



INTEROFFICE CORRESPONDENCE

DATE: November 4, 1993

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SUBJECT: ACCELERATED SLUDGE REMOVAL PROJECT 207C PONDS, SLUDGE
GEOTECHNICAL DATA - LAC-002-93

INTRODUCTION

The purpose of this memorandum is to transmit to you Solar Pond(s) **sludge geotechnical characterization data**. These data were obtained by analyzing samples taken in September 1991.

ANALYTICAL METHODS

The HNUS laboratory had considerable difficulty performing the method of analyses as requested by Brown & Root. The method calls for all analyses to start with the production of a filter cake and subsequent drying of the cake at 45-55°C. Because of the unique nature of the solids, the cakes were literally taking weeks to dry, and some did not dry at all. In response to this problem, a decision was made to increase the oven temperature to 110°C to facilitate cake drying. However, the majority of pond sludge cake samples were dried at the lower temperature. One sample of Pond 207C sludge (PS-207C-NW) was dried at 50°C and at 110°C for the determination of moisture content. Both analyses were 29.5% solids, showing that the drying temperature had little effect on the solids determination.

To aid in the interpretation of the modified methods, a flow chart (Figure 1) was developed to show the origin of the various filter cakes and filtrates generated during performance of the modified methods.

ANALYTICAL DATA

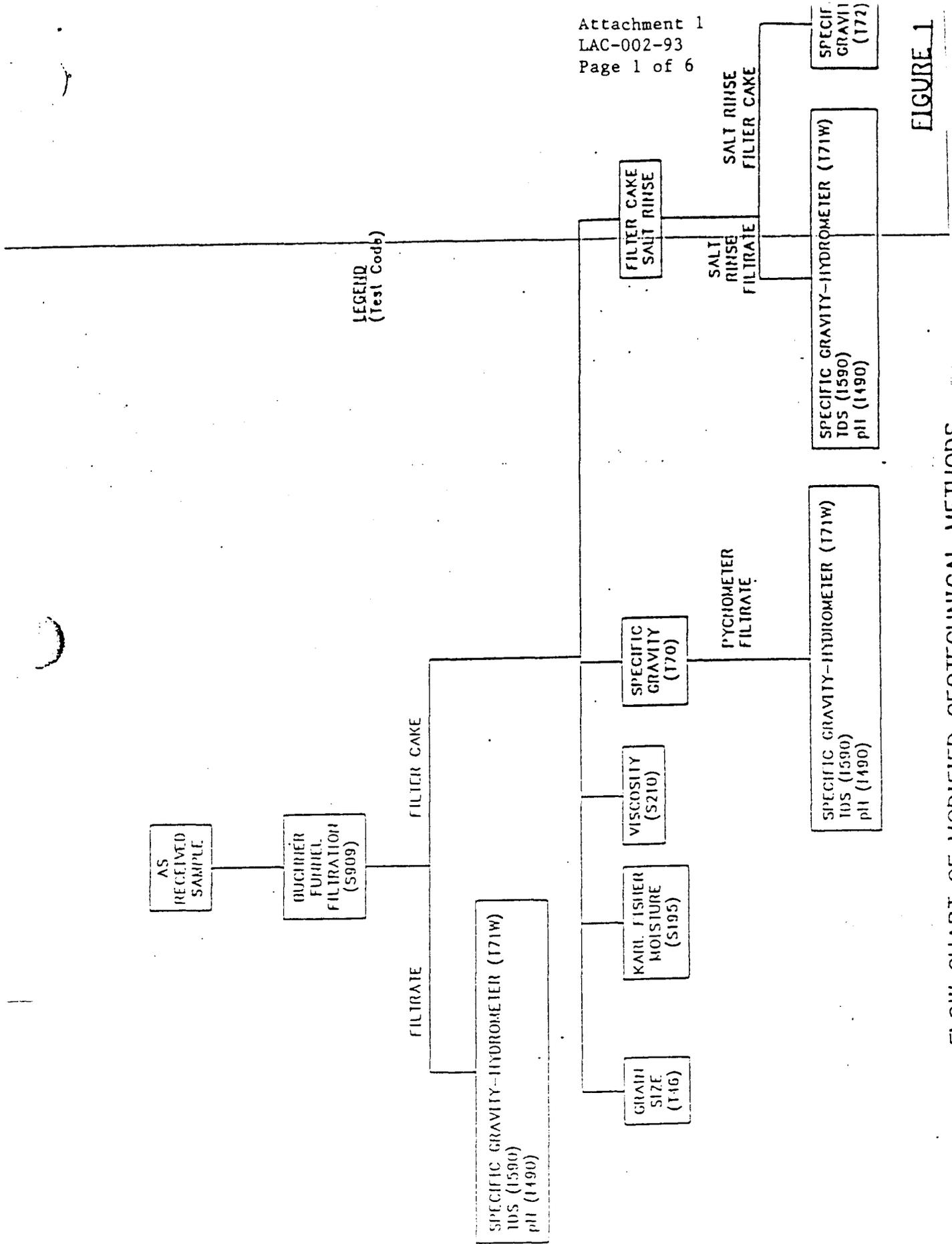
The analytical data are presented in Tables 1 through 5. It should be noted that the decision to dry the solids before performing the grain size *analysis* resulted in interference on certain samples. It is also apparent that drying the solids before size analysis has resulted in data that appears to overstate the weights of the coarser fractions. Previous wet sieve data and visual observations (reported in the Pondsludge Characterization Report) do not support the data generated by this method.

Attachment:
As Stated

jec

cc:
File
S. R. Keith
ERM (2)

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FLOW CHART OF MODIFIED GEOTECHNICAL METHODS
 POND SLUDGE GEOTECHNICAL DATA

FIGURE 1

TABLE 1
GEOTECHNICAL DATA - MODIFIED METHOD
POND 207A

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
<u>FILTERCAKE</u>				
Specific Gravity	2.00	2.15	1.63	2.17
Specific Gravity (Salt Rinsed)	2.18	2.03	2.18	2.39
Viscosity (CP)	830 ⁽¹⁾	1260 ⁽¹⁾	660 ⁽¹⁾	240
Percent Water (Karl Fisher)	45.0	35.0	43.0	25.0
Percent Solids (Filtercake)	23.5	15.9	22.0	44.0
Grain Size (% passing sieve)				
Sieve 3/8 inch	100	100	100	100
Sieve No. 4	98.1	97.4	98.4	98.4
Sieve No. 10	77.9	74.5	80.8	92.7
Sieve No. 20	44.2	53.6	48.1	67.3
Sieve No. 50	19.8	33.4	16.7	24.4
Sieve No. 100	8.1	19.6	8.2	8.9
Sieve No. 200	2.2	8.2	2.8	2.2
<u>FILTRATE</u>				
Specific Gravity (Hydrometer)	1.014	1.012	1.012	1.014
Solids Dissolved (180°C), mg/L	14,000	13,000	13,000	16,000
pH	8.3	8.3	8.3	8.2
<u>PYCNOMETER FILTRATE</u>				
Specific Gravity (Hydrometer)	0.998	0.998	0.998	0.996
Solids Dissolved (180°C), mg/L	2900	2000	3200	1500
pH	7.5	7.4	7.9	8.1
<u>SALT RINSE FILTRATE</u>				
Specific Gravity (Hydrometer)	0.998	0.998	1.000	0.998
Solids Dissolved (180°C), mg/L	1600	3400	2300	860
pH	7.6	10.6	7.4	7.8

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Data Testing.

⁽¹⁾ Viscosity determination done on a 1:1 ratio, solids:pond liquid

TABLE 2
GEOTECHNICAL DATA - MODIFIED METHOD
POND 207B NORTH

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
<u>FILTERCAKE</u>				
Specific Gravity	2.50	2.48	2.53	2.44
Specific Gravity (Salt Rinsed)	2.46	2.43	2.46	2.43
Viscosity (CP)	860	620	690	1200
Percent Water (Karl Fisher)	34.0	42.0	39.0	38.0
Percent Solids (Filtercake)	25.3	27.5	25.3	26.8
Grain Size (% passing sieve)				
Sieve 3/8 inch	100	100	100	100
Sieve No. 4	98.5	97.4	98.5	97.6
Sieve No. 10	86.8	85.9	87.3	86.1
Sieve No. 20	57.7	59.2	57.7	61.1
Sieve No. 50	35.0	35.5	34.2	37.0
Sieve No. 100	18.2	26.9	16.8	22.0
Sieve No. 200	8.5	12.6	6.2	7.4
<u>FILTRATE</u>				
Specific Gravity (Hydrometer)	1.003	1.003	1.003	1.003
Solids Dissolved (180°C), mg/L	1900	1300	1600	1500
pH	8.0	8.2	7.9	7.8
<u>PYCNOMETER FILTRATE</u>				
Specific Gravity (Hydrometer)	0.996	0.996	0.996	0.996
Solids Dissolved (180°C), mg/L	540	580	650	680
pH	7.5	7.5	7.5	7.5
<u>SALT RINSE FILTRATE</u>				
Specific Gravity (Hydrometer)	0.996	0.994	0.994	0.996
Solids Dissolved (180°C), mg/L	340	580	460	460
pH	7.7	7.7	7.6	7.6

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Engineering Data Testing.

TABLE 3
GEOTECHNICAL DATA - MODIFIED METHOD
POND 207B CENTER

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
<u>FILTERCAKE</u>				
Specific Gravity	1.41	1.47	1.61	1.70
Specific Gravity (Salt Rinsed)	1.82	1.80	1.81	1.93
Viscosity (CP)	880 ⁽¹⁾	1600 ⁽³⁾	1360 ⁽¹⁾	1280 ⁽¹⁾
Percent Water (Karl Fisher)	50.0	52.0	72.0	56.0
Percent Solids (Filtercake)	4.5	4.9	6.3	6.7
Grain Size (% passing sieve)				
Sieve 3/8 inch	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
Sieve No. 4	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
Sieve No. 10	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
Sieve No. 20	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
Sieve No. 50	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
Sieve No. 100	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
Sieve No. 200	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾	INT ⁽²⁾
<u>FILTRATE</u>				
Specific Gravity (Hydrometer)	1.011	1.015	1.015	1.015
Solids Dissolved (180°C), mg/L	20,000	20,000	21,000	21,000
pH	9.1	9.1	9.2	9.1
<u>PYCNOMETER FILTRATE</u>				
Specific Gravity (Hydrometer)	1.002	1.002	1.002	1.002
Solids Dissolved (180°C), mg/L	9100	11,000	8700	8200
pH	8.8	8.7	9.0	8.6
<u>SALT RINSE FILTRATE</u>				
Specific Gravity (Hydrometer)	1.000	1.001	1.007	1.002
Solids Dissolved (180°C), mg/L	7900	9000	13,000	7600
pH	9.2	8.9	8.7	8.3

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Engineering Data Testing.

- (1) Result at a 1:1.5 ratio, wet cake:pond liquid
- (2) Interference- sample can't be broken up with a rubber tipped pestle. Sample dried into a hard, ceramic-like disk. To break the disk up with a harder pestle would crush the individual particles.
- (3) Result at a 1:2 ratio, wet cake:pond liquid

TABLE 4
 GEOTECHNICAL DATA - MODIFIED METHOD
 POND 207B SOUTH

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
<u>FILTERCAKE</u>				
Specific Gravity	1.78	2.17	1.93	1.90
Specific Gravity (Salt Rinsed)	1.85	1.98	1.99	2.08
Viscosity (CP)	1430 ⁽¹⁾	1570 ⁽³⁾	770 ⁽¹⁾	1650 ⁽³⁾
Percent Water (Karl Fisher)	70.0	62.0	56.0	64.0
Percent Solids (Filtercake)	6.3	14.5	9.6	10.1
Grain Size (% passing sieve)				
Sieve 3/8 inch	INT ⁽²⁾	90.8	100	100
Sieve No. 4	INT ⁽²⁾	48.0	80.7	84.3
Sieve No. 10	INT ⁽²⁾	25.1	51.5	55.8
Sieve No. 20	INT ⁽²⁾	15.2	33.2	35.8
Sieve No. 50	INT ⁽²⁾	8.6	20.3	21.2
Sieve No. 100	INT ⁽²⁾	5.8	14.4	15.3
Sieve No. 200	INT ⁽²⁾	3.6	8.2	8.9
<u>FILTRATE</u>				
Specific Gravity (Hydrometer)	1.014	1.014	1.012	1.012
Solids Dissolved (180°C), mg/L	16,000	18,000	33,000	7000
pH	8.6	9.1	8.6	8.6
<u>PYCNOMETER FILTRATE</u>				
Specific Gravity (Hydrometer)	1.002	1.002	1.000	1.000
Solids Dissolved (180°C), mg/L	7900	5000	5000	4400
pH	8.8	9.2	9.5	9.6
<u>SALT RINSE FILTRATE</u>				
Specific Gravity (Hydrometer)	1.002	1.004	1.004	1.02 ⁽⁴⁾
Solids Dissolved (180°C), mg/L	5800	13,000	7600	19,000
pH	8.7	8.8	8.8	8.9

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Engineering Data Testing.

- (1) Result at a 1:1.5 ratio, wet cake:pond liquid
- (2) Interference - sample can't be broken up with a rubber tipped pestle. Sample dried into a hard, ceramic-like disk. To break the disk up with a harder pestle would crush the individual particles.
- (3) Result at a 1:1 ratio, wet cake:pond liquid
- (4) Not sufficient quantity to be tested by hydrometer, done by pycnometer

TABLE 5
GEOTECHNICAL DATA - MODIFIED METHOD
POND 207C

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST	Ave.
<u>FILTERCAKE</u>					
Specific Gravity	2.92 ⁽¹⁾	2.84	2.87	2.82	2.86
Specific Gravity (Salt Rinsed)	2.41	2.27	2.31	1.93	2.23
Viscosity (CP)	1660	600 ⁽²⁾	INT ⁽³⁾	INT ⁽³⁾	
Percent Water (Karl Fisher)	41.1	40.1	30.7	24.9	
Percent Solids (Filtercake)	29.5	33.7	40.8	56.1	
Grain Size (% passing sieve)					
Sieve 3/8 inch	100	100	100	100	
Sieve No. 4	94.9	97.5	98.4	95.1	
Sieve No. 10	58.6	71.6	76.3	67.2	
Sieve No. 20	32.9	42.5	48.8	39.7	
Sieve No. 50	14.6	19.9	23.9	17.2	
Sieve No. 100	7.9	10.7	13.4	10.0	
Sieve No. 200	3.5	4.2	5.7	4.1	
<u>FILTRATE</u>					
Specific Gravity (Hydrometer)	1.402	1.404	1.404	1.418	
Solids Dissolved (180°C), mg/L	45.6% 640,000	620,000	630,000	630,000	
pH	10.6	10.7	10.5	10.5	
<u>PYCNOMETER FILTRATE</u>					
Specific Gravity (Hydrometer)	1.062	1.067	1.077	1.082	
Solids Dissolved (180°C), mg/L	88,000	82,000	100,000	100,000	
pH	10.3	10.6	10.7	10.7	
<u>SALT RINSE FILTRATE</u>					
Specific Gravity (Hydrometer)	1.102	1.102	1.117	1.122	
Solids Dissolved (180°C), mg/L	130,000	120,000	150,000	160,000	
pH	10.1	10.5	10.6	10.6	

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Data Testing.

- (1) Dried at 110 degrees Celcius.
- (2) Encountered some interference with crystal formation.
- (3) Interference - unable to conduct test due to sample matrix, i.e...crystal formation.