



Project Summary

Identification and Characterization of Missing or Unaccounted for Area Source Categories

S. Kersteter, D. Zimmerman, R. Cawkwell, A. Chadha, B. Henning, M. Henning, T. Lynch, P. Marsosudiro, W. Tax, D. Winkler, and G. Woodall, Jr.

Area source emissions of particulate matter (TSP), sulfur dioxide (SO₂), oxides of nitrogen (NO_x), reactive volatile organic compounds (VOCs) and carbon monoxide (CO) are estimated annually by the National Air Data Branch (NADB) of EPA's Office of Air Quality Planning and Standards. Area sources include all mobile sources and any stationary sources that are too small, difficult, or numerous to be inventoried as point sources. The NADB defines an area source as an anthropogenic mobile or stationary source that emits less than 100 tons* per year of TSP, SO₂, NO_x, VOC, and CO. The original National Emissions Data System (NEDS) area source methodologies and algorithms were developed in 1973 and 1974, using 1960 census data, and identified 64 area source categories. The National Acid Precipitation Assessment Program (NAPAP) expanded the NEDS area source category list to 97 categories.

Chapter 4 of *Procedures for the Preparation of Emission Inventories for Precursors of Ozone, Volume I* (EPA-450/4-88-021, December 1988) lists area source categories to be included in a State Implementation Plan (SIP) inventory. The list of area source categories to be inventoried and the emissions estimation methodologies given in the SIP guidance differ noticeably from the NEDS categories and methodologies. While emissions sources included in NEDS and SIP inventories cover a large portion of anthropogenic emissions, many smaller source categories are not included in either inventory. Identification, charac-

terization, and inclusion of these categories and their emissions in the inventory program will result in a more thorough and complete emissions inventory.

This report gives results of work completed under three work assignments under EPA Contract 68-D9-0173. The objectives of this work were to identify and characterize emissions sources not currently accounted for by either the existing NEDS or SIP area source methodologies. In all, 70 missing source categories were characterized, to the extent possible, in 12 areas:

- definition/description of the category and activity
- process breakdown (if applicable)
- importance of the category (i.e., reason for considering the category)
- pollutants emitted
- estimate of the pollutant levels
- point/area source cutoff (i.e., does the category have both a point source and an area source component?)
- level of detail of available information
- level of detail required by users
- emission factor requirements
- regional, seasonal, or temporal characteristics
- urban or rural characteristics
- potential emissions estimation methodology

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

*1 ton = 907 kg.



Introduction

A missing or unaccounted for source category is one that does not explicitly appear on the NEDS area source category list or the SIP area source category list as presented in Chapter 4 of *Procedures for the Preparation of Emission Inventory for Precursors of Ozone*, Volume I (EPA-450/4-88-021, December 1988). Exceptions to this generic definition include, for example, residential liquefied petroleum gas (LPG) consumption, and light-duty diesel passenger cars and trucks. Residential LPG consumption is not explicitly listed as a NEDS area source category but is accounted for within the methodology for residential natural gas consumption. Light-duty diesel passenger cars and trucks are also not explicitly accounted for in the NEDS mobile sources methodology, although diesel vehicle miles traveled (VMT) and diesel fuel consumption are assigned to the heavy duty diesel category. Examples of true missing or unaccounted for source categories include cooling towers, street sweeping, street sanding, restaurant charbroiling operations (wood- or charcoal-fired), and aircraft cruise (inflight) operations.

Addressing the area of missing or unaccounted for source categories involves several steps:

- identifying source categories
- data gathering and initial characterization of categories
- priority ranking of characterized categories
- more detailed, in-depth characterization of high ranking categories and emissions estimation methodology development

This project was designed to identify and characterize the missing or unaccounted for area sources. The complete effort has been divided into phases. In all, 70 missing or unaccounted for source categories were identified.

Identification of Missing or Unaccounted for Source Categories

Missing or unaccounted for source categories were identified by contacting various individuals and groups, conducting literature searches, reviewing the Clean Air Act Amendments of 1990 (CAAA) and Superfund Amendments and Reauthorization Act (SARA) Title III, investigating changing technologies, and reviewing other information sources (e.g., in-house knowl-

edge, telephone book yellow pages). Groups and individuals contacted include: EPA personnel, including Regional SIP representatives and other knowledgeable personnel from the Office of Air Quality Planning and Standards (OAQPS), Office of Mobile Sources (OMS), Office of Toxic Substances (OTS), Air and Energy Engineering Research Laboratory (AEERL), and Atmospheric Research and Exposure Assessment Laboratory (AREAL); state and local agencies; NAPAP participants; Environment Canada; trade and professional organizations; and environmental groups.

A partial list of missing or unaccounted for categories identified by this process include: roofing activities; airport, rail yard, and marine port support activities; charbroiling; automobile fires; paving or traffic paints; road and highway construction; and wineries. Some contacts provided information useful for characterizing the categories or estimating emissions from the categories. In addition, several contacts expressed concern about current methodologies.

The National Technical Information Service (NTIS) database, ChemAbstracts (using the Dialog Information Service), EPA holdings, and Triangle university collections were searched for reports or papers identifying emissions sources not included in NEDS or SIP methodologies. The NTIS database was searched through the CD-ROM system for the period 1985 through April 1990. General keyword identifiers (e.g., area source, emission inventory) were used, as well as specific category keyword identifiers (e.g., cooling tower, pesticide air emissions). Approximately 135 pages of bibliographic information with abstracts were reviewed. Many of the citations referred to documentation from the 1980 and 1985 NAPAP inventories. Ten documents were selected for further review. These NTIS documents were retrieved on fiche from the North Carolina State University public documents collection.

No relevant citations were identified from the EPA holdings search or an on-line title and subject search of the Triangle University Bibliographic Information Service (BIS). An initial search of ChemAbstracts (1967 to the present) produced 60 citations and bibliographic citations, which were reviewed. Relevant documents were retrieved from the EPA/ERC Library and Duke University's Engineering Library.

Other information sources reviewed include annual Air and Waste Management Association (AWMA) (formerly Air Pollution Control Association) proceedings, AWMA specialty session proceedings, EPRI documents, Third Party NAPAP review documentation, and state NAPAP review comments.

Those documents identified during the literature search and considered useful for this work assignment were summarized briefly for this report. A comment was added after each document summary to characterize the relevant source types and usefulness of information in the document. Documents summarized include:

- *Hazardous Waste TSDF (Treatment, Storage, and Disposal Facilities): Fugitive Particulate Matter Air Emissions Guidance Document*, C. Cowherd et al., EPA-450/3-89-019 (PB89-103250), May 1989.
- *Area Sources of VOC (Volatile Organic Compounds) Emissions and Their Contribution to Tropospheric Ozone Concentrations*, M. Kosusko and S.L. Nolan, EPA-600/D-89-075 (PB89-181291), June 1989.
- *Screening-Level Assessment of Airborne Carcinogen Risks from Uncontrolled Waste Sites*, T.F. Wolfinger, JAPCA 39:461-468, April 1989.
- *Ethanol Emissions and Control for Wine Fermentation Tanks*, California Air Resources Board, ARB/ML-88-027 (PB88-223540), April 1989.
- *Assessment of Non-Regulated Sources in the Seattle Area*, G.M. Savage and H. Sharpe, Waste Management and Research 5:159-171, 1989.
- *PM₁₀ Emission Factors for Specialized Open Dust Sources*, C. Cowherd and M.A. Grelinger, In *Proceedings of the 81st Annual Meeting of APCA*, Dallas, TX, June 19-24, 1988 (88-71B.3).
- *Evaluation of Emissions from Selected Uninventoried Sources in the State of California*, Radian Corporation, ARB/R-88-343 (PB88-215215), April 1988.
- *Sources and Concentration of Chloroform Emissions in the South Coast Air Basin*, Science Applications International Corporation, ARB-R-88/344 (PB88-215678), April 1988.
- *Updating Nontraditional VOC Source Inventories*, R.M. Leone, E.W. Davis, and A.D. Jones, In *Proceedings of the 80th Annual Meeting of APCA*, New York, NY, June 21-26, 1987 (87-58.2).
- *Photochemically Reactive Organic Compound Emissions from Consumer and Commercial Products*, A. Jones et al., EPA-902/4-86-001 (PB88-216940), November 1986.
- *Determination of Air Toxic Emissions from Non-Traditional Sources in the Puget Sound Region*, Engineering-Science, EPA-910/9-86-148 (PB87-123550), April 1986.
- *Air Toxics Technical Assistance for the State of Alaska*, R. Dickson, S. Peoples, and W. Oliver, EPA-910/9-87-159 (PB89-217897), March 1987.

¹Charbroil is used as defined in *Webster's New World Dictionary of the American Language*, Second College Edition. Simon & Schuster, Inc., New York, NY. 1986.

- *Effect of Wind Speed on the Atmospheric Levels of Particles Produced by Traditional and Nontraditional Sources on the Island of Curacao*, E. Sanhueza, J. Romero, and E. Gijssbertha, *Chemosphere* 14:91-97, 1985.

The CAAA were reviewed to identify source categories not addressed in NEDS or the SIP inventories, using the House version H.R.3030 (November 9, 1989; renumbered to House of Representatives Bill S.1630) and the Senate version S.1630 (January 23, 1990). Subsequent to passage of the final law in October 1990, the CAAA were reviewed for any material changes to the identification of source categories. Provisions in the SARA Title III legislation were also examined for specific area source categories.

Although little mention of specific area sources of emissions was made in the CAAA, several sources were identified, including: clean fuels; marine vessels; urban fugitive dust; residential wood combustion; prescribed agricultural burning; prescribed silvicultural burning; rocket engine and motor firing and cleaning; shipbuilding and repair; aerospace coatings and solvent; oxygenated fuel; outer continental shelf (OCS) oil and gas activities; research facilities; and oil and gas production. Of these sources, residential wood combustion, prescribed agricultural and silvicultural burning, and marine vessels are already included in the NEDS or SIP methodologies.

Title III of SARA (also known as the Emergency Planning and Community Right-To-Know Act of 1986) was reviewed for any mention of area sources not included in NEDS or SIP inventories; however, no sources were mentioned.

Using in-house knowledge and experience, several area source categories (where changing technologies may result in emissions from source categories not currently included in NEDS or SIP inventories) were identified. Some categories identified through this process include:

- ultraviolet (UV) and electron beam (EB) curable coatings
- clean fuels/alternate fuels
- chlorofluorocarbon (CFC) substitutes
- artificial wetlands designed to treat domestic sewage
- compressed natural gas
- pulp bleaching by ozone
- recycling activities
- drinking water ozonation
- coronal discharge
- innovative hazardous waste destruction and remediation techniques

In addition to the activities described earlier, telephone book yellow pages were searched. These searches not only helped

to directly identify sources not currently in the area source inventories, but also provided insight to the identification process. Sources identified through this process include small bakeries; fermentation processes found in breweries, distilleries, and wineries; adhesives and glues application; commercial pesticide use; photocopiers and laser printers; and commercial charbroiling and deep fat frying.

Development of Lists and Definitions

Categories identified through the search phase were combined into a master list of missing/unaccounted for sources. This list contains all the identified categories, regardless of their emissions potential. The master list was reviewed, and a preliminary working list was developed containing those categories considered most important to characterize. The working list was submitted to EPA for review and was revised based on the comments received. Identified categories were aggregated into major headings and then disaggregated into specific category listings. Definitions were developed for each source category.

Characterization of Missing/Unaccounted for Source Categories

To facilitate the characterization process and to ensure consistency, a template was developed to be used for each category characterization. The template defined the types of information to be collected for the source and provided a common format. Categories were characterized, to the extent possible, in 12 areas:

- definition/description of the category and activity
- process breakdown (if applicable)
- importance of the category (i.e., reason for considering the category)
- pollutants emitted
- estimate of the pollutant levels
- point/area source cutoff (i.e., does the category have both a point source and an area source component?)
- level of detail of available information
- level of detail required by users
- emission factor requirements
- regional, seasonal, or temporal characteristics
- urban or rural characteristics
- potential emissions estimation methodology

In all, 70 categories were characterized for this project:

- Adhesives and Sealants - Commercial
- Adhesives and Sealants - Consumer
- Aircraft Deicing
- Aircraft Refueling

- Airport Support Vehicles
- Automotive Cleaners/Waxes/Polishes
- Automotive Fluids and Fluid Leaks
- Automotive Rustproofing/Undercoating
- Backyard Charcoal Grills
- Bakeries
- Barge, Tank, Tank Truck, Rail Car, and Drum Cleaning
- Breweries
- Catastrophic/Accidental Releases - Rail Car, Tank Truck, and Industrial Accidents
- Cigarette Smoke
- Commercial Charbroiling
- Commercial Deep Fat Frying at Restaurants
- Compressed Natural Gas Vehicles
- Cooling Towers
- Diesel Fuel - Evaporative Emissions from Service Station Operations
- Distilleries
- Drinking Water Treatment with Ozone
- Extra High Voltage (EHV) Transmission Lines
- Farming Operations
- Fireplaces
- Grain Grinding and Feed Preparation
- Household Cleaners and Polishes
- Inflight Aircraft
- Innovative Waste Treatment Technologies
- Kerosene Space Heaters
- Laminating
- Landfill Activities - TSP
- Landfill Methane
- Laundry Products - Commercial and Consumer
- Lawn Care Products
- Mobile Sources Evaporative and Running Losses
- Motor Vehicle Racing
- Natural Gas Well Blowouts
- Oil and Gas Production - Field Activity
- Oil and Gas Production - Well Drilling
- Oil Spills
- Package Plants (Wastewater Treatment)
- Personal Products
- Pesticide Application
- Petroleum Vessel Loading and Unloading Losses
- Photocopiers and Laser Printers
- Pulp Bleaching with Ozone
- Recycling Processes
- Refinery Sludge Dewatering
- Refrigerants - Leaking Coolant
- Refrigerated Trucks
- Refrigeration/Air Conditioning Equipment
- Research and Testing Laboratories
- Residential Deep Fat Frying
- Road Construction
- Road Salting and Sanding
- Rocket Launches and Test Firings
- Sandblasting
- Silage Storage
- Small Electric Utility Boilers

- Street Sweeping and Cleaning
- Synthetic Organic Chemical Storage Tanks
- Traffic Painting
- Ultraviolet (UV) and Electron Beam (EB) Curable Coating
- Vehicle Lubricating
- Vehicle Repair
- Waste Incineration - Developing Technologies for Hazardous Waste
- Waste Oil Disposal
- Welding
- Wineries
- Wood Stoves

Characterization Activities

Each of the 70 area source categories was characterized using the template. Information for the characterizations was derived from a number of sources, many of which had been identified during the search phase of this project. The principal sources of information were available literature, industry and trade association publications and contacts, and knowledgeable federal and state personnel.

Available literature was identified based on the original literature search and included reference materials related to specific processes. These documents included EPA and other government reports, journal and conference reports, and trade association reports and bulletins. *AP-42 (Compila-*

tion of Air Pollutant Emission Factors, Fourth Edition and Supplements, September 1985 through September 1991) was consulted for emission factor data.

Where applicable, trade associations were contacted for information. In some cases, association contacts were able to offer unpublished or otherwise unavailable test reports and clarify process descriptions. If the information could be obtained quickly, published materials were requested.

Federal and state personnel were identified through the category identification phase, guidance from the EPA project team, or experience with Federal Implementation Plan (FIP), SIP, or NAPAP programs. Agencies contacted included EPA/OAQPS, Environment Canada, state agencies including CARB, and regional agencies such as the South Coast (California) Air Quality Management District (SCAQMD). These contacts provided process descriptions, emission factors and activity data, emissions estimates, and comments on a number of source categories.

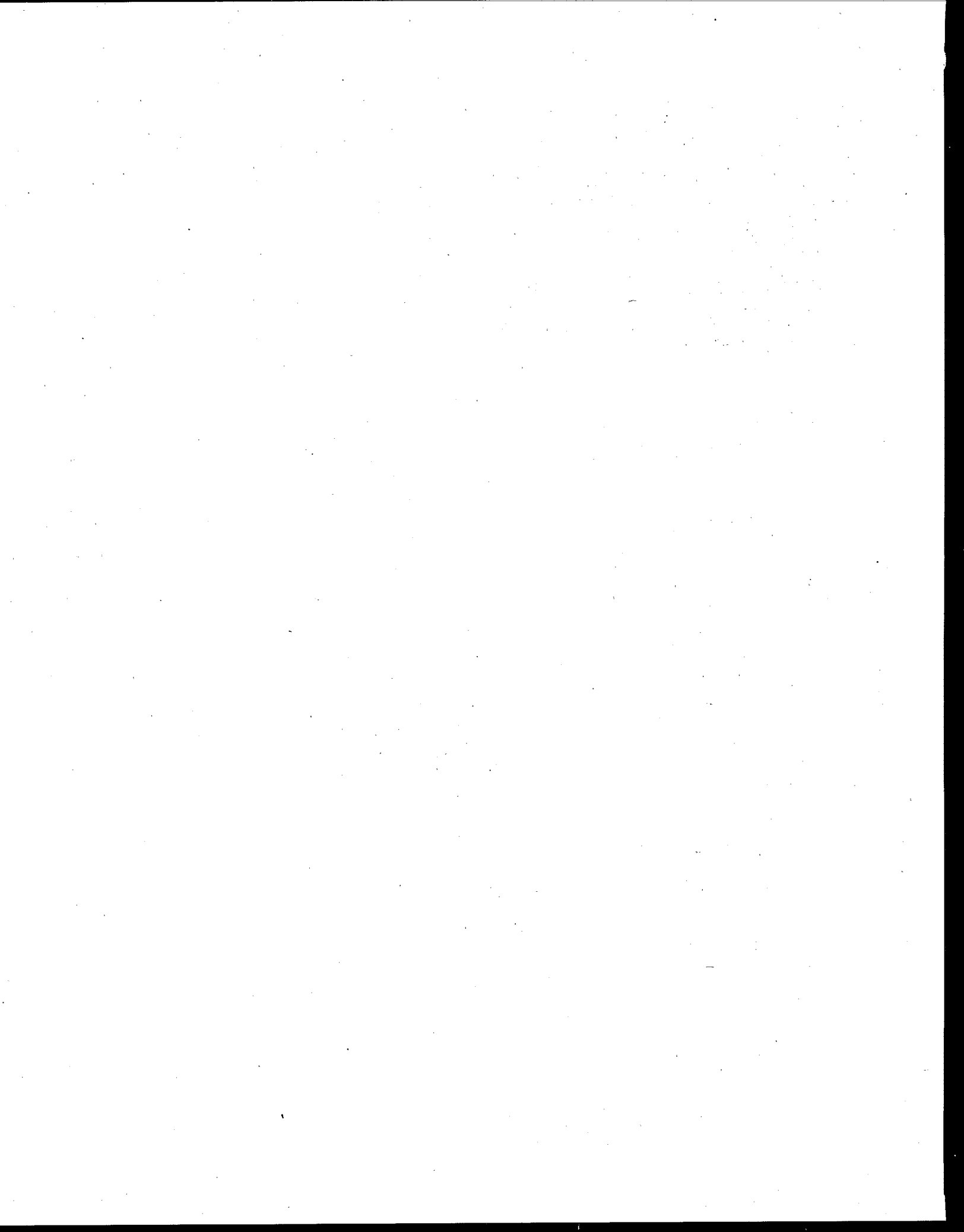
Discussion of Results

Characterization of the 70 source categories revealed a broad range of source types and availability of information sources. Research indicates that the sources may lack applicable emission factors, current activity data, or both, for the development of

emissions estimation strategies. In some cases (e.g., backyard charcoal grilling), state agencies such as CARB have begun to study these sources for inclusion in state or local inventories and can provide their research results. Trade associations may maintain industry statistics, research and testing divisions useful to source description, emission factor development, and activity data identification. However, most of the source categories lack a current emissions estimation methodology adequate for NEDS or SIP applications.

The information presented in these characterizations provides an initial overview of the process and its emissions, an indication and/or summary of the data available from standard reference materials and primary contacts, alternate methodology development strategies, and a basis for ranking these source categories for methodology development. Once the source categories are ranked, research directed at methodology development will be able to focus on each source category individually and provide a more exhaustive search of available resources, where warranted.

Additional work on missing and unaccounted for source categories may involve data gathering and analysis, measurements, and other research activities.



S. Kersteter, D. Zimmerman, R. Cawkwell, A. Chadha, B. Henning, M. Henning, T. Lynch, P. Marsosudiro, W. Tax, D. Winkler, and G. Woodwall, Jr., are with Alliance Technologies Corp., Chapel Hill, NC 27514

E. Sue Kimbrough is the EPA Project Officer (see below).

The complete report, entitled "Identification and Characterization of Missing or Unaccounted for Area Source Categories," (Order No. PB92-139 377/AS; Cost: \$43.00, subject to change) will be available only from:

National Technical Information Service

5285 Port Royal Road

Springfield, VA 22161

Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

Air and Energy Engineering Research Laboratory

U.S. Environmental Protection Agency

Research Triangle Park, NC 27711

United States
Environmental Protection
Agency

Center for Environmental
Research Information
Cincinnati, OH 45268

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