



Brown & Root, Inc.

Post Office Box 3
Houston, TX 77001-0003

6575

March 10, 1992

Letter No.: BAR-HED-0005
File No.: 732.3

Halliburton NUS Environmental Corporation
452 Burbank Street
Broomfield, Colorado 80020

ATTENTION: Ted Bittner

SUBJECT: Rocky Flats Solar Pond/Pondcrete
Stabilization Project
Brown & Root Job No. JR-1198

REFERENCE: Dewatering Subcontractor Laboratory Tests

Dear Mr. Bittner:

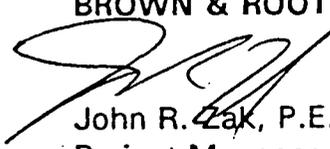
Attached hereto for your records are copies of the above referenced test reports from the following subcontractors:

1. OHM Corporation
2. Laidlaw Environmental Services
3. Mobile Dredging & Pumping Co.
4. Ecotek

We have not received reports as of this date from the other two subcontractors. When these additional reports are received, they will be forwarded to you.

Very truly yours,

BROWN & ROOT, INC.


John R. Zak, P.E.
Project Manager

JRZ:fh

Attachment

cc: D. N. Assar
L. Moreland
D. Parikh



FAX Transmission

■ To: Larry Moreland ■ Fax #: 713/267-9559

■ Company: Brown/Root

■ Department: Purchasing

■ From: ALFREDO CARRASO (713/935-3543) ZAR
CC: D. PARIKH
FILE

■ Page 1 of 4 ■ Time: 0956 ■ Date: 02/26/92

■ Comments: Revised copy, correcting flow rate error!! on 1st page - Please forward copy to Dinah P.

(Rocky Flats Testing Outline)

If you do not receive the pages as specified, please call as soon as possible:

713.467.3433 Ext: _____ or for Altair Landfill Facility 409.234.2045 Ext: _____

FAX Reply To:

Accounting/Safety/Human Resources/MIS/Purchasing/Gulf Coast Region 713.465.4328

Remedial and Altair Landfill Administration 713.467.0537

Altair Landfill Facility 409.234.5096



HOUSEHOLD HAZARDOUS WASTE



RESOURCE RECOVERY



SITE REMEDIATION



LAB PACK SERVICES



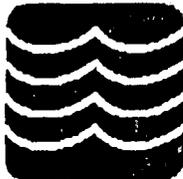
LABORATORY SERVICES



TRANSPORTATION



INCINERATION



WASTEWATER TREATMENT



SECURE LANDFILLS



BIOLOGICAL TREATMENT



GOVERNMENT SERVICES

To : Larry Moreland
(Brown & Root Inc.)

Date: 2/26/92

From : Alfredo Cavazos
(Laidlaw Environmental Services
Houston DeWatering Lab)

Subject: "Rocky Flats Solar Pond Project Dewatering Trial"

Copy : Ed Tobia

Summary:

On the week of February 27th to 29th, I visited N.U.S. Pittsburgh-Lab to perform dewatering evaluation on "207a & 207b Sludge" samples. After initial screening sludge for physical characteristics, we started our trial runs on the JWI recess chamber lab simulator. We made a "blank" run to see the flow pattern of the "as is" sludge, but the mixture blinded the clothes. Therefore, we changed our plan to include chemical treatment, American Cyanamid 581 was introduced into the sludge. This time we had an excellent result:

Cake: Very Firm
59% Solids
26.6% Karl Fisher Moisture

Filtrate: Clean/Clear (Blue-Green Color)
Ph= 8
TDS= 1.4%

Process: Volume Reduction (est.) 94%
3500 to 4000 gal. process rate (@ 9.3%
Solids "asis" feed charge)
Cycle Time (est.) 45 minutes
3.9 tons/hr. wet cake output (est.)
2.3 dry tons cake solids/hr. output (est.)

Equipment/Chemicals:

- 1) JWI 3 inch cell Filter Press Simulator
- 2) "Membrane Squeeze Simulator"
- 3) Miscellaneous items:
 - a) Filter Cell and Clothes
 - b) Collection vessels
 - c) Nitrogen power supply
- 4) Chemicals and Additives:
 - a) American Cyanamid "polymer test kit"
 - b) Filter Aids

Test Trials:

Notes:

- 1) We evaluated sludge for physical characteristics:
(Sp.Gr., % solids, ph)
- 2) Blank run to see filterability of sludge
- 3) Started evaluating chemical treatment

Given:

asis sludge --- ph= 8, % solids= 2.6, Sp.Gr.= 1.01

Run # 1: (900 mls. asis sludge)

Note: JWI unit---Green Clothes, small cell, Fenco (F)
precoat, 140 psi. feed pressure

Time (sec.)	Filtrate (mils.)
40	50
255	100

Conclusion:

- 1) Stopped, material will not filter without treatment!

Run # 2: (1400 mls. asis sludge treated with Am. Cy. 581 at 15
lbs./ dry ton of solids)

Same JWI unit test condition

Time (sec.)	Filtrate (mils.)
30	100
98	200
260	300
390	400
510	500
655	600
930	800
1080	900
1770	1000
2145	1150

Conclusion:

- 1) Stopped filtration cycle, cell full-- Started membrane squeeze cycle.
- 2) 540 sec. squeeze at 150 psi. Total cycle time was 840 sec. (inflation and deflation steps included)

3) RESULTS:

CAKE : very firm % solids= 55 to 62 range
Sp.Gr.= 1.24 to 1.34 range
FILTRATE: clean and clear (blue-green color)
ph= 8, TDS= 1.4%

Process Data of Cycle:

Volume Reduction (est) 97%
Process Cycle (est) 45 mins.
Process Rate (est) 15,000 to 16,000 gals. at 2.6%
solid load

Run # 3 (Evaluating other chemical treatments)

Note:

- 1) Several trials were tried using other polymers and additives to see if better filtration could be achieved.
- 2) We didn't find another polymer that did better, but Fenco (F) additive in conjunction with Am. Cy. 581 did increase filtrate rate and decrease cycle time.

(900 mls. asis sludge, 0.3% by weight Fenco (F) added as Body Feed, 15 lbs/dry ton of solids) Same JWI unit. test conditions

Time (sec.)	Filtrate (mls.)
12	100
22	200
85	300
160	400
225	500
280	600
305	700
460	800

RESULTS:

- 1) Filtration rate was increased, with no change in cake properties or filtrate quality.

Run #4 (Increase % solids in Feed Charge)

Note:

- 1) Question was brought up about percent solids in dredged sludge increasing from previous runs to upwards of 10 percent. How would this effect process?
- 2) Bucket was allowed to sit and free water layer was decanted to concentrate solids.

Given: %solids of "new" sludge feed charge increased to 9.3 (same test conditions were duplicated as run number 3)

Time (sec.)	Filtrate (mls.)
130	100
400	200
780	300
1230	400

RESULTS:

- 1) No change in cake solids or filtrate quality were encountered.
- 2) Cycle time would be shorten caused by increase of solids going to press (filling up cells faster) actual time would be determined by field conditions.

CC: J ZAK
D. PARIKH
W. HENDERTSON
FILE 732.5

FAX TRANSMITTAL

OHM Corporation
Project #11972
~~P.O. Box 3338~~
~~Texas City, Tx 77592-3338~~
Telephone: 409-945-1109
Fax: 409-945-1400

Date: 2/28/92
From: Debbie Jorgensen
To: Larry Moreland
Fax No: 713/267-9559
Total Pages (Inc. Cover Sheet): 8
Original Documents Sent by Mail N Y

Talk to you soon!
Have a great weekend!

16666 Northchase
Suite 100
Houston, TX 77060

Larry Moreland
Brown & Root, Inc.
P.O. Box 4824
Houston, TX 77210

Dear Mr. Moreland,

Please find the attached report for the Dewatering Treatability Study that Bob Shock performed at your NUS Laboratory on February 18 and 19, 1992.

Please let me know if this meets all of your requirements and I will have it typed and forwarded to you in final form immediately.

Sincerely,



Debbie Jorgensen
Project Manager

DRAFT

With respect to the bench scale de-watering experiments conducted at the NUS-Haliburton facility on February 18th and 19th, we have determined that de-watering of the sludges in pond 207 A/B will work using our experiment. It would be highly advisable that, should OHM be awarded the work at Rock Flats, that bench scale testing be performed to "fine tune" the process.

Several preliminary tests were performed on 50ml samples of the supplied materials to determine the starting point prior to bench scale testing. The following is a synopsis of each test, along with relevant observations for each test:

- * All polymers used for testing were prepared at a concentration level of 0.5% polymer in 100ml of water.
- * Ferric chloride was a 40% by weight solution in water.
- * The sludge provided had an initial pH=8.0, a density of approximately 1.02g/cc and a solids content of less than 5%.

Trial #1 used 0.3g of ferric chloride and about 0.2g of lime. It filtered well, and ~~g~~ what appeared to be a good residue, however, the pH of the sludge was 13 after the addition of lime.

Trial #2 used 0.4g of ferric chloride and 0.3g of diatomaceous earth filter aid. ~~g~~ appears to be a fairly good starting point; the material filtered in less than 10 seconds, and yielded what appeared to be a good "cake".

DRAFT
Pg. 2

Trial #3 used 0.4g of ferric Chloride and 0.3g of ferris sulfate. This trial took approximately a minute to filter, although the resultant residue did "crack" well as the moisture was removed.

Trial # 4 used only 0.4g of ferric chloride. Again, good precipitation was observed, but the material would not filter well. Some type of filter aid must be included to enhance moisture removal.

Trial #5 used 3ml of Exxon 800 polymer. A flock formed, however, it was small and not well defined.

Trial #6 used 4ml of Exxon 803 polymer. Again, the "flock" that formed was not suitable for de-watering.

Trial #7 used 4ml of polymer 806 and produced a flock that appeared unsuitable for testing therefor filtration was not performed on this sample.

Trial #8 was an attempt to improve the flock formation by adding ferric chloride to the sludge in conjunction with the polymers. 3.0ml of polymer 805 and 0.4g of ferric chloride produced a somewhat better result but still not adequate for dewatering.

Trial #9 was a combination of 0.4g of ferric chloride with polymer 800 in varying amounts. Again the results were not sufficient to produce what would be considered a good cake.

DRAFT
Pg 3

Trial #10 used 0.4g of ferric chloride and 2ml of polymer 803. this mixture seemed to produce a fairly good flock that filtered well in a reasonable time frame.

Trial #11 used 0.4g of ferric chloride with 2ml of polymer 806. Again a fairly good looking flock was formed however it did not filter well.

Trial #12 used 3ml of polymer 810 produced what appeared to be a good flock but again the filtering characteristics were poor.

Trial #13 used 3ml of polymer 810 with the addition of 0.4g of ferric chloride. The flock that was produced appeared fairly good with reasonable filtering characteristics.

Trial #14 used 2ml of polymer 813 to produce what appeared to be a good flock however, it filtered poorly and took a long time to dry.

Trial #15 used 2ml of polymer 813 with 0.4g of ferric chloride. The resultant flock appeared fairly good but did not filter well.

Trial #16 used 2ml of polymer 814 and produced a large flock, however it again had poor filtering properties.

Trial #17 used 0.4g of ferric chloride in conjunction with polymer 814. The resultant flock appeared large and well defined but again did not filter well.

DRAFT
Pg. 4

Trial #18 used 1.5ml of polymer 817 to produce a large well defined flock however, it had very poor filtering properties.

Trial #19 used 1.5ml of polymer 817 in addition to 0.4g of ferric chloride. Again a good flock seemed to be produced but filtration was very slow.

Trial #20 used 2.5ml of polymer 819 to produce a poorly defined flock that did not filter well.

Trial #21 used a total of 4ml of polymer 925 to produce a poorly defined flock that did not filter.

Trial #22 used 1ml of polymer 928 to produce a heavy large heavy flock that settled quickly but did not filter well.

Review of the initial test runs using small amounts of sludge indicated that a mixture using ferric chloride and polymer 803 might produce a suitable cake in the bench scale press.

Bench Test 1

1600 ml of sludge containing 16ml of ferric chloride and 64ml of polymer 803 produced a cake containing 22% solids in a time span of 30 minutes at a final pressure of 95psi; total volume reduction was 95%.

The resultant cake had a good screen release but was very soft and no doubt should have been under a higher pressure for a longer period of time.

DRAFT
Pg. 5

Addition of a filter aid coupled with a longer cycle time should produce an acceptable cake.

Bench Test 2

1600 ml of sludge containing 32ml of polymer 982 produce a cake with 22% solids and a volume reduction of 95%. Total cycle time for this trial was 33 minutes at a final pressure of 120psi.

The cake produced did not release well from the screens and appeared soft and pulpy, in addition, the cake did not hold together well.

Addition of a filter aid and perhaps precoating the screens with an increased cycle time may produce an acceptable cake.

Bench Test 3

In an effort to use lime in conjunction with ferric chloride, an attempt was made to use sulfuric acid to keep the pH within acceptable levels.

500ml of sludge was treated with 5ml of ferric chloride, 2.5ml of 5% sulfuric acid, and 0.85g of lime (0.113, 0.005, and 0.011b/gal respectively).

This mixture produced a visually acceptable in the beaker however it took 40 minutes to recover 480ml of liquid at a pressure of

FEB 28 '92 9:50 FROM OHM TX DIU

TO AMOCO SURG

PAGE.007

DRAFT
Pg. 6

200psi. Total solids content of the cake produced was 25.4%. Again addition of a filter aid would no doubt help to improve the process.

Bench Test 4

1000ml of sludge was treated with ferric chloride, lime and diatomaceous earth at a ratio of 0.113, 0.01, and 0.05 lb/gal respectively to yield a cake with 33.3% solids. Cycle time was 1 hour at an operating pressure of 200psi.

This was the best cake produced in that it was fairly hard and had good release from the screens. Again in retrospect an increase in cycle time, precoating of the screens and or the addition of more filter aid should produce better results.

File: 765.9 & 732.3

C.C. JRZ
WCH
LHM
DAP
DNA



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February 20, 1992

RECEIVED
BROWN & ROOT

FEB 24 1992

EG&G ROCKY FLATS
SOLAR POND/PONDCRETE
WASTE DISPOSAL PROJECT

Brown & Root
1500 City West Blvd.
Houston, TX 77042

Attn: Dilip Assar/Larry Moreland

Gentlemen:

Below are the results of laboratory testing conducted at HNUS Lab, Pittsburgh, PA by Joe Foisy of Mobile Dredging & Pumping Co.:

Sample: 5 gallons mixed sample from ponds 207A & 207B.
Solids as received were 2.87%, pH = 8

Belt Filter Press Testing:

Rocky Flats - Belt Press - 300 ml

7113 Nalco Polymer - good floc, clear filtrate - some debris in it, good doctor - no residue, will run slow

<u>CAKE%</u>	<u>AMT PPM</u>
39.69%	100

Note: - Material has low "as received" solids (2.87%), based on this fact, I used a high charge cationic polymer to hopefully get as close to the 30% cake requirement as possible.

- lower charge cats would only reduce cake solids
- material would run slow, would need to remove as much liquid as possible after flocculation before pressing
- material gives off a lot of liquid
- can probably use lower amount of poly
- ran press for 2 min. @ 500 PSI

Brown & Root
 Page Two
 February 20, 1992

Barrel Test (to determine best sludge/treatment combination for plate & frame test):

Rocky Flats - Barrel Test - 300 ml

	<u>FeCl3 PPM</u>	<u>Lime PPM</u>
Conditioning FeCl3 Lime 0		
- slight stream, long drip	0	0
- clear filtrate (greenish)		
- stopped test, too slow		
1.5g FeCl3, 2.5g lime		
- good stream from start to finish	5,000	8,333
- very little foaming	cake: 24.50%	
- clear filtrate (light green)		
- good release from paper		
- good, hard cake		
- FeCl3 = ph 5-6		
- lime = ph 12		
- 275/199-1.382		
0.75g FeCl3, 1.25g lime -	2,500	4,166
- no noticeable foaming	cake: 20.25%	
- stream, then drip		
- filtrate is clear, but more greenish		
- FeCl3 = ph 6-7		
- lime = ph 10		
- cake is not as good, wetter		
- 275/323-8.51		
2.5g lime - stream, then drip	0	8,333
- clear filtrate, greenish	cake: 27.76%	
- ph12		
- 280/295-.949		
1.3g lime - stream, very long drip	0	4,333
- clear filtrate, greenish	cake: 24.74%	
- ph11		
- 280/784-.357		

Brown & Root
Page Three
February 20, 1992

Filter Press: See attached Run Form

Technician's Notes on Filter Press Test:

Rocky Flats - Filter press info

- Notes:
- 1) lab was only able to supply 10 bar pressure, 12 bar needed
 - 2) FeCl₃ and lime needed for best results
 - 3) Expect up to 3 hour cycle times
 - 4) Filtrate is very clear/aqua marine in color
 - 5) Cake was hard in some places, soft in others, even with it being soft/wet, there was very good release.
 - 6) Expect high volume reduction, up to 20:1
 - 7) In filter press test, used 8,333 ppm lime

We hope these results are satisfactory, please don't hesitate to call if you have any questions.

Respectfully submitted,

MOBILE DREDGING & PUMPING CO.



Lamar Walters
Field Service Representative

LW/mgg

FILTER PRESS RUN FORM

RUN 1

START - 0

UP - 31 min

STOP - 2 hr. 20 min.
(140 min)

Expect 2-3 hr. cycles or more?
(4 hr. would be great)

Test not completely accurate - not enough pressure

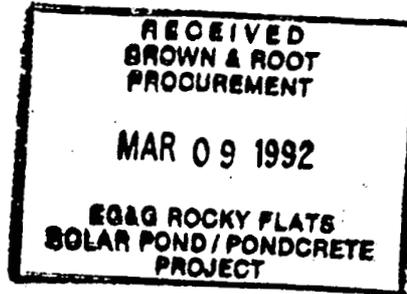
Time of Filtration	minutes	109 min - could have run a little longer
Filtrate Volume	liters	111 + 850 (8,850 ml)
Filtration Rate End	L/hm ²	-
Pressure	ATM	10.25 PSI - all the pressure there was
Filtration Rate @ 12 ATM	L/hm ²	-
Reduction in Volume	x : 1	20.1 : 1
Filter Cloth Type		polyprop
Cake Release		good
Condition of Cake		hard in some place; soft in some
Filtrate Clarity		clear/aqua blue
Total Filtration Area	M ²	.0308
Cake Volume	Liters	462 ml (30mm plate)
Type of Additive		lime
Amount of Additive		8,333 ppm
Cake Solids	%	50.82%
Cake Density	kg/Lt	-
Infeed Solids	Gr/Lt	2.87%
Ph of Infeed	Ph	8.
Infeed Density		-
CAKE WET		-
CAKE DRY		-



P.O. Box 369
1219 Banner Hill Road
Erwin, Tennessee 37650
(615) 743-6186

March 5, 1992
92CMH2-019

Mr. Larry Moreland
Brown & Root, Inc.
Bldg. 25, Rm 668
1500 City West Blvd.
Houston, Texas 70042



CC ZAK
D. PARIKH
HENDERSON
PO-FILE

Dear Mr. Moreland:

Subject: Submission of Report

Reference: a) Brown & Root Job No. JR-1198
b) Consultant Agreement No. 031-2904-S-0006
c) Telcon Hessick/Moreland on 03/05/92

In fulfillment of the deliverable requirement specified in Exhibit A of our Consultant Agreement, EcoTek submits to Brown & Root our dewatering test data and activity report. This document provides information concerning the filter/dewatering characteristics of the Rocky Flats Solar Pond sludge.

If we can be of additional assistance to your organization, please do not hesitate to contact us.

Sincerely yours,

ECOTEK, INC.

Carl M. Hessick
Contracts Manager

