavation) the Sondex and BHP instrumentation was read on a weekly basis. Following installation of the structural bench marks on the various foundations and during the commencement of the recompression cycle, the instruments continued to be read on a weekly basis assuring overlap of the subsoil data with the structural bench mark data. Thereafter, the frequency of observation of the subsoil instruments and their counterpart (adjacent) structural bench marks varies from weekly to bimonthly readings; while, the frequency of observation of structural bench marks that were not immediately adjacent to subsoil instrumentation is varied from bimonthly to monthly readings.

2.5.C.4.4 Interpretation of Field Data. The heave/settlement monitoring data are subject to evaluation by geotechnical engineering personnel. The processed data are also reviewed before the information is used for subsequent studies and analysis. 35

For the preliminary construction plans settlement studies (1979 & 1981) the behavior of the instrument data (time-histories) was studied with respect to:

1. Reliability, i.e., the field measurements were obtained with the required accuracy. 35

2. Validity, i.e., the measurements as observed represent ground movement at the observation point. The validity study is focused sequentially on: 35

   a. Reasonableness, i.e, the observation being in general agreements with the expectations. 35

   b. Responsiveness, i.e., the observed movements correlate positively with known stress changes and that the movements are in the expected direction.

   c. Representativeness, i.e., assessment of the mass of soil represented by the instrument and the correlation of the observed movement to this defined mass. 35

2.5.C.4.4.1 Construction Phase Settlement Studies: The heave/settlement behavior to be expected during the plant construction period was analyzed during the design phase (1974-1975). A preliminary construction phase re-analysis was started during 1977 using the same model and parameters as used during the design studies; however, the actual schedule and load application events were used as input for the stress history. Reasonable comparisons between predictions and actual performance were generally obtained near the foundation elevations. 35

The preliminary construction phase re-analysis also included using a deeper stratigraphic column and a more efficient and versatile computer program. The preliminary (1979) studies included two of the three regimes of heave/settlement process, that is, heave and recompression of heave. The third regime, net settlement, was being approached when the preliminary study was completed.

In 1983, an additional settlement evaluation was made which included projections of the movement curves. 35
This evaluation included the use of the revised construction load schedule, and the use of the field instrument data obtained through April 1983. The study also considered the effect of the main cooling reservoir (MCR) embankment load and water load (Ref. 2.5.C-1). The study utilized the information from the previous (1979) analysis, an interim (1981) study, and the trend line plots of instrumentation data from construction day 1500 (approximately 19 October 1979) to construction day 2800 (approximately 11 May 1983).

The projections of future settlement were made using the previous analyses and instrument data. This was confirmed with an analysis using a consolidated model based on a compressibility concept similar to a compression/tension spring analogy.

The results of the construction phase settlement analysis described herein are further addressed in Section 2.5.C.4.5 below. The settlement projection curves for the behavior of the structures are shown on Figure 2.5.C-9, 35
2.5.C-9A, 2.5.C-10, and 2.5.C-10A superimposed on the actual observations.

2.5.C.4.5 <u>Predicted and Actual Movement</u>.

2.5.C.4.5.1 <u>Unit 1 Area:</u> The actual movements for the Reactor Containment, Fuel Handling, Mechanical-Electrical Auxiliaries, and Diesel-Generator 26
Buildings are shown on Figures 2.5.C-9 and 2.5.C-9A. These curves have been Q
taken directly from Sondex, BHP, and Structural Bench Mark observations at 241
points near the foundation elevations for the buildings, as noted on the fig- 01N
ure. The projected movement curves, based on the settlement analysis as 26
described in Section 2.5.C.4.4.1 above, have been superimposed on the observed Q
movement curves for each building. These projected movement curves are based 241
on the settlement analysis for actual construction loads and instrument data 01N
to April 1983. The projected movement curves show an agreement with the actu- 44
al observed heave, recompression, and settlement. 35

The projected maximum differential settlement between structural bench mark (SBM) locations, see Figure 2.5.C-3, is shown on Table 2.5.C-4. The projected tilt within the various structures is shown on Table 2.5.C-5. The observed differential movement between buildings is shown on Figure 2.5.C-11. The differential movement profile within buildings (tilt) is shown on Figures 2.5.C-13A and 2.5.C-13B.

The effect of the embankment load and water load of the essential cooling pond was considered in the Design Phase (1974-1975) analysis and the recent (1983) settlement projections. The essential cooling pond has little effect on the settlement of Unit 1 because there is very little load and subsequent subsurface stress field change. The pond is but a rearrangement of load due to the shallow excavation and low dikes.

The effects of the MCR embankment and water load have been considered (Ref. 2.5.C-1). The effect of the embankment, which has been in place some time, is accounted for in the field instrument data and subsequently the current (1983) settlement projections which used the instrument data. The effect of the MCR water load (Ref. 2.5.C-3) on the structures will be small. It is on the order 35
of 0.005 feet (approximately 1/16 inch) and was not taken into direct account because it is such a small value.

Very little differential settlement has been observed between the Unit 1 buildings. Also, very little anticipated differential settlement is projected for the Unit 1 structures (Table 2.5.C-4). The anticipated tilt after day 3400 (Approximately end of 1984) for Unit 1 (Table 2.5.C-5) is projected to be 39
small.

2.5.C.4.5.2 <u>Unit 2 Area</u>: The actual movements for the Reactor Containment, Fuel Handling, Mechanical-Electrical Auxiliaries, and Diesel-Generator 26
Buildings are shown on Figures 2.5.C-10 and 2.5.C-10A. These curves have been Q 3
obtained directly from Sondex, BHP, and Structural Bench Mark observations at 241
points near the foundation elevations for the buildings as noted on the figure. .01N

The projected movement curves are based on the settlement analysis as described in Section 2.5.C.4.4.1, above, have been superimposed on the observed movement curves for each building. 35 The projected movement curves are based on the settlement analysis for actual construction loads and instrument data to May 1983 and the anticipated Unit 2 construction loads and schedule. 44 The projected movement curves show an agreement with the actual observed heave, recompression and settlement.

The projected maximum differential settlement between locations (see Figure 2.5.C-3) are shown on Table 2.5.C-6. The projected tilt within the various structures is shown on Table 2.5.C-7. The observed differential movement between buildings is shown on Figure 2.5.C-12. The differential movement profile within buildings (tilt) is shown on Figure 2.5.C-14.

The effect of the essential cooling pond embankment load an water load was not 35
considered for the Unit 2 settlement evaluation and projection. It was not considered because it is quite distant from Unit 2 and has no effect on the stress field beneath Unit 2.

The effect of MCR is the same as previously discussed for Unit 1.

A small amount of differential settlement has been observed between the Unit 2 buildings. Generally only a small amount of future differential settlement is anticipated. The anticipated tilt for Unit 2, Table 2.5.C-7, is generally small.

2.5.C.4.6 <u>Conclusions</u>.

2.5.C.4.6.1 <u>Behavior of Foundation Soils and Structures</u>: The current geotechnical instrumentation data show that the foundations soils in the plant area did heave and recompress in good agreement with the projections obtained from the preliminary construction phase analysis. The projections have been 35
updated (1983) to reflect the actual load history, the projected loading, and

schedule to completion, and are shown on Figures 2.5.C-9 and 2.5.C-9A for Unit 35
1 and Figures 2.5.C-10 and 2.5.C-10A for Unit 2.

The differential movements between Unit 1 structures measured as of mid 1984 are shown on Figures 2.5.C-11 and 2.5.C-11A. The recorded differential movements vary from negligible between the Isolation Valve Cubicle (IVC) and the Reactor Containment Building (RCB) to about 1 in. between the IVC and the 44
Turbine-Generator Building (TGB).

The differential movements between the Unit 2 structures measured as of mid 1984 are shown on Figures 2.5.C-12 and 2.5.C-12A. These differential movements vary from negligible between the Mechanical Electric Auxiliary Building (MEAB) and the RCB to 0.4 in. between the MEAB and the FHB.

The measured differential movements between structures for Unit 1 and Unit 2 35
to date are within the design criteria defined in Section 2.5.4.11.

The measured differential movements within the structures of Unit 1, as of mid 44
1984 are shown on Figures 2.5.C-13A and 2.5.C-13B. These figures indicate
that there was very little change in the differential movements since February 35
1982. The maximum differential movements were 0.2 in. in the RCB, 0.6 in. in
the FHB (north-south section), 0.7 in. in the MEAB (east-west section) and 0.1 44
in. in the DGB. 35

The measured differential movements within the structures of Unit 2 as of mid 1984 are shown on Figures 2.5.C-14 and 2.5.C-14A. The measured maximum dif- 44
ferential movements were 0.1 in. in the RCB, 0.6 in. in the FHB (north-south section) 0.6 in the MEAB (east-west section) and 0.2 in. in the DGB.

The measured differential movements and tilt within structures for Unit 1 and 35
2 are within the design criteria defined in Section 2.5.4.11.

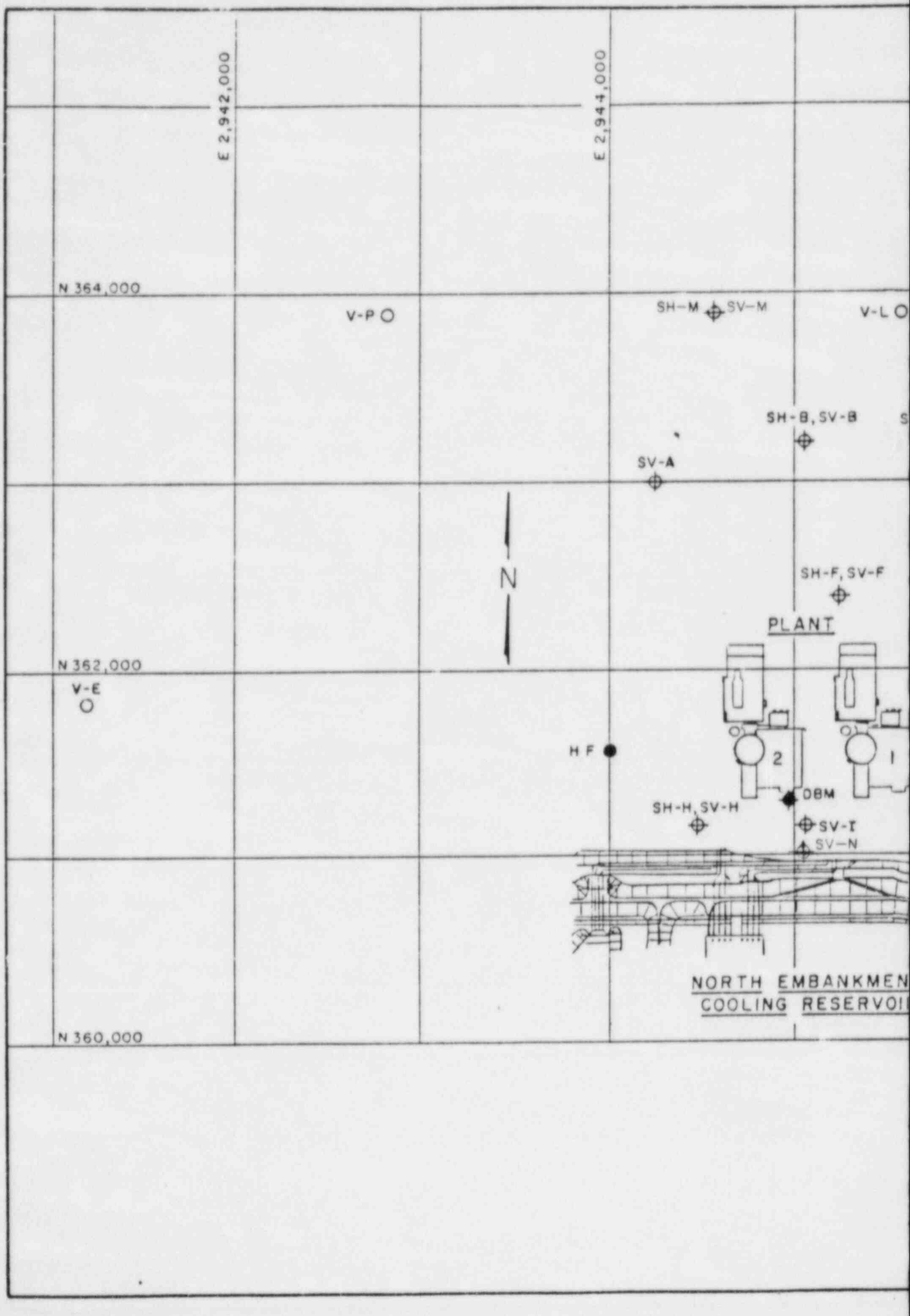
2.5.C.4.6.2 Predictions of Differential Movements During Plant Operation: The design criteria for differential settlement affecting piping systems are defined in Section 2.5.4.11 and are applicable after the actual
pipe connections between the buildings have been made. It is estimated that 43
no pipe connections are to be made prior to the end of 1984. 39

The projected tilt and differential settlement for Unit 1, after construction 35
day 3400 (end of 1984) are reported in Tables 2.5.C-4 and 2.5.C-5. The values are acceptably small.

The projected tilt and differential settlement for Unit 2, after construction 39
day 3400, are reported in Tables 2.5.C-6 and 2.5.C-7. The projected tilt and differential settlement for Unit 2 after day 3400 will be acceptably small.

2.5.C.5 Regional Subsidence Monitoring Program

2.5.C.5.1 Regional Subsidence Monitoring System Description. The regional subsidence monitoring program is capable of monitoring both vertical and horizontal ground surface movements at the STP site. This is accomplished by the installation of a deep reference bench mark, 13 near-surface monuments for measurement of vertical ground surface movement, and 9 near-surface monuments for measurement of horizontal ground surface movement (see Figure



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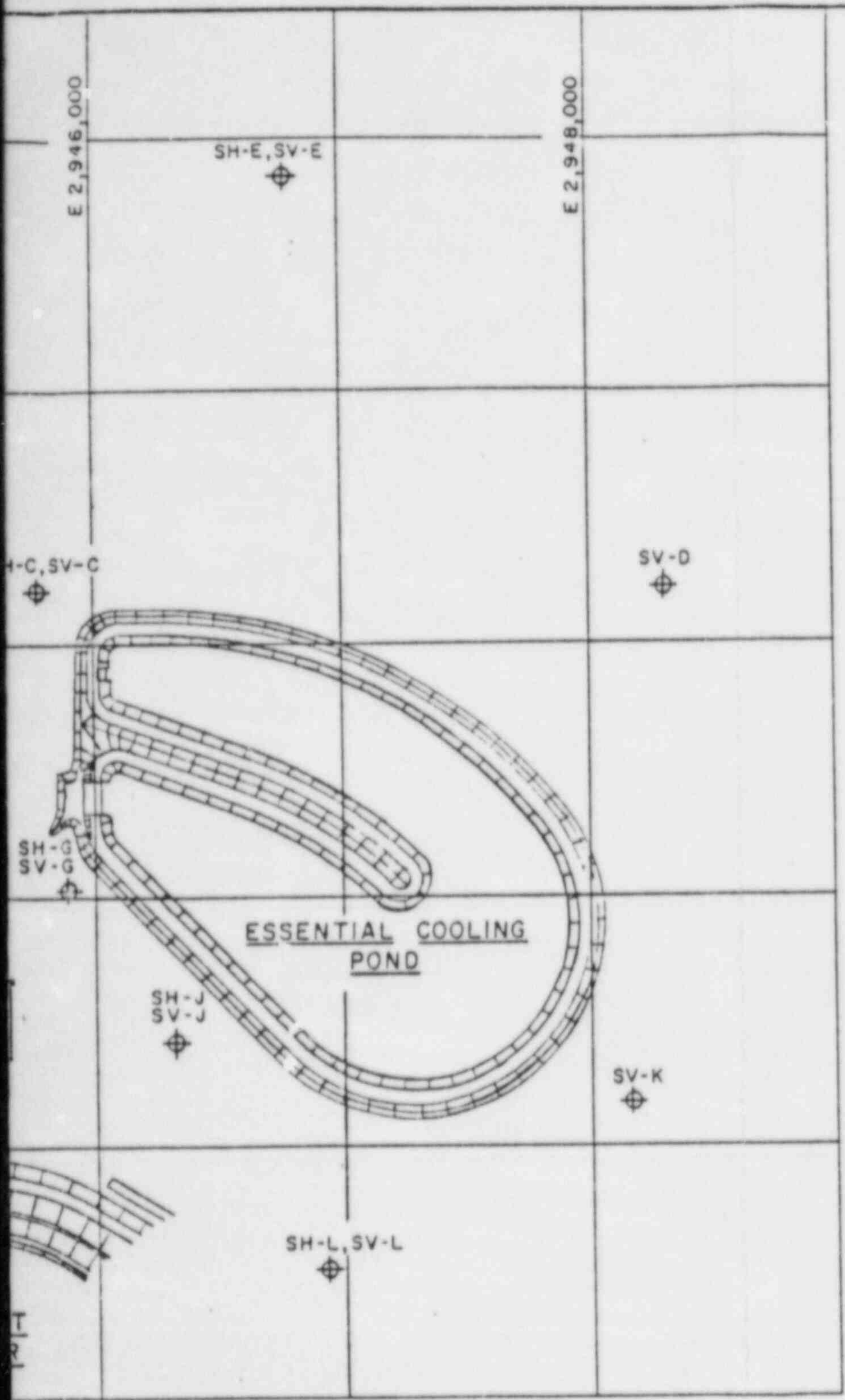
SH-H, SV-H
SV-I
SV-N
NORTH EMBANKMEN
COOLING RESERVOI
N 360,000



LEGEND

- ⌖ NEAR SURFACE MONUMENT
- ○ PRIMARY REFERENCE BENCHMARK
- ● SECONDARY REFERENCE BENCHMARK
- ◆ DEEP REFERENCE BENCHMARK

NOTES:

1. SV DENOTES VERTICAL NEAR SURFACE MONUMENT AND SH DENOTES HORIZONTAL NEAR SURFACE MONUMENT.
2. MONUMENT "M" WAS INSTALLED IN APRIL, 1978 AS A REPLACEMENT AND A BACKUP FOR MONUMENT "B".
3. MONUMENT "N" WAS INSTALLED IN MAY, 1980 AS A REPLACEMENT FOR MONUMENT "I".

500 0 500 1000

SCALE IN FEET

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APERTURE
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Amendment 20

SOUTH TEXAS PROJECT
UNITS 1 & 2

LOCATION MAP
HORIZONTAL AND VERTICAL
BASELINE AND CONTROL
MONUMENTS
FIGURE 2.5.C-1

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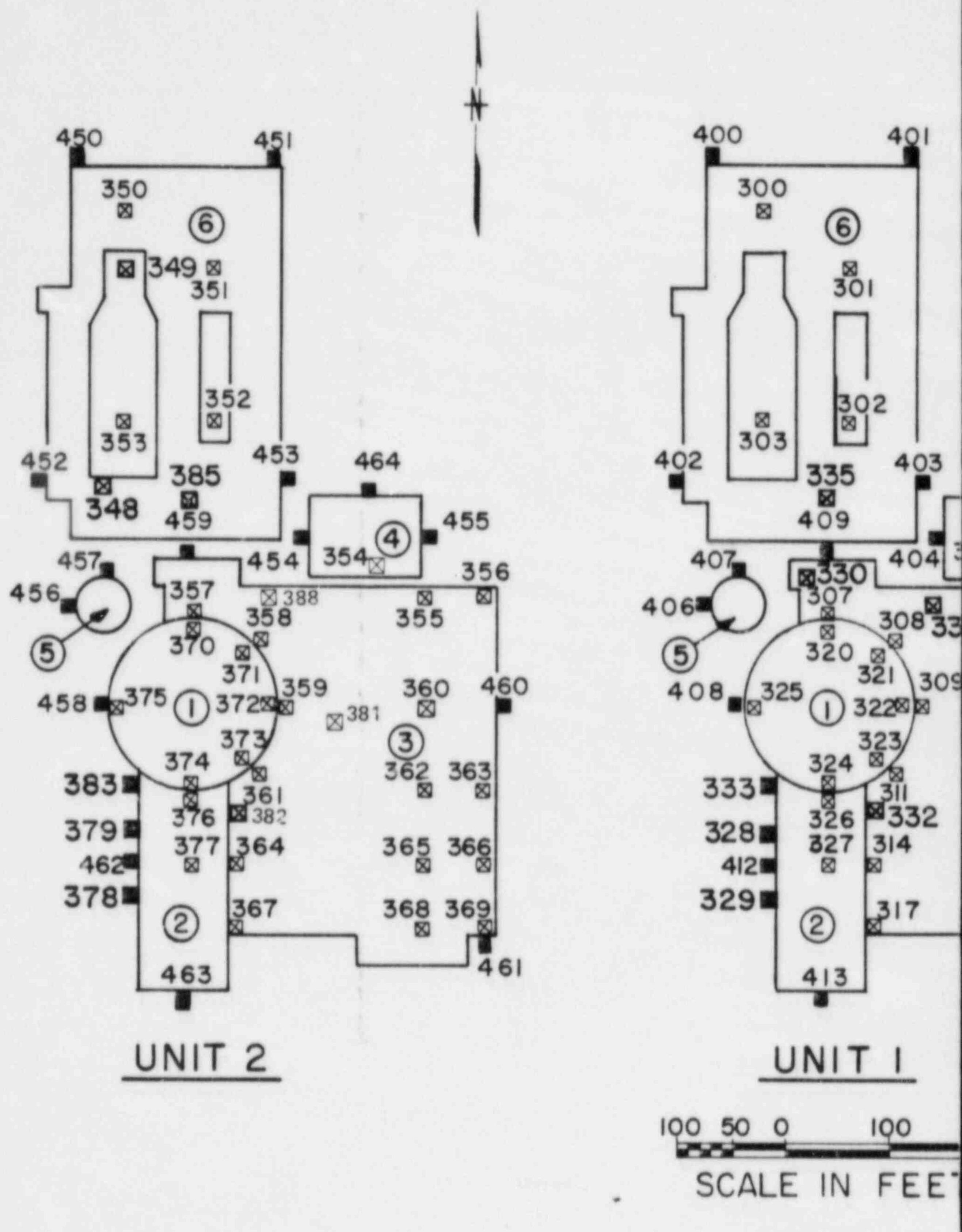
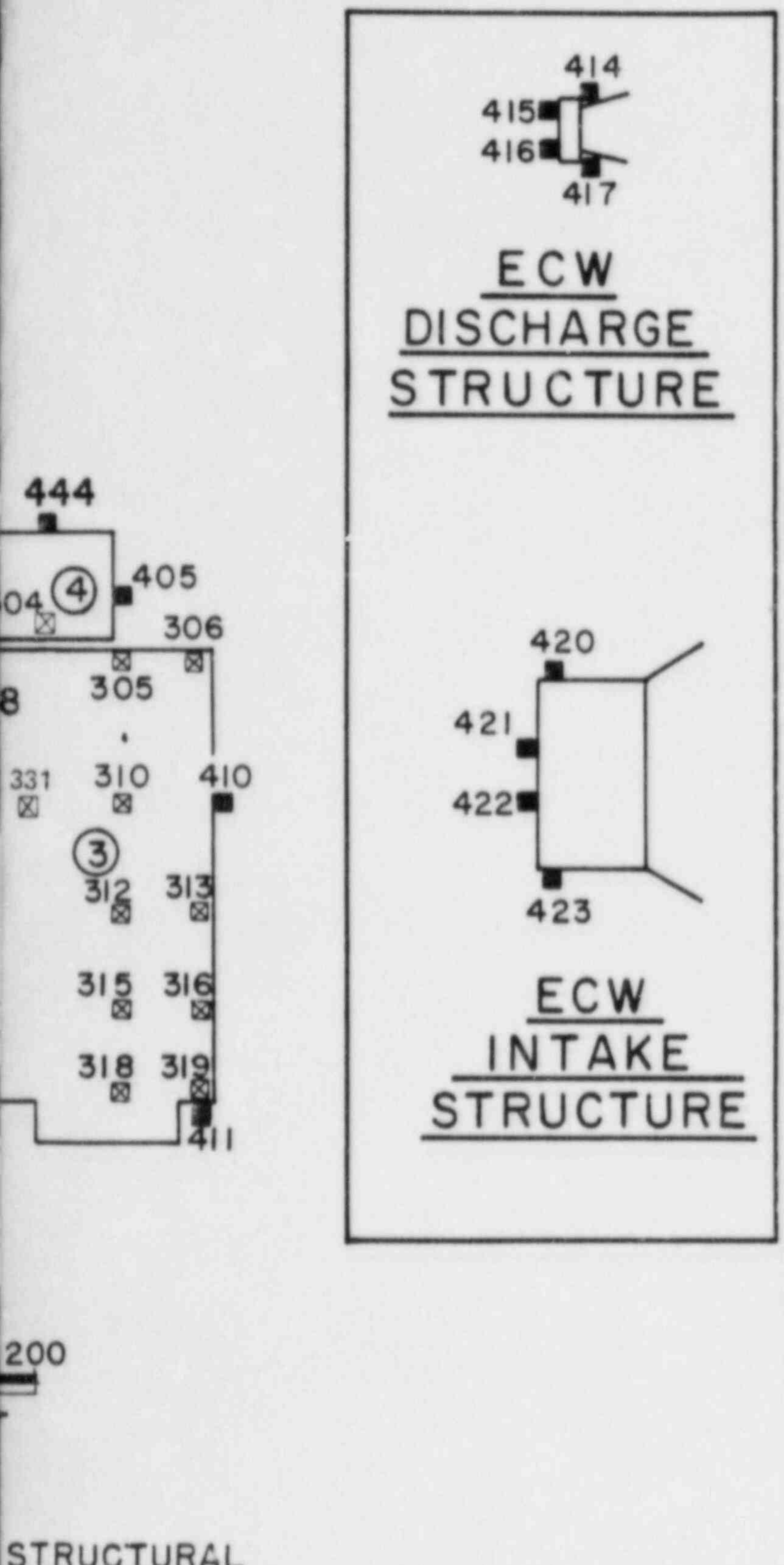


NOTE : REFER TO SUBSECTION 2.5.C.4.2.3 FOR DESCRIPTION OF
BENCH MARK DESIGN AND INSTALLATION



LEGEND

① REACTOR CONTAINMENT BUILDING

② FUEL HANDLING BUILDING

③ MECHANICAL & ELECTRICAL AUXILIARY BUILDING

④ DIESEL GENERATOR BUILDING

⑤ CONDENSATE STORAGE TANK

⑥ TURBINE GENERATOR BUILDING

⊠ INTERNAL STRUCTURAL BENCH MARK

■ EXTERNAL STRUCTURAL BENCH MARK

Also Available On Aperture Card

TI APERTURE CARD

SOUTH TEXAS PROJECT
UNITS 1 & 2

PERMANENT STRUCTURAL BENCH MARK LOCATION

Figure 2.5.C-3

Amendment 44

8505010514-02

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
HOUSTON LIGHTING & POWER COMPANY, ET AL.)
)
(South Texas Project, Units 1 and 2))

Docket Nos. 50-498 OL
50-499 OL

CERTIFICATE OF SERVICE

I hereby certify that a copy of Applicants' letter enclosing (1) "Applicants' Reply to CCANP Response to ASLB Memorandum and Order of February 26, 1985 and Applicants' Suggested Specification of Quadrex Findings To Be Litigated," and (2) "Applicants' Suggested Specification of Issue Relating to Soils," has been served on the following individuals and entities either by deposit in the United States mail, first class, postage prepaid, on April 26, 1985, or by air courier as indicated by "*" on April 26, 1985.

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