**Characterization of Coal Combustion By-Products for the Re-Evolution of Mercury
into Ecosystems**

**Quarterly Technical Progress Report
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ABSTRACT

EPA and state environmental agencies are suggesting that mercury (Hg) in coal combustion by-products is re-emitted into local ecosystems by additional processing to final products (i.e., wallboard, etc.), by dissolution into groundwater, or by reactions with anaerobic bacteria. This perception may limit the opportunities to use coal combustion by-products in recycle/reuse applications. In this program, CONSOL Energy is conducting a comprehensive sampling and analytical program to address this concern. If the results of this work demonstrate that re-emissions of Hg from waste disposal and by-product utilization are over-stated, additional regulations regarding coal combustion, waste disposal, and waste material utilization will not be required. This will result in continued low energy cost that is beneficial to the national economy and stability of local economies that are dependent on coal.

In this quarter, laboratory equipment was assembled and blank test runs were made, manufactured aggregate and spray dryer ash samples were collected and leached, and fly ash and FGD slurry samples from an Ohio bituminous coal-fired utility were collected for leaching.

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INTRODUCTION

This is the Technical Progress Report for the second quarter of activities under DOE Cooperative Agreement No. DE-FC26-00NT40906. It covers the period December 1, 2000 through February 28, 2001.

OVERVIEW

In a number of policy papers, EPA and state environmental agencies suggest that mercury (Hg) in coal combustion by-products may be re-emitted into the ecosystem by processing into products (i.e., wallboard), by dissolution into groundwater, or by reactions with anaerobic bacteria. This perception may limit the opportunities to use coal combustion by-products in recycle/reuse applications.

CONSOL Energy Inc. Research & Development recently conducted a study, co-funded by DOE and the Ohio Coal Development Office (OCDO), which showed that the mercury disposed with fixated FGD solids was stable. The solids passed the standard TCLP toxicity test procedures, and no re-emissions occurred when the FGD solids were exposed to an elevated temperature for three months. While these results are encouraging because they do not show any adverse environmental impacts, they represent only two data points. In this program, CONSOL Energy will expand this data set by conducting a comprehensive sampling and analytical program to include ash, FGD products, and coal combustion by-products representative of the entire coal-fired industry. This work is necessary to help identify potential problems and solutions important to energy production from fossil fuels. If the results of this work prove that re-emissions of Hg from waste disposal and by-product utilization are over-stated, additional regulations regarding coal combustion, waste disposal, and waste material utilization will not be required. This will result in continued low energy cost that is beneficial to the national economy and stability of local economies that are dependent on coal.

AGREEMENT OBJECTIVES

Specific research objectives are to:

- Determine the Hg concentration in coal combustion waste streams
- Estimate the percentage of Hg collected in the combustion waste streams

- Determine if the Hg in these samples is leachable or volatile
- Evaluate the fate of Hg in coal fly ash during the manufacture of Portland cement
- Evaluate the fate of Hg in FGD gypsum during the manufacture of wallboard
- Evaluate the fate of Hg in coal ash material used to make manufactured aggregate
- Compile a literature review of the Hg chemistry and transformations in ecosystems
- Evaluate the extent that Hg is leached and converted to methylmercury in sulfite sludge FGD landfill
- Evaluate the extent that Hg is leached and converted to methylmercury in fly ash slurry impoundments
- Objectively report findings to the scientific community and regulatory agencies

COOPERATIVE AGREEMENT ACTIVITIES – THIS PERIOD

The Cooperative Agreement is divided into six tasks: 1) Program Development; 2) Literature Review of the Chemistry in Both Natural and Industrial Environments Specific to Factors that Enhance or Inhibit Mercury Methylation; 3) Sampling and Characterization of Coal Combustion Samples and By-Products; 4) Characterization of Ground Water Around an Active FGD Disposal Site to Determine the Potential for Hg Release into the Local Ecosystem; 5) Characterization of Ground and Surface Water from Active Fly Ash Slurry Surface Impoundments to Determine the Potential for Hg Release into the Local Ecosystem; 6) Data Reduction and Reporting; 7) Technology Transfer; and 8) Final Report. Agreement activities for this quarter are listed below.

- Task 2 (Literature Review of the Chemistry in Both Natural and Industrial Environments Specific to Factors that Enhance or Inhibit Mercury Methylation). The literature review was completed in April and the results will be documented by December 31, 2001.
- Task 3 (Sampling and Characterization of Coal Combustion Samples and By-Products) sample collection and laboratory work began.

RESULTS AND DISCUSSION

TASK 1 – PROGRAM DEVELOPMENT

This Task was completed in November 2000.

TASK 2 - LITERATURE REVIEW OF THE CHEMISTRY IN BOTH NATURAL AND INDUSTRIAL ENVIRONMENTS SPECIFIC TO FACTORS THAT ENHANCE OR INHIBIT MERCURY METHYLATION

The objective of Task 2 is to conduct a comprehensive literature review that includes data from recent studies (i.e., within the last two years) conducted as a result of a variety of clean water initiatives. Work conducted in Task 2 for this reporting period includes reviewing literature from the past two years, ordering past event papers, and beginning to prepare the literature review section of the final report. We plan to complete the review by December 31, 2001.

TASK 3 - SAMPLING AND CHARACTERIZATION OF COAL COMBUSTION SAMPLES AND BY-PRODUCTS

The objective of Task 3 is to obtain coal ash, FGD sludge, by-product feedstock, and by-product samples, and determine their Hg content and potential for ground water contamination. The potential for Hg re-emission during the manufacturing of Portland cement, wallboard, and manufactured aggregate also will be determined. Work conducted in Task 3 for this reporting period includes completion of laboratory equipment assembly, analysis of lab blank samples, and collection and leaching the first set of samples.

Laboratory equipment for the leaching tests was purchased, assembled and tested. Laboratory blank samples of the HCl, HNO₃, and the extraction fluid were submitted for analysis; all were below the quantitation limit (<0.5 ng Hg/mL). A blank extraction confirmed that mercury contamination is not a problem during leaching. The mercury content of the extraction blank filter was below the quantitation limit (<1.0 ng Hg/filter).

Samples of manufactured aggregate and the spray dryer ash feedstock were collected, and leached. Mercury analyses are pending.

Samples of FGD slurry and fly ash were collected at a coal-fired utility, burning Ohio bituminous coal, equipped with a wet lime scrubber. These samples will be analyzed and leached in the next quarter.

ADDITIONAL ACTIVITIES

A project update was given to the DOE Contracting Officer's Representative in a June meeting.

CONCLUSIONS

The major conclusions in this quarter are summarized below:

1. Task 2, the literature review, was completed. A low level literature survey is continuing to obtain current literature material.
2. Laboratory equipment was assembled and blank test runs were made in Task 3.
3. Manufactured aggregate and spray dryer ash samples were collected and leached in Task 3.
4. Fly ash and FGD slurry samples from an Ohio bituminous coal-fired utility were collected for leaching in Task 3.

REFERENCES

(None)