ORNL/ER-118

MARTIN MARIETTA

**ENVIRONMENTAL
RESTORATION
PROGRAM**

**Dewatering Equipment
Recommendations for the Solids/Liquid
Separation Project at Waste Area
Grouping 6 at Oak Ridge
National Laboratory,
Oak Ridge, Tennessee**

P. A. Taylor

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Environmental Restoration Division
ORNL Environmental Restoration Program

**Dewatering Equipment Recommendations for the Solids/Liquid
Separation Project for Waste Area Grouping 6 at Oak Ridge
National Laboratory, Oak Ridge, Tennessee**

P. A. Taylor

Date Issued—May 1992

Prepared by
Chemical Technology Division
Oak Ridge National Laboratory

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting code EW 20

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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Author Affiliation

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CONTENTS

EXECUTIVE SUMMARY	iv
BACKGROUND	1
SOLIDS CHARACTERIZATION	1
DEWATERING EQUIPMENT CHARACTERISTICS	1
RECOMMENDATIONS	2
REFERENCE	2
APPENDIX—DESCRIPTIONS OF DEWATERING EQUIPMENT	3

EXECUTIVE SUMMARY

The final closure of Waste Area Grouping (WAG) 6 at Oak Ridge National Laboratory will include the plugging and abandonment of many existing wells and boreholes and the installation of diversion trenches for groundwater control. These activities will generate soil that must be dewatered before it can be disposed of. Three different types of dewatering equipment—rotary vacuum drum filters, automatic discharge pressure filters, and centrifuges—have been evaluated to assess their suitability for the WAG 6 project. Because of its lower cost and minimal prescreening requirements, it is recommended that a centrifuge be used to dewater the WAG 6 soils.

BACKGROUND

The Environmental Restoration Division is examining methods for final closure of Waste Area Grouping (WAG) 6 at Oak Ridge National Laboratory (ORNL). Closure activities will include the plugging and abandonment (P&A) of many existing wells and boreholes and the installation of diversion trenches for groundwater control. These activities may generate radioactively contaminated soil containing large amounts of water. Before the contaminated soil can be disposed of, it must be dewatered. The dewatering equipment will be housed in the support facilities building that is being designed by Ebasco Services, Inc. The ORNL Chemical Technology Division was responsible for selecting the solids/liquid separation equipment for use in dewatering the soils.

SOLIDS CHARACTERIZATION

The amount of contaminated soil generated by the P&A activities was originally estimated by ORNL Engineering to be about 85 m³/month. Recent developments in the proposed methods for P&A have greatly reduced the amount of contaminated soil that is likely to be generated, but the groundwater interceptor trenches could also generate large quantities of contaminated soil, so the dewatering equipment was sized to handle 85 m³/month. Assuming operation for 7 h/d, 20 d/month, the equipment was sized to handle at least 800 kg/h. Any contaminated soil that does not contain free water could be placed directly into B-25 boxes for disposal.

A particle size analysis for soil from three disposal trenches in WAG 6 was performed in 1984.¹ This analysis showed that the soil was 36% sand (45 to 1000 μ m), 22% silt (2 to 45 μ m), and 42% clay (<2 μ m), on average, for the three trenches at a depth of 0.2 to 2 m. A high clay content greatly increases the difficulty of dewatering the soil.

Since no actual samples are available of the interceptor trench soil or drill cuttings to be generated during the closure activities, a worst-case situation (very high clay content) was assumed in sizing the dewatering equipment.

DEWATERING EQUIPMENT CHARACTERISTICS

Information was collected from manufacturers of three different types of dewatering equipment: rotary vacuum drum filters, automatic discharge pressure filters, and centrifuges (see Appendix for equipment specifications). Each of these types of equipment has different prescreening requirements. The vacuum drum filter is limited by the requirement that the solids stay suspended in the trough that feeds the filter; the manufacturer recommends prescreening down to 30-40 mesh (about 0.4 mm). The manufacturer of the pressure filter recommends prescreening down to 1.5 mm, and the centrifuge manufacturer suggests prescreening down to 100 mm. The estimated purchase cost for the equipment is \$80,000 for the rotary vacuum drum filter, \$320,000 for the pressure filter, and \$65,000 for the centrifuge. For all three types of equipment, the smallest commercial unit available is substantially larger

than required to process 800 kg/h, so the actual operation time required would be much less than 7 h/d.

Prescreening to 100 mm, as required for the centrifuge, could be accomplished by a fixed basket strainer. Either type of filter would require a vibrating screen unit with a water spray to flush the soil through the screens. The estimated cost for a 48-in. vibrating screen unit, which should be able to handle at least 800 kg/h of soil, is \$24,000 (information supplied by Sweco Inc., Florence, Kentucky).

RECOMMENDATIONS

Because of its lower cost and minimal prescreening requirements, a centrifuge is recommended to dewater the WAG 6 soils. The incoming soil and water slurry should be dumped through a 100-mm (1/2-in.) basket strainer into a settling tank. After settling, the water should be decanted, and the settled solids should be pumped to the centrifuge. It is recommended that the amount of water pumped to the centrifuge be minimized, since excess water can wash fine solids out of the centrifuge. The water discharged by the centrifuge could be routed back to the settling tank, or pumped through a bag filter, to remove any excess solids. The dewatered soil from the centrifuge could be discharged directly into a B-25 box for disposal.

It is recommended that the settling tank be sized to accommodate one day's production of soil slurry. The slurry would then have all night to settle before decanting the water and dewatering the soil. The centrifuge could process the solids in a few hours (or less), freeing the settling tank for the next day's accumulation of slurry.

REFERENCE

1. E. C. Davis, *Site Characterization Techniques Used at a Low-Level Waste Shallow Land Burial Field Demonstration Facility*, ORNL/TM-9146, Oak Ridge National Laboratory, 1984.

APPENDIX
DESCRIPTIONS OF DEWATERING EQUIPMENT

FROM: D-O MINERALS-PULPING

TO:

615 576 4195

FEB 7, 1992 4:02PM

P.01

DORR-OLIVER

Dorr-Oliver Incorporated
612 Wheeler's Farm Road
P.O. Box 3819
Milford, CT 06460-8719

MINERALS/PULP-PAPER PROCESSING

FAX NUMBER: 203-876-5599

If you have any problems receiving this message
please contact our Department Secretary at
telephone no. 203/876-5637

FAX MESSAGE

FAX NO: 615 - 576 - 4195

DATE: 7 Feb 92

TO: PAUL TAYLOR @ OAK RIDGE

FROM: JIM BOWENSON @ DORR

RE: YOUR FAX OF 4 FEB

I HAVE EXAMINED THE DATA IN YOUR FAX OF 4 FEB TO ME. BASED ON MY ESTIMATE OUR SMALLEST DRUM FILTER IS PROBABLY SOMEWHAT LARGE FOR YOUR APPLICATION. HOWEVER I WILL STILL SUGGEST THAT YOU USE A 6 FT DIA BY 4 FT FACE WIDTH FILTER AT THIS POINT. A RATHER QUICK AND DIRTY COST ESTIMATE FOR THAT FILTER COMPLETE WITH VACUUM PUMP, RECEIVERS, ETC IS ABOUT \$80,000. DRUM FILTER DIMENSION DATA IS SHOWN ON THE ATTACHED DATA SHEET.

Pre-screen - to 30-40 mesh ~ 1/8"

Floor space = 8 ft x 8 1/2 ft.

Weight ~ 7400 lbs

FROM: D-O MINERALS-PULPING

TO:

615 576 4195

FEB 7, 1992

4:03PM

P.02

Vorr-Oliver drum filter dimensional data.

LENGTH ft.	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	DIA. ft.	6	8	10	12	13
A	7'-10"	8'-10"	11'-10"	13'-10"	15'-10"	17'-10"	19'-10"	21'-10"	23'-10"	25'-10"	27'-10"	30'-7"	32'-7"	34'-7"	36'-7"	38'-7"	C	8'-4"	10'-4"	12'-4"	14'-4"	17'-0"
B	Drain on drum. $\odot$											8'-11"	7'-3"	7'-11"	8'-5"	8'-11"	D	8'-10"	8'-10"	10'-10"	12'-10"	14'-0"
V	Valve can be located on either or both ends. See dia. table for projection.																V	1'-5"	1'-7"	1'-7"	1'-7"	2'-1"
																	W	Add approx. 12" all dia.				

DIA. ft.	TOTAL FILTER AREA — SQ. FT. LENGTH IN FEET															
	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
6	76	113	151	188	226											
8			200	250	300	350	400									
10				310	372	434	496	558	620							
12					456	532	603	684	760	836	912					
13											980	1061	1143	1225	1306	1388

DIA. ft.	APPROXIMATE OPERATING WEIGHT — LBS. LENGTH IN FEET															
	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
6	7400	8900	10300	11700	13100											
8			20800	22000	24100	26250	28200									
10				24100	29500	35000	40250	45700	51000							
12					37000	40300	43700	47000	50300	53600	57000					
13											77000	82000	84300	88500	92900	122500

*Assume contents at 62.4 lbs./cu. ft. and 35% drum submergence.

4

01/23/92 09:44

301 381 4490

Larox Inc.

001

LAROX H

Page 1 of 2
January 23, 1992

To: Oak Ridge National Laboratory

Attn: Paul Taylor

From: Kevin/Larox, Inc.

Paul:

After reviewing your fax I am providing you with the following information. I have sized a filter conservatively and assume that if we get reasonable results the sizing, in terms of required ft², would be less. However, if we reduce the area required, the foot print would remain the same.

The filter I recommend is a Larox PF 9.5 AOH Filter. This filter has 101ft² of filtration area and is expandable to 135ft² if required. the dimensions for this filter are as follows:

Length	12'6"
Width	10'5"
Height	8'6"
Weight	11 tons

Budget prices for this filter is as follows:

Epoxy painted mild steel,	\$ 320,000.00
304 stainless steel,	\$ 360,000.00

We recommend that you pre-screen out and solids larger than 1/16" so as not to have any blockage concern with the filter.

I hope this information is helpful. I am also sending a spec sheet that includes this model filter. Please feel free to call me if you have any questions.

Sincerely,

Kevin J. Haggerty
Larox Inc.

LAROX

FILTERS

Larox PF 1625 A OH

Larox PF Automatic Pressure Filter

Technical data*/Hydraulic operation Type PF 9.5-38 H

Type Larox PF — H	9.5	12.5	16	19	22	25	28	32	35	38
Filtration area	sq ft	101.7	136.6	169.5	203.4	237.3	271.2	305	338.9	406.7
Filter plate size	in.	35-7/16" x 68-7/8"								
Number of filter plates		6	8	10	12	14	16	18	20	24
Maximum pressure	psi	232								
Filter cloth — width	in.	41-5/16"								
— length	ft	72.2	88.6	108.9	123	142.7	159.1	177.2	191.9	211.6
Basic dimensions:										
— length	in.	151-1/2"								
— width	in.	128"								
— height	in.	141-3/4"								
— weight, does not include auxiliary equipment	tons	11	12.1	14.3	16.4	18.5	17.8	18.7	19.8	20.9
Required floor area	sq ft	376.6								
Required power										
— hydraulic unit	kW	18.5								
— water pump	kW	5.5			11.0				15.0	

Construction material alternatives for wetted parts:

0 = epoxy painted mild steel, 1 = stainless steel AISI 304, 2 = stainless steel AISI 316, 3 = sulphuric-acid proof stainless steel.

Please note that the Larox PF filter is designed for easy and economical expansion through the addition of extra chambers to the basic frame. For example a PF filter initially having a filtration area of 169.5 ft² can be expanded to up to 271.2 ft².

*Subject to change without notice.

**FAX FROM:
CENTRIFUGAL & MECHANICAL INDUSTRIES**

TELECOPY COVER SHEET

WE ARE TRANSMITTING FROM A DEX 6700 FACSIMILE MACHINE.
OUR NUMBER IS 314-894-7867. PLEASE PHONE US, AT 314-894-1711
IF THERE IS ANY PROBLEM WITH THIS TRANSMISSION.

DATE: March 4, 1992 FROM: Buddy Sebastiao

TO: Mr. Paul Taylor FAX #: 615-576-4195

COMPANY: Oakridge National Laboratories PAGES (INCL. THIS): 9

RE: CMI Model EBW Centrifuge

MESSAGE:

Dear Mr. Taylor:

As you requested, we have attached copies of our brochure pages and two drawings related to the CMI Model EBW Centrifuge. We will also be forwarding these by mail in case anything comes out hard to read. Let me know if you require any additional information.

Sincerely,

CENTRIFUGAL & MECHANICAL INDUSTRIES

A. Buddy Sebastiao

A. Buddy Sebastiao
Manager of Marketing
& International Sales

*Cost ~ \$65,000
Prescreen < 1/2"*

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37. Office of Assistant Manager for Energy Research and Development, DOE Oak Ridge Field Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
38. P. Chatterji, Ebasco Services, Inc., Union Valley Road, Oak Ridge, TN 37830
39. P. H. Edmonds, Radian Corporation, 120 South Jefferson Circle, Oak Ridge, TN 37830
- 40-43. W. E. Murphie, Department of Energy, Office of Environmental Restoration, Eastern Area D&D Branch, EM-423 (GTN), Washington, DC 20545
- 44-45. R. C. Sleeman, DOE Oak Ridge Field Office, P.O. Box 2001, Oak Ridge, TN 37831-8540
46. S. P. Riddle, DOE Oak Ridge Field Office, P.O. Box 2001, Oak Ridge, TN 37831-8541
- 47-48. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831

END

**DATE
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7 / 29 / 92