



PROSPECTUS ON ELIMINATION OF REFUSE PONDS USING PASTE THICKENING TECHNIQUE



Fine coal refuse slurry ponds are seen as a liability for the coal industry. The purpose of this prospectus is to set-up a group research program for the coal industry to investigate a novel refuse disposal technique which will eliminate or reduce the size of the slurry ponds.

INTRODUCTION

Increased mechanization in the underground coal mining industry has decreased selectivity and increased the volume of refuse produced. Coal preparation separates non-combustible material from coal. Thus, a coal preparation plant separates the material it receives into a product stream and a reject streams, which may be further divided into coarse and fine refuse streams. Depending on the source, 20 to 50 percent of the run-of-mine material ends up in reject streams. One of the reject streams is slurry, which consists of water, coal fines, silt, sand, and clay particles,

and is commonly disposed of in an impoundment. MSHA oversees 713 active fresh-water and slurry impoundments in the United States. The coal industry is required to monitor the impoundments constantly and maintain the dikes holding the slurry. There have been several incidents of impoundment breakthroughs. Of these, Buffalo Creek in 1972 and Martin County coal in 2000 have drawn the attention of federal and state governments and local people due to heavy losses that occurred. A recent study conducted by the National Research Council defined the problem in detail and provided several recommendations to avoid the slurry impoundment breakage. One of the recommendations referred to utilizing advanced dewatering technology, which would reduce the amount of water being stored in the slurry.

Because refuse ponds' problems are common to the coal industry, the University of Kentucky Center for Applied Energy (CAER) is proposing a group research program to solve the refuse disposal problem. The research program



will be conducted in collaboration with Eimco Process Equipment Company to evaluate their "Paste Thickening Technology" for disposal of fine-size

coal waste slurry to eliminate the slurry ponds. Eimco, a leader in thickener design and marketing, has successfully applied the "Paste Thickening Technology" in the alumina processing industry. "Paste Thickening Technology," the only known and proven technique for effective dewatering of tailings, holds a promise of dewatering the fine-coal tailings to a high percent solids and discharging it as a paste. This material could be stacked rather than stored in a pond. Thus, the slurry pond could be drastically reduced or eliminated.

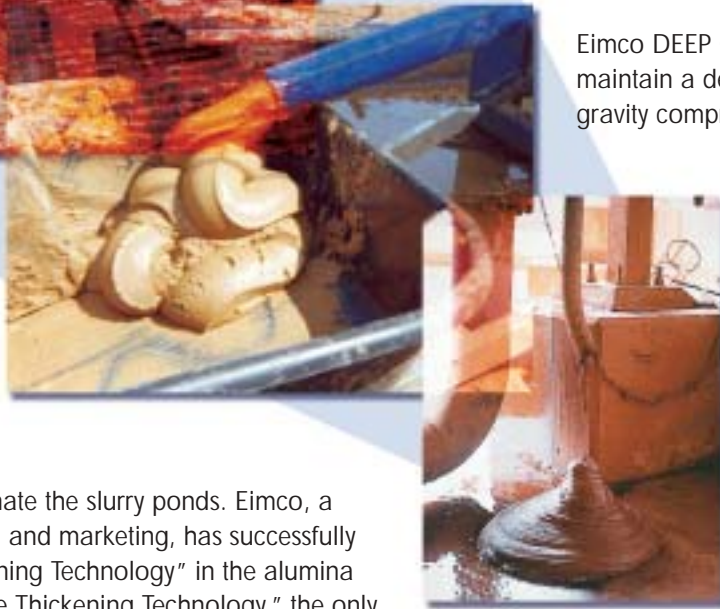
PROCESS DESCRIPTION

The "Paste Thickening Technology" was developed by Alcan International to improve disposal of high volume, low solids red mud tailings from alumina production. Eimco obtained the exclusive rights to the technology and improved the design of the thickener named DEEP CONE™. The basic concept of the process is similar to the conventional thickener technology, except that the DEEP CONE™ Paste Thickener has been designed to accommodate up to 20 times the solid mass flow and 10 times the hydraulic loading of conventional thickeners. This is accomplished by optimizing solids concentration for feed dilution, chemical addition, and floc formation while minimizing floc degradation. These benefits are achieved in the patented EIMCO EDUC™ feed system. This ensures adequate feed pulp

dilution, efficient chemical dispersion, and rapid flocculation, which results in maximum settling rates.

The rake drive is a key and critical component of the paste thickener. A highly flocculated solids bed covers the entire rake structure. This, coupled with high viscosities of the underflow, reaches paste consistency, which requires that drives must be designed to meet unusually high torque requirements. The rake drive transmits torque to the rake mechanism that is designed to keep the thickened solids flowing toward the discharge and to assist with releasing water from the flocculated solids bed.

Eimco DEEP CONE™ Paste Thickener is designed to maintain a deep bed of settled solids and maximize gravity compression, achieving discharge solids concentration that can approach the limits of flowability.



PROCESS ECONOMICS

At present no definite capital or operating cost data on fine coal waste treatment using the DEEP CONE™ Paste Thickener are available. The program proposed here will identify both the capital and operating cost information. The Red Mud disposal application data have shown that the process requires about 20% less flocculants than those currently used. Also, the

process will recover more water for recycling; thus, will reduce fresh water requirements, thereby reducing the cost of the process.

POTENTIAL BENEFITS

The key benefits of the process will be:

- ▶ Maximum water recovery for recycling
- ▶ Disposal by stacking not ponding
- ▶ Total tails backfill disposal
- ▶ No maintenance of dams
- ▶ Minimum installed thickener area
- ▶ Minimum disposal volume
- ▶ Sludge transportable by pumps
- ▶ Minimum liquid discharge after deposition

PROGRAM STRUCTURE

The basic program structure involves a multi-partner research program to investigate the applicability of an advanced refuse disposal system. The program will require coal companies' participation and agreement on proposed tasks. The program

is targeted to have at least 10 coal companies' participation, along with support from federal as well as state governments.

PROGRAM TASKS

A four-task program is suggested, as described below.

TASK 1. Laboratory Studies

The main objective of this task is to select (based on the recommendation of the group members) at least three types of fine coal waste slurries. The slurries will be characterized for particle-size distribution, pH, rheology, and composition. The flocculation studies will be conducted with respect to: percent solids, pH, type and amount of currently used flocculants. Rheology studies will be conducted of the flocculated solids obtained under different conditions. This task will identify the optimum conditions for producing favorable flocculated solids for the DEEP CONE™ Paste Thickener.

TASK 2. Design, Construction and Commissioning of Pilot Plant

The project team will install a pilot-scale unit of 5 ft. diameter and 25 ft. tall DEEP CONE™ Paste Thickener unit at a coal preparation plant selected by the participating organizations. This unit is capable of processing up to 2 tons/hr of solids. The installation and shakedown task will involve preparation of the pilot-scale unit location, installation of control instruments, interconnection, and tie-ins for utilities. After completion of the pilot-plant installation, each section of the plant will be run and adjusted, and instrumentation will be calibrated.

TASK 3. Operation of Pilot-Plant and Process Optimization

With all of the individual sections tested and adjusted, the program will begin the pilot-scale testing in a continuously integrated manner. The operation will be tuned to obtain maximum compaction and solids discharge from the thickener. New correlations will be developed in those cases in which pilot-scale results differ from bench-scale results. Potential commercial scale application will be identified.

TASK 4. Conceptual Commercial Design and Economic Analysis

Process improvements identified during the pilot-scale testing will be incorporated into the original flow sheet and mass and energy balance to form the basis of a commer-

cial-scale design. Based on this design, capital and operating costs will be determined.

DELIVERABLES FROM PROPOSED GROUP PROGRAM

Members of the group program will receive test results, a conceptual flow sheet, and a techno-economic assessment of the DEEP CONE™ Paste Thickener technology. These will be communicated through oral presentations, and written reports.

BENEFITS TO SPONSORS

The potential benefits of participating in this program include:

- ▶ Cost-effective research and development, since all the design data and economic feasibility data will be provided for a fraction of the total cost of the program.
- ▶ Opportunity to install the advanced waste disposal technique with minimum potential of spill.
- ▶ Chance to save considerable money in maintaining the dams.
- ▶ Ability to affect rapid technology transfers through personnel training and data acquisition.
- ▶ Early implementation of new technology.
- ▶ Interaction with other sponsors.

ESTIMATED TIME AND COST

The duration of the proposed program is estimated to be about 18 to 24 months. The total cost of the full program is expected to be about \$500,000. An effort will be made to obtain contributions from the federal and state governments for the program; however, coal industry contributions will be required. These contributions are expected to be about \$20,000 - \$25,000 per company.

ACTION

We are in the process of finalizing the details of this program and expect to prepare a proposal shortly. To express your opinion on this program, please complete and return the attached (obligation-free) questionnaire. If you are interested in participating in the program, please call or write:

Dr. B.K. Parekh
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Center for Applied Energy Research
Environmental and Coal Technology Program
2540 Research Park Drive
Lexington, KY 40511-8410
Tel: 859-257-0239
E-mail: parekh@caer.uky.edu, who will be the Principal Investigator of the proposed program.



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Dear Dr. Parekh:

Please advise us of the University of Kentucky’s plan to present a proposal on the subject. This statement of interest will involve no obligation to participate in the planned study.

Name _____ Title _____

Company _____ Division _____

Address _____

Telephone _____ Fax _____

E-mail _____

Questionnaire

_____ Interested in program as proposed _____ Interested subject to change

I/We suggest the following changes to proposed program: _____

Please mail, fax or e-mail to:
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