Task 2.3 - Review and Assessment of Results From the Comprehensive Characterization of Toxic Emissions from Coal-Fired Power Plants

**Semi-Annual Report
July 1 - December 31, 1996**

**By
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TASK 2.3 - REVIEW AND ASSESSMENT OF RESULTS FROM THE COMPREHENSIVE CHARACTERIZATION OF AIR TOXIC EMISSIONS FROM COAL-FIRED POWER PLANTS

EXECUTIVE SUMMARY - ACCOMPLISHMENTS FOR THE PERIOD

- The air toxic emission data from Phase I were summarized and evaluated in the final Phase I summary report, published in September 1996 and available for distribution in October 1996.
- Data from Phase I were presented at the Center for Air Toxic Metals annual review meeting at the Energy & Environmental Research Center in October 1996.

1.0 INTRODUCTION

To help meet the requirements of the 1990 Clean Air Act Amendments, the U.S. Department of Energy (DOE) sponsored Phase I of a study entitled "Comprehensive Characterization of Toxic Emissions from Coal-Fired Power Plants" in 1992. Final reports which detail air toxic emissions from eight power plants (nine configurations) were completed by the contractors. The Energy & Environmental Research Center (EERC) served as an independent third-party reviewer of these reports; it has completed the activities as outlined for the initial review process and has prepared two reports. The first report, entitled "A Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plants: Phase I Results from the U.S. Department of Energy Study" was published in September 1996 and is available to the public and private sectors through the U.S. Department of Energy (DOE) Federal Energy Technology Center (FETC) at Pittsburgh. This report summarizes and evaluates the stack emission data. The second report prepared by the EERC, entitled "A Comprehensive Assessment of Toxic Emission from Coal-Fired Power Plants: Statistical Correlations from the Combined DOE and EPRI Field Test Data," details empirical correlations derived from the Phase I DOE data and the Electric Power Research Institute (EPRI) PISCES (Power Plant Integrated Systems: Chemical Emissions Studies) data.

2.0 OBJECTIVES

The objective of the project was to provide an independent review of the Phase I data, evaluate the scientific validity of the conclusions, identify significant correlations between emissions and fuel or process parameters, compare the data with available data from EPRI studies, make recommendations for future studies, and complete a combined report that summarizes Phase I, Phase II, and EPRI findings.

3.0 SCOPE OF WORK/RESULTS

The work was divided into seven tasks beginning with the initial review of nine draft reports from Phase I through the completion of a final summary report targeted to include Phase I, Phase II, and EPRI results.

Subtask 1 – Initial Review of Nine Draft Field Reports

The EERC review team compiled comments for each of the nine draft field reports to serve as a guide for the individual contractors to prepare their final reports. Conference calls were held between the EERC, DOE, and the respective contractors for each of these reports. Final reports for each field site were completed in 1994.

Subtask 2 – Recommendations for Phase II Field Tests

Based on the review of the Phase I reports and past EERC experience, a report entitled "Task 2 – Recommendations for Phase II Field Tests" 95-EERC-01-03, was delivered in April 1995 to DOE which included suggested reporting format changes, a pre-field-sampling laboratory preparation and qualification exercise, a data-reporting and flagging system, quantity and types of required samples, changes in inorganic and organic sampling and analytical procedures, and quality assurance/quality control (QA/QC) target objectives.

Subtask 3 – Summary Report of Phase I Tests

The summary report of the Phase I tests was completed and published by the EERC (1) in September 1996 and is available to the public and private sectors through DOE FETC at Pittsburgh. Information presented in the summary report includes the round-robin coal analyses and the individual site coal data; the emission factors for inorganic, organic, radionuclide, and acid gas-halogen species; the effects of coal characteristics and process configurations on emission factors; and several special topics, including plume simulation dilution sampling, the distribution of hazardous air pollutants (HAPs) as a function of particle size, chromium sampling and speciation, the effect of sootblowing on metals emissions, and others.

Subtask 4 – Engineering Analysis of Combined DOE and EPRI Data

The objectives of Subtask 4 were to compare the trace element emissions data from Phase I with the trace element emissions data that are available from EPRI-sponsored field tests to identify potential relationships between stack emissions of trace element species and coal, operating, and process parameters.

A Microsoft® Access database of DOE and EPRI data was completed and used to develop empirical models describing the emission for trace element species derived from the statistical evaluation of likely variables in the database. The number of variables used in the empirical models were systematically reduced using the multiple linear regression procedure (REG) from the SAS™ statistical software package. A written draft of this correlation report was submitted, and highlights were presented to DOE in July 1995.

Subtask 5 – Incorporation of DOE Data into Database

The Phase I data were entered into the Center for Air Toxic Metals (CATM) database which is now available to CATM sponsors including DOE.

Subtask 6 – Review of Phase II Reports

No Phase II reports have been reviewed to date because of a delay in the DOE sampling efforts. In lieu of Phase II reports, the Paradise Plant and Blacksville Plant reports written by Southern Research Institute were reviewed as well as Battelle's QA/QC plan and final report for pilot-scale sampling performed at DOE and its Sammis Plant report.

Subtask 7 – Summary Report of Phase I, Phase II, and EPRI Data

This report will be written under this project.

4.0 FUTURE WORK

The objectives of this project were met by the EERC with the available data, and additional reports were reviewed by the EERC in lieu of the data not available. The EERC has submitted a \$250,000 proposal to DOE FETC for continued work in the area of air toxics review with the following objectives:

- Finalize and publish the existing Phase I statistical correlations report, and prepare a Phase II statistical correlations report integrating Phase I data with Phase II data.
- Compare toxic emission data from the Sammis Plant (full-scale) with data from the DOE FETC at Pittsburgh 500-lb/hr plant (pilot-scale) data to determine whether the pilot-scale data are representative of the full-scale data.
- Update and publish the existing Phase I recommendations report for the benefit of air toxic sampling and analytical teams in both the public and private sectors.
- Prepare journal articles from the Phase I site reports and summary report to make these valuable data easily accessible to the public and the scientific communities.
- Ensure the highest possible data quality in Phase II by providing review of QA/QC sampling and analytical plans prior to field sampling and on-site auditing during field sampling.
- Perform both a technical and general review of the data reduction and sample analyses in the Phase II draft reports to ensure that the data are documented and presented in a standard format that is easily interpreted by other users.
- Prepare a combined Phase I and II final summary report to be used as a basis for further HAP research and regulation.

The objectives would be met under the following seven tasks:

- Task 1 - Finalization of the Statistical Correlations Report
- Task 2 - Sammis Plant and FETC Pilot Plant Comparison
- Task 3 - Finalization and Publication of the Recommendations Report
- Task 4 - Publishing Activities
- Task 5 - QA/QC Support for Phase II Testing
- Task 6 - Review of Phase II Reports
- Task 7 - Final Phase I and Phase II Report

5.0 REFERENCES

1. Miller, S.J.; Ness, S.R.; Weber, G.F.; Erickson, T.A.; Hassett, D.J.; Hawthorne, S.B.; Katrinak, K.A.; Louie, P.K.K. "A Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plants: Phase I Results from the U.S. Department of Energy Study," final report for U.S. DOE DE-FC21-93MC30097; EERC publication, Sept. 1996.

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1. Program/Project Identification No. DE-FC21-93MC30097	2. Program/Project Title 2.0 Air Quality Assessment and Control	3. Reporting Period 10-1-96 through 12-31-96
4. Name and Address Energy & Environmental Research Center University of North Dakota PO Box 9018, Grand Forks, ND 58202-9018 (701) 777-5000		5. Program Start Date 01-12-93
		6. Completion Date 12-31-97

7. FY 94/95	8. Months or Quarters Quarters	b. Dollar Scale	1st JAN	FEB	MAR	2nd APR	MAY	JUN	3rd JUL	AUG	SEP	4th OCT	NOV	DEC
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9. Cost Status
a. Dollars Expressed In Thousands

10. Cost Chart

Fund Source		Quarter				Cum. to Date	Tot. Plan
		1st	2nd	3rd	4th		
DOE	P	40	90	90	790	1010	1010
	A	12	158	52	113	335	
	P						
	A						
	P						
	A						
	P						
	A						
Total P		40	90	90	790	1010	1010
Total A		12	158	52	113	335	
Variance		28	(68)	38	677	675	

P = Planned A = Actual

Total Planned Costs for Program/Project
\$1010

c. Cumulative Accrued Costs

Planned		40		130		220		1010
Actual		12		170		222		335
Variance		28		-40		-2		675

11. Major Milestone Status	Units Planned	
	Units Complete	
2.3 Review and Assessment of Results from the Comprehensive Characterization of Air Toxics Emissions from Coal-Fired Power Plants	P	
	C	
2.4 Air Toxic Fine Particulate Control	P	
	C	
2.4.1 Pilot-Scale Testing of CeraMem Filters	P	
	C	
2.5 Effectiveness of Sorbents for Trace Elements	P	
	C	
2.6 Catalyst for Utilization of Methane in Selective Catalytic Reduction of NOx	P	
	C	
	P	
	C	
	P	
	C	

12. Remarks

13. Signature of Recipient and Date <i>[Signature]</i> 2/3/97	14. Signature of DOE Reviewing Representative and Date
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