September 15, 2000

MEMORANDUM

To: William Maxwell, EPA/OAQPS/ESD/CG

From: Jeffrey Cole, RTI

Subject: Draft Interim Report on Data Analyses

PURPOSE

The purpose of this memorandum is to discuss RTI's data analyses after the delivery of the Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units Final Report to Congress (issued on February 24, 1998)

BACKGROUND

Section 112(a)(8) of the Clean Air Act, as amended (CAA), defines an "electric utility steam-generating unit" as "any fossil-fuel–fired combustion unit of more than 25 megawatts electric (MWe) that serves a generator that produces electricity for sale." A unit that cogenerates steam and electricity and supplies more than one-third of its potential electric output capacity and more than 25 MWe output to any utility power distribution system for sale is also considered an electric utility (EU) steam-generating unit (i.e., utility unit).

Section 112(n)(1)(A) also requires that:

- The EPA develop and describe alternative control strategies for hazardous air pollutants (HAPs) that may warrant regulation under section 112; and

- The EPA proceed with rulemaking activities under section 112 to control HAP emissions from utilities if EPA finds such regulation is appropriate and necessary after considering the results of the study.

Based on available information and current analyses, the EPA concluded that: mercury from coal-fired utilities is the HAP of greatest potential concern and merits additional research and monitoring; and, further research and evaluation are needed to gain a better understanding of the risks and impacts of utility mercury emissions.

Two of the potential areas identified for further study included: (1)additional data on the mercury content of various types of coal fired in U.S. utility units; and (2) additional data on mercury emissions (e.g., how much is emitted from various types of units, how much is divalent vs elemental mercury, and how do factors such as control device, fuel type, and plant configuration affect emissions and speciation).

DATA COLLECTION

Following the issuance of the Report to Congress, EPA initiated, under the authority of section 114 of the CAA, the Electric Utility Steam Generating Unit Mercury Emissions Information Collection Effort (EU/ICE). As a part of this effort, RTI provided support to EPA in the EU/ICE development, distribution and processing. The EU/ICE has three basic sections: Part 1: General Facility Information; Part II: Coal/Fuel Analysis; and Part III: Speciated Mercury Emissions Testing Data. Parts I, II, and III of the EU/ICE; were mailed out to all facilities that met the CAA definition. As the completed Part I data forms were returned to EPA, they had their data extracted to create a unit configuration database.

From January through December 1999, Part II of the EU/ICE resulted in the collection of data for over 152,000 coal shipments from 1,143 units at 464 coal-fired facilities, a total of approximately 40,500 individual mercury and chlorine analyses. To achieve this compilation of data, a web-based data collection system was developed to allow the affected electric utilities to submit their Part II data over the Internet. The website provided a high-end technical solution to a large data collection effort and reduced the time required for data submission and the potential for data entry errors. The website ended up collecting greater than 8 million pieces of data.

Under Part III of the EU/ICE, stack tests were conducted at 85 separate EU units to measure speciated mercury emissions. These data were reported by the companies to EPA and were entered into a database. These data were used in the emission program (see below) developed to estimate nationwide mercury emissions as well as to estimate mercury collection across different control devices, boilers, and fuel types.

WEBSITE

A web-based, interactive data collection system was developed to gather data on the mercury and chlorine content of the coals fired (including tire-derived fuel and petroleum coke) in U.S. utility units, as well as the fuel consumption data, directly for each electric utility company or facility. The data were collected through the development and use of user-friendly web pages. The website had two different portions, a nonsecure and a secure portion, each with different

purposes. The nonsecure portion of the website was developed to serve as a conduit for information from EPA in response to questions from the electric utility industry. The nonsecure website also served as an entry point to the secure website.

The secure website was developed as an online collection point for EU/ICE Part II shipment, analysis, and fuel usage data by unit and by month from 464 coal-fired facilities. To familiarize EU/ICEindustry contacts with the on-line data entry procedures, a website user guide was created in Adobe Acrobat format.

A toll-free customer service hotline (with email access) was manned to answer questions and disseminate information to the participants of the EU/ICE. If a question was thought to be of interest to more than just the facility/company that submitted it, the question and answer were posted in the frequently-asked-question (FAQ) webpage on the nonsecure website. The process was initiated by requesting e-mails from the EU/ICE contacts explaining their problems. The EPA would then answer the questioning facility by e-mail with a copy being posted on the website's FAQ pages.

This method of answering EU/ICE questions had the additional benefit of creating a paper trail of EU/ICE modifications that could be recorded in the Electric Utility Hazardous Air Pollutant Emission Study Docket No. A-92-55.

QUALITY CONTROL

Quality control and customer service were important parts of the EU/ICE. To enhance quality control and customer service during the EU/ICE, the following actions were initiated.

Early in the planning of the EU/ICE, EPA determined that the data from each facility should be able to pass a statistical confidence test on their coal/fuel analyses data. EPA statisticians established what confidence intervals were necessary to determine if the industry were sampling and analyzing at a sufficient frequency to obtain statistically reliable data. Programmers created a statistical evaluation portion of the website to determine if incoming data could pass the EPA-imposed confidence interval test for data quality. The EU/ICE website was programmed to advise contacts on how to increase or decrease the frequency of analyses through a set of flow tables.

For those EU/ICE contacts with numerous facilities who found webpage data entry too time-consuming, a data-upload capability was developed through the use of data entry spreadsheets (saved as text files). To familiarize EU/ICE contacts with these data entry spreadsheets, a spreadsheet user guide was created in Adobe Acrobat format.

Before a data entry spreadsheet-based, tab-delimited, text file upload was allowed, the website checked the data for completeness. If there were data missing from the upload, loading would not occur, and an error message would be displayed. The website was also designed to flag

errors in data and to stop all incomplete or incorrect data loading. This error checking was accomplished by implementing online quality control checks. These online checks would not allow the entry of obviously incorrect data (e.g., zeros, text in numeric fields).

Programmers also created a duplicate development website (a mirror image of the live website, but not available to the public) where new features and changes could be tried without affecting the live website. This tactic proved to be a valuable tool because complex procedures could be fully developed before being seen by the EU/ICE contacts.

DATA ANALYSIS

To estimate total mercury emissions from coal-fired electric utility units, an emission factor program (EFP) was developed. The EFP was built to accept data from the three data sources in the EU/ICE. The first is a data input file containing plant configurations created from responses from the ICE (Part I). The second source is a database containing detailed mercury analyses and fuel consumption data, by unit, and by month for all of 1999 (Part II). The third data file is the emission modification factor (EMF) database. This database contains results from the 85 speciated mercury emission tests conducted by the electric utility industry under authority of the ICE (Part III). Eight of the 85 tests were done previously under a DOE study between 1996 and 1998. The use of the eight tests was permitted by EPA because the test methods were the same as or similar to the EU/ICE Part III units (tested in 1999 and 2000) and were tested for speciated mercury.

The program first categorizes each coal-fired electric utility unit by its fuel type/boiler type/emission control system(s) and assigns them to bins with other common units. The program then categorizes the 85 units that were subject to stack testing under Part III by fuel type/boiler type/emission control system(s) and places them into similar combinations of bins. The program then computes unit-by-unit the mercury loading by analyzing the fuel burned by the unit for 1999 and the concentration of mercury in the facilities fuel in 1999 (from Part II). The mercury removals are then averaged from all the units in the stack-tested bins and that removal is applied to the mercury loading for each individual unit. This procedure results in a kg/yr mercury output for each unit and thus, when all units emissions are totaled, estimates nationwide mercury emissions.

Because stack testing did not analyze every configuration of fuel type/emission control/boiler type system, the units that did not match perfectly had to be assigned a stack-tested bin in order for their emissions to be quantified. A hierarchy (fuel type/boiler type/emission control system) was used, as well as engineering judgment, to assign bins to those units that did not perfectly fit into a stack-tested bin.

RESULTS

The results of the EFP model are the following. The estimated national total of mercury emitted from all coal-fired electric utility steam-generating units in 1999 is 43.4 tons. This amount of mercury was emitted from 1,143 units at 464 facilities.