

MAINTENANCE OF THE COAL SAMPLE BANK AND DATABASE

Quarterly Technical Progress Report

Reporting Period: 1/01/99 - 3/30/99

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ABSTRACT

This project generated and provided coal samples and accompanying analytical data for research by DOE contractors and others. The five-year contract and a six-month no-cost extension have been completed. The Final Technical Progress Report is being prepared.

All activities specified under the five-year contract and its six-month no-cost extension have been completed. Eleven DECS samples were collected, processed to a variety of particle sizes, heat-sealed in foil laminate bags under argon, and placed in refrigerated storage. All were analyzed for basic chemical composition, inorganic major and trace element composition including hazardous air pollutant elements, petrographic composition and characteristics, thermoplastic behavior (if applicable), and other properties relevant to commercial utilization. Most were also analyzed by NMR, py/gc/ms, and a standardized liquefaction test; trends and relationships observed were evaluated and summarized. Twenty-two DECS samples collected under the previous contract received further processing, and most of these were subjected to organic geochemical and standardized liquefaction tests as well. Selected DECS samples were monitored annually to evaluate the effectiveness of foil laminate bags for long-term sample storage. Twenty-three PSOC samples collected under previous contracts and purged with argon before storage were also maintained and distributed, for a total of 56 samples covered by the contract. During the contract, 804 samples in 1586 containers, 2109 data printouts, and individual data items from 34208 samples were distributed.

In the subject quarter, 25 samples, 18 data printouts, and individual data items from 1374 samples were distributed. All DECS samples are now available for immediate distribution at minus 6 mm (-1/4 inch), minus 0.85 mm (- 20 mesh U.S.), and minus 0.25 mm (- 60 mesh U.S.).

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EXECUTIVE SUMMARY

Maintenance of the Coal Sample Bank and Database

Quarterly Technical Progress Report 1/01/99 - 3/30/99

The mission of the DOE Coal Sample Bank and Database has been to provide a variety of well-characterized, high-quality coal samples for public and private coal research. Eleven coal samples collected under the current contract and 45 from previous contracts, along with analytical data, have been distributed on a continuing basis to DOE contractors and others performing coal research. This report is the last of the contract; it represents the second half of a six-month no-cost extension which continues the limited distribution of samples and data. All activities specified under the contract have been completed and the Final Technical Progress Report is being prepared.

Additional analyses of liquefaction behavior and organic geochemical characteristics were performed under the contract. The samples are stored to minimize deterioration, and 10 samples were analyzed annually to monitor the effectiveness of the storage methods. Foil laminate bags purged with argon gas and stored under refrigeration were shown to perform well in preserving the properties of the coal samples.

This report reflects the level of effort described in the revised work statement submitted to DOE on September 5, 1996, setting out a reduction in effort following a cut in the level of funding of the project.

INTRODUCTION

This five and one-half year project has been intended to ensure the availability of well-characterized, high-quality coal samples for public and private coal research. It continued support of the DOE Coal Sample Bank and Database at The Pennsylvania State University. Eleven coal samples in the DECS- series have been collected, processed, packaged, and analyzed under the contract, and a resulting database is being maintained. These samples and data, as well as 45 samples collected under previous contracts, were distributed on a continuing basis to DOE contractors and others performing coal research. A six-month no-cost extension to the original five-year contract, allowing this distribution to continue, has now been completed.

Samples were chosen to maintain a sample bank of 56 coals representing the major U.S. coal fields and a variety of coal ranks and compositions. In addition to standard analyses, liquefaction tests and organic geochemical analyses have been performed. The samples are stored to minimize deterioration, and 10 samples were monitored annually by proximate, sulfur forms, and gaseous oxygen analysis to evaluate their condition. The monitoring program showed that foil laminate bags continue to preserve the samples well. Full results of the monitoring performed during the subject quarter will be presented in the Final Technical Progress Report.

RESULTS AND DISCUSSION

Task 1B. Storage and Inventory of Samples

All samples supported by the contract are stored in containers purged with argon before sealing; container locations are tracked by a computer inventory program. All DECS-series samples are sealed under argon in foil laminate bags and stored under refrigeration. PSOC-series samples are stored in drums or buckets at the Coal Sample Bank building, or in cans in the Coal and Organic Petrology Laboratories.

During the quarter, 25 samples in 29 containers were distributed (see Task 1I) and inventory records were updated. The University's discontinuation of its mainframe computer operating system in the year 2000 will necessitate moving and rewriting of the computerized container inventory system. Activity under the subject contract has now ended, but storage and inventory of sample containers is expected to continue.

Task 1C. Monitoring of Sample Quality

It was planned that one 300 g (2/3 lb) bag of each DECS sample would be analyzed annually to monitor sample condition and evaluate the ability of the storage procedures to preserve the initial properties of the samples. This Task has been reduced in scope, to 10 samples per year in most years, because of reduction in funding. Effort in the related study of liquefaction behavior (under Task 1F) over time was also reduced.

In the subject quarter, additional samples (a total of 17) and additional monitoring analyses were performed in order to provide data for the final evaluation of the foil laminate bag storage method. The data were received late in the quarter and will be included in the Final Technical Progress Report.

Task 1D. Collection and Processing of Replacement Samples

Collection and processing of 11 samples, as described in the Revised Statement of Work (Sept. 6, 1996), have been completed. Portions of each of the 22 DECS samples collected under the previous contract were processed to minus 0.25 mm (minus 60 mesh. When the stock of 2.3 kg (5 lb) bags of a specific sample was depleted, additional bags were split out from larger bulk storage bags.

Task 1E. Basic Characterization of Coal Samples

All basic characterization of samples planned for collection under the contract has been completed. In addition, 22 DECS samples collected under the previous contract underwent analysis for hazardous air pollutant elements (HAPs).

Task 1F. Liquefaction Testing

In this Task, appropriate samples were subjected to a standardized liquefaction test and subsequent product workup. Analytical work in this Task has been completed, although the total number of samples tested was reduced following a cut in the level of funding. Review and synthesis of the data were presented in the 19th Quarterly Technical Progress Report.

Task 1G. Investigation of Changes in Surface Chemistry During Storage

This Task has been discontinued.

Task 1H. Organic Geochemistry

Selected DECS coal samples were subjected to a series of organic geochemical tests to provide baseline data for use in a variety of projects. The tests were basically solid-state ^{13}C NMR (CPMAS, DDMAS and Bloch decay) analyses and pyrolysis/gas chromatography/mass spectrometry; review and synthesis of the data was presented in the 19th Quarterly Technical Progress Report.

Task 1I. Distribution of Coal Samples to Users

During the period 1/01/99 - 3/30/99, a total of 25 samples of various sizes from the DOE Sample Bank in 29 containers were distributed. See Task 2C for a list of sample and data recipients.

Task 2A. Programming

Programming of a new system for standard formatted report printouts of Coal Database data continued during the quarter. The mainframe computer printing system previously used was discontinued by the University's Center for Academic Computing on June 1, 1998. The current implementation of the mainframe operating system under which the Coal Database has operated will be discontinued prior to December 31, 1999. This will affect the container inventory system (Task 1B) as well. See also the discussion of the world wide web site under Task 2C, 'Distribution of Data to Users.'

Task 2B. Data Entry

Entry of basic characterization data for the 11 samples collected under the contract has been completed.

Task 2C. Distribution of Data to Users

During the quarter a total of 18 data printouts were distributed. In addition, 30 special data requests were filled by database searches and printed output or computer media, resulting in distribution of information on 1374 samples. Requests for general Sample Bank and Database information were filled during the quarter.

Organizations supplied with coal samples and/or data during the quarter include:

ABB Combustion Engineering
Arizona State University, Chemistry Department
Battelle Memorial Institute
Carbon Sales
Coal Education Development and Resources of Eastern Kentucky
CSIRO Division of Energy Technology (Australia)
Foster-Wheeler Development Corporation
Pennsylvania State University, Chemical Engineering Department
Pennsylvania State University, Energy and Geo-Environmental Engineering Department (2)
Pennsylvania State University, The Energy Institute (3)
Reaction Engineering

Shell Exploration and Production Technology Company (2)
Tuskegee Institute
U.S. Office of Surface Mining

The numbers in parentheses represent multiple requests which were separately processed.

Additional clients have received information via a world wide web site (<http://www.ems.psu.edu/COPL/>), which was accessed 663 times during the quarter by those outside the Coal and Organic Petrology Laboratories. It includes a table of basic data for the 56 samples supported under the current contract, and a searchable database of those and 522 other samples from the Penn State Coal Database. The Department of Energy Coal Sample Bank and Database section of the web site was accessed 166 times during the quarter, and pages for individual DECS samples were accessed 133 times. The web site was rewritten as part of a reorganization of The Energy Institute's web site.

CONCLUSIONS

The coal samples and data supported under this project have been used on an ongoing basis by DOE contractors and others performing coal research. Sample collection, processing, analysis, and monitoring has been completed.

Samples collected under the current contract continue to be stored in argon under refrigeration in multilaminate bags which have demonstrated an ability to preserve the properties of the fresh coal. All 33 DECS samples are available for distribution in three sizes of foil laminate bags: 2.3 kg of minus 6.4 mm (-1/4 inch) coal, 300 g of minus 0.85 mm (-20 mesh U.S.) coal, and 75 g of minus 0.25 mm (-60 mesh U.S.) coal. It is expected that samples and data will continue to be distributed to researchers.