

Information Collection Request

CATM Database Incorporates ICR Data

On November 17, 1998, the Environmental Protection Agency (EPA) issued an Information Collection Request (ICR) requiring coal-fired electricity generating plants to collect and report information on mercury (Hg) in coal and stacks. EPA required each coal-fired electricity generating plant to

assurance/quality control (QA/QC) procedures are required for each part of the Hg emissions data collection effort. These data will be used to address the following uncertainties: the actual cumulative amount of Hg being emitted by all electric utility steam-generating units on an annual basis; the speciation of the Hg that is being emitted; and the effectiveness of various control technologies in reducing the amount of each form of Hg that is emitted.

The available ICR data on coal have been entered into the the CATM database. The CATM database includes data sources and data man-

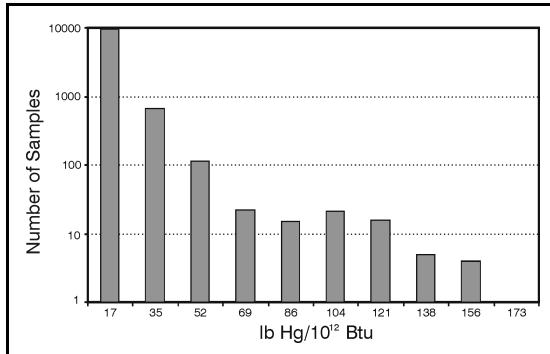


Figure 1 – Frequency of lb Hg/10¹² Btu.

conduct coal sampling and analysis. The analysis of the coals included Hg content, heating value, ash content, and chlorine content. EPA also required stack testing at randomly selected plants representing all major coal types and sulfur (S) control systems to determine the abundance and species of Hg present. Sampling and analyses of Hg species in flue gases are being conducted simultaneously before and after the air pollution control device at each location.

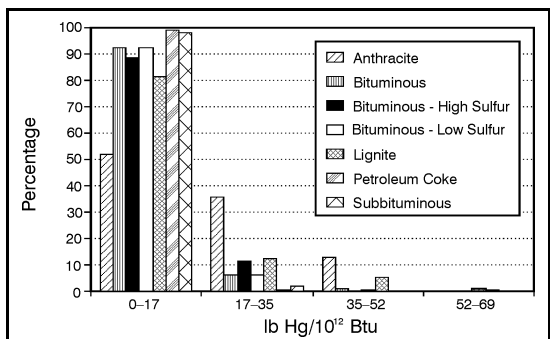


Figure 2 – Frequency of lb Hg/10¹² Btu.

Three as-fired coal samples will be collected during the Hg flue gas sampling. The results of each series of stack tests and coal sample analyses are required to be reported to the EPA using a specified standardized electronic format within 45 days of the date of testing. Specified quality

management systems for information related to the fate and formation of trace elements within power systems. The CATM database is fully relational and is user-friendly. The database contains analytical, materials, and engineering information. Analytical data include the results of laboratory analysis, information about the analytical technique and the laboratory that performed the analysis, and QA/QC flags. Materials data in the database include all available information pertaining to the type of material, location where the material was collected, and collection device. Engineering data include information on the system, both configuration and operational parameters, such as flow rates, temperatures, pressures, and steam flow rates.

The database can be used to view the ICR data in various forms. Figure 1 is a histogram showing the number of coal samples with varying levels of Hg expressed on a lb/10¹² Btu basis. Figures 1 and 2 show almost all of the coals fall below 50 lb of Hg/10¹² Btu, with the majority below 20 lb of Hg/10¹² Btu. Figure 3 shows the

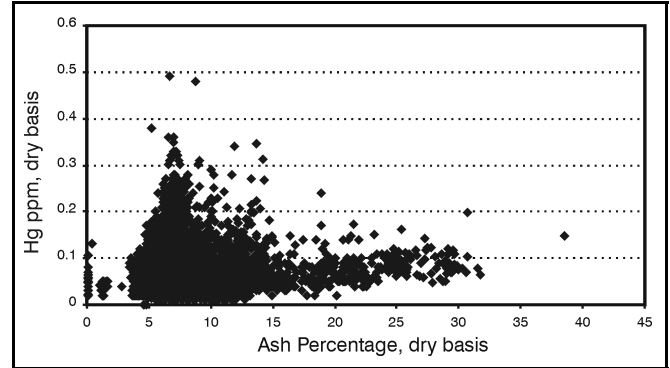


Figure 3 – Hg Versus Ash Content for Subbituminous Coals.

relationship of Hg and ash content for subbituminous coal. Figure 4 shows Hg content plotted versus S for the high-S bituminous coals, which includes several different populations. One population shows an increase in Hg with increasing S content, and another shows no increase with increasing S.

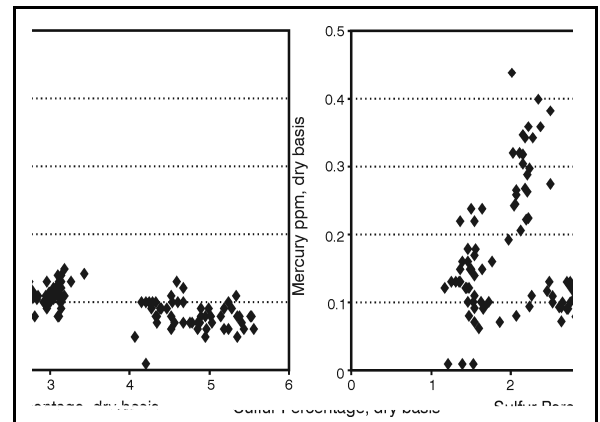


Figure 4 – S Versus Hg for Bituminous High-S Coal.

These are only a few examples of the plots and data interpretations that can be developed using data from the CATM database. ICR data are being added to the CATM database as they become available and after they have undergone appropriate QA/QC review. The CATM database can be downloaded from the EERC web site (www.undeerc.org).

For further information, please contact Steve Benson, CATM Director, at (701) 777-5177 or at sbenson@undeerc.org; or Robert Jensen, EERC Research Specialist, at (701) 777-5016 or at bjensen@undeerc.org.

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EERC Plays Role in QA of ICR Data

Since the EPA issued the Information Collection Request (ICR), approximately 30,000 coals from coal-fired utilities have been collected and analyzed to determine the level of mercury (Hg) in the coal, along with traditional analyses such as sulfur, chlorine, ash, and heating value. Additionally, 85 power plants have been sampled to determine the species of Hg found in the flue gases before and after the air pollution control system. Several sampling organizations and analytical laboratories have been involved in this effort.

To help address quality assurance (QA) needs for the ICR data, the EERC has become involved in evaluating analytical methods for Hg and Cl in coal, as well as providing QA for the Hg measurements at power plants.

Mercury and Chlorine Round-Robin Highlights

In an effort to determine the reliability of analytical methods for Hg and Cl in coal and ash, EPRI initiated an extensive round-robin study involving 40 national and international laboratories. The EERC is participating in this study, which consists of analyzing SRMs, ashes, and coals, including bituminous, subbituminous, and lignite, ranging in Hg concentration from 20–230 ng/g.

The results of this study will provide valuable information about the precision and accuracy of analytical methods for Hg and Cl. The methods that were used in the round-robin are listed in the table, along with estimated method detection limits (MDL).

As this study nears completion, the preliminary data show some interesting trends. The accuracy data obtained from recoveries of Hg in the SRMs show that all the methods performed very well, with 88% to 100% recovery of the reference value, except for low recovery using D3684 on one of the SRMs, perhaps because of the high ash content of that particular coal.

Although specific precision data are not available at this time, the trend appears to show that the thermal decomposition method showed the best precision among the Hg methods and the bomb combustion method showed the poorest precision.

The Cl data are rather limited, but a preliminary conclusion is that existing methods for Cl analysis in coal appear to have poor precision and accuracy at levels less than 200 µg/g, indicating a need for more reliable methods for Cl analysis.

Final results from the round-robin will be available in the fall, which will include intralaboratory and interlaboratory precision for all of the methods, as well as a breakdown of method performance based on concentration levels, coal rank, and ash content.

Flue Gas Sampling for Hg Species

The validated method for ICR flue gas sampling for Hg is the Ontario Hydro Method. The EERC performed testing to validate the method, which was found to provide reliable Hg speciation data. An ASTM (American Society for Testing and Materials) procedure has been drafted. As

Additional analytical QA issues were addressed by chemists at the EERC by initiating a Hg proficiency testing program in August 1999. The goal of this program was to evaluate the analytical capabilities of other laboratories for Hg determination and to provide assistance to those who were less experienced with the Ontario Hydro Method. For the proficiency testing, the EERC prepared blank solutions and spiked solutions of known Hg concentration in the same matrices as the impingers used in the Ontario Hydro Method to simulate field samples. The samples were sent to participating laboratories, which were instructed to prepare and analyze the samples in the same manner as the samples they were receiving from the sampling contractors. This effort revealed some critical analytical concerns for some of the laboratories.

Two of the most significant problems were high blank readings, possibly due to contamination, and high detection limits resulting in several nondetect values being reported. To address these analytical issues, Jenny Sun, an analytical chemist at the EERC, worked with other laboratory staff to assist in the identification of problematic areas in preparing and analyzing the samples from the Ontario Hydro Method. The EERC also served as a reference laboratory to perform repeat analyses on several coal, ash, and impinger samples.

The Ontario Hydro Method has been proven to be an extremely reliable method for Hg speciation. However, its widespread use by individuals with varying degrees of training has unveiled some unexpected concerns that are currently being reviewed. Changes have been made to the Ontario Hydro Method to help clarify procedures and techniques.

For additional information, please contact Carolyn Lillemoen, EERC Analytical Research Laboratory Manager, at (701) 777-5057 or at clillemoen@undeerc.org; or Dennis Laudal, EERC Research Manager, at (701) 777-5138 or at dlaudal@undeerc.org.

Hg Methods		
Designation	Description	MDL, ng/g
ASTM D3684	Bomb combustion/CVAA	50
ASTM D6414	Acid extraction/CVAA	30
EPA 3052	Microwave digestion/CVAA	30
EPA 7473	Thermal decomposition amalgamation/AA	20
Cl Methods		
Designation	Description	MDL, µg/g
ASTM D4208	Bomb combustion/IC	200
	Eschka's Fusion/IC	200

a result of this work and extensive experience in sampling analysis for Hg, EERC researchers were selected to assist and oversee other organizations involved in the ICR effort to help ensure the proper implementation of the method.

Richard Schulz, sampling manager at the EERC, along with Ralph Roberson of RMB Consulting, acted as independent observers to ensure that selected sampling contractors were performing the Ontario Hydro Method properly and that adequate QA/QC controls were in place.