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July 1, 1985
ST-HL-AE-1293
File No.: G4.2, G9.17,
C13.5.3

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 & 2
Docket Nos. STN 50-498, STN 50-499
Response to Main Cooling
Reservoir Meeting Action Items

Reference: ST-HL-AE-1240, May 6, 1985

Dear Mr. Knighton:

As discussed in the April 2, 1985 meeting with your staff and discussed in the above referenced letter, the following items are provided in reference to the Main Cooling Reservoir (MCR):

(1) Results from the supplemental tests/borings in the area near Embankment Station 40 + 00. [Attachment I].

(2) Figures to be added to the FSAR of the wave barriers used in the area where the circulating water pipes cross over the embankment [Attachment II; figures 2.5.6-20 and 2.5.6-21]. These will be included in an amendment to the FSAR by September 30, 1985.

(3) A draft outline of the MCR operating procedures applicable after initiation of STP commercial operation. [Attachment III]. Appropriate procedure text will be drafted subsequent to the elevation 35 foot hold evaluation. These procedures will be submitted by October 31, 1986.

A001
1/1

W2/NRC4/g

If you should have any questions, please contact Mr. M. E. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

RLE/as
Attachments: (1) Results of Embankment Foundation Investigation @ Station 40 + 00
(2) Wave Wall Figures
(3) Draft Outline for the Operating Procedures for the MCR

W2/NRC4/g

cc:

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SOUTH TEXAS PROJECT
MAIN COOLING RESERVOIR EMBANKMENT

Embankment Foundation Investigation at Station 40+00

General

A subsurface exploration program was recently completed in the vicinity of Station 40+00 of the Main Cooling Reservoir (MCR) embankment. The purpose of th. exploration program was to identify the presence and extent of .ow blowcount silty sands. The exploration program was the result of a recommendation by Professor H.B. Seed at the April 2, 1985 Nuclear Regulatory Commission (NRC) presentation concerning stability of the MCR embankment opposite the power block. Previous work by McClelland Engineers, Inc (MEI) in the area near Station 40+00 indicated the possible presence of a very low blowcount silty sand material (Borehole R-63).

Harza's presentation to the NRC on April 2, 1985 considered the silty sand material between Station 30± to 45± to have an average fines content (i.e. passing #200 sieve) of 36% and a thirty-three percentile value of corrected blowcount of about 8 (Exhibit 1). The range of factors of safety against liquefaction for this reach considering the material to have 15% fines was shown to be 1.2 to 2.6. Considering the material with 35% fines the range of factors of safety was shown to be 1.5 to 3.1 (Exhibit 2).

Field Exploration Program

The post NRC meeting exploration program around Station 40+00 consisted of 5 boreholes. Hole L1 was located very close (within 10ft) to the MEI borehole R-63 at Station 40+00 and was drilled from the crest (El. 66±) of the MCR embankment. Holes L2 and L3 were also drilled from the crest (El. 66±) of the MCR embankment at Stations 38+75 and 41+25, respectively. Hole L4 was advanced from the downstream berm (El. 35±) at Station 40+00 of the MCR embankment. Hole L5 was located at the upstream toe (El. 30±) at Station 40+00 of the MCR embankment. The location of these boreholes as well as previous exploratory boreholes in the area near Station 40+00 are shown on Exhibit 3.

The most recent exploration program consisted of 298 linear feet of drilling. Nominal 4-inch diameter holes were advanced using rotary wash techniques with a side discharge bit. Bentonite drilling mud was used to stabilize the boreholes. Standard penetration tests (SPT) were conducted at 2.5 ft intervals in the foundation material in each of the boreholes. All testing

conformed with ASTM-1586. The same calibrated drill rig and operator used in the previous Harza exploration were used during this exploration to avoid having to determine the operator/rig energy efficiency again.

Data Evaluation

An energy efficiency of 47% (calibration value used during the Harza 1984 investigation) was used to adjust the SPT blowcounts from this program to an average of 60% delivered energy. Blowcounts were also corrected for the effects of confinement. The corrected blowcounts, $N_1(_{60})$, and subsurface stratigraphy for the cross section at Station 40+00 and the profile along the dam axis from Station 38+75 to 41+25 are shown on Exhibits 4 and 5, respectively. For comparison MEI borehole R-63 has also been included on these exhibits.

A laboratory testing program consisting of natural moisture content, gradation and Atterberg limits was performed on selected SPT samples from the boreholes. A total of 21 SPT samples were tested to verify field classifications and determine the percentage of fines. Laboratory testing was performed on the site by Pittsburgh Testing Laboratory (PTL) personnel. The results of the laboratory testing program are presented in summary form in Exhibit 6

The vertical and horizontal extent of low blowcount silty sand ($N_1(60) \leq 15$) material is identified on Exhibits 4 and 5. The zone of low blowcount material is located between Elevations 7 and 15.

Laboratory testing of SPT samples of silty sand material within the identified zone indicates an average fines content of about 20% in the vicinity of Station 40+00. The corresponding average corrected blowcount for this same silty sand was found to be about 12. The thirty-three percentile value of the corrected blowcount is 11.2 and was used to determine the cyclic strength of the material under investigation. A summary of the corrected blowcounts and percent fines used to characterize this silty sand material near Station 40+00 is presented in Exhibit 7. The cyclic strength corresponding to a corrected blowcount of 11.2 with a fines content of 20% was interpolated using the strength curves for materials with fines contents of 15% and 35% (Exhibit 8). A correction factor of 1.32 was used, as recommended in Reference 1, to obtain the liquefaction resistance (strength) equal to 0.24 for the SSE M=6 earthquake. This strength is higher than the values reported for this area at the NRC presentation in April 1985. As seen on Exhibit 1,

the cyclic strength reported previously corresponding to the thirty-three percentile value of corrected blowcount of 8.1 ranged from 0.18 to 0.22 for fines contents of 15% and 35%, respectively. Therefore, the resulting computed factor of safety against liquefaction for the low blowcount zone around Station 40+00 would be higher than the minimum value for the zone from Station 30± to 45± reported previously at the NRC meeting. The computed factor of safety against liquefaction under the crest, berm and in the free field are found to be 3.4, 1.6 and 1.8, respectively.

Summary

A foundation investigation program around Station 40+00 was performed to identify the possible presence of a very low blowcount silty sand material reported in one borehole (R-63) during the design phase investigations by MEI. Five boreholes extending through the full depth of low blowcount silty sands were drilled at and around the location of borehole R-63. Standard penetration tests were conducted at 2.5 ft. intervals in the foundation material in each of the boreholes. The holes were drilled and SPT were performed using recommended SPT procedures for use in liquefaction correlations (Ref. 2). The exploration was performed using the same operator and rig which were previously calibrated for energy efficiency during an earlier Harza exploration in 1984. Laboratory classification tests were also performed for identification of material and to determine the percentage of fines (material passing No. 200 sieve).

The recently collected data were evaluated to identify the presence of low blowcount silty sand material in the foundation of the MCR embankment. Representative blowcount values were used to determine the cyclic strength of the identified material and were compared with the values which were presented at the NRC meeting on April 2, 1985.

The major findings of this investigation and evaluation are summarized below:

- The very low blowcount silty sand (N=3 at El 10± and N=4 at El 5±) reported in the design phase borehole R-63 was not encountered in the recent investigation around Station 40+00. The previously reported very low blowcounts could possibly be due to the variation of drilling and SPT operations.

- A low blowcount silty sand layer ($N_1 \leq 15$) has been identified between El. 7 and 15. The cyclic shear strength corresponding to the thirty-three percentile value of the corrected blowcount of 11.2 with about 20% fines is found to be 0.24. This strength value is higher than the previ-

ous values for the identified low blowcount material from Station 30+ to 45+ presented at the NRC meeting on April 2, 1985 and the factor of safety is correspondingly increased. The minimum computed factor of safety around Station 40+00 is 1.6, compared with a minimum of 1.2 for the reach from Station 30+ to 45+ determined on the basis of the earlier data.

References:

1. Seed, H.B., Idriss, I.M., and Arango, I., (1983) "Evaluation of Liquefaction Potential Using Field Performance Data," Journal of the Geotechnical Engineering Division, Vol. 109, No. 3, March, 1983.

2. Seed, H.B., Tokimatsu, K., Harder, L.F., and Chung, R.M., (1984) "The Influence of SPT Procedures in Soil Liquefaction Resistance Evaluations," University of California, Berkeley, EERC Report No. UCB/EERC-84/15, October.

CYCLIC STRENGTH

(As presented in April 2, 1985 meeting)

Station	Elevation	Material Type	-#200 Sieve	$\bar{N}_{1(60)} - \frac{1}{2}\sigma$	Cyclic Strength* ($\tau_{ave}/\sigma_{v'}$)	
					15% Fines	35% Fines
637± to 10±	-13 to -3	SM-ML	90.0	9.8	0.21	0.25
637± to 10±	+5 to +10	SM-ML	58.0	9.3	0.20	0.24
16± to 40±	+2 to +10	SM-ML	53.0	13.9	0.26	0.32
30± to 45±	+13 to +16	SM-ML	36.0	8.1	0.18	0.22

* Based on figure published in UCB/EERC Report No. 84/15 October 1984 (Seed, Tokimatsu, Harder & Chung)

EXHIBIT
ST-HL-AE-1293

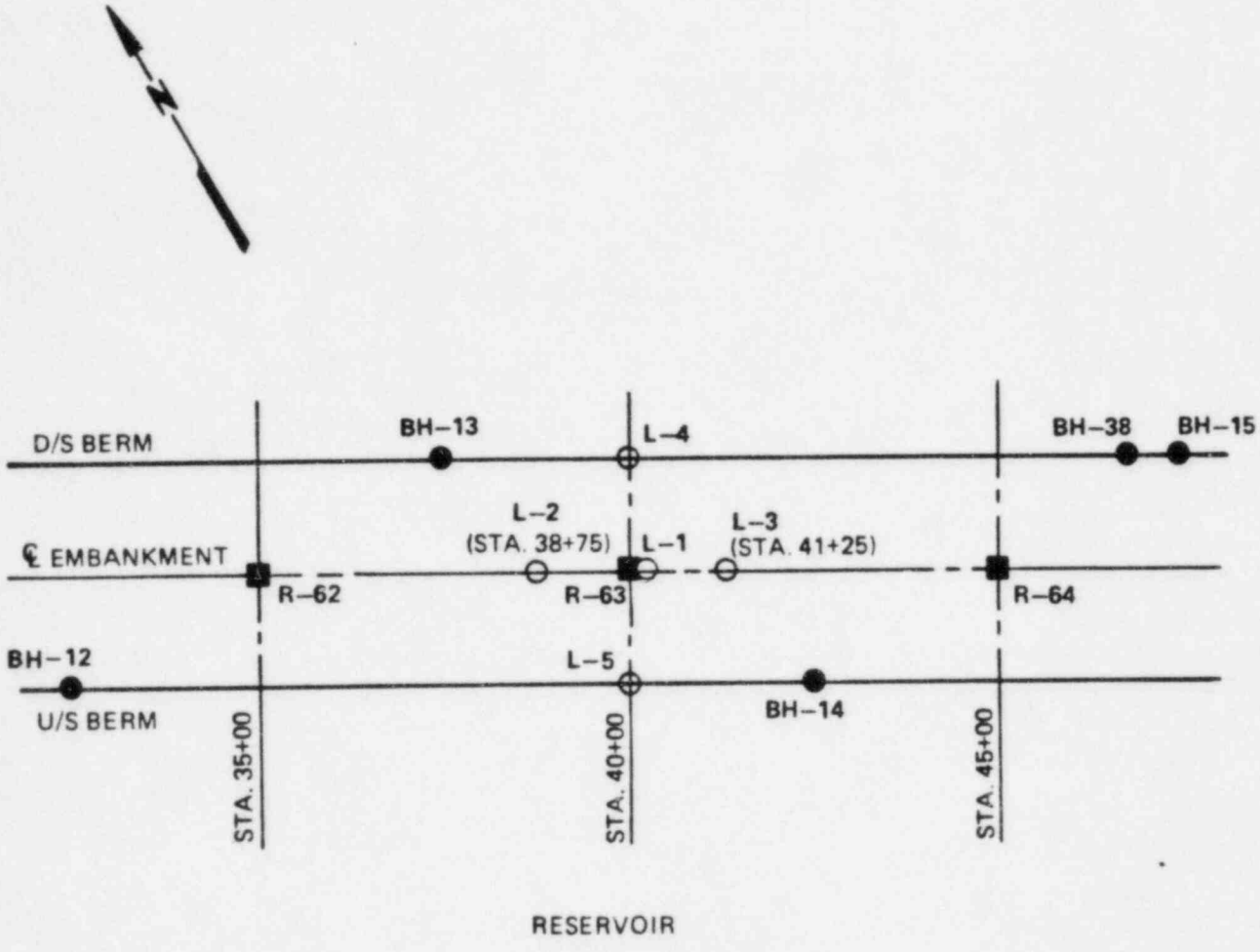
FACTOR OF SAFETY AGAINST LIQUEFACTION

(As presented in April 2, 1985 meeting)

Station	Elevation	$F.S. = \frac{\text{Cyclic Strength}}{\text{Cyclic Stress}}$		
		Crest	D/S Berm	Free Field
		Fines 15% - 35%	Fines 15% - 35%	Fines 15% - 35%
637± to 10±	-13 to -3	3.0 - 3.6	1.8 - 2.1	1.8 - 2.1
637± to 10±	+ 5 to +10	2.9 - 3.4	1.4 - 1.7	1.5 - 1.8
16± to 40±	+ 2 to +10	3.7 - 4.6	1.9 - 2.3	2.0 - 2.5
30± to 45±	+13 to +16	2.6 - 3.1	1.2 - 1.5	1.4 - 1.7

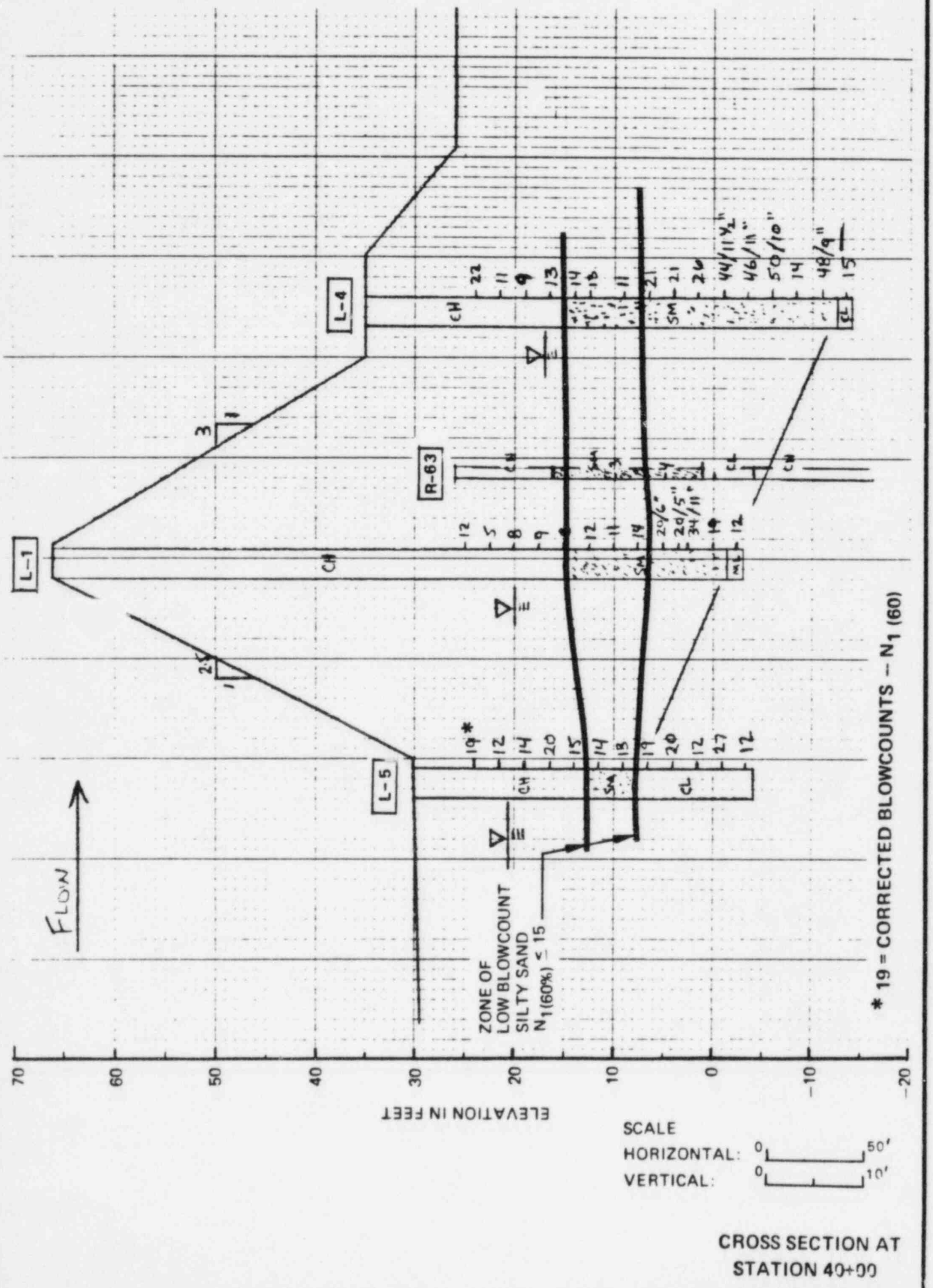
EXHIBIT 2
ST-HL-AE-1293

EXHIBIT 3
ST-HL-AE-1293



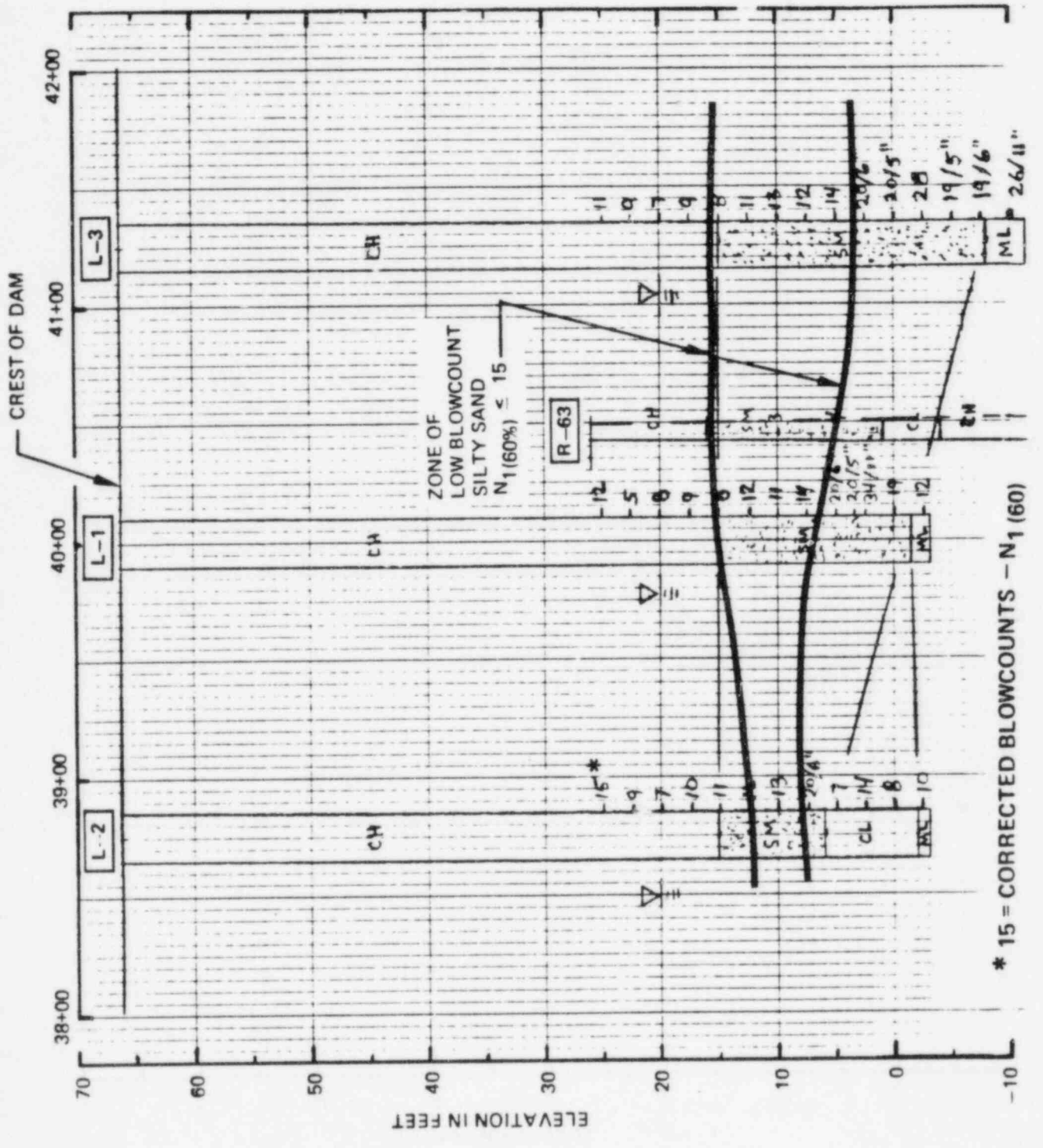
LOCATION OF BOREHOLES NEAR STATION 40+00

EXHIBIT 4
ST-HL-AE-1293



CROSS SECTION AT STATION 40+00

EXHIBIT 5
ST-HL-AE-1293



SCALE
HORIZONTAL: 0 50'
VERTICAL: 0 10'

PROFILE ALONG DAM AXIS
STATION 38+75 TO STATION 41+25

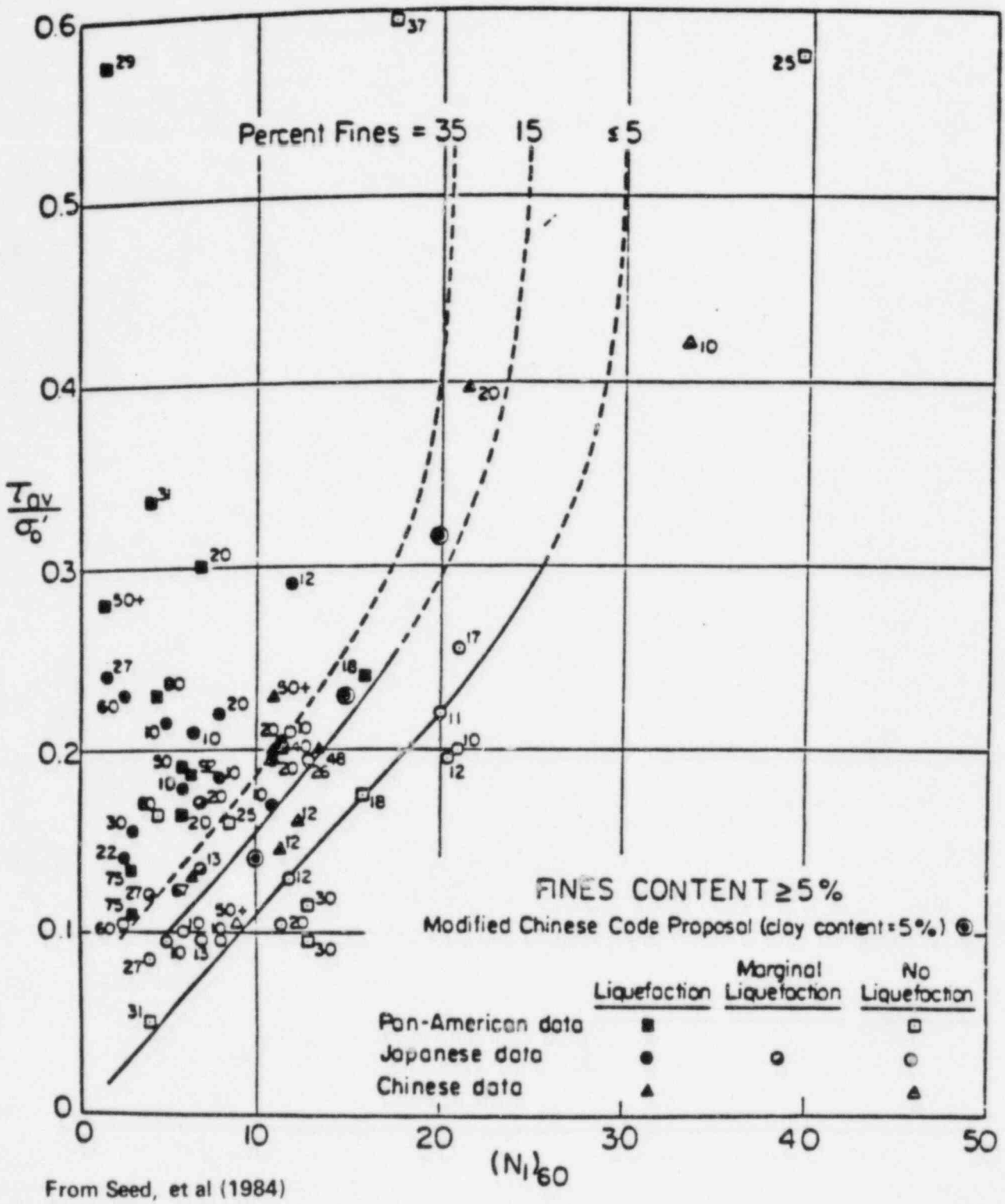
SOUTH TEXAS PROJECT
STATION 40+00 EXPLORATION
LABORATORY TESTING SUMMARY

Borehole No	Sample Depth	Sample Elevation	$N_1(_{60})$	Classification	#200	LL	PL
L-1	50	16.0	8	SM	32.3	-	-
L-1	52.5	13.5	12	SM	12.3	-	-
L-1	55	11.0	11	SM	12.8	-	-
L-1	65	1.0	19	SP-SM	9.5	-	-
L-1	67.5	-1.5	12	CL	88.5	35	15
L-2	50	16.0	11	CL	57.7	31	16
L-2	55	11.0	13	SM	17.6	-	-
L-2	60	6.0	7	CL	67.8	32	14
L-3	50	16.0	8	SM	36.9	-	-
L-3	52.5	13.5	11	SM	17.4	-	-
L-3	55	11.0	13	SM	12.8	-	-
L-3	57.5	8.5	12	SM	11.9	-	-
L-3	60	6.0	14	SM	11.9	-	-
L-4	17.5	17.5	13	CH	81.3	51	14
L-4	20	15.0	14	SM	30.9	-	-
L-4	21.5	13.5	13	SM	29.6	-	-
L-4	25	10.0	11	SM	14.2	-	-
L-4	27.5	7.5	21	SM	15.6	-	-
L-4	42.5	-7.5	14	SP-SM	11.6	-	-
L-5	17.5	12.5	14	SM	25.5	-	-
L-5	20	10.0	13	SP-SM	11.1	-	-

EXHIBIT 6
ST-HL-AE-1293

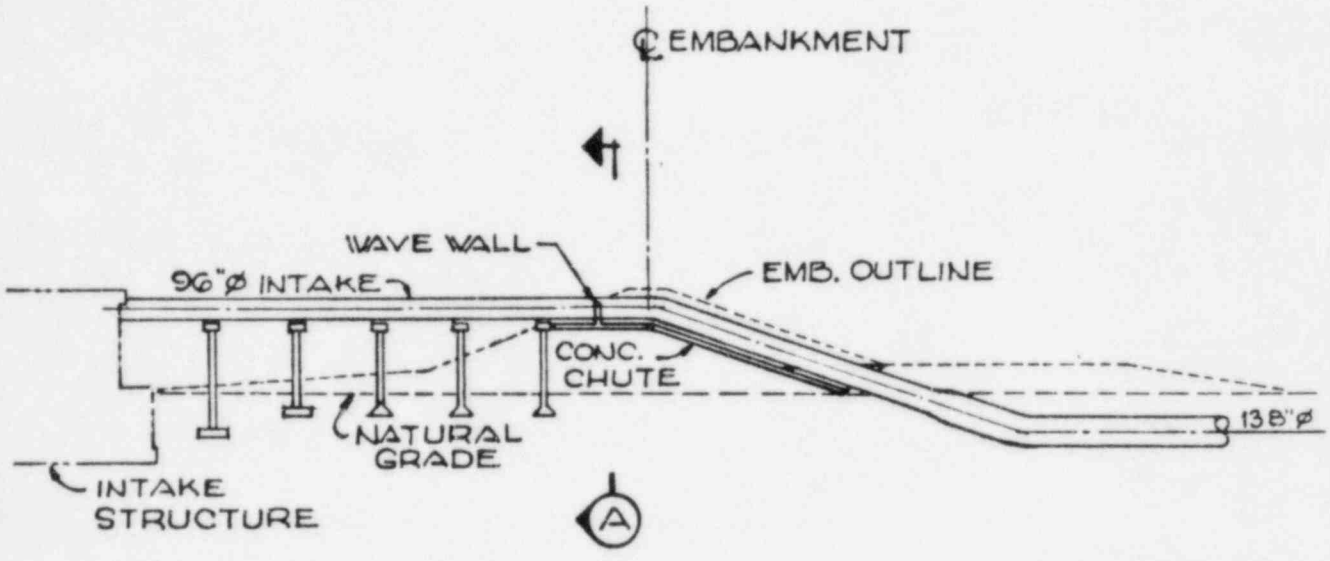
CHARACTERIZATION OF LOW BLOW COUNT SILTY SAND MATERIAL-$N_1(60) \leq 15$

Station	Borehole No.	Sample Depth	Sample Elevation	Material Type	-#200 %	$N_1(_{60})$	$\bar{N}_1(60)-1/2\sigma$	Avg. -#200 %
40+00	L-1	50.0	16.0	SM	32.3	8	12.1-0.9	19.8
	L-1	52.5	13.5	SM	12.3	12	= 11.2	
	L-1	55.0	11.0	SM	12.8	11		
	L-1	57.5	8.5	SM	-	14		
38+75	L-2	55.0	11.0	SM	17.6	13		
41+25	L-3	50.0	16.0	SM	36.9	8		
	L-3	52.5	13.5	SM	17.4	11		
	L-3	55.0	13.0	SM	12.8	13		
	L-3	57.5	8.5	SM	11.9	12		
	L-3	60.0	6.0	SM	11.9	14		
40+00	L-4	20.0	15.0	SM	30.9	14		
D/S Berm	L-4	21.5	13.5	SM	29.6	13		
	L-4	25.0	10.0	SM	14.2	11		
40+00	L-5	17.5	12.5	SM	25.5	14		
U/S Toe	L-5	20.0	10.0	SP-SM	11.1	13		

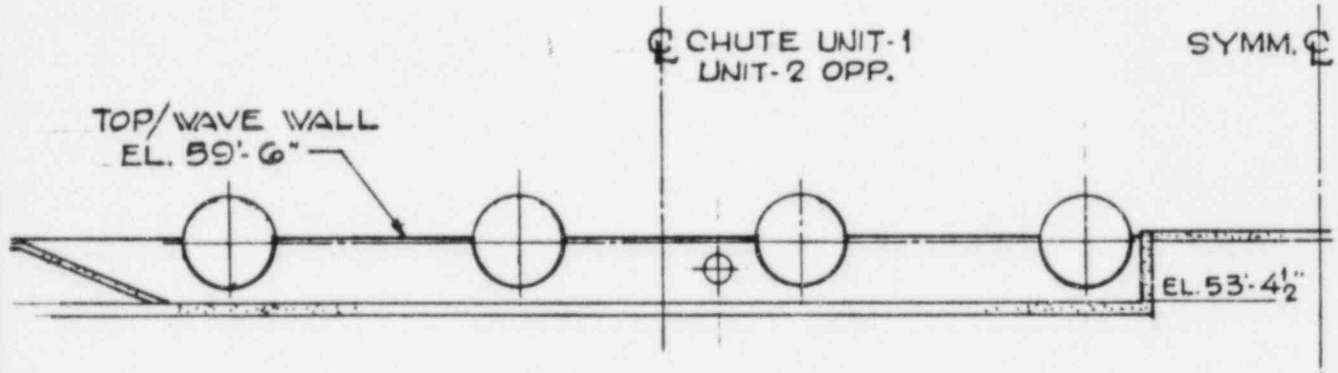


From Seed, et al (1984)

BECHTEL ENERGY CORPORATION SOUTH TEXAS PROJECT	
CYCLIC STRENGTH OF POTENTIALLY LIQUEFIABLE MATERIALS	
HARZA ENGINEERING CO., CHICAGO PROJECT MANAGER	
DATE APRIL 1985	DWG. NO.



ELEVATION VIEW

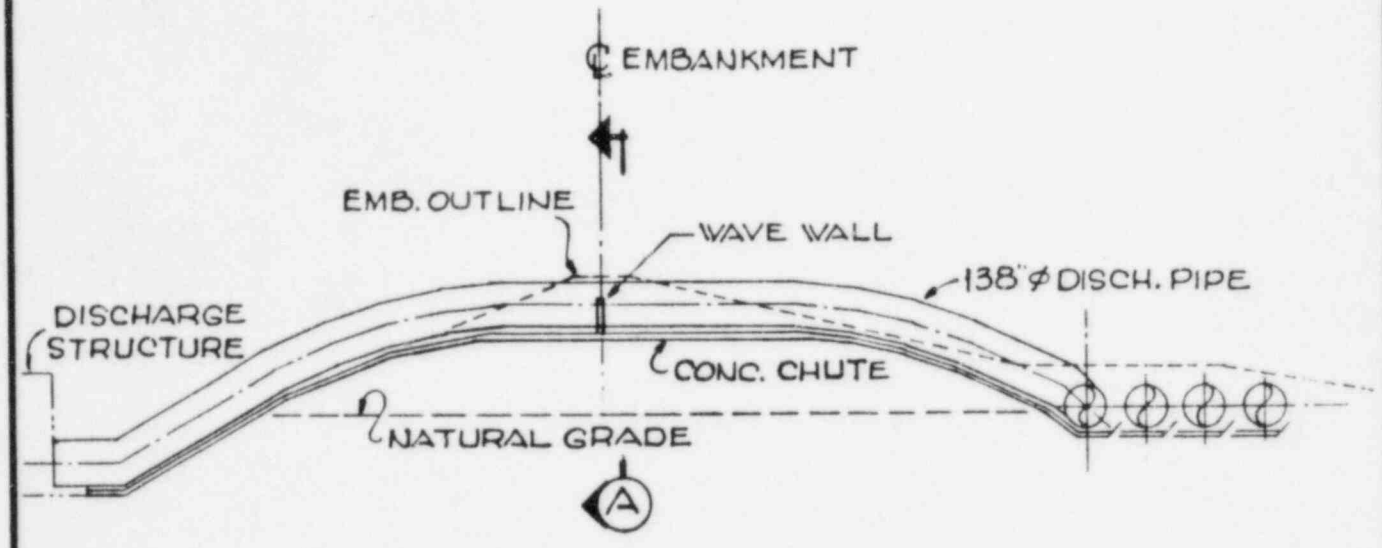


SECTION A

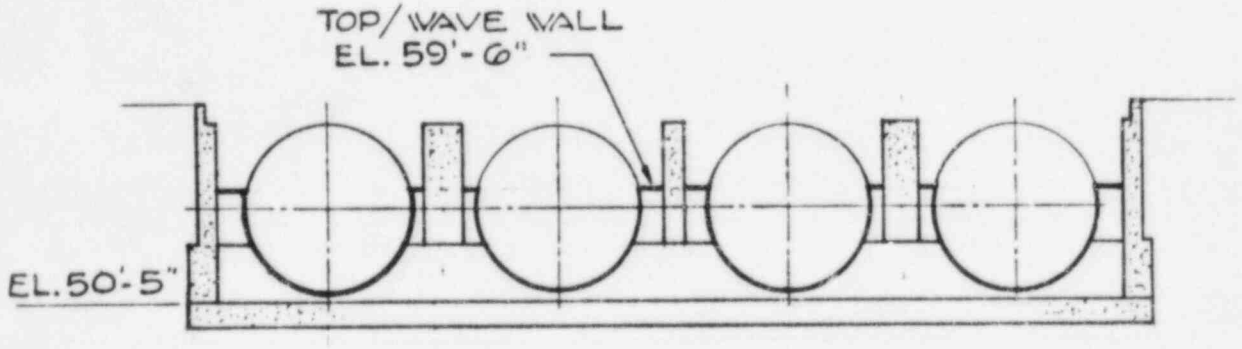
SOUTH TEXAS PROJECT
UNITS 1 & 2

WAVE WALL AT CIRCULATING WATER INTAKE CHUTE

Figure 2.5.6-20



ELEVATION VIEW



SECTION (A)

SOUTH TEXAS PROJECT
UNITS 1 & 2

WAVE WALL AT CIRCULATING WATER DISCHARGE CHUTE

Figure 2.5.6-21

South Texas Project
Main Cooling Reservoir (MCR)
OPERATING PROCEDURES
(Outline)

1. PHYSICAL DESCRIPTION OF THE MCR

This section will cover the following aspects of the MCR:

1A. Embankment

Physical description of the embankment geometry and physical characteristics of the various features of the MCR.

1B. Underseepage Control System

A description of the underseepage control system, details of typical relief wells.

1C. Instrumentation

A description of the instrumentation system, including placement of instruments around the reservoir and pertinent details on each instrument type (piezometers, inclinometers, settlement points and benchmarks, centerline surveys and lateral displacement pins, and relief well monitoring system).

1D. MCR Systems

Brief description of Makeup, Blowdown, Spillway and Circulating Water Systems.

2. OPERATING PROCEDURES FOR SYSTEMS

This section will contain guidance on the operation of the systems listed below. Criteria for making withdrawals from the Colorado River, criteria for withdrawals during drought, conditions under which the Blowdown system would be operated, and procedure during floods will be discussed.

2A. Makeup

2B. Blowdown

2C. Spillway

2D. Circulating Water Intake and Discharge

2E. Other Systems

MCR OPERATING PROCEDURES (Cont'd)

3. NORMAL MAINTENANCE PROCEDURES

This section will contain detailed procedures for general maintenance of the MCR, the MCR embankment and related systems.

3A. Dike Maintenance

This subsection will contain general data and procedures on slope maintenance including weed and brush control and mowing schedule. Guidance for routine repair of embankment crest and slope cracks will also be provided. Criteria for determining what constitutes a serious embankment crack that should be reported to higher authority prior to repair will be presented.

3B. Relief Well Maintenance

This subsection will cover routine maintenance which will be performed to ensure the system performs its function of controlling seepage and seepage pressures.

3C. Drainage System Maintenance

This subsection will contain instructions for maintaining site drainage ditches, and those sections of the embankment where a horizontal drainage blanket and collector pipe is provided. Frequencies of required maintenance and observations to be made during the course of maintenance work will be included once sufficient operating history is available.

3D. Mechanical Systems Maintenance

This section will contain guidance for checking the physical condition of exposed Circulating Water piping and routine repair of joint packing or corrosion protection. Recommendations for routine exercise of spillway and blowdown gates will be provided. Pump and equipment maintenance procedures will be included in specific system descriptions/operating procedures and will be cross referenced here.

4. ORGANIZATION

4A. Organization Chart During Operation

4B. Response/Notification System

This section will cover the lines of communication during operation, for routine inspections and evaluations as well as abnormal conditions.

MCR OPERATING PROCEDURES (Cont'd)

5. INSPECTION AND MONITORING PROGRAMS

This section will contain guidance and frequencies for routine inspections and instrumentation monitoring. Procedures for preparing reports and reducing and presenting data will also be specified. Reg. Guide 1.127 and the existing project monitoring and inspection specification will be used as a guide in preparing this section.

6. EVALUATION OF ABNORMAL (UNUSUAL) CONDITIONS

Details of this the section will be provided once an operating history has been developed during filling and hold periods.

7. REMEDIAL ACTION

This section will contain guidance for rapid response should remedial action be required. Sources of filter material and fill, along with sources of emergency embankment repair equipment will be identified. Emergency remedial action procedures for the various mechanical systems will be presented.

[redacted]

NRC Letter
628132

REQUEST FOR HL&P REPROGRAPHIC SERVICES

NAME Ann Alexander DATE 6/28

DEPARTMENT Licensing LOCATION 5400 TELEPHONE # 1329

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