

Report Title:

**USE OF THE GRANUFLOW PROCESS IN COAL PREPARATION  
PLANTS TO IMPROVE ENERGY RECOVERY AND  
REDUCE COAL PROCESSING WASTES**

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Submitting

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CAUTION

Restricted Distribution Data Under 35 U.S.C. § 205  
USDOE Docket No. S-104,303

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## **ABSTRACT**

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GranuFlow setup tests were performed at Edison Mission Energy's Homer City Coal Processing (HCCP) Plant. An asphalt emulsion (CCB as supplied by Asphalt Materials Inc.) was added to the plant's froth flotation concentrate stream at dosages ranging from 3.5% to 5.5%. Baseline tests (no emulsion added) were conducted immediately prior to and after each emulsion test. For each test, samples were collected around a single screen bowl centrifuge, including the centrifuge feed, filter cake product, main effluent, and screen drain effluent. A total of 12 tests were conducted, and each sample analyzed for moisture (percent solids), ash, sulfur, heating value (Btu/lb), and size consist.

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# PROJECT SUMMARY

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## OBJECTIVES

The overall objective of the project is to generate all necessary information and data required to commercialize the GranuFlow™ Technology. GranuFlow uses a bitumen emulsion to displace water from fine coal, agglomerating the coal prior to dewatering and thereby improving coal recovery in coal preparation facilities. The technology will be evaluated under full-scale operating conditions at three commercial coal preparation plants to determine operating performance and economics. The handling, storage, and combustion properties of the coal produced by this process will be compared to untreated coal during power plant combustion tests.

## SCOPE OF WORK

Bench-, pilot-, and limited full-scale testing of Granuflow indicates that treating coal fines with a bitumen emulsion prior to dewatering can improve coal recovery, reduce clean coal moisture content, and improve fine coal handling characteristics. Granuflow will be demonstrated at three commercial coal cleaning plants to confirm previous test results and establish operating parameters for future commercialization. In collaboration with each of the host test sites, test plans will be developed to define a test program which meets the requirements and expectations of all parties. Initially, set-up tests will be performed at each site over a one-week period to evaluate various emulsion dosages (0.5 to 2.0 percent) under steady plant operating conditions. During this period, extended shift-long (8 hours) tests will be conducted to evaluate the effects of longer-term emulsion addition. Subsequently, a one-week evaluation will be performed at each host site at an optimum emulsion dosage as determined by the set-up tests. Finally, a comprehensive one-month test of the GranuFlow process will be performed at one of the host sites to evaluate its long-term performance and impacts on plant operations, and to generate data for future commercialization efforts. Power plant tests will provide information on the handling, storage, combustion, and emission properties of the treated coal as compared to untreated coal.

## TASK SCHEDULE

The major tasks to be performed during this project will be guided by the Work Breakdown Structure(WBS) shown in the table below.

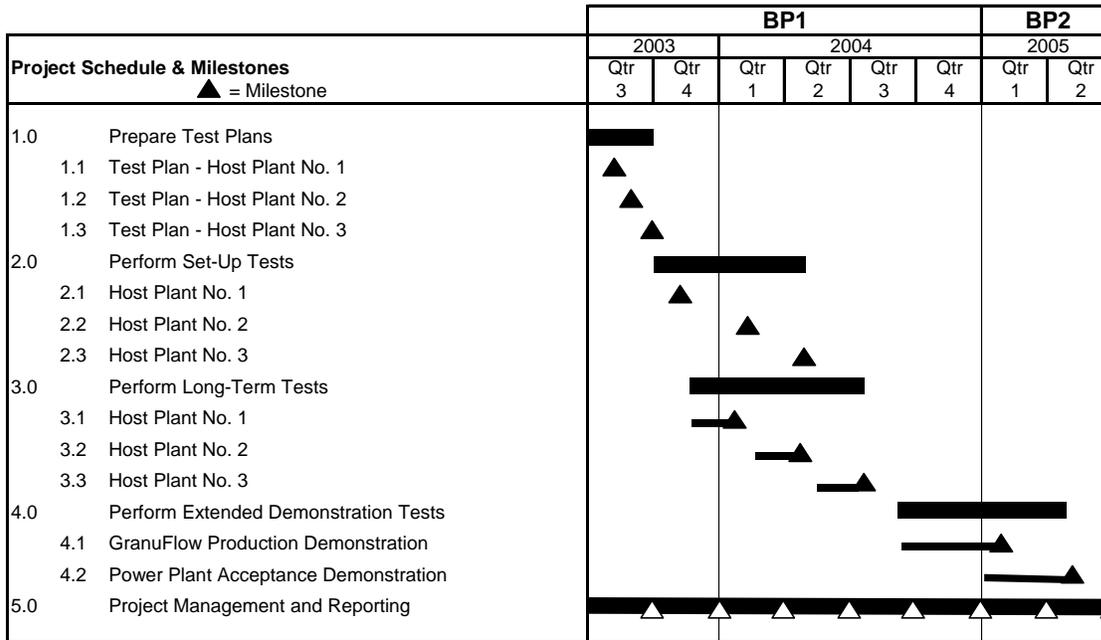
### Project Work Breakdown Structure

WBS	Description	Duration (mos.)
1.0	Prepare Test Plans	3
2.0	Perform Set-Up Tests	6
3.0	Perform Long-Term Tests at Optimum Conditions	6
4.0	Perform Extended Demonstration Tests	9
5.0	Project Management and Reporting	<u>24</u>
	Total Project	24

# INTRODUCTION

The Cooperative Agreement was executed in July 2003, with a 24-month term starting July 17, 2003 and continuing through July 16, 2005. A project budget/cost plan and milestone schedule was promptly prepared and submitted to the DOE Project Officer.

## PROJECT MILESTONE SCHEDULE DOE DE-FC26-03NT41788 GranuFlow Demonstration



During the past quarter, GranuFlow setup tests were performed at Edison Mission Energy's Homer City Coal Processing (HCCP) Plant (Homer City, PA). During these tests, an asphalt emulsion was added to the fine coal stream, and samples were collected around a fine-coal screen bowl centrifuge to evaluate coal recovery and quality impacts.

## **EXECUTIVE SUMMARY**

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GranuFlow setup tests were performed at Edison Mission Energy's Homer City Coal Processing (HCCP) Plant June 7-10, 2004. Prior to these tests, sampling devices were fabricated and installed to ensure that representative samples would be obtained from the screen bowl centrifuge circuit. An asphalt emulsion (CCB as supplied by Asphalt Materials Inc.) was added to the froth flotation concentrate stream at dosages ranging from 3.5% to 5.5%. Baseline tests (no emulsion added) were conducted immediately prior to and after each emulsion test.

For each test, samples were collected around a single screen bowl centrifuge, including the centrifuge feed, filter cake product, main effluent, and screen drain effluent. Test conditions and operational data were collected in the plant's control room during each test. A total of 12 tests were conducted, and each sample analyzed for moisture (percent solids), ash, sulfur, heating value (Btu/lb), and size consist. Test and sample data will be analyzed during the next quarter, and additional GranuFlow tests will be performed at the HCCP.

## STATUS BY WBS ELEMENT

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### WBS 2.0 – Set Up Tests (EME HCCP)

In June 2004, setup tests were performed at Edison Mission Energy’s HCCP Plant. This plant is a dual-circuit plant (“A” and “B”), with each circuit processing 550 tph (1,100 tph total) of raw coal to produce 400 tph (800 tph total) of clean coal for firing at the adjacent EME Homer City Generation Station. The setup tests were performed on the “A” circuit (all process data to follow applies to only the “A” circuit).



Edison Mission Energy’s 1,100-tph Homer City Coal Processing Plant (left) provides clean coal to its adjacent 1,850-MW Homer City Power Plant.

### Plant Flow Sheet

The plant’s flow sheet uses heavy-media cyclones to clean the coarse coal, and a combination of classifying cyclones, spirals, and froth flotation to clean the intermediate- and fine-sized coal. The clean coal products from the spirals and froth flotation cells are dewatered by screen bowl centrifuges. The overflow from the classifying cyclones is fed to flotation (two banks of four 500-ft<sup>3</sup> cells), while the cyclone underflow is the feed to three banks of eight double-start spirals. The flotation and spiral clean-coal products are combined and fed to a 4-way distributor, which splits the total volume of flow for feed to four 36” x 72” screen bowl centrifuges. Although the asphalt emulsion was added to the flotation product from both banks on the “A” circuit, sampling was confined to a single screen bowl centrifuge.

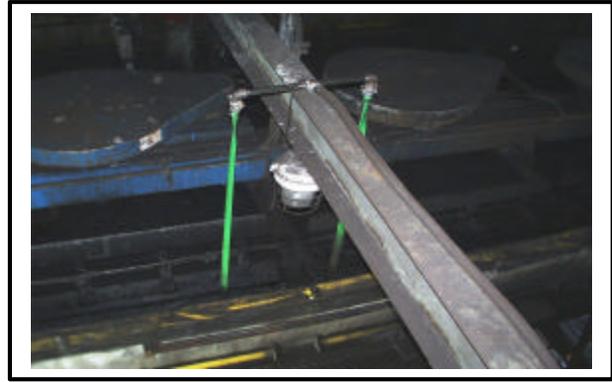
### Test Site Preparation and Equipment Setup

Prior to performing the setup tests, CQ Inc. personnel designed, installed, and tested “in-pipe” coal slurry samplers at the HCCP. These samplers were used during the test program to collect full-stream samples of the screen bowl main effluent and screen drain streams. The screen bowl feed was sampled by dipping the 4-way feed distributor, and the screen bowl cake product was sampled at the discharge chute of the screen bowl. Three-way valves were installed to measure flow rates for the screen bowl feed, main effluent, and screen drain streams.

An emulsion pump, totalizing meter, suction hose, and discharge hose were installed prior to testing. The discharge hose from the pump was run up the outside wall of the plant approximately 120 feet to the flotation cell floor. The discharge hose was connected to a header pipe located just above the flotation cells, where the flow was split into two streams to feed emulsion into the flotation cell concentrate launders. One tanker (5,000 gallons) of CCB asphalt emulsion was provided by Asphalt Materials Inc. (Heritage Research Group), and located adjacent to the plant.



Asphalt Emulsion (CCB) Supply Tanker



Emulsion added to Flotation Cells Clean Coal Launderers

### **Test Conditions and Procedures**

The setup tests were performed according to the following procedures as defined in the test plan:

- ? All relevant plant/circuit operations, test parameters, and test data were continuously observed and logged by a test engineer for the duration of each test. In addition, for each test, the test engineer recorded the plant raw coal feed, clean coal output, and clean coal yield continually.
- ? The feed rate to the test circuit was maintained at or near its maximum.
- ? Any plant shutdowns or significant prolonged reductions in plant/test circuit feed rate were followed by a minimum of 30 minutes of normal resumed operation prior to the resumption of sampling.
- ? A minimum of 30 increments were taken for each sample at appropriate intervals to ensure the collection of sufficient mass for all analytical procedures.
- ? In as much as operations, sampling location accessibility, and sampler safety considerations allow, full-stream samples were collected.
- ? The flow rate (gpm) of the emulsion was pre-set manually to allow for a minimum of 30 minutes of treatment of the appropriate dosage before the initiation of sampling and data collection activities.

? The flow rate (gpm) of the emulsion was monitored continually by an in-stream flow meter for the duration of each test.

The CCB asphalt emulsion was added to the flotation clean-coal product at the flotation cell clean-coal launders. The emulsion was added at dosages ranging from 3.5% to 5.5% (4.4 to 6.6 gpm). Baseline tests (no emulsion added) were conducted immediately prior to and after each emulsion test. For each test, the plant circuit was allowed to stabilize for 30 minutes following a condition change (emulsion on or off) before sampling was initiated. Following the 30-minute stabilization period, samples were collected for one hour around a single screen bowl centrifuge, including the centrifuge feed, filter cake product, main effluent, and screen drain effluent.



**An in-pipe sampler was used to collect the screen drain sample from the screen bowl centrifuge**

All samples were collected in 5-gal buckets, sealed, labeled, and transported to Standard Laboratories (Cresson, PA) for the following analyses:

- ? % Moisture (% Solids)
- ? % Ash
- ? % Sulfur
- ? Heating Value (Btu/lb)
- ? Size Consist & Ash Distribution @ + 28 mesh, 28M x 150M, 150M x 325M, 325M x 500M, and 500M x 0.

A total of 12 tests were performed during the period June 7-10, 2004. Sample analytical and data analyses will continue in Q3 2004.

#### **Plans for Q3/2004**

Project activities planned for the 3<sup>rd</sup> quarter of 2004 include:

- ? Analyze test samples from the initial HCCP setup tests.
- ? Analyze sample and test data for HCCP setup tests.
- ? Perform additional GranuFlow testing at HCCP to confirm setup test results.