

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

**Semi-Annual Report  
January 1- June 30, 1996**

**By  
Sumitra R. Ness**

Work Performed Under Contract No.: DE-FC21 -93 MC30097

For  
U.S. Department of Energy  
Office of Fossil Energy  
Morgantown Energy Technology Center  
P.O. Box 880  
Morgantown, West Virginia 26507-0880

By  
Energy and Environmental Research Center  
University of North Dakota  
P. O. Box 9018  
Grand Forks, North Dakota 58202-9018

## **Disclaimer**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

## **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

## **ACKNOWLEDGMENT**

This semiannual was prepared with the support of the U.S. Department of Energy (DOE), Morgantown Energy Technology Center, Cooperative Agreement No. DE-FC21 -93MC30097. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the DOE.

## **EERC DISCLAIMER**

**LEGAL NOTICE** This research report was prepared by the Energy & Environmental Research Center (**EERC**), an agency of the University of North Dakota, as an account of work sponsored by the U.S. Department of Energy. Because of the research nature of the work performed, neither the EERC nor any of its employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement or recommendation by the **EERC**.

## TABLE OF CONTENTS

1.0 INTRODUCTION . . . . .	1
2.0 OBJECTIVES . . . . .	1
3.0 SCOPE OF WORK/RESULTS . . . . .	1
Subtask 1- Initial Review of Nine Draft Field Reports . . . . .	2
Subtask 2- Recommendations for Phase II Fieldtests . . . . .	2
Subtask 3- Summary Report of Phase I Tests . . . . .	2
Subtask 4- Engineering Analysis of Combined DOE and EPRI Data . . . . .	3
Subtask 5- Incorporation of DOE Data into Database . . . . .	3
Subtask 6- Review of Phase II Reports . . . . .	3
Subtask 7- Summary Report of Phase I, Phase II, and EPRI Data . . . . .	4

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

### **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 University of North Dakota Energy & Environmental Research Center (EERC) served as an independent third-party reviewer of these reports. In addition, the EERC prepared two reports. The first report, a summary and evaluation of the stack emissions, is entitled "A Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plants: Phase I Results from the U.S. Department of Energy Study, " of which a draft has been submitted to DOE and the individual contractors for input. Review comments were received, evaluated, and incorporated into the final report which is now under final review by DOE. In August 1996, 500-1000 copies of the report will be published by the EERC and be made available for distribution to the public and private sectors through DOE Pittsburgh Energy Technology Center (PETC). The second report, entitled "A Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plants: Statistical Correlations from the Combined DOE and EPRI Field Test Data, " prepared by the EERC, 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. Review comments from the contractors and DOE have been received and responses prepared. Further work on the statistical correlations report is on hold until Phase II data are available to be incorporated.

### **2.0 OBJECTIVES**

The objective of the project is 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 is divided into seven tasks that cover the entire scope of work, beginning with initial review of nine draft reports from Phase I through completion of a final summary report that includes Phase I, Phase II, and EPRI results.

### **Subtask 1- Initial Review of Nine Draft Field Reports**

Subtask 1 has been completed and consisted of the EERC review team reviewing the first nine draft field reports. Comments were compiled for each report to serve as a guide for the individual contractors to prepare the 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.

#### ***Deliverables***

Review comments were faxed to DOE and respective contractors. Comments were discussed via conference calls.

### **Subtask 2- Recommendations for Phase II Field Tests**

The purpose of Subtask 2 was to provide DOE a summary of recommendations for improving the quality of data in Phase II, based on review of the Phase I reports and past EERC experience. The report, entitled "Task 2- Recommendations for Phase II Field Tests" 95-EERC-01-03, was finalized in April 1995 and 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.

#### ***Deliverables***

The report, "Task 2- Recommendations for Phase II Field Tests, " 95-EERC-01-03, was prepared and sent to the individual contractors and DOE.

### **Subtask 3- Summary Report of Phase I Tests**

The purpose of Subtask 3 was to complete a summary report of the nine Phase I site reports. A draft version of this report was submitted to DOE PETC in early July 1995, and highlights of the report were presented at that time. Information presented in the summary report includes the round-robin coal analyses and 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 metal emissions, and others.

#### ***Deliverables***

Review comments from DOE and participating contractors were addressed in the final draft of the summary report which is currently under evaluation at DOE. In August 1996, 500-1000 copies of the summary report will be published at the EERC and distributed by DOE PETC to the public and private sector.

#### **Subtask 4- Engineering Analysis of Combined DOE and EPRI Data**

The objectives of Subtask 4 were to compare the trace element emission data from Phase I with the trace element emission 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. Such relationships may be useful for identifying factors that may affect the removal of HAPs and for focusing future research toward a better understanding of these variables or processes.

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

All review comments from the contractors and DOE were received by January 1996. Responses will be written for all comments and submitted to DOE. Finalization of the report is on hold, by request of DOE, until Phase II data are available for comparison and/or incorporation into the correlations.

##### *Deliverables*

A final correlation report will be discussed with DOE when Phase II data are available.

#### **Subtask 5- Incorporation of DOE Data into Database**

All of the Phase I data have been entered into the Center for Air Toxic Metals (CATM) database. A CATM database demonstration is now available to CATM sponsors, including DOE.

##### *Deliverables*

A CATM database demonstration including Phase I data is 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. The Paradise Plant and Blacksville Plant reports written by Southern Research Institute (SRI) have been reviewed and comments sent to DOE and SRI. No follow-up discussions were held. The EERC also reviewed Battelle's QA/QC plan and final report for pilot-scale sampling performed at PETC as well as Battelle's Sammis Plant report. A comparison between these two data sets will be made when revised copies of each report are made available.

### *Deliverables*

The EERC has reviewed several reports in lieu of Phase II reports, including Paradise and Blacksville Plant reports written by SRI as well as Battelle's QA/QC plan and final report for sampling performed at PETC and the Sammis Plant report. Phase II reports will be reviewed when requested by DOE.

### **Subtask 7- Summary Report of Phase I, Phase II, and EPRI Data**

The objective of Subtask 7 is to summarize all of the Phase I, Phase II, and PISCES data, depending on availability, into one concise report that will be made available to the public. The EERC recommends that this report be published by a commercial publisher so that it is widely available.

The scope of the combined Phase I and Phase H summary report has not been established because of changes in the Phase II sampling schedule from DOE.

### *Deliverables*

A combined Phase I and II summary report will be prepared when requested by DOE.