SECTION V

SLUDGE DEWATERING "PILOT PLANT" TESTS

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A. General

Sludge dewatering considerations necessitated the on site services of "pilot plants" of various types and modes of dewatering to effectively evaluate and determine the most cost effective system. Initially the evaluation was considered to be based solely upon reports and discussions of similar processes already in existence. However, services of two proprietary dewatering equipment assemblies were secured to produce additional. data. The unique sludges generated at the treatment plant and the availability of a third non-proprietary dewatering assembly excited the idea that new up-to-date and relative test results would appreciably complement the objectives of the study.

Subsequent to disappointing results at Warminster, PA with the Sharples centrifuge it was deemed advisable to try the D.E.R. "Yellowboy" centrifuge at the AMD plant, especially in view of lack of testing by the other centrifuge manufacturer contacted Bird Machine. Prior unsatisfactory results were borne out.

Consequently, four "pilot plants" were ultimately operated and produced sludge dewatering criteria. Each of the "pilot plants" were self-contained units, brought to the project site by the owner or fabricator along with the necessary complement of operating personnel. The units were located outside, to the rear of the control building. Electrical power was supplied from the treatment plant by connection to existing circuitry. The treatment plant operations personnel assisted as requested and provided facilities for sanitary, laboratory, communications, statistical ledgering, etc. to assist in the "pilot plant" operations. Representatives of L. Robert Kimball & Associates were present and provided guidance and direction of operations as well as the performance of many of the chemical analyses.

Each available option of treatment plant operations was pursued to produce a representative sludge from the clarifiers. Sludge recirculation in the abandoned mine was held to a minimum in order that typical treatment plant operations would be occurring.

The dialogue in this section of the report is intended to provide a concise but clear understanding of each of the four "pilot plants" utilized. To assist in this presentation the use of photographs, (Section X-Appendix A) taken at the time of "pilot plant" operation, is included. Each assembly is considered individually due to the extreme differences in functioning and operation of the various equipment components.

B. <u>Ancatec - Barefoot Corporation - Vacuum Filter Leg</u>

The first "pilot plant" operation began July 16, 1979 and concluded July 20, 1979. This unit was by:

Ancatec - Barefoot Corporation
4261 William Penn Highway
Murrysville, Pennsylvania 15668
Phone (412) 327-7737
President - Gary S. Barefoot

The "vacuum filter leg" and attached components were vehicle mounted readily set up on the ground near clarifier number 4. Accessory equipment was located nearby as space permitted its installation and proper functioning.

1. Major Equipment Items (See Figure V-1)

a. Dewatering Cone

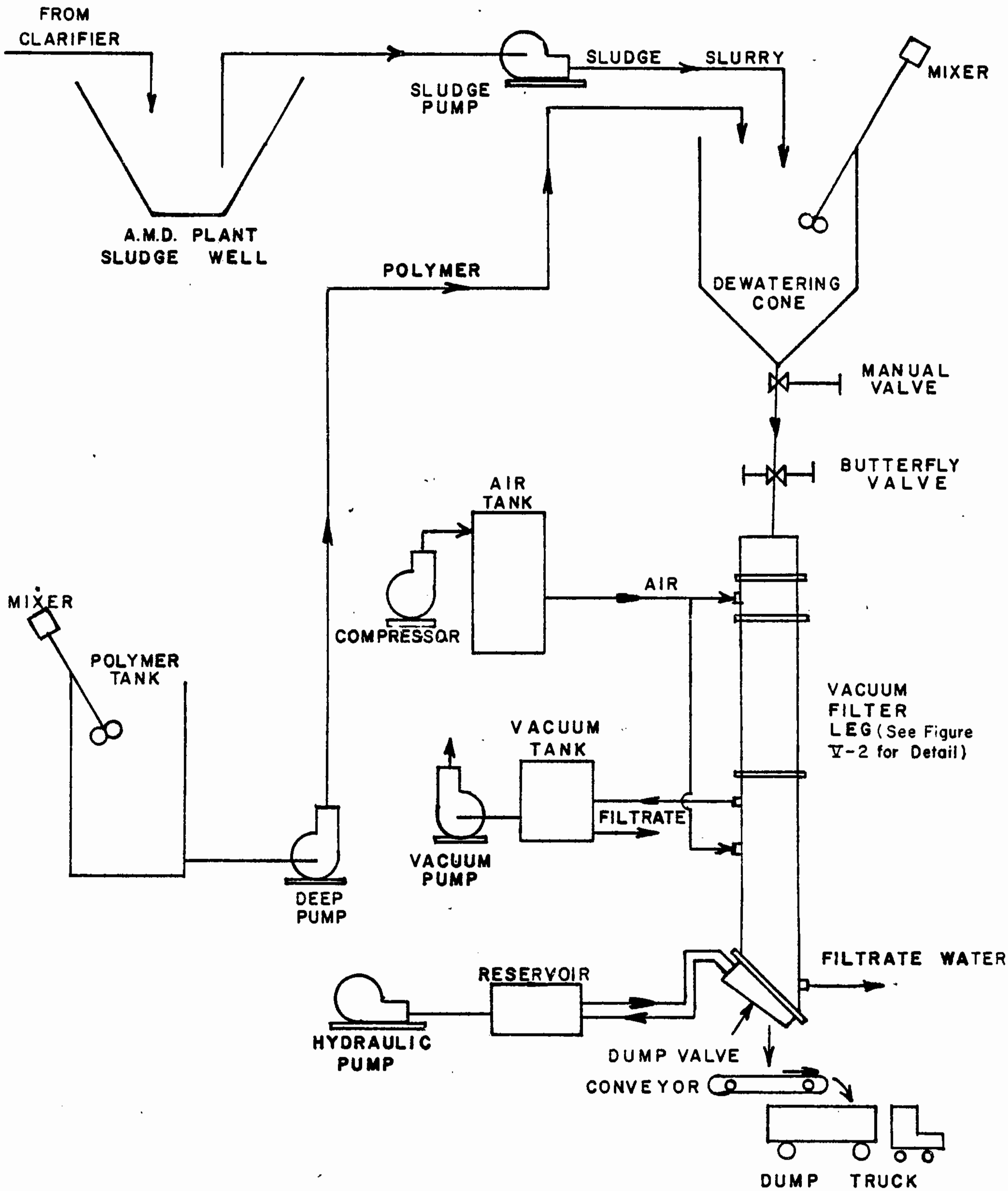
This unit provided a detention time. needed for mixing and action of flocculants in the feed sludge. It was fitted with a mixer and a hose from the polymer feed unit. On the picture (Appendix A) it is the top most tank with the hopper (or conical) bottom. The bottom of the dewatering cone was equipped with a manually operated shut off valve.

b. Vacuum Filtering Leg (See Figure V-2)

This unit was an eight (8) inch unit with total capacity of 12.82 gallons. Preconditioned sludge entered this unit at the top, was compressed by air, dewatered by a vacuum system and emptied from the bottom utilizing a hydraulic cylinder operated dump valve. The vacuum filtering leg was equipped with taps for air and vacuum connections. The picture, second photo in Section X, shows this item of equipment directly under the cone in the center of the structural framework. It appears as a light colored pipe with a top horizontal flange and a bottom flange at an angle to the unit centerline axis. The hydraulic system and pump is near the electrical box.

c. Vacuum System

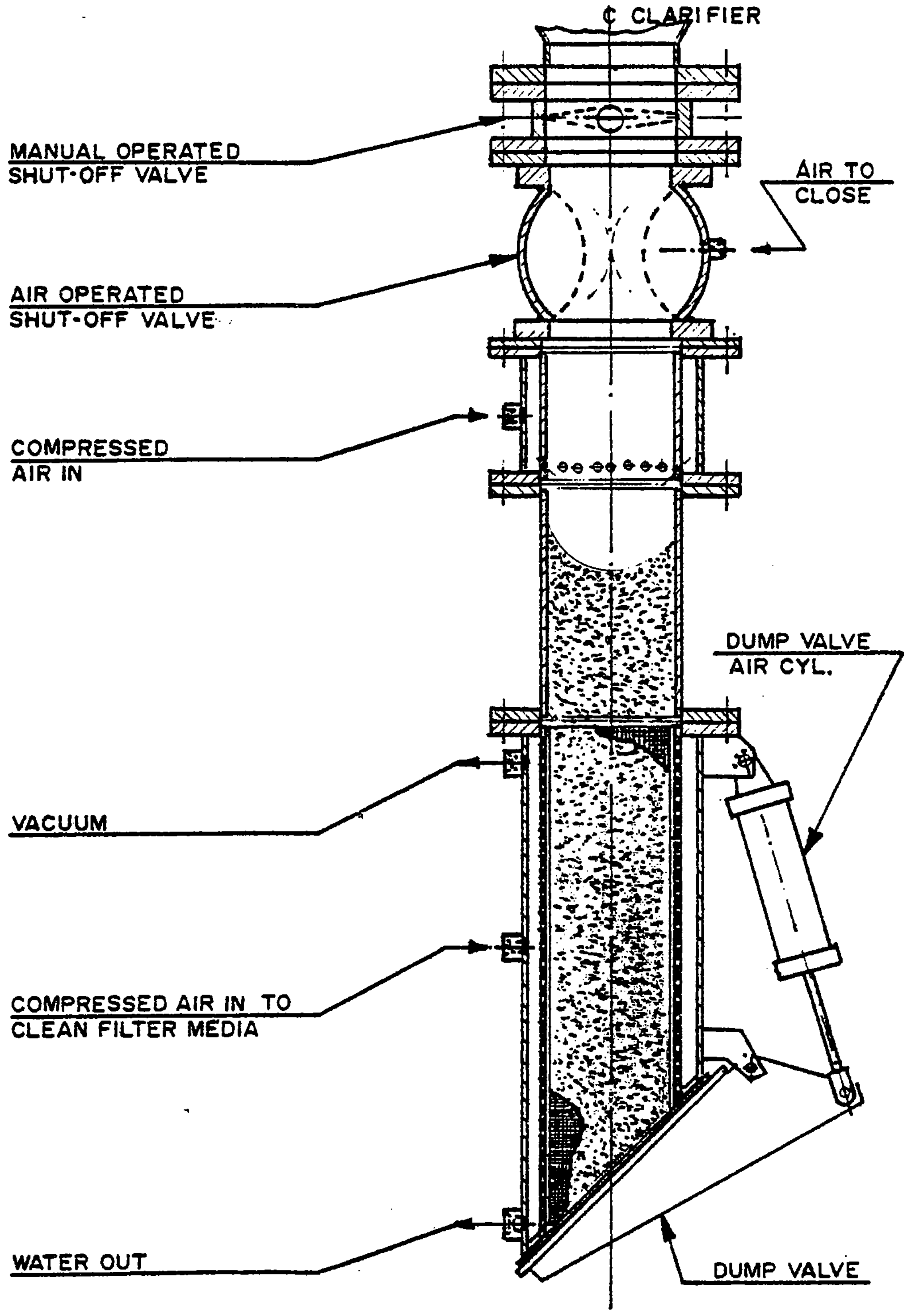
The vacuum system consisted of a vacuum - pump mounted adjacent to the vacuum filter leg tower and fitted with a vacuum/dewatering tank, piping, solenoid valves, gauges, etc. for dewatering the compressed sludge in the vacuum filter leg. The unit is pictured between the trailer mounted equipment and the treatment plant Aerator Number 2. (See Appendix A).



ANCATEC - BAREFOOT CORPORATION

VACUUM FILTER LEG SCHEMATIC

Figure V-1



VACUUM FILTER LEG DETAIL

Figure V-2

d. Compressed Air System

The supply of compressed air came from the pressure air supply reservoir located near the front of the trailer. Note the light colored tank near the 55 gallon polymer drums. This system consisted of a compressor, storage tank, gauges, piping, solenoid valves, etc. for compressing the sludge in the vacuum filter leg.

e. Flocculant System

Mounted on the trailer were two 55 gallon drums containing polymers. One drum had a mixer mounted on it to assure proper polymer mixing. A flocculant feed pump adjacent to the polymer drums furnished the polymer to the dewatering cone where it was thoroughly mixed with the feed sludge.

f. Electrical Controls

A full complement of electrical controls including terminal strips, motor starters and heaters, timers, lights meters and accessories were located in a weatherproof electrical control center mounted on the structural framework near the vacuum filter leg. This unit was supplied with power from the treatment plant power supply to the one waste sludge pump.

2. General Plant Operations

Treatment plant sludge was received from waste sludge well number 2. It was pumped to the dewatering cone by using a small gasoline operated lift pump. In the dewatering cone the sludge was mixed with a polymer and detained until fed by gravity into the vacuum filter leg. NOTE: The polymer utilized was not disclosed although it was a liquid type flocculant aid.

The vacuum filter leg operated as follows: Sludge slurry was allowed to enter the leg through the top and with the dump valve (bottom valve) closed the cylinder filled with slurry. The top valve was then closed with compressed air. An air vacuum was then made in the air chamber space of the bottom stand pipe section which extracted the water from the slurry by allowing compressed air to be filtered into the top space through perforations in the upper stand pipe section. Any water not entrained in the evacuated air was drained by gravity from the bottom of the air chamber space through a pipe provided with an automatic shut-off valve to hold the evacuated water from the slurry.

The slurry in the center of the cavity is dewatered and formed into a slug which is discharged by opening the dump valve. The remaining solids is discharged by applying compressed air to the outside of the filter media (bag which lines the vacuum filter leg cylinder).

VACUUM FILTER LEG OPERATION SEQUENCE

i. Flap Valve Closes
ii. Vacuum Fill - Butterfly Valve Open
iii. Butterfly Valve Closes
iv. Pressurize/Vacuum
v. Breakthrough (Optional)
vi. Vacuum Refill- Butterfly Valve Open
vii. Butterfly Valve Closes
viii. Pressurize/Vacuum
ix. Relieve
x. Flap Valve Open
xi. Purge

The operation of the Vacuum Filter Leg is normally accomplished automatically by means of adjustable electrical timers to energize the compressed air solenoid valves to perform all the described sequences of opening and closing the valves (shut off and dump valves), start and stop the vacuum system, relieve the vacuum system, purge the air chamber space, clean the filter media surface with compressed air and drain the evacuated water away for disposal from the vacuum filter leg and reset the timers to repeat automatically all the above described sequences.

During the operation of the pilot plant a total of six runs were performed. This being only a single unit, a batch type operation was necessitated. Multiple units would operate in a sequence to produce a continuous discharge of dewatered material.

Filtrate was returned to Aerator Number 2 for processing through the mine water treatment plant.

3. Proprietary Considerations

The process of dewatering sludge or slurry by the use of a vacuum filter leg is a patented process which implies that there are certain protection of interest features attached to its performance. The "pilot plant" report therefore is confidential and is available only on a limited basis.

Equipment uitlized in the process can be bid competitively except the vacuum filter leg. The process cannot be bid competitively, however, the process can be bid against another process.

4. Results

The "pilot plant" produced a sludge cake that could be hauled on a standard truck over public thorofares to a point of ultimate disposal. A visual description of the cake showed moderate dryness with some free water. Percent solids by weight after 9 hours drying time at 100°C ranged from 13.2% to 16.5%. The slurry from the leg core averaged 3.7% solids.

C. Liquid Removal Service Company, Inc. (L-R-S) - "Black Box"

The second "pilot plant" operation began September 6, 1979 and concluded September 14, 1979. This unit was by:

Liquid Removal Service Company, Inc.
P.O. Box 130
Broomall, Pennsylvania 19008
Phone (215) 328-9292
Agent - Alex Petroski

This "pilot Plant" is commonly referred to as the "black box" process since access to the working components was not permitted. The equipment was housed in a closed tractor-trailer and parked on the service roadway behind the control building near clarifier number 2 (See photographs in Appendix A).

1. Major Equipment Items (See Figure V-3)

a. Tank Truck

Sludge from the treatment plant was discharged into a closed tanker type truck body where we assume the sludge slurry was mixed with a flocculant. Access to the truck was not permitted and an explanation was not made as to its function and operation.

b. Tractor-Trailer

From the tank truck, materials were pumped to a nozzle on the exterior of a closed tractor-trailer. This nozzle was the feed opening to certain equipment and machinery inside the trailer. The final sludge cake was discharged through a hole in the underside of the trailer at the opposite end from the entrance nozzle. Prohibited access to the tractor-trailer prevented our identifying any equipment inside the trailer.

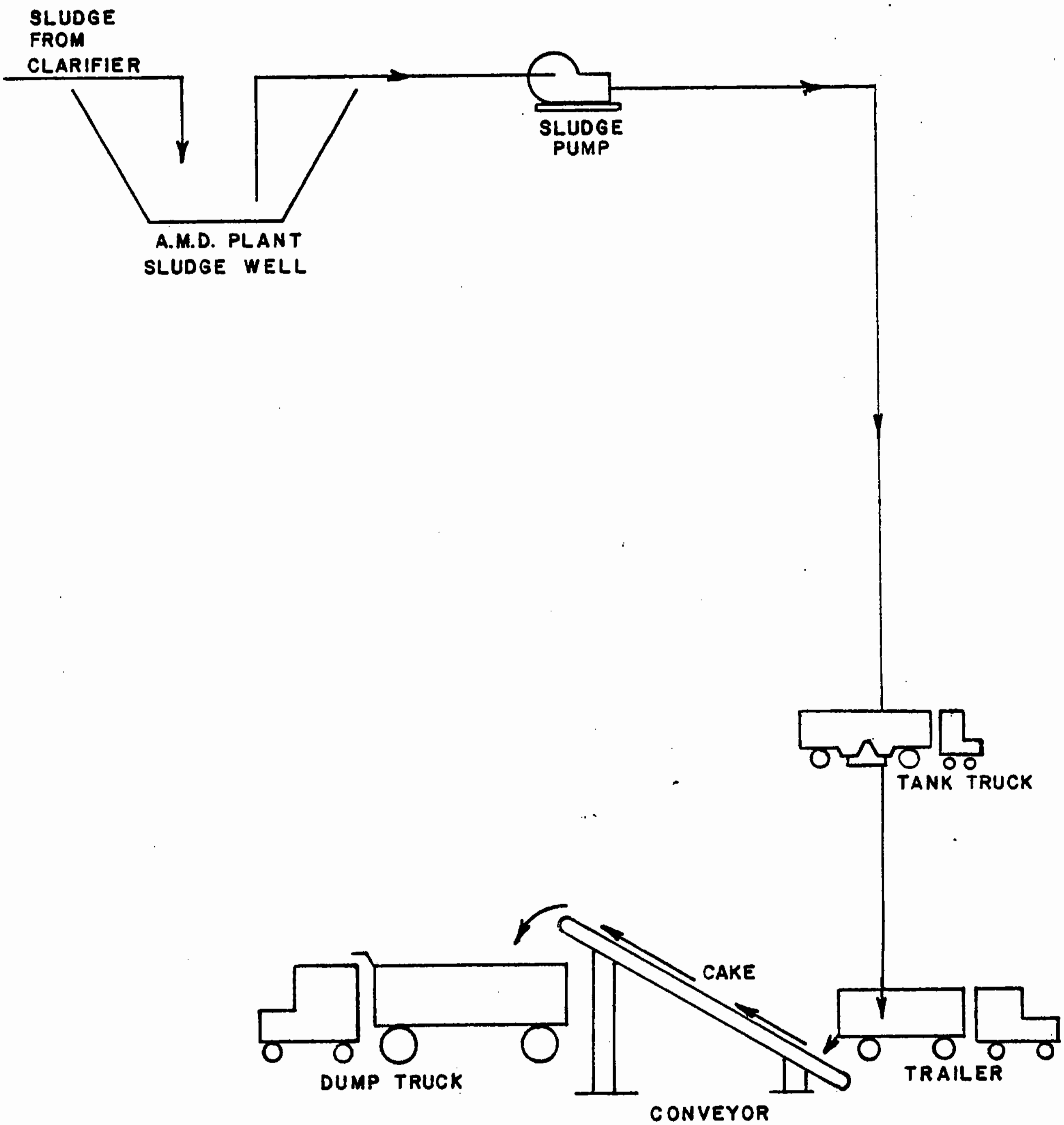
c. Conveyor

From the trailer outlet, the filter cake dropped onto a conveyor belt which lifted the final sludge cake to a parked dump truck (DER's) which would haul it to a disposal site.

2. General Plant Operations

Treatment plant sludge was received from waste sludge well number 1. It was pumped to the tanker truck as needed in a batch type operation.

The secrecy of plant operations prohibit a detailed listing of plant operations. Operations personnel admitted that they were using proprietary flocculants (polymers) in conditioning the sludge slurry for dewatering.



LIQUID REMOVAL SERVICE
"BLACK BOX"
SCHEMATIC

Figure V-3

Filtrate was returned to a clarifier where a significant reduction in sludge volume was obtained. Even the clarifier supernatant became considerably clearer. A test of clarifier sludge showed that it had advanced from 0.5% solids to about 3.5% solids.

Approximately 60 tests were run during the period this facility was in operation.

3. Proprietary Considerations

Again, due to the limited access provided representatives of L. Robert Kimball & Associates as well as DER personnel, an evaluation of the amount of proprietary items utilized cannot be determined. The company agent said that the polymer used was a proprietary item.

It is possibly due to proprietary considerations that an extremely limited final result report and analysis was provided L. Robert Kimball & Associates by L-R-S.

4. Results

The "pilot plant" produced a sludge cake that could be hauled on a standard truck over public thorofares to a point of utimate disposal. A visual description of the cake showed very little moisture. Depositing in a container of water showed no immediate evidence of slaking or absorption of water by the cake. Prolonged weathering of the cake on a pile outside the treatment plant fence showed evidence of deterioration of cake into powder; however, no evidence of iron in the leachate was visable. Percent solids after stabilization was reported to be from 19.5% to 25.5%. L-R-S reported the need for a successful thickening operation prior to sludge dewatering by their process.

D. <u>Euramca "Ecosystems," Inc. - Belt Filter Press</u>

The third "pilot plant" operation began November 8, 1979 and concluded November 9, 1979. This unit was by:

Euramca, Inc.
P.O. Box 349 40 Fay Avenue
Addison, Illinois 60101
Phone (312) 628-1313
Agent - John A. Drozda

The continuous belt filter press and accessories were all vehicle mounted on a single tractor trailer. The unit was parked behind the control building near the loading dock. (See photographs in Appendix A).

1. Major Equipment Items (See Figure V-4)

a. Flocculant System

A complete mixing and polymer feed system was located on the front end of the trailer. Equipment included storage tanks, mixers, feeders, controls, piping, etc. all as might be needed to thoroughly and effectively supply selected flocculants to the raw material inflow to the dewatering facilities.

b. Electrical Controls

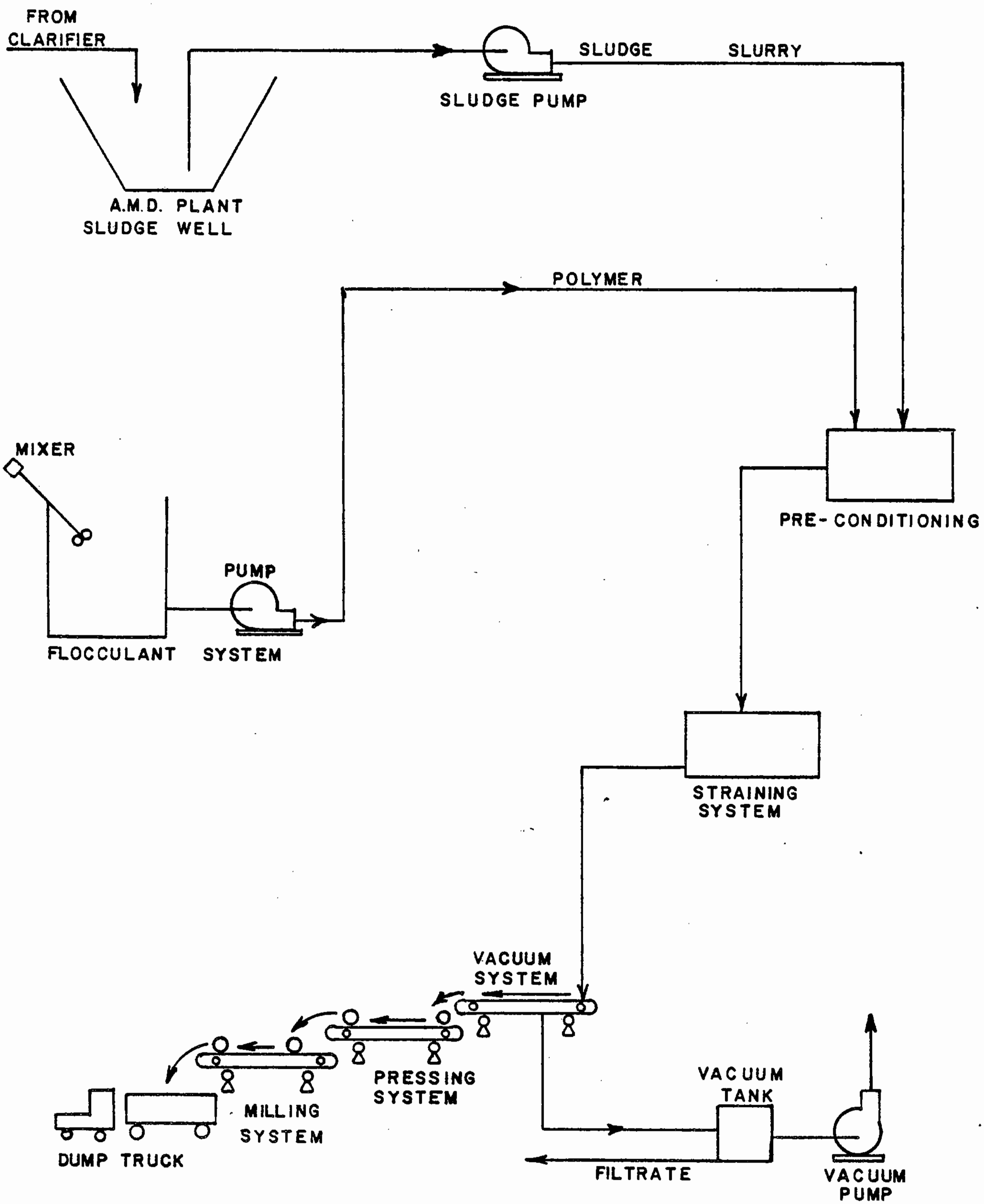
Just behind the flocculant system, near the middle of the trailer, was located a full complement of electrical controls housed in weatherproof enclosures. Electrical controls for all the various components of sludge dewatering were located at the same place to facilitate total plant operation. This unit was supplied with power from the treatment plant power supply to the one waste sludge pump.

c. Straining System

Following the pre-conditioning of the sludge slurry with polymer/polymers the slurry passes through a duplex perforated revolving drum section where the free water drips away and the sludge is uniformly distributed on the filter belt. At the discharge point of the straining system the dry solids content of the sludge was approximately 6.3%. Therefore, the solids content had increased from 1.7% out of the clarifiers by 4.6% through the straining system to a discharge quantity of 6.3%.

d. Vacuum System

A vacuum system was mounted on the pilot plant vehicle to create a slight vacuum in one section of the filter belt press. This vacuum created a suction on the filter belt which assisted in dewatering the sludge prior to entering the pressing area of the filter belt press. This suction on the layer of sludge on the filter belt forms a micro-filter and the sludge cake becomes a plastic, easily pressable consistency. A vacuum pump, motor, piping, controls and vacuum adjustment featrues were provided for maximum flexibility in the vacuum sytem.



EURAMCA "ECOSYSTEM" BELT FILTER PRESS SCHEMATIC

Figure V-4

e. Pressing System

The pressing system existed within the filter belt mechanism. Following the sludge conditioning to a plastic consistency, the pressing zone further dewatered the sludge until it was of maximum solids content. By vacuuming the sludge before pressing, the sludge did not stick to the filter belt or squeeze through the filter belt material. It was easily discharged to the receiving vehicle that was used to haul the final product away. The pressing system consisted of a slight belt tension which created a nominal pressure.

f. Milling System

Following the pressing system is a milling zone within the filter belt mechanism. This high pressure area was on the pilot plant unit but was not used on this pilot plant study. Further dewatering beyond the pressing system could not be accomplished. This was attributed to the cellular water remaining in the sludge which could not be removed by filter belt pressing. This "milling system" is an optional zone for the Euramca Ecopress. This zone is a high belt tension area which would create a high pressure situation. Dewatered sludge passed through the milling area without further action on the sludge. It then was discharged onto the vehicle used for hauling the final sludge cake to ultimate disposal.

2. General Plant Operation

The pilot plant dewatering team spent the first day at the acid mine drainage treatment plant testing various polymers on the sludge generated from the plant. Polymers were cationic, anionic/cationic and anionic substances which produced varying degrees of activity with the clarifier sludge. A total of 26 polymer clarifier sludge combinations were tested utilizing 10 different polymers.

Conditioned sludge samples were poured onto a filter belt screen of mesh opening of 550-750 microns. This provided an evaluation of the ability of the sludge to filtrate by measuring the filtrate quantity against time for each sample. Compression tests of the flocculated and gravity dewatered sludge were conducted on a bench scale (0.2 meter) laboratory belt press. It was discovered that the conditioned sludge could be moderately compressed and maintain good release characteristics. High pressure caused the sludge to exude through the belt media; due to the fineness of the sludge solids.

During full scale operation of the "pilot plant" the treatment plant sludge was received from waste sludge well number 1. It was pumped to a conditioning unit where it was thoroughly mixed with a flocculant. The flocculant used was a cationic polymer called Percol 767. This polymer had previously been tested on a laboratory belt press on similar sludge.

Operation of the "pilot Plant" belt filter press was continuous (unlike the other two pilot plant operations); the only limitation was maintaining a supply of polymer for pre-conditioning of the sludge slurry. Operation continued for about a six hour period until the polymer supply was exhausted. No adjustments in the operational mode was made after the preliminary belt tests were completed and the unit was operating at a stable rate.

3. Proprietary Considerations

The process of dewatering sludge or slurry by the use of belt filter presses is not a proprietary method or process. Although certain elements of various manufacturers belt filter presses may be patented and therefore proprietary, there are several manufacturers of similar equipment to perform this process and consequently this process can be bid competitively.

A summary of test results was prepared in report form and submitted by Euramca, Inc. to L. Robert Kimball & Associates. This report is made a part of this report and is found in Appendix B.

4. Results

The "pilot plant" produced a sludge cake that could be hauled on a standard truck over public thorofares to a point of ultimate disposal. A visual description of the cake showed moderate dryness with a slight amount of free water. Percent solids by weight after 18 hours drying time at 103°C ranged from 12.8% to 14.0%.

Opinions from the owner of the "pilot plant" indicate that a 14% solids is readily obtained on the AMD sludge. With an optimized "Ecopress" belt filter operation, polymer use could increase the dewatering efficiency to 16% solids. Further solids content (such as 20% or greater) can be obtained by installing a "quick lime stabilization" system which would add lime to the cake, mix the cake and lime together, and produce a larger volume. but higher solids content sludge cake.

E. <u>"Yellowboy" Operation - Centrifuge</u>

1. Introduction

The Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Operations provided the services of the "Yellowboy" trailer at the Carl A. White Water Reclamation Plant. The purpose of this operation was to determine what dewatering capabilities the centrifuge had on the sludge generated from the AMD plant. The data secured from this "pilot" operation will then be compared with data received from other centrifuge operations to substantiate the validity of the manufacturer's information.

The "Yellowboy" trailer contains a Mercobowl Centrifuge, Model Z-1 which was manufactured by Dorr-Oliver Incorporated of Stamford, Connecticut. A Moyno, type CDQ progressing cavity pump feeds the centrifuge. The pump receives sludge from the underflow of a clarifier located on the trailer.

2. Machine Description

a) Centrifuge

The MercoBowl is a horizontal, fully continuous, solid bowl centrifuge suitable for a wide range of applications; separation of solids from liquids, classification of solids, and clarification of liquids.

The centrifuge machine consists of a rotating conicalcylindrical bowl with an inner hollowshaft conveyor scroll rotating at a slightly higher speed than the bowl. This differential speed is obtained through a special cyclodrive gear. Feed introduced internally through a stationary pipe in the hub of the scroll, accelerates to machine speed and is distributed to the liquid pool through ports in the scroll. Solids in the feed settle and compact under centrifugal force (up to 5200 x gravity) against the walls of the bowl and are conveyed by the scroll up the conical bowl, out of the liquid pool to the drying beach area. Here drainage is accelerated under the influence of high centrifugal force, producing a substantially dry cake that is discharged through ports in the small diameter end of the bowl into the stationary solids discharge chute. Clarified liquid flows to the opposite or large diameter end of the bowl, overflows the pool depth regulating ring and is discharged by the integral overflow pump under pressure. A discharge pressure of 30 psi is considered to be the maximum discharge pressure obtainable with normal power consumption.

A special design feature of the centrifuge provides small ribs on the interior surface of the bowl. These ribs retain a stationary coating of solids on the bowl wall, preventing bowl wear. All parts of the machine, including the motor, are mounted on a common base. The base rests on rubber mounts which absorb vibration. Besides serving as a means of mounting, the base also provides weight and mass to give the machine rigidity.

The centrifuge is driven by a 10 Horsepower, 220 volt, three phase centrifugal squirrel cage type motor. The motor speed is rated at 3600 RPM with a belt drive and sheave arrangement to the centrifuge to produce a centrifuge speed of 5600 RPM. The full load current draw of the motor is 27 amperes.

b) Pump

The progressing cavity slurry feed pump is fitted with a variable speed (manually operated) controller. The pump utilizes a 3/4 Horsepower motor suitable for use on either 208 or 220 volt three phase service. The motor speed is 1800 RPM. The full load current draw of the motor is 3.1 amperes. The output rating of the pump is from 0 to 9 gallons per minute.

c) Clarifier

A 6'-0" diameter by 5'-6" high stainless steel clarifier with bottom sludge scrapers is utilized as a thickening and/or settling basin. The clarifier outlet is from the center bottom. The inlet is center feed through a skirted center well. The supernatant flows over a "V" notch weir overflow plate. The total clarifier volume is 1,163 gallons. Effective capacity is approximately 1,000 gallons.

3. Coagulant Aid (Polymer)

Several different types of polymers were tested in the Professionals laboratory on sludge samples from the Ernest Mine AMD plant. The ultimate selection for use was Percol 727 which is an Anionic polymer produced by the Allied Chemical Company. This material is purchased in granular form and must be mixed with water prior to application to the sludge.

The polymer solution was prepared at a strength of 0.2%. This choice was selected with consideration given the size of mixing and holding apparatus available of the Ernest Mine Plant. A 0.2% polymer mix is equilvalent to 756.8 grams of polymer per 100 gallons of water. The polymer solution was mixed in one of the lime slurry vats and pumped to the "Yellowboy" with the lime slurry progressive cavity pump.

4. Work Description

The pilot plant operation was performed on two separate days: March 26, 1980 and March 28, 1980 with Run 1 thru 4 completed the first day and Runs 5 thru 10 completed the second day.

Sludge was transferred from the AMD plant waste sludge well #2 to the "Yellowboy" clarifier using a portable pump. Some sludge was taken from the sludge recirculation force main which terminates on the top floor of the Control Building.

On the first day 530 gallons of AMD sludge was placed in the Yellowboy Clarifier. The first two runs of the centrifuge used 142 gallons of sludge with no polymer added. With 388 gallons of sludge remaining, 78 gallons of 0.2% polymer were added to the clarifier. Runs 3 and 4 were then conducted.

On the second day 650 gallons of AMD sludge was placed in the Yellowboy clarifier. 10 gallons of 0.2% polymer solution was added to the 647 gallons of sludge. Runs 5 and 6 then were performed which used 220 gallons of conditioned sludge. To the remaining 440 gallons of conditioned sludge was added 10 gallons of 0.2% solution of polymer. Runs 7 and 8 then were performed which used 230 gallons of conditioned sludge. To the remaining 220 gallons of conditioned sludge was added 10 gallons of 0.2% solution of polymer. Runs 9 and 10 then were performed which used 180 gallons of conditioned sludge.

The sludge volume was not measured for Runs 1 thru 4; however, the dried sludge from Runs 5 thru 10 (630 gallons of AMD sludge) totaled 1.295 Cu.Ft. or 9.7 gallons.

5. Test Data Tabulation

Two pages titled "Carl A. White Water Reclamation Plant Yellowboy Centrifuge "Pilot Plant " Operation" display the results of the tests run on the Yellowboy for these two days. See pages 5 and 6 of this report.

6. Results

The results obtained indicate that a sludge cake with percent solids between 12.6 and 18.3 can be obtained by utilizing a centrifuge for dewatering the sludge. However, a considerable quantity of sludge remained in the centrate in all runs performed. The best run was number 7 where a high solids content in the sludge cake was observed with a low solids content in the centrate. During this run the centrifuge feed was at a low rate which magnifies the size of centrifuge needed for full scale operation. The centrifuge produced an acceptable sludge cake (13.6% to 17.5% solids) for land disposal without the use of polymers (see runs 1 and 2); however, the total sludge removed was not as good as desired.

7. Conclusions

A centrifuge can be used to dewater the sludge to a point acceptable for landfill disposal. The quantity of sludge remaining in the centrate is high, which will contribute to a build-up of sludge within the AMD plant. The composition of the sludge in the centrate is estimated to be of such chemical and physical quality that it cannot effectively be dewatered. As a concluding remark, the consultant does not feel that centrifuge dewatering is a viable method of dewatering the Ernest Mine AMD sludge.

8. Recommendations

The data generated from the "Yellowboy" centrifuge has not provided the consultant with information upon which to recommend this process for utilization in sludge dewatering. Therefore, the consultant does not recommend that sludge dewatering by a centrifuge be considered.

CARL A. WHITE
WATER RECLAMATION PLANT

YELLOWBOY CENTRIFUGE "PILOT PLANT" OPERATION

TEST RUN	1	2	3	4	5
DATE RUN	3/26/80	3/26/80	3/26/80	3/26/80	3/28/80
CENTRIFUGE RUNNING TIME (MIN.)	60	30	20	20	30
POLYMER NAME	None	None	Percol 727	Percol 727	Percol 727
POLYMER CONCENTRATION (%)	0	0	0.2	0.2	0.2
POLYMER VOLUME (GAL)	0	0	78	78	10
AMD SLUDGE VOLUME (GAL)	530	497	388	388	650
RAW FEED SLUDGE (% SOLIDS)	1.7	1.7	1.7	1.7	1.2
THICKENER SUPERNATANT (% SOLIDS)	1.2	1.1	0.2	0.2	1.0
THICKENER UNDERFLOW (% SOLIDS)	1.5	1.3	1.9	1.6	1.5
SLUDGE CAKE (% SOLIDS)	17.5	13.6	12.6	11.3	18.3
CENTRATE (% SOLIDS)	1.2	1.1	1.4	1.6	1.2
FEED SLUDGE VOLUME (GAL)	33	109	70	110	105
FEED PUMP SETTING (0-9)	4	8	4	8	4
FEED RATE (GAL/MIN)	3.5	5.6	3.5	5.6	3.5
LENGTH OF RUN (MIN.)	10	20	20	20	30
CENTRIFUGE AMPERAGE	13.2	14.0	13.0	14.0	13.0
SLUDGE CAKE VOLUME (Cu.In.)			259	94	*

CARL A. WHITE
WATER RECLAMATION PLANT

YELLOWBOY CENTRIFUGE "PILOT PLANT" OPERATION

TEST RUN	6	7	8	9	10
DATE RUN	3/28/80	3/28/80	3/28/80	3/28/80	3/28/80
CENTRIFUGE RUNNING TIME (MIN.)	20	30	20	20	20
POLYMER NAME	Percol 727	Percol 727	Percol 727	Percol 727	Percol 727
POLYMER CONCENTRATION (%)	0.2	0.2	0.2	0.2	0.2
POLYMER VOLUME (GAL)	10	17	17	19	19
AMD SLUDGE VOLUME (GAL)	650	450	450	230	230
RAW FEED SLUDGE (% SOLIDS)	1.2	1.2	1.2	1.2	1.2
THICKENER SUPERNATANT (% SOLIDS)	1.1	0.3	0.2	0.2	0.2
THICKENER UNDERFLOW (% SOLIDS)	1.5	1.5			
SLUDGE CAKE (% SOLIDS)	16.7	18.0	17.3	17.0	12.8
CENTRATE (% SOLIDS)	1.2	1.1	1.2	1.2	1.4
FEED SLUDGE VOLUME (GAL)	115	90	140	60	120
FEED PUMP SETTING (0-9)	8	4	8	4	8
FEED RATE (GAL/MIN)	5.6	3.5	5.6	3.5	5.6
LENGTH OF RUN (MIN.)	20	30	20	20	20
CENTRIFUGE AMPERAGE	14.0	12.5	14.0	12.5	14.0
SLUDGE CAKE VOLUME (Cu.In.)	*	*	*	*	*

* Total of all asterisks = 1.295 Cu.Ft. or 9.7 gal.

Composite cake of runs with asterisks = 13.7% solids by weight