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

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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

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) have been 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 has prepared two reports. The first report is a summary and evaluation of the stack emissions, 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. All review comments were received as of January 1996 and are currently being incorporated into the final report. 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 final reports from the nine Phase I sites. A written draft version of this report was submitted to the DOE Pittsburgh Energy Technology Center (PETC) in early July 1995, and highlights of the report were presented in July also. In this report, information is presented concerning the eight field sites at which sampling was completed, assessing nine system configurations; the round-robin coal analyses and individual site 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.

All review comments from the contractors and DOE were received by January 1996. Efforts are currently under way to incorporate the necessary changes into the final summary report. Responses will be written for all comments and submitted to DOE as well.

Deliverables

A final summary report of Phase I stack emissions data will be finalized and sent to the individual contractors and DOE by April 1.

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. 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 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 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 correlations 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 and are now being verified. After verification, a database demonstration will be made available to CATM sponsors including DOE.

Deliverables

Phase I DOE data have been entered into the CATM database.

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 for pilot-scale sampling performed at PETC in September 1995 and is currently reviewing Battelle's Sammis Plant report.

Deliverables

Paradise and Blacksville Plant reports and Batelle's QA/QC plan were reviewed. The Sammis Plant review will be completed in February 1996.

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 II 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.

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