

Active EIP Projects

October 2003

CHEMICAL SPECIATION OF VEHICLE EMISSION SAMPLES FOR THE KANSAS CITY PARTICULATE MATTER EMISSIONS STUDY

GOAL

Determine the distribution of PM emissions and identify the percent of high emitters in the fleet by testing exhaust emissions from 480 light-duty, gasoline vehicles in the Kansas City Metropolitan Area (KCMA). EIP is funding speciation of gaseous and PM toxics samples from a portion of these light-duty vehicles.

FUNDING

\$500,000

CONTACT

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DESCRIPTION

The U.S. Environmental Protection Agency is conducting a program to evaluate particulate matter (PM) exhaust emissions from light-duty gasoline vehicles. The program consists of measuring PM in exhaust emissions of up to 500 randomly selected, light-duty vehicles in the Kansas City Metropolitan Area. A sampling plan has been developed that will allow for the determination of the distribution of PM emissions in the sampled fleet as well as the identification of the percent of high emitters. Data obtained from this program will be used to evaluate and update existing and future mobile source emission models, evaluate existing emission inventories and recent source apportionment studies comparing the contribution of gasoline and diesel combustion to ambient PM concentrations, and assess the representativeness of previous PM emissions studies.

Laboratory preparation and analysis activities will need to be conducted to support the Kansas City Particulate Matter Emissions Study. Results from the physical and chemical characterization of emissions will provide information for national emission inventories, the SPECIATE emission factor database, profiles for source apportionment studies, and air toxics emission estimates for trends assessments.

The EPA will operate gasoline-powered motor vehicles on their transportable dynamometer at a location in the Kansas City area. The Coordinating Research Council, through the University of Kansas, will recruit vehicles to the testing site. The EPA will drive the vehicles over specified test cycles on the dynamometer, and operate the primary dilution tunnel during the testing

operations, where samples will be collected.

Vehicles will be tested on the EPA transportable dynamometer using a modified driving cycle that will be composed of four phases: 1) a cold start, 2) hot stabilized operation after a cold start, 3) a warm start, and 4) hot stabilized operation after a warm start. One sample will be collected for the first phase and a composite sample for phases 2 through 4 will be collected for each vehicle.

Measurement methods to be used in this project include continuous monitoring and integrated sample collection. Continuous monitoring and integrated gravimetric analysis will likely occur for all vehicles tested, while full chemical speciation will likely be conducted for a select percentage of vehicles.

NONROAD PILOT PROGRAM

GOAL

Develop Pilot Program to better understand in-use, nonroad emissions, activity and population data

FUNDING

\$255,000

CONTACT

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DESCRIPTION

Over the past decade, we have made important strides in understanding and regulating the harmful emissions from nonroad sources. On the modeling side, we have developed first NEVES and more recently the NONROAD model to estimate nonroad source emissions. On the regulatory side, we have begun to regulate emissions from most categories of nonroad engines, including diesel engines, small gasoline engines, marine engines, and others. However, even with these nonroad regulations in place, based on our best data, we estimate that by 2020 (with all current nonroad and highway regulations in place) nonroad engines will emit over 75 percent of PM10, over 65 percent of NOx, and over 50 percent of benzene from mobile sources. Because of their important contributions to air emission inventories, it is critical that we continue to improve our understanding and add to our knowledge of nonroad emissions and inventories.

As we attempt to model and regulate the nonroad sector, we face certain unique challenges that we don't face for highway mobile sources. First of all, there is very little in-use data available on

nonroad sources. We have fewer than 50 in-use data points in our model, on only 15 of the 89 equipment categories, covering only 5 of the 11 sectors. By contrast, on the highway side, we have 30 years of data and thousands of in-use tests. Where we lack in-use data for our nonroad model, we rely on laboratory or certification data. That data likely under-estimates nonroad emission rates in the real world. In part, the reason for the disparity between highway and nonroad data collection is based on two facts: interest in nonroad has grown only in the last decade as highway emissions have been tightly controlled, and the cost of testing nonroad equipment is far greater than highway vehicles.

Second, nonroad engines are very different from highway vehicles. Nonroad equipment comprises a tremendous variety of engines, configurations, applications, and usage patterns (lawn mowers, bulldozers, generators, snowmobiles and so on). For example, the nonroad model includes 89 equipment types in 11 different major sectors (farm, construction, industrial, etc.). By way of contrast, most light duty cars are used in basically the same ways; the variables are limited to a reasonable set.

Third, state departments of transportation and motor vehicle registration bureaus routinely collect data on highway motor vehicles that are essential for emission modeling, including data on vehicle activity (VMT) and vehicle registration data. Similar infrastructure and routine data collection do not exist for nonroad equipment activity and population. Nonroad equipment is not registered, tracked, counted, taxed, tested, or controlled by states or by the federal government. Most importantly, methods and guidance on how to collect such data do not even exist.

Fourth, EPA does not have approval from the Office of Management and Budget under the Paperwork Reduction Act to conduct studies of nonroad emissions, activity, or population.

To address these problems, OTAQ has prepared a master plan for nonroad data collection. That plan has three major elements: develop a pilot program to better understand in-use, nonroad emissions, activity and population; obtain OMB approval for the routine collection of nonroad data; and implement an ongoing data collection program. We are developing a fourth element to this plan with the assistance of the Emission Inventory Improvement Program: develop guidance on the design and implementation of programs to collect nonroad activity and population data.

OTAQ has already done significant planning for the first two elements of this program - the pilot project and OMB approval. We plan to launch the ground phase of the pilot project in 2003. The study area for the pilot will be one metropolitan statistical area (MSA) and some outlying rural counties, in which we will study population, activity and emissions of the full range of nonroad equipment, including locomotives, commercial marine, and aircraft. The study will have two major components: a survey of owners, both residential and commercial; and, site visits. The site visits will involve counting equipment, reading hour meters, obtaining historical usage databases, and deploying PEMS (portable emission measurement systems) and PAMs (portable activity measurement systems) on selected equipment.

At this point, we have designed and pre-tested the questionnaires that will be used in the mail surveys. We are also working closely with OMB for approval of the Information Collection

Request under the Paperwork Reduction Act for this program. The data gathering portion of the pilot program will span a 12-month time period. We hope to collect over 300 PEMS samples, 1,200 PAMS samples, and several thousand surveys. The expectation is that we will have thoroughly characterized nonroad equipment population, activity, and emissions of targeted equipment in that particular area as a result of this study.

The goals of the pilot include gaining experience on how to effectively collect in-use data and vetting techniques for data collection, bounding uncertainly around activity population and emission estimates, and gaining experience in how to design ongoing research programs. Deliverables include a review of whether Nonroad 2002 addresses issues noted by states and whether the model agrees with the results of local studies such as the Houston Construction Study.

EIIP support for this project will help translate the experience gained into guidance and protocols for states to conduct similar studies in the future.

FUGITIVE DUST MODEL ENHANCEMENTS

GOALS

1. Couple Fugitive Dust Model with GIS input data
2. Add NH₃ emission emissions module for fertilized fields

FUNDING

\$175,000

CONTACT

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DESCRIPTION

This project entails coding a fugitive dust model for use in stand-alone applications and as part of the Sparse Matrix Operator Kernel Emissions (SMOKE) emissions processor. A geographical database will be generated to allow users to develop emission estimates for unpaved roads, windblown dust and agricultural operations using information such as crop calendars, tillage methods and meteorological data.

A module to facilitate calculating NH₃ emissions from fertilized fields is planned. It will be based upon a theoretical approach to estimating emissions and will rely on fertilizer values from the NH₃ emissions model developed by Ross Strader of the Carnegie Mellon Institute as well as elements of the Pesticides Emissions Model.

Gridscales as small as 4 kilometers will be supported. Episodic events and annual emission estimates will be possible by county and aggregated if desired.

Completion of the fugitive dust portion of the project is targeted for mid-2003 with the coding and testing of the NH3 module to completed by the end of calendar year 2003.

GASOLINE MARKETING & RESIDENTIAL FUEL COMBUSTION

GOAL

Improve national county level emission estimates for gasoline marketing operations and residential fuel combustion.

FUNDING

\$152,000

CONTACT

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DESCRIPTION

The EIIP Area Sources Committee has completed work to estimate emissions for residential fuel combustion and gasoline marketing. The residential fuel combustion project had a two-fold goal: to analyze the reported residential fuel combustion emissions estimates in the 1999 NEI, and to develop and apply a methodology for estimating residential fuel combustion emissions on a state and county level for the whole nation. The EIIP estimates have been incorporated into the 1999 Final Version 3 criteria pollutant NEI after being reviewed by state, local and tribal agencies as part of the draft Version 3 inventory.

The methodology developed for estimating residential fuel combustion emissions makes use of publicly available data sets. Separate data sets were obtained for state fuel consumption, and for allocating fuel to individual counties. Emission factors from AP-42 were reviewed and selected. Using the data and emission factors, emissions calculations were prepared for the following pollutants:

- Carbon monoxide
- Nitrogen oxides
- Sulfur dioxide
- Volatile organic compounds
- Condensable and filterable particulate matter (both PM10 and PM2.5)

A second part of the project involved comparing 1999 NEI Version 2 VOC emissions from

gasoline station operations (Stage I and Stage II) for all counties with estimates developed using a consistent methodology. The work was begun primarily because of suspicions that the NEI criteria inventory (VOC) contained data of highly variable quality - while many jurisdictions had been submitting updates thru the years, estimates for many other counties were apparently grown from estimates at least 10 years old, while fuels and control levels had been changing. Issues were noted with trying to make comparisons when certain SCCs had been included and others were missing. Some jurisdictions have included gasoline stations in their point source submittals. The NEI HAP inventory was believed to be of better quality because of efforts associated with the 1996 and 1999 inventories to apply consistent methodologies across all counties using DOE thruput data as a starting value. However, the VOC estimates generated as an intermediate step to developing the HAP estimates have not been used to update the criteria pollutant inventory. State and county-level emissions comparisons were developed to show the differences between NEI reported emissions and emissions estimates developed for this project.

QA/QC TOOLS FOR TOXICS INVENTORIES

GOAL

Develop tools for state and local agencies to use for improving the quality of Hazardous Air Pollutant emission inventories

FUNDING

\$125,000

CONTACT

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DESCRIPTION

The stationary source National Emission Inventory (NEI) for hazardous air pollutants (HAPs) is compiled by EPA with state and local agency inventory data included as the highest priority data source. For air toxics in the NEI, data from EPA's Maximum Achievable Control Technology (MACT) and Toxic Release Inventory (TRI) programs are also included. To ensure consistency and aid in development of a high quality inventory, EPA requires that agencies submit their inventories in the NEI Input Format (NIF) or Extensible Markup Language (XML). The NIF is available in ACCESS™. The standardized NIF format makes it easier for EPA to provide tools that state and local agencies can use to evaluate their inventories, including the composite databases of state/MACT/TRI air toxics data for various base years released by the Emission Factor and Inventory Group (EFIG).

Key to the effort in the developing the NEI for HAPs are quality control (QC)/quality assurance

(QA) activities. The EPA's EFIG has developed a tool, *NIF Version 2.0 QA Software*, that state and local agencies and tribes can use to identify potential format errors with data integrity, code values and range checks. The *NIF Version 2.0 QA Software* reads state and local agency and tribal ACCESS™ NIF files and prepares output QC reports in ACCESS™.

In order to improve the quality of emissions data in the NEI for HAPs, the EFIG has developed an additional tool for state and local agencies and tribes that will QC the emissions data received from State/local/tribal agencies. The QC of emissions data is needed to determine if emissions for sources in similar categories are of similar magnitude and at similar resolution. The QC of emissions data includes comparative analyses and statistical identification of outliers. By improving the State/local/tribal submissions, we improve the National Emission Inventory for all.

Another key QC activity is to compare HAP and criteria emissions in the NEI. Historically, the criteria inventory and the HAP inventory files were developed independently. In the future, these two inventory efforts will be combined so that they are more consistent and serve greater inventory needs. Volatile HAPs are a subset of total volatile organic compounds (VOCs). A number of HAPs are a subset of particulate matter (PM), although their delineation is not necessarily straightforward. A useful first step in the merging of the two inventory development efforts is an assessment of their similarities and differences. The goal is to identify sources of discrepancies in emissions, source categories, and facilities.

USE OF TRAVEL DEMAND MODELS WITH MOBILE6

GOAL

Develop guidance methods for incorporating travel demand model data into emission estimates using MOBILE6.

FUNDING

\$80,000

CONTACT

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DESCRIPTION

MOBILE6 was developed by EPA's Office of Transportation and Air Quality to utilize more complex locally derived inputs. A critical component in developing these inputs is use of travel demand models (TDMs). TDMs provide important data related to the calculation of quality emission estimates by providing better spatial, temporal, speed, trip end and fleet mix

information. These improvements however, can present certain difficulties. Often, speed information is not realistic, temporal and spatial information is appropriate for weekday activities but inappropriate for weekends, and not all TDMs properly account for fleet mix. Therefore, guidance materials are needed that address methods for the incorporation of TDM data into emission estimates using MOBILE6.

This project will develop needed guidance for the following subject areas:

- Temporal distribution of speed, VMT, starts/stops and vehicle mix
- Spatial distribution of network VMT, links and traffic analysis zones
- Spatial distribution of non-network VMT
- Use of TDM trip starts/stops to reflect hot and cold starts
- Use of TDM speeds in a trip based emission factor model (MOBILE6)
- Improvements for weekend travel

PAINT AND INK MANUFACTURING

GOAL

Improve existing guidance for estimating VOC and HAP emissions from paint and ink manufacturing facilities.

FUNDING

\$75,000

CONTACT

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DESCRIPTION

The existing guidance document presents preferred and alternative methods for estimating VOC and HAP emissions from paint and ink manufacturing operations. Included is use of emission models based upon theoretical approaches. A comprehensive review of the emission models is being conducted to ensure all emission mechanisms are addressed. New procedures for estimating emissions from operations not addressed such as “nitrogen sweeps” are being added as well as tools to facilitate calculation of emissions from open top tanks. Several new examples will help simplify calculation of emissions.

SCHEDULE

An updated draft of the existing EIP document for paint and ink manufacturing will be available for review shortly. An additional document on batch processing for the chemical industry has

also been developed as a by-product of the update effort and will also be available for review.

AREA SOURCE SOLVENT USE

GOAL

Improve solvent usage data for 11 area source categories and update county level emission estimates

DESCRIPTION

Many of the EIIP area source solvent estimation methods and emission factors are based on allocating national solvent consumption data to state and local locations. Due to process changes and introduction of new technology, the national solvent consumption patterns have changed over time. This project developed improved area source numbers using national solvent usage data from 1999 developed by The Freedonia Group for the following source categories:

- Architectural surface coatings
- Automobile refinishing
- Traffic paints
- Industrial coating operations
- Surface cleaning (degreasing)
- Consumer and commercial products
- Graphic arts
- Pesticide application
- Dry cleaning
- Industrial adhesives and sealants
- Process solvents and other operations

The area source solvent process categories were initially divided into two groups according to the availability and specificity of solvent utilization data. One group consisted of four “paint and coating (P&C)” area source solvent process categories and the other group consisted of seven “non-paint (NP)” area source solvent process categories. Solvent consumption was allocated to counties and information gathered to estimate /document controls in place on the solvent consumed.

The calculation procedure included the following basic steps:

- National solvent utilization data was obtained from available marketing reports for 1998, distributed into specific solvent emission process activity classifications, entered into the

electronic database, and converted to tons per year VOC use/emissions;

- The VOC solvent emission process data were grown to 1999;
- Spatial surrogates were chosen to allocate the VOC data to the county level;
- Applicable national regulatory programs and effect of controls were determined; and
- The EPA's 1999 National Criteria Emission Inventory (NEI) was used to represent the point source portion of the VOC solvent process emissions, and were subtracted to obtain the area source solvent category emission estimates.

FUNDING

\$70,000

CONTACT

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LOCOMOTIVE AIR EMISSIONS INVENTORY PROJECT

GOAL

Develop a guidance document containing improved methods for collecting detailed rail activity data that state and local agencies can use for estimating local emissions from railway locomotives.

FUNDING

\$60,000

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DESCRIPTION

A survey of the 1999 National Emissions Inventory revealed that just four states, one county and one city submitted emissions estimates for railroads. Meanwhile, the U.S. Bureau of Transportation Statistics' 1999 Annual Report indicates that rail shipments account for 27 % of the ton-miles by domestic freight shipments. According to the Intermodal Association of North America, rail intermodal traffic continues to increase at a rate of approximately 5-6 % per year

and several major shipping ports in the U.S. are expanding their intermodal container handling capabilities to handle expected increases in demand for overseas shipments. These port expansions typically include the addition of rail facilities to ship containers to interior portions of the Country. To meet the increasing demand at port facilities, railroads are opening and improving rail terminals in several major cities across the nation.

Rail growth has been spurred over the last 20 years by efficiency improvements as well as increased federal and private funding. Prior to 1980, rail transportation suffered from an aging infrastructure and increasing competition from highway transportation. The advent of double-stacked container capabilities on important rail routes in 1980 however, has spurred new life into railroads. With double-stacked container capability came increased demand for rail shipments. Bolstered by this demand, rail transporters have used private capital as well as federal funding from the Intermodal Surface Transportation Efficiency Act of 1991 and other federal programs to upgrade the rail infrastructure. These upgrades have created a continued increase in capacity and demand for rail services.

Failure to account for this growing source of emissions in state and local inventories appears to be a result of a lack of usable guidance and available data. The existing EPA guidance for generating estimates of railroad emissions is out of date. Even though updated EPA guidance has been issued for highway sources, no updated guidance has been issued for nonroad sources such as locomotives. This project is intended to give states, local governments and others the data sources and methodology needed to generate a railroad emissions inventory that would then be useful to SIP, photochemical modeling and other efforts that require accurate estimates of rail emissions.

Under the current guidance, the emissions are computed by fuel-based emission factors, expressed in units of pounds of emissions per thousand gallons of fuel burned. The emission factors for various pollutants are based on two national averages: (1) the average duty cycle represented as a fraction of time in each notch, and (2) the national average locomotive fleet weighted by expected use of the various locomotives in the fleet.

This project will develop a report on locomotive emission inventory methods, issues and preferred/alternative methods. At a minimum, the following will be addressed:

- Background information on locomotive air emissions
 - EPA regulatory actions and emission factors
 - What state and local air agencies need to collect for data
 - Preferred methods using surveys
 - Alternate methods using default parameters and available databases
 - Data encoding issues
 - Annotated bibliography
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MANMADE STATIONARY SOURCES OF AMMONIA

GOAL

Update emission estimates for manmade stationary sources of ammonia in a report developed for EPA entitled *Development and Selection of Ammonia Emission Factors*, August 1994 by EC/R (commonly referred to as the Battye Report).

FUNDING

\$52,000

CONTACT

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DESCRIPTION

Chapter 4 (Ammonia Emissions in Industry) and Chapter 5 (Ammonia Emissions from Combustion) of the Battye Report will be updated. This will involve consulting the literature, working with state and local agencies across the Country to update NH₃ emissions for stationary source categories identified in the subject chapters, and extracting information from EPA's Toxics Release Inventory (TRI). The TRI is expected to be a valuable resource since many sources and updated emissions information are expected to have been added since publication of the Battye Report.

STATUS

A draft report is now available and a new work assignment has been developed to address work group comments. The final report should be completed by January 1, 2004.

CARBON "SPLITS" FOR PM

GOALS

1. Review PM profile assignments for source categories used in air quality modeling
2. Determine organic & elemental carbon fractions

FUNDING

\$35,000

CONTACT

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DESCRIPTION

This project has two goals: (1) review and update where possible, the assignment of existing profiles for PM fine to source categories used by emission models, and (2) examine data on the forms of carbon that are emitted to establish new factors that will be used to determine the fractions of carbon that are “organic” and “elemental.”

The profiles for updating consist of factors used for separating PM fine emissions into the component parts of organic carbon, elemental carbon, sulfates, nitrates, and “all other” category that consists primarily of crustal material. A review of “gray” and published literature will be conducted to identify data for updating existing profiles with a focus on developing new “splits” for carbon.

This project will address differences in analytical techniques for carbon, develop default factors to use for sources not assigned to existing profiles, and examine the feasibility of developing factors that are year specific which may be important for mobile sources due to changing combustion and control technologies. Of significance will be the generation of meta data files to allow users to assess data quality and evaluate the appropriateness of profile assignments to source categories with localized characteristics that may appreciably deviate from the national average.

RESULTS

A set of updated profiles has been prepared, including added documentation for the older existing profiles. The SCC-to-profile assignment file has been reviewed and revised to both incorporate the new profiles and to check for anomalous assignments of the older existing profiles. Those materials have been posted to the CHIEF Web page (www.epa.gov/ttn/chief/emch/speciation) for review & comment as of October 14, 2003.

RESIDENTIAL WOOD COMBUSTION ACTIVITY DATA

GOAL

Form a national ad hoc workgroup to share information in order to improve activity data for residential wood combustion.

FUNDING

\$15,000

CONTACTS

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DESCRIPTION

There have been numerous surveys to collect information about residential wood combustion activity in the United States. When a municipality completes a residential wood combustion activity study, often the study is repeated in subsequent years to track the change in activity or effect of regulations. As a result, there is a significant amount of information available about residential wood combustion activity in some areas. The objective of this project is to form a national ad hoc workgroup to share information in order to improve activity data for residential wood combustion. MARAMA will create a forum to discuss the survey methodologies and results of these studies. The residential wood combustion activity information will then be compiled into a format that will provide access to residential wood combustion studies information. This format could be in the form of a Web site, report or other means of information transfer. The project will address residential wood combustion from home fireplaces, woodstoves and other wood burning sources for rural and urban areas.

SCHEDULE

A draft report is now available from MARAMA.

SCHOOL BUS DIESEL EMISSIONS

GOAL

Meet the need for emission inventories from school bus retrofit programs

FUNDING

\$15,000

CONTACT

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DESCRIPTION

This project will supplement use of the Voluntary Diesel Retrofit Program Calculator developed by EPA's Office of Transportation and Air Quality. It will simplify calculations for school district sponsors and provide a means for agencies creating emission inventories to manage their data related to school bus fleet emissions. School districts and policy decision makers will be better able to evaluate emission reduction credits for their proposed or existing programs.