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Staten Island/New Jersey Urban Air Toxics Assessment Project Report

Volume II

Description of the Project

ACKNOWLEDGEMENTS

This report is a collaborative effort of the staffs of the Region II Office of the U.S. Environmental Protection Agency (EPA), the New Jersey Department of Environmental Protection and Energy, the New York State Department of Environmental Conservation, the New York State Department of Health, the University of Medicine and Dentistry of New Jersey and the College of Staten Island. The project was undertaken at the request of elected officials and other representatives of Staten Island concerned that emissions from neighboring industrial sources might be responsible for suspected excess cancer incidences in the area.

Other EPA offices that provided assistance included the Office of Air Quality Planning and Standards, which provided contract support and advice; and particularly the Atmospheric Research and Exposure Assessment Laboratory, which provided contract support, quality assurance materials, and sampling and analysis guidance, and participated in the quality assurance testing that provided a common basis of comparison for the volatile organic compound analyses. The Region II Office of Policy and Management and its counterparts in the States of New York and New Jersey processed the many grants and procurements, and assisted in routing funding to the project where it was needed.

The project was conceived and directed by Conrad Simon, Director of the Air and Waste Management Division, who organized and obtained the necessary federal funding.

Oversight of the overall project was provided by a Management Steering Committee and oversight of specific activities, by a Project Work Group. The members of these groups are listed in Volume II of the report. The Project Coordinators for EPA, Robert Kelly, Rudolph K. Kapichak, and Carol Bellizzi, were responsible for the final preparation of this document and for editing the materials provided by the project subcommittee chairs. William Baker facilitated the coordinators' work.

Drs. Edward Ferrand and, later, Dr. Theo. J. Kneip, working under contract for EPA, wrote several sections, coordinated others, and provided a technical review of the work.

The project was made possible by the strong commitment it received from its inception by Christopher Daggett as Regional Administrator (RA) for EPA Region II, and by the continuing support it received from William Muszynski as Acting RA and as Deputy RA, and from Constantine Sidamon-Eristoff, the current RA. The project has received considerable support from the other

project organizations via the Management Steering Committee, whose members are listed in Volume II.

PREFACE - DESCRIPTION OF THE STATEN ISLAND/NEW JERSEY URBAN AIR TOXICS ASSESSMENT PROJECT REPORT

This report describes a project undertaken by the States of New York and New Jersey and the United States Environmental Protection Agency with the assistance of the College of Staten Island, the University of Medicine and Dentistry of New Jersey and, as a contractor, the New Jersey Institute of Technology.

Volume I contains the historical basis for the project and a summary of Volumes II, III, IV, and V of the project report.

Volume II of the report lists the objectives necessary for achieving the overall purpose of the project, the organizational structure of the project, and the tasks and responsibilities assigned to the participants.

Volume III of the report presents the results and discussion of each portion of the project for ambient air. It includes monitoring data, the emission inventory, the results of the source identification analyses, and comparisons of the monitoring results with the results of other studies. Volume III is divided into Part A for volatile organic compounds, and Part B for metals, benzo[α]pyrene (BaP), and formaldehyde. Part B includes the quality assurance (QA) reports for the metals, BaP, and formaldehyde.

Volume IV presents the results and discussion for the indoor air study performed in this project. It contains the QA reports for the indoor air study, and a paper on the method for sampling formaldehyde.

Volume V presents the results of the detailed statistical analysis of the VOCs data, and the exposure and health risk analyses for the project.

Volume VI, in two parts, consists of information on air quality in the project area prior to the SI/NJ UATAP; quality assurance (QA) reports that supplement the QA information in Volume III, Parts A and B; the detailed workplans and QA plans of each of the technical subcommittees; the QA reports prepared by the organizations that analyzed the VOC samples; descriptions of the sampling sites; assessment of the meteorological sites; and a paper on emissions inventory development for publicly-owned treatment works.

The AIRS database is the resource for recovery of the daily data for the project. The quarterly summary reports from the sampling organizations are available on a computer diskette from the National Technical Information Service.

STATEN ISLAND/NEW JERSEY
URBAN AIR TOXICS ASSESSMENT PROJECT

VOLUME II. DESCRIPTION OF THE PROJECT EPA/902/R-93-001b

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1. PROJECT OVERVIEW

1.1 INTRODUCTION

The SI/NJ UATAP is a study of the ambient levels of selected volatile organic compounds and particulate matter species in the county of Richmond (Staten Island), New York, and in neighboring counties (Middlesex, Union, and Essex) of New Jersey to determine the exposures (and associated risk) of residents of the area to a variety of toxic air pollutants. The study was undertaken in response to concerns of these residents that their health may be at serious risk due to exposure to toxic air pollutants emitted routinely by industrial sources in the area, as well as by episodic releases often characterized by disagreeable odors. Furthermore, a number of studies had concluded that residents of Staten Island had experienced a higher incidence of cancers than other communities of similar socioeconomic status.[1] Reflecting the concerns of their constituents, elected officials and other representatives of Staten Island asked state and federal officials to investigate the causes of recurrent odor episodes, and to determine whether or not emissions from neighboring industrial sources might be responsible for suspected excess cancer incidences in the area.

Because of Staten Island's low population density relative to other parts of New York City, it has generally experienced lower concentrations of the criteria air pollutants than those other areas of New York City. However, the Island is bordered on the west by a complex of major industries including pharmaceutical plants, oil refineries, and chemical storage facilities. Other potential sources of toxic and/or odorous organic compounds include sewage treatment plants and the 1400-acre Fresh Kills Landfill, the world's largest landfill. Therefore, many of the residents have developed a high level of concern about the toxicity of the ambient air.

According to a 1985 series of articles in a local newspaper, the Staten Island Advance, Staten Island residents had been concerned about pollution from New Jersey for over 100 years. An 1882 report of the New York State Board of Health stated, "Most of the buildings on the North Shore of Staten Island are private

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[1] Section 2.3 of this volume describes ATSDR (Agency for Toxics Substances and Disease Registry) reviews of three of these studies, and the findings that the studies were flawed and not supportive of the asserted association between cancer incidence and air pollution.

residences, occupied by families long residing on the Island, and from the causes here named, and for the first time, their homes have been made uncomfortable and in the case of many of their inmates, unhealthy, from causes beyond their reach, but wholly under the control of a neighboring state and people."

In 1928, J. Meyers, writing in "The New York State Journal of Medicine," said that in the period from 1911 to 1920, Staten Island was ranked first in New York City in terms of cancer deaths with a rate of 92.5 in 100,000 people. The identified cause was that "much of [Staten Island's] northern shore had suffered for many years from smoke, fumes and vapors from the great oil refineries, and chemical, metal and other works situated on Constable Hook, Bayonne and adjacent territory."

In 1967, a study published in "Archives of Environment and Health" concluded that respiratory cancer rates for Staten Islanders exposed to the highest amount of air pollution from New Jersey were higher than for Islanders in low pollution areas.

In 1983, the New York City Department of Health (NYCDOH) found in a study on the trends in New York City's respiratory cancer deaths that Staten Island's death rate was the highest of the boroughs in the City between 1960 and 1980. The rate had risen from 27 out of every 100,000 people to 42.3 out of every 100,000 people, an increase of more than 57 percent in the 20-year period compared to a citywide death rate increase of 35 percent.

In May 1985, Staten Island Congressman Guy Molinari called a special town meeting featuring a panel of scientists including a toxicologist from the University of Medicine and Dentistry of New Jersey, a pulmonary specialist from the VA Medical Center in Brooklyn, an industrial hygienist from Mt. Sinai Hospital, a pulmonary specialist (physician) in private practice on Staten Island, and a health effects researcher from the College of Staten Island. The meeting was convened because many people in the community had expressed increasing concern that toxic contaminants in the Staten Island air were the cause of unusually high respiratory cancer rates on Staten Island. The panelists shared a common position that the residents were at considerable risk due to emissions from the petrochemical complex in the nearby New Jersey area. One of the panelists also asserted that children raised on Staten Island and in New York City's other boroughs exhibit disproportionately high incidences of pediatric asthma.

In the same year (1985), a study entitled "Ill Winds," conducted by the staff of Congressman Molinari, used published census data, cancer statistics, and prevailing wind pattern data to demonstrate that in the United States, counties such as Staten Island, located downwind from petrochemical plants, have a higher incidence of respiratory cancer than those upwind.

In an effort to be responsive to these concerns, federal, state, and local officials met from time to time during the early 1980's to determine what appropriate actions they might take to address the concerns that had been expressed about the frequent odor episodes, as well as the unscheduled or accidental release of chemicals by industries bordering the Arthur Kill (the river separating Staten Island from New Jersey). When, in a period of months from October 1984 to January 1985, fifteen major chemical release incidents occurred, officials again called for special federal investigations. Among the officials who pressed for these investigations, were the Borough President of Staten Island and the Congressional representative for the area. Both made personal appeals to the EPA Administrator to undertake the necessary studies. These meetings and consultations led to the undertaking of a number of specific initiatives.

In March of 1984, the EPA Region II Administrator sent the EPA National Emergency Response Team (ERT) based in Edison, New Jersey, into the field in an attempt to document the presence of toxic substances in the ambient atmosphere on Staten Island and neighboring New Jersey. The ERT performed a one-week investigation of ambient air concentrations in areas using state-of-the-art measurement techniques. It identified the presence of about 30 toxic chemicals near many of the sources suspected of causing odor and toxics problems. However, it could not quantify the contaminant concentrations nor conclusively link the identified chemicals with emissions or odors from any specific source. Gusty wind conditions prevailed during the monitoring period and no serious odor events occurred during the time.

In a related investigation later that year (September 1984), the EPA's National Enforcement Investigations Center (NEIC) agents visited locations identified as possible sources of odors. They identified liquid effluent from a sewage treatment plant as the possible source of the so-described cat-urine odor that had often been the basis for complaints. From this effluent, it was possible to trace the origin of the offending substance to a nearby pharmaceutical plant. The discharge of the offending liquid into the sewage system was discontinued as a result of this investigation.

In the same year (1984), the EPA released a report referred to as the Six-Month Study, which documented that significant amounts of toxic substances existed in the air over large, densely-populated urban areas. This provided further incentive for the EPA Regional Office to design and conduct an ambient air quality monitoring and assessment project. Lacking sufficient funding and resources to conduct an independent study, the Regional Office set out to undertake a cooperative effort with other units of government, with industry, and with environmental and academic institutions.

Through its inquiries, the Regional Office discovered that a number of agencies and organizations had themselves independently planned to undertake some form of ambient air monitoring activity in the Staten Island/Northern New Jersey Area.

- The New York State Department of Environmental Conservation (NYSDEC) had decided to undertake a $5 million statewide enhancement of its ongoing sampling program with approximately $1 million of the total to be used for airborne toxics throughout the state. NYSDEC planned to set up monitoring sites for air toxics at four locations in Staten Island.

- The New Jersey Department of Environmental Protection (NJDEP, now NJDEPE) was about to undertake an ambient air monitoring program for a variety of volatile organic compounds at two sites in northern New Jersey with technical support from the New Jersey Institute of Technology (NJIT).

- The College of Staten Island (CSI) was about to undertake an Island-wide ambient air monitoring program for volatile organic compounds using funds provided by the Governor of New York State. CSI also planned to undertake a health effects study of the area.

- The New York City Department of Environmental Protection (NYCDEP) was planning to conduct ambient air monitoring activities in the Staten Island area, but had not yet formulated specific plans.

- The Interstate Sanitation Commission (ISC) which had over the years received and responded to citizens' complaints concerning interstate odors and pollution transport, was interested in participating in the study.

- The Arthur Kill Industrial Business Association (AKIBA), a consortium of businesses, expressed an interest in joining a cooperative effort provided that a major emphasis was placed on odor tracking.

At the request of the EPA Region II Administrator Christopher Daggett, representatives of these organizations and agencies met on several occasions in 1984 to determine what kind of cooperative project could be put together using the pooled resources of these organizations. It was agreed that an AKIBA-developed odor tracking project[2] should proceed on its own with whatever assistance might be provided by the ISC because of the common interest of both organizations in odor problems and because of their experiences in addressing both odor episodes and episode response. It was decided, as well, that those agencies in a position to contribute resources and expertise for performing air quality sampling and analysis using advanced techniques would join together under the leadership of the EPA Region II Office to develop an ambient air monitoring project. The group decided to invite the University of Medicine and Dentistry of New Jersey (UMDNJ) and the New York State Department of Health (NYSDOH) to participate in order to provide needed expertise in risk assessment. The NYCDEP and the ISC failed to obtain the necessary resources to join in the project.

In October 1986, the project's Steering Committee formulated the objectives for the project, listing nine specific objectives. Ambient air monitoring would be the most expensive and extensive project activity, and would be used to address most of the objectives. In addition, the Committee agreed to pursue indoor monitoring, emission inventories, various levels of data assessment and interpretation, and exposure and health risk assessment, along with quality assurance and data handling for all of the other phases of the project.

In 1987, the ambient air monitoring phase of the project was initiated. Monitoring activities and other field work continued until 1989. The ambient monitoring phase of the project included 15 sites (see Map I-1) at which the following parameters were measured:

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1 The AKIBA study was conducted by The Research Corporation of New England (TRC) using meteorological data and odor reports to develop a methodology for tracking the sources of odors during odor incidents. Its final report (released in 1989) concluded that municipal facilities (sewage treatment plants and landfills) were the most frequent and the most intense sources of odors in the Arthur Kill region and often had adverse impacts on nearby communities. The report specifically pointed to the Linden-Roselle sewage treatment plant at Tremley Point and the Fresh Kills Landfill as making major contributions to the regions's odor problems. As a follow-up to the study, AKIBA installed an odor hotline for use during odor episodes to alert industries to check their facilities for malfunctions and potential unauthorized releases.

volatile organic compounds at 13 sites,
metals at 5 sites,
formaldehyde at 5 sites, and
meteorological data at 4 sites.

The indoor air monitoring phase of the project began in July 1990 and concluded in March 1991, encompassing four indoor sites and two associated outdoor sites. The emission inventory portion of the project spanned the period from October 1987 to December 1991. Once the monitoring and inventory data began to appear, the data handling, data interpretation, and exposure and health risk assessment phases were initiated.

In 1990, EPA also undertook an ancillary study, called the Staten Island Citizen's Odor Network, to further address the concerns of the Staten Islanders about air quality during odor events. EPA supplied canister devices similar to those utilized in the ambient monitoring phase of the project to six Staten Island homeowners and asked them to activate the devices when they detected odors of concern. There were few occasions in which odor episodes triggered the use of these samplers. On no occasions were unusually high concentrations of air toxics found to correlate with odor episodes.

In an effort to address the health effects issues, EPA asked the Agency for Toxic Substances and Disease Registry (ATSDR) to review the 1979 NYCDOH and the 1984 CSI cancer incidence studies, and the 1985 Ill Winds study developed by the staff of Congressman Molinari. ATSDR determined that all three studies were flawed in design, in the handling of statistical information, and in the conclusions reached. Based on this, the conclusions that there were links between reported cancer incidence and air pollution could not be supported. CSI expressed an interest in conducting further health-based studies.

It is important to realize that the incidence of cancer and other diseases in a population is determined by the combined effects of many genetic, socioeconomic and environmental factors in addition to air contaminant exposure. Studies of other communities with a concentration of petroleum refineries and other industries, and cancer rates higher than in other nearby communities, have failed to show statistically significant correlations of cancer incidence and air contaminant levels. In a study in Contra Costa County, California,[3] for example, the only variable identified as a significant factor in lung cancer

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[3] Personal communication of J. Wesolowski of the California State Department of Health to T.J. Kneip in 1991 concerning the results of an unpublished report of a study by California in Contra Costa County.

was smoking. Thus, the assignment of possible sources of cancer may be difficult without a carefully planned epidemiological study.

In studies of air pollution directed toward an understanding of population exposures, risks, and health effects, it is important to recognize (a) limitations in approaches to and, hence, in results associated with estimation of lifetime exposure; (b) the relative contributions of indoor air and ambient air to total inhalation exposure; and (c) the relative contribution of inhalation exposure to total exposure via all routes. Studies (Wallace et al., 1987) have shown that personal exposures to VOCs--that is, integrated, measured concentrations for 24-hour personal air samples--are usually more closely related to indoor air concentrations than to ambient air concentrations. Nevertheless, the sources of concern in this study were industrial and non-point sources whose impact would be assessed by evaluating ambient air quality.

1.2 GENERAL DESCRIPTION OF THE PROJECT

The Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP) was designed to assess potential long-term exposures to various airborne toxics on the basis of measurements of ambient air concentrations at sites throughout the project area, and of indoor air at a limited number of sites.

The characterization of human health risk due to inhalation of air pollutants in the project area addressed cancer and non-cancer adverse effects. Information on adverse effects was based on available cancer unit risk factors and non-cancer recommended or regulatory reference concentrations. The unit risk factors or reference concentrations were applied to concentration data using selected exposure scenarios to estimate potential incremental risk.

The measured concentrations were compared to those at a site upwind of the industrialized area and to concentrations reported for other locations nationwide. The objective of the comparison was to assess whether risk arising from air pollutants in the project area was substantially different from that arising from these air pollutants in other urban areas.

In addition, possible relationships between air toxics sources and the observed ambient air concentrations were examined through the development of emission inventories and the use of appropriate back-trajectory meteorological models.

1.3 Objectives

The project objective as defined by the Management/Steering Committee in December 1986 was to provide information about the toxic substances in the ambient air in Staten Island and selected areas of New Jersey; this information was to include a comparison of population exposures to these substances in the study area with such exposures in other areas, and an assessment of possible sources of the toxic substances. This objective was formalized as the nine objectives that follow.

<u>Objectives</u>

1. Characterize air quality for selected volatile organic compounds (VOCs) for the purpose of doing an exposure assessment for various population, commercial, and industrial interfaces.

2. Characterize air quality for the parameters identified by EPA as high-risk urban toxics for the purpose of using exposure assessment for comparison with other studies.

3. Characterize indoor air quality for selected VOCs for the purpose of doing exposure assessment for various types of commercial facilities and residences.

4. Evaluate indoor/outdoor concentration relationships for selected VOCs.

5. Perform an emission source inventory (including point, area, and mobile sources), so as to formulate hypotheses linking major contaminants to potential sources.

6. Obtain air quality data for the purpose of identifying potential sources using meteorological modeling.

7. Evaluate indoor air quality data to identify possible sources.

8. Evaluate episodic odor occurrences and relate such episodes to air quality data.

9. Evaluate some general abatement strategies.

1.4 AIR TOXICS OF INTEREST

A specific list of target pollutants was selected at the outset of the project and modified slightly based on monitoring experience. Pollutants were included on the list for various reasons, but generally because they

1. are chemicals identified by EPA as high risk urban air toxics,
2. are known to cause or are suspected of causing harm,
3. are measurable using available methodologies, and
4. are known to be present or suspected of being present in the air in the project area.

The pollutants measured are listed in Tables II-6 and 7.

1.5 PARTICIPATING ORGANIZATIONS

One of the greatest strengths of this project has been the interaction and support of the great variety of organizations involved in the work: a federal agency, three state agencies, and three universities. Another great strength has been the ambitious scope of the project, including the study of many different aspects of the interaction between air toxics and the environment, from emissions, through air concentrations, to health assessments. However, this multi-faceted project required a well-designed operating structure to ensure

1. logical and consistent planning,
2. detailed and timely tracking of progress,
3. identification of shortcomings,
4. initiation of timely corrective action, and
5. coordination of the diverse participants.

Cognizant of this, the participating organizations designed and implemented a structured committee system for dealing with management and technical implementation. The interactions of the participants through this committee structure was a primary factor in the success of the project.

2. ORGANIZATIONAL STRUCTURE

2.1 COMMITTEE STRUCTURE

This project involved people in many organizations performing overlapping functions over a period greater than three years. (See Table II-1). The complexity of these interactions required the development of an organizational structure that could ensure effective project planning, timely performance, and quality assurance at all stages of the program. Project coordination and public communication were provided by EPA Region II.

The participants designed and implemented this project through a Management/Steering Committee, a Project Work Group and Technical Subcommittees. The members, with their affiliations, are listed in Tables II-2 through 4. The functions of these three organizational units are as described in the following paragraphs.

2.1.1 Management/Steering Committee

Senior representatives from the participating agencies served on this committee. The members are listed in Table II-2. The function of this committee was to define the project and set policy. It directed the project and acted as arbitrator and decision-maker when major questions arose. It approved the final report of the project.

2.1.2 Project Work Group

The Project Work Group (Table II-3) provided the project management and technical oversight, and reported to the Management/Steering Committee. It was responsible for ensuring that the commitments made by the respective agencies were carried out. The Project Work Group monitored and reported on progress; it designed and applied management procedures for efficient and expeditious implementation of the project.

Table II-1: Project Participants

GOVERNMENT

Federal - U.S. EPA

Region II

Air and Waste Management Division (EPA Region II)
Environmental Services Division (EPA Region II)

Headquarters

Office of Air Quality Planning and Standards (EPA-OAQPS)
Atmospheric Research and Exposure Assessment Laboratory (EPA-AREAL)

States

New Jersey Department of Environmental Protection (NJDEP)*
New York State Department of Environmental Conservation (NYSDEC)
New York State Department of Health (NYSDOH)

ACADEMIA

College of Staten Island of the City University of New York (CSI)
University of Medicine and Dentistry of New Jersey (UMDNJ)
New Jersey Institute of Technology (NJIT) (contractor to NJDEP)

* At the time of publication of this report, the New Jersey Department of Environmental Protection and Energy (NJDEPE).

Table II-2: Management/Steering Committee

Conrad Simon	EPA Region II - Chair
Thomas Allen	NYSDEC
John Elston	NJDEP
Paul Lioy	UMDNJ
John Oppenheimer	CSI
John Hawley	NYSDOH

Table II-3: Project Work Group

Theo. J Kneip	EPA Region II - Chair, and Project Manager
Charles Pietarinen	NJDEP
Donald Gower	NYSDEC
John Hawley	NYSDOH
Clifford Weisel	UMDNJ
Marcus Kantz	EPA Region II
John Oppenheimer	CSI

Table II-4: Technical Subcommittees

Project Coordination — Robert Kelly, EPA Region II

Subcommittee	Chair
Ambient Monitoring	Clifford Weisel, UMDNJ
Quality Assurance	Marcus Kantz, EPA Region II
Emission Inventory	Andrew Opperman, NJDEP
Data Management	Rudolph K. Kapichak, EPA Region II
Modeling	Raymond Werner, EPA Region II
Exposure and Health Risk Assessment	Paul Lioy, UMDNJ
Indoor Air	Mark Knudsen, NYSDOH

Note: Some participants' affiliations and roles changed during the project. Dr. Weisel was CSI's Work Group representative when the project began. Mr. Kapichak coordinated the technical subcommittees from 1988 to 1990. Dr. Jorge Berkowitz, formerly with the NJDEP, was NJDEP's Management/Steering Committee (M/SC) representative. Dr. Edward Ferrand was the Project Manager and chaired the Project Work Group while assigned to EPA Region II from 1986 to 1989, when he was succeeded by Dr. Theo. J. Kneip. Ms. Carol A. Bellizzi coordinated the technical subcommittees in 1991 and 1992.

2.1.3 Technical Subcommittees

The subcommittees developed the specific procedures and schedules for the project and incorporated them into documented workplans and timetables. They were responsible for changes or modifications of the workplans. The responsibilities of the members included ascertaining that their respective organizations approved of the workplan details before submission to the Project Work Group.

2.1.4 Community Advisory Group

Elected officials, government agencies, community and environmental groups, and other interested persons were to participate in the project through the mechanism of an Advisory Group.

The responsibilities of the Advisory Group were as follows:

1. To identify specific activities that group members could perform in order to help and enhance the project.
2. To identify areas in which the current effort could be helpful.
3. To identify supplemental activities already underway or planned that would expand or supplement the project activities.
4. To identify/provide services or funding to carry out any additional work in the area.

After its first organizational meeting the Advisory Group did not meet again.

2.2 INTERACTION BETWEEN COMMITTEES AND PARTICIPANTS

An outstanding feature of the project was the extent, variety, and quality of the interactions between the participants throughout its duration. Participating organizations were closely integrated through grants, contracts, and the project organization.

Each committee relied heavily upon the independent efforts of the participating organizations. The final products in every case were the direct result of those individual efforts carefully coordinated and combined through the technical and management committees, and staffed by the participating organizations.

3. PROJECT OPERATION

3.1 AMBIENT MONITORING

3.1.1 Introduction

The Monitoring Subcommittee was established to develop overall guidance for the participating organizations and laboratories on procedures to be used in monitoring and to provide insight into the state-of-the-art methodologies that were to be used during this project. Representatives from all of the organizations participating in the SI/NJ UATAP were included. The members were individuals technically trained in air sampling, laboratory analysis, and/or quality assurance. They provided necessary expertise for monitoring since guidelines for some of the analyses, particularly volatile organic compounds (VOCs), using both Tenax sorbent and canister sampling, and formaldehyde, had not been formally established by any of the regulatory agencies when this project commenced.

Additionally, the approaches, laboratory facilities and goals of each of the organizations were different. Therefore, it was decided that an exchange of information among the technical individuals involved in the project would facilitate the development of the procedures required for the collection and analysis of the samples needed to meet the overall objectives of the SI/NJ UATAP. This organizational format worked well, as the exchange of ideas among the participants during the setup and initial analysis was helpful to a number of organizations. The Management/Steering Committee also requested that the Monitoring Subcommittee be responsible for site selection, siting criteria, comparability of methodologies, setting a timetable for sample collection, and tracking the progress of each organization.

The primary objectives of the Monitoring Subcommittee included the following:

1) selection of ambient sampling sites that were spatially distributed to meet the objectives of the SI/NJ UATAP;

2) determination of the criteria that would be used for placement of the ambient air samplers;

3) assurance that the different analytical methodologies used were comparable;

4) selection of the target compounds and sampling frequency used;

5) exchange of information among the different groups within the project to provide the variety of expertise needed to proceed with the project; and

6) establishment of a time schedule and tracking framework for the setup and sampling at each site.

3.1.2 Purpose

The purpose of the Monitoring Subcommittee was to provide technical expertise to facilitate the monitoring required to meet the project's objectives, to track the progress of each organization in setting up and operating the sites, to provide an exchange of technical information among the members, and to address technical issues concerning sampling and analysis raised by the Management/Steering Committee or a work group.

3.1.3 Subcommittee Structure

The subcommittee consisted of one or more individuals from each organization within the SI/NJ UATAP with expertise in sample collection, analysis and quality assurance. The individuals who were part of the subcommittee changed during the project. The members included the following:

Clifford Weisel, Chair, CSI/UMDNJ
Cas Czarkowski, NYSDEC
Andrew Opperman, NJDEP
Barbara Kebbekus, NJIT
Robert Kelly, EPA Region II
Marcus Kantz, EPA Region II
Garry Boynton, NYSDEC
Mike Steiniger, NYSDEC
Charlie Pietarinen, NJDEP
Linda Berrafato, UMDNJ
Rudolph K. Kapichak, EPA Region II

3.1.4 Relation to Project Objectives

The Monitoring Subcommittee's charge was to design a sampling network and suggest analytical procedures that would measure the ambient air concentrations of volatile organic compounds, particulate trace metals, benzo[α]pyrene (B[α]P), and formaldehyde, and the meteorological conditions during sampling. The concentrations would be used to calculate the annual average concentrations, and their spatial and temporal variations as needed to meet many of the project objectives.

The data obtained would be used to address directly the following six project objectives:

Objective 1. Characterize air quality for selected volatile organic compounds (VOCs) for the purpose of having an exposure assessment for various population, commercial, and industrial interfaces.

Objective 2. Characterize air quality for the parameters identified by EPA as high-risk urban toxics for the purpose of using exposure assessment for comparison with other studies.

Objective 4. Evaluate indoor/outdoor concentration relationships for selected VOCs.

Objective 6. Obtain air quality data for the purpose of identifying potential sources using meteorological modeling.

Objective 8. Evaluate episodic odor occurrences and relate such episodes to air quality data.

Objective 9. Evaluate some general abatement strategies.

3.1.5 Summary of Project Plan

The project workplan for the Monitoring Subcommittee outlined the objectives and tasks required for a systematic establishment of the monitoring network. Initial decisions included which air toxics were to be measured, the spatial region to be covered, the location of the sites for each organization, and the establishment of a mechanism for exchanging information and reporting progress.

The toxics to be examined were grouped into the following three categories based on the required sampling technique:

volatile organic compounds (non-polar),
formaldehyde and other aldehydes, and
B[α]P and trace metals found on particulate matter.

Three substances on the EPA urban air toxics list were not included in the project: asbestos, products of incomplete combustion (other than B[α]P), and ethylene oxide.

Asbestos was not included since asbestosis, the primary cancer from exposure to asbestos, is not expected to be found at elevated concentrations in the study area. Incomplete combustion products, such as semi-volatile organic compounds, and ethylene oxide were not included since the methodologies for their collection and analysis were not available to the organizations involved in the program, and development of these methodologies was beyond the project funding commitments.

The analytical resources available to the project included the following capabilities:

three laboratories for VOC analysis (CSI, NJIT, and NYSDEC),

two laboratories for trace metals and B[α]P (NJDEP and NYSDEC),

two laboratories for aldehyde analysis (EPA-Research Triangle Park (EPA-RTP), NJIT),

two organizations for meteorological data (NJDEP and NYSDEC), and

several organizations for quality assurance capabilities. (EPA Region II, EPA-RTP, and PEI as a contract laboratory).

In addition, field personnel were committed to the project for sample collection (CSI, NJDEP, NJIT, NYSDEC, and UMDNJ) and for oversight of quality assurance (EPA Region II).

The sampling region included Staten Island and the industrialized region of New Jersey immediately west of Staten Island. One New Jersey site not within the heavily industrialized portion of New Jersey was designated the background site for VOCs and formaldehyde; and another, for particulate samples. Thirteen sites were chosen for the collection of samples for VOC analysis, five for aldehydes, seven for particulate matter, and four for meteorological measurements. The sites were chosen to give optimal spatial coverage of the region. More sites were sampled for VOCs than for the particulate toxics since a greater variability in ambient air concentrations was expected for these substances than for the particulates.

A sampling frequency of once every sixth day was planned for a duration of two years. Three of the VOC sites in Staten Island were sampled daily during most of the program.

3.1.6 Summary of Anticipated Outputs

3.1.6.1 Sampling sites

A total of fifteen sites, ten in Staten Island and five in New Jersey, were used during this project. Figure II-1 is a map showing the location of the sites. The sites were chosen to be representative of residential communities within the region. The community name, assigned project number, type of sample collected, sampling frequency, and start date for each site are given in Tables II-5a and 5b. Sampling at each site commenced when the organization responsible for sampling and analysis indicated that it was ready. The sampling was continued until September 30, 1989.

The sites (except the background sites) were selected to provide the largest spatial distribution within the region downwind of primary sources. The background sites were selected to be upwind of the suspected source regions and away from local sources. The general source regions considered were the industrial complex bordered by the Raritan River, the New Jersey Turnpike, the City of Bayonne, and Fresh Kills Landfill. Stations were selected to be as close to breathing height as possible, with all, except the Susan Wagner site, located at or below third story height.

Thirteen sites were chosen for collection of VOCs. The samplers were placed using EPA's accepted sulfur dioxide siting criteria, since no siting criteria had been established for VOCs. Of the seven sites chosen for particulate matter samplers using siting criteria for particulates sampling, only five generated useful data. Five sites were used for formaldehyde sampling.

Four meteorological stations were established specifically for this project. Additional meteorological data were expected to be available from stations collecting data for other purposes during the same time period as this project.

3.1.6.2 Sampling and analytical procedures

Two major sampling techniques were used to collect VOC samples, and two general methods were used to analyze the samples. For VOC sample collection, ambient air was drawn by a low-volume pump through tubes containing adsorbent material, or pumped into specially polished evacuated stainless steel canisters. Three different sorbents were used during the project - Tenax and two different gradient sorbent combinations. The sampling trains were equipped with various flow controllers, timers, and solenoid-controlled valves.

After the sorbent samples were picked up and returned to the laboratory, they were thermally desorbed from the adsorbent, cryogenically focused, and transferred to a capillary gas chromatograph (GC) for analysis. The GC peaks were quantified and verified by mass spectrometry in all laboratories but one. For that laboratory, the GC peaks were quantified with either a flame ionization detector or an electron capture detector, with 10% of the samples analyzed by mass spectrometry for peak verification. The canister samples were analyzed in an analogous manner to the adsorbent samples, but without thermal desorption.

Details of each laboratory's procedures are given in the individual Standard Operating Procedures (SOPs) developed by the respective laboratories. The VOCs analyzed during the project are given in Table II-6. Not all compounds were analyzed by all organizations. From time to time during the project, changes were made in the pollutants monitored and analyzed by each organization.

Since the collection and analytical procedures were not identical across the organizations, inter-comparison procedures were followed to determine the comparability. These included coincident sampling by all groups at a single site during several periods, and collocation of both Tenax and canister collection systems periodically at all sites. Details of these procedures are in the Quality Assurance section of this volume (Section 3.7); and in the QA workplan, reports, and discussion in Volume VI.

The trace metals and B[α]P were collected using a high-volume sampler and analyzed by two laboratories according to established regulatory procedures. Details are given in the Standard Operating Procedures (SOPs) supplied by the individual organizations and found in Volume VI. The list of metals analyzed for the project is given in Table II-7.

Formaldehyde and other aldehydes were collected using a cartridge coated with 2,4-dinitrophenylhydrazine. Analyses were performed by two laboratories using the same methodology based on a high-performance liquid chromotography separation after elution of the aldehydes from the sampling cartridge. This method was based on an experimental methodology which, during the course of the project, was found to have an ozone interference; i.e., the presence of ozone results in an under-reporting of formaldehyde concentrations in ambient air that was not amenable to use of a correction factor[4]. Since completion of the ambient air sampling

[4] Memorandum of July 13, 1989, J.E. Sigsby (MSERB/CPCD/AREAL) to R. Kelly (U.S. EPA Region II), "Ozone Interference in the Determination of Aldehydes using DNPH Cartridges."

for this project, the sampler was modified to prevent ozone interference.

3.1.6.3 Tracking of progress

EPA Region II had the major responsibility for tracking the starting dates for the establishment of the sampling sites. After the majority of the sites was established, the subcommittee restricted meetings to conference calls, and relied upon the Region II office for updates of the status of the sites. Each organization was contacted quarterly to ascertain the status of its sites, and whether any change in sampling protocol or frequency had occurred. The sites were established as permission, manpower, and equipment allowed. Thus, the setting-up of some of the sites was delayed.

3.1.6.4 Reporting of the results

The reports of the concentrations and meteorological data for each site were sent to the Data Management Subcommittee.

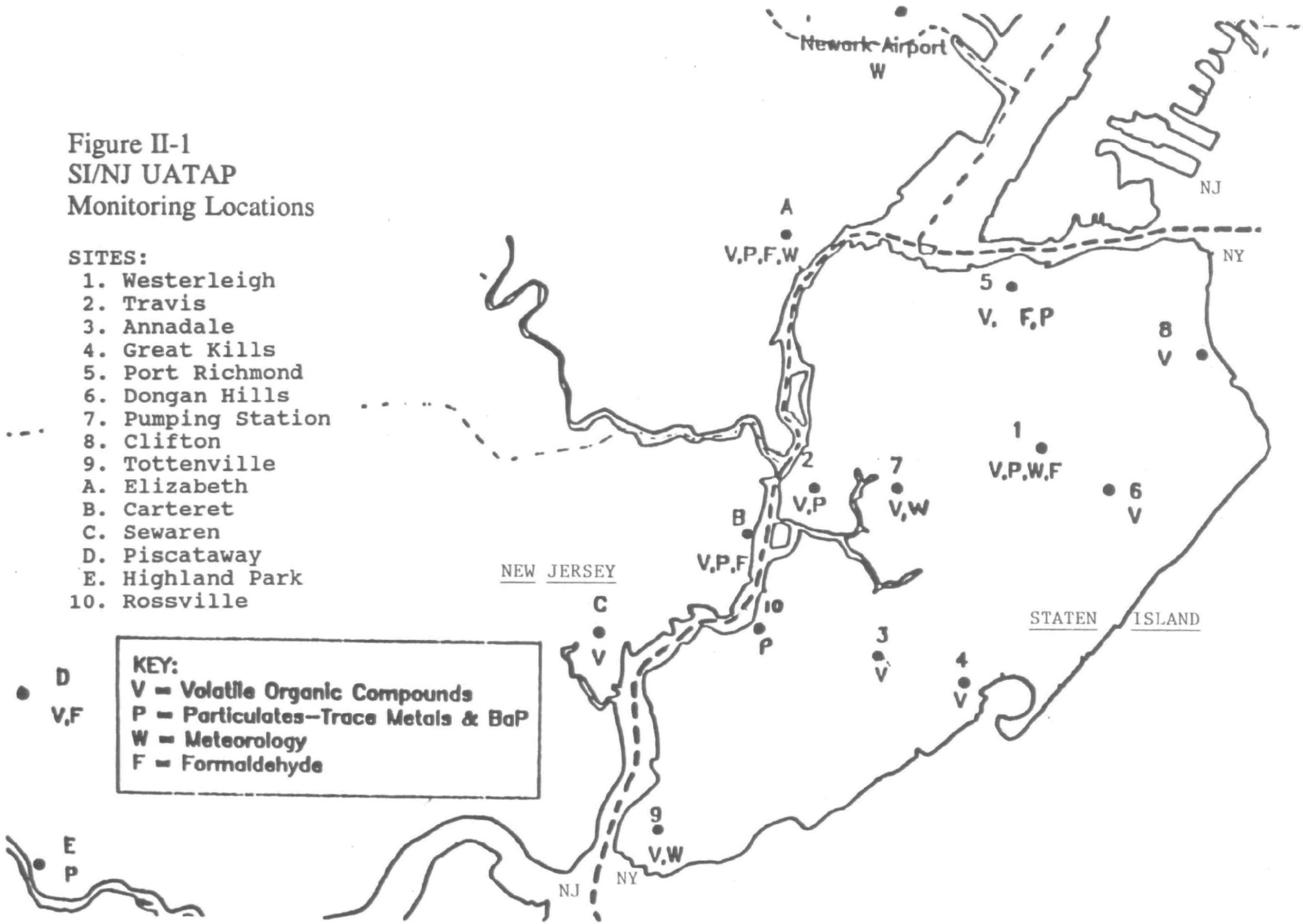

Figure II-1
SI/NJ UATAP
Monitoring Locations

Table II-5a: Sampling Sites - Staten Island

Site Code	Community Site Name	Sampling Type	Frequency	Operating dates
1	Westerleigh	NYSDEC Sorbent	every sixth day	10/87- 9/89
	Susan Wagner H.S.	Tenax	"	10/87-12/87
		Canister	"	4/88- 9/89
		Hi Volume Filter	"	10/87- 9/89
		Formaldehyde	"	7/88- 9/89
		Meteorology	continuous	4/88- 9/89
2	Travis	NYSDEC Sorbent	every sixth day	10/87- 9/89
	P.S. 26	Tenax	"	5/88-10/88[a]
		Canister	"	8/88- 9/89
		Hi Volume Filter	"	10/87- 9/89
3	Annadale, Eltingville	Tenax	every day[1]	10/87- 9/89
	Fire Station 167	Canister	every eighteenth day[2]	12/87- 9/89
4	Great Kills	NYSDEC Sorbent	every sixth day	9/88- 9/89
	Fire Station 162	Canister	every eighteenth day	9/88- 9/89
5	Port Richmond	NYSDEC Sorbent	every sixth day	10/87- 9/89
	Post Office	Tenax	"	6/88- 1/89[b]
		Canister	"	6/88- 9/89
		Formaldehyde	"	7/88- 9/89
6	Dongan Hills	Tenax	every day[1]	10/87- 9/89
	Fire Station 159	Canister	every eighteenth day[2]	1/88- 9/89
7	Pumping Station	NYSDEC Sorbent	every sixth day	10/88- 9/89
	Near Landfill, near	Canister	every eighteenth day	10/88- 9/89
	Staten Island Mall	Meteorology	continuous	10/88- 9/89
8	Clifton	Tenax	every day[1]	10/87- 9/89
	Bayley Seton Hospital	Canister	every eighteenth day[2]	2/88- 9/89
9	Tottenville	NYSDEC Sorbent	every sixth day	10/87- 9/89
	Fire Station 151	Tenax	"	6/88- 1/89[b]
		Canister	every eighteenth day	7/88- 9/89
		Meteorology	continuous	4/88- 9/89
10	Arthur Kill, Rossville	High Volume Filter	every sixth day	3/88-9/89[c]
	New York Telephone			

[1] Through 3/89. Every sixth day to 9/89.
[2] Rotated among sites 3, 6, and 8 on a monthly basis.
[a] Data did not meet QA requirements.
[b] Some data did not meet QA requirements.
[c] Samples taken only occasionally, not enough data to report.

Table II-5b: Sampling Sites - New Jersey

Site Code	Community Site Name	Sampling Type	Frequency	Operating dates
A	Elizabeth	Tenax	every sixth day	5/88- 9/89
	Mattano Park	Canister	"	5/88- 9/89
		High Volume Filter	"	5/88- 9/89
		Formaldehyde	"	5/88- 9/89
B	Carteret	Tenax	every sixth day	10/87- 9/89
	Police Station	Canister	"	10/87- 9/89
		High Volume Filter	"	10/87- 9/89
		Formaldehyde	"	11/87- 9/89
C	Sewaren	Tenax	every sixth day	11/88- 9/89
	Glen Cove School	Canister	every eighteenth day[1]	12/87- 9/89
D	Piscataway	Tenax	every sixth day	11/88- 9/89
	Pvt. Residence	Canister	every eighteenth day[1]	11/87- 9/89
		Formaldehyde	every sixth day	11/88- 4/89[2]
				5/89- 9/89[3]
E	Highland Park	High Volume Filter	every sixth day	11/88- 9/89
	Fire Station			
--	Newark Airport	Meteorological Data	hourly	routine NWS[b] data
--	Elizabeth NJDEP Trailer	Meteorological Data	continuous	

[1] Rotated between sites C and D on a monthly basis.
[2] Analysis by EPA contractor lab.
[3] Analysis by NJIT.
[a] National Weather Service
[b] Data were not used due to equipment problems.

Table II-6: VOCs Analyzed During Project

Chloromethane[1]
Dichloromethane (Methylene Chloride)
Trichloromethane (Chloroform)
Trichloroethane, 1,1,1-
Trichloroethane, 1,1,2-
Tetrachloromethane (Carbon Tetrachloride)
Trichloroethylene
Tetrachloroethylene (Tetracholoroethene, perchloroethylene)
Dichloroethane, 1,1-
Dichloroethane, 1,2- (Ethylene Dichloride)
Tribromomethane (Bromoform)
Benzene
Toluene
Hexane
Xylene, o-
Xylene, m- and p- [2]
Ethlybenzene
Chlorobenzene
Styrene
Dichlorobenzene, o- (1,2 - dichlorobenzene)
Dichlorobenzene, m- (1,3 - dichlorobenzene)
Dichlorobenzene, p- (1,4 - dichlorobenzene)

[1] No valid data obtained.
[2] Not separated by analytical method.

Table II-7: Particulate Species Analyzed During Project

Arsenic
Barium
Benzo[α]pyrene
Beryllium[1]
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium[2]
Vanadium
Zinc

[1] Never detected.
[2] No valid data were obtained.

3.2 INDOOR AIR MONITORING

3.2.1 Introduction

The Indoor Air Subcommittee was created to formulate and oversee execution of the indoor air component of the SI/NJ UATAP. Three of the primary objectives of the project required systematic analysis of indoor air. In order to fulfill these objectives an indoor air study consistent with the theory and methodology of the project was developed. The indoor air study was implemented in three stages: (1) selection of sampling sites, (2) sample collection and analysis, and (3) interpretation of results.

Because of the small number of sampling locations, the data collected were not expected to be representative in the sense of permitting extrapolation to the entire study area, but were intended to aid in characterizing the relative risks of indoor and outdoor exposure for those homes tested in the SI/NJ area.

3.2.2 Purpose

The indoor air study was designed to provide information about what may be a significant source of the exposure of project area residents to toxic air pollutants--indoor air. Also, a time series of indoor/outdoor measurements would help further understanding of how indoor concentrations are related to outdoor air. Some sources of indoor air pollution were to be identified, if possible.

3.2.3 Subcommittee Structure

The Indoor Air Subcommittee membership was as follows:

Mark Knudsen	NYSDOH, Chair
Marlon Gonzales	EPA Region II
Brian Lay	NYSDEC
Joann Held	NJDEP
Elizabeth Agle	EPA - Air & Radiation

NYSDOH staff was responsible for field work related to air sampling and preparation of the final report. NYSDOH Wadsworth Center for Laboratories and Research was responsible for all analysis of air samples for VOCs. Formaldehyde samples were analyzed by the EPA contract laboratory. Subcommittee members reviewed all plans, reports, and data; assisted in obtaining equipment; and aided in the selection of sampling sites.

3.2.4 Relation to Project Objectives

Results obtained from the indoor air study were to be used to address project objectives concerning characterization of levels of selected VOCs in indoor air, estimation of indoor air contribution to an individual's inhalation exposure to airborne VOCs, evaluation of indoor/outdoor air concentration relationships, and identification of possible indoor air sources.

3.2.5 Summary of Project Plan

Indoor air samples were collected in two homes in Staten Island and two homes in New Jersey located within one half mile of project ambient air monitoring stations. These homes met the selection criteria identified in the workplan. Samples were collected every twelve days for eight months. Ambient air sampling was conducted concurrently with indoor air sampling. All samples were analyzed for the specified VOCs. The chemicals analyzed for the indoor air portion of the project were a subset of the chemicals in the ambient air sampling portion of the project; their selection was based on the analytical ability of the NYSDOH laboratory, and reports that the chemicals had been found in indoor air.

The list of target VOCs is as follows:

chloromethane	tetrachloroethylene
methylene chloride	benzene
chloroform	toluene
1,1,1-trichloroethane	hexane
carbon tetrachloride	m-,p-xylenes
trichloroethylene	o-xylene
	ethylbenzene

In addition to the VOCs, radon and formaldehyde, two important contributors to indoor air pollution, were sampled.

Meteorological instruments were utilized at both sites to aid in identification of any dominant pollutant sources.

Special questionnaires were developed to ensure collection of all pertinent data for each house. Residential indoor air quality questionnaires were completed for each home. A daily activity/product use questionnaire was completed for each sampling episode.

Data reports were to be issued every three months during sampling. Within 45 days of the last data report, a final reportwas to be prepared to present all data gathered during the study and to provide conclusions regarding the data.

3.2.6 Summary of Anticipated Outputs

Conclusions drawn from the indoor air quality data were to provide information regarding the following:

- indoor sources of VOCs and formaldehyde;
- levels of contaminants in indoor air;
- relationships between indoor and outdoor air pollutant concentrations;
- indoor sources of the air pollutants;
- seasonal changes in indoor air contamination and in indoor/outdoor relationships;
- contribution of indoor air to total inhalation exposure;
- the effects of personal activity/product use on indoor air quality; and
- impact of any predominant sources affecting one or more of the study homes.

3.3 EMISSION INVENTORY

3.3.1 Introduction

The development of a VOC/air toxics emission inventory was considered essential to enhancing our understanding of the urban air toxics problem and facilitating the evaluation of general abatement strategies for toxic air pollutants.

The compilation of an air toxics emission inventory including point, area, and mobile sources was a highly resource-intensive effort. The foundation of the project inventory was to be the existing data bases of NJDEP and NYSDEC.

A review of the available information in October 1986, at the start of the Subcommittee's efforts, showed that the existing inventories were restricted to point sources. Therefore, the development of a comprehensive inventory necessitated the generation of information previously unknown or unavailable to the project participants. The objectives and tasks outlined in the Subcommittee's workplan present the scope of work developed to provide the best information available within the limitations of the available resources. Further, the workplan identifies areas where additional information and resources were required. While the generation of contaminant-specific reports and other point source-related information were the responsibility of NJDEP and NYSDEC, the members of the Subcommittee agreed to a cooperative effort, thereby enlisting the support of the participating agencies in the development and production of all final deliverables committed to in this plan.

3.3.2 Purpose

The subcommittee was charged with the development of an inventory of toxic substance emissions from traditional and non-traditional sources, including point, area, and mobile sources, so as to formulate hypotheses linking major contaminants to potential sources.

3.3.3 Subcommittee Structure

The subcommittee was comprised of staff from the three major agencies that managed emission inventories for the study area--the NJDEP, NYSDEC, and EPA Region II.

The structure of the subcommittee was as follows:

Chair: Andrew Opperman
Role: Coordinate and oversee all subcommittee activities; prepare quarterly reports and the workplan.

NJDEP: Tom Ballou
Andrew Opperman
Role: Provide Air Pollution Enforcement Data System (APEDS) data; provide Superfund Amendments and Reauthorization Act (SARA) Section 313 data i.e., data from the Toxics Release Inventory (TRI) data base; generate and provide New Jersey area and mobile source data; perform microinventories at New Jersey sites; perform quality assurance.

NYSDEC: Sam Lieblich
Mike Kormanik
Dave MacPherson (retired)

Role: Provide Source Management System (SMS) data; generate and provide New York area and mobile source data; perform microinventories at New York sites; perform quality assurance.

EPA Region II: Roch Baamonde
John Filippelli
Al Forte

Role: Compile states' inventories and SARA data; map point, area, and mobile sources; perform microinventories for both states and prepare microinventory reports; prepare quarterly reports; perform quality assurance.

Additional personnel from each of the three agencies provided support for specific tasks.

3.3.4 Relationship to Project Objectives

The work of the subcommittee was directed at providing the information required for project objective 5.

Objective 5. Perform emission source inventory (including point, area, and mobile sources), so as to formulate hypotheses linking major contaminants to potential sources.

The emission inventory generated by the subcommittee was to be used to address four additional project objectives primarily in the purview of other subcommittees:

Objective 6. Obtain air quality data for the purpose of identifying potential sources using meteorological modeling;

Objective 7. Evaluate indoor air quality data to identify possible sources;

Objective 9. Evaluate some general abatement strategies.

3.3.5 Summary of Project Plan

The members of the subcommittee, with input from other project participants, particularly the Quality Assurance Subcommittee, developed an extensive workplan to address Project

Objective 5. The workplan details six objectives through which its purpose would be fulfilled:

A. Define the study area. Identify the geographic area for which sources would or might impact the monitoring stations and contribute to the so-called toxics soup in the study area.

B. Assess the foundation for the existing data bases and develop a unified project data base. (1) Draw comparisons among the participating agencies' existing data bases so as to present the information as uniformly as possible; (2) develop a limited-capability unified data base; and (3) define the capabilities and limitations of the unified data base.

C. Prepare, summarize, and provide external reports for point sources. (1) Generate point source summary reports in various formats to identify the types of information available; (2) use contaminant-specific summary reports as the foundation for the point source inventory; (3) identify data fields to be incorporated into the unified data base.

D. Develop area source and mobile source inventories. Provide information for such non-traditional source types. Develop a 2 km X 2 km grid system for both area and mobile source inventories. Generate area source inventories based upon population-based emission factors, and a mobile source inventory based on population and vehicle-miles-traveled (VMT) emission factors.

E. Enhance the developed emission inventory. Conduct a microinventory around the 15 monitoring sites to (1) identify and account for influences of nearby sources, (2) assess the comprehensiveness of the point source inventories, (3) identify obvious non-complying sources for future enforcement actions, and (4) assess the needs of the Modeling and Source Identification Subcommittee.

F. Provide to the project a quality assurance assessment of the emission inventory. Assess the capabilities and limitations of the various data bases; and assess the relative levels of precision, accuracy, representativeness, and completeness of the utilized data bases, including record reviews and limited plant inspections. (Quality Assurance was developed as a component of the subcommittee's workplan. See Volume VI.)

3.3.6 Summary of Anticipated Outputs

The Emission Inventory Subcommittee initiated the inventory development with the list of monitored substances. This list was expanded as information became available from other air toxics studies, as the existing inventories for the region were reviewed, and as results from the ambient air samples were produced. The complete list of substances to be included in the emission inventory is in the subcommittee's workplan. (See Volume VI).

Only direct releases into the ambient atmosphere were to be inventoried. For area and mobile sources, emissions were to be developed and apportioned over the study area.

The results of this effort were to be summarized in tables, graphs, and maps to facilitate their use by the other subcommittees.

3.4 MODELING AND SOURCE IDENTIFICATION

3.4.1 Introduction

The Modeling and Source Identification Subcommittee (MSIS) was established to provide a bridge between the efforts of the Monitoring and Emissions Inventory Subcommittees and the completion of one of the project's goals--identification of potential source areas of toxic air contaminants.

The principal resources used by the MSIS to aid in accomplishing this goal were a surface trajectory model and a pollutant rose. With the surface trajectory model, the geographical position of a parcel of air can be traced backwards in time toward its source area using meteorological data as input to drive the model. It was decided that these trajectories would be generated for sampling days that were found to have high air toxics concentrations, or for days representative of frequent ambient concentration conditions. The specific days, pollutants, and sites were chosen by both the Data Management Subcommittee and the MSIS.

Pollutant/wind direction relationships on an annual average basis were presented graphically through use of a pollutant rose.

3.4.2 Purpose

The work of this subcommittee was to provide the project with the capability to relate air toxics source areas to potential receptors using surface trajectory and pollutant rose computer models.

3.4.3 Subcommittee Structure

The MSIS was composed of a chairman and three members as follows:

Chair: Raymond Werner
Role: Integrate workplan efforts and direct and guide members in completion of their tasks.

EPA Region II: William Barrett
Role: Gather meteorological/other data from various sources and use the data to drive surface trajectory and wind/pollutant rose computer models.

NYSDEC: Vito Pagnotti
Role: Provide technical guidance to subcommittee regarding model selection, implementation, and result interpretation.

NJDEP: Joann Held
Role: Provide a link between the MSIS and the Exposure and Health Risk Assessment Subcommittee to help integrate the work of the two subcommittees.

3.4.4 Relation to Project Objectives

The subcommittee was particularly concerned with the following project objective:

Objective 6. Obtain air quality data for the purpose of identifying potential sources using meteorological modeling.

The subcommittee was to attempt to identify potential air toxics source areas by using surface trajectory modeling, and, for longer-term data, pollutant and wind rose models. The models were to be adapted for use with the pertinent, available meteorological data, and the ambient concentration data.

3.4.5 Summary of Subcommittee Workplan

The subcommittee workplan is composed of four project objectives. The first objective concerns the identification of applicable methods. The second concerns the collection of meteorological data using sources such as the National Climatic Data Center, NYSDEC, and NJDEP. The third and fourth objectives involve procedures used to identify potential air toxics source areas.

3.4.6 Summary of Anticipated Outputs

The subcommittee was to generate pollutant roses and surface back-trajectories, analyze them in conjunction with the project's emission inventory, and discuss the results in the context of possible source areas for the pollutant/site combinations addressed.

3.4.6.1 Surface trajectory model

Analyses were performed using a surface trajectory model. This model assumes low-level transport of air parcels with no vertical motion. Parcels are adverted from one location to another in accordance with a resultant wind field, which is generated by input of wind data from up to 10 locations in the immediate region.

The model uses three input parameters. They are as follows:

(1) UTM coordinates of atmospheric parcel ending point.
(2) UTM coordinates of all wind stations used to create the resultant wind field.
(3) Wind data (direction and velocity) for each station for the hours of interest. Stations used included six National Weather Service Offices and three NYSDEC sites located on Staten Island.

Several trial runs of the model using two-,four-, and nine-hour parcel travel times showed the influence of short-term fluctuations in wind direction and the need for careful application of the model to actual project situations.

3.4.6.2 Pollutant rose

A pollutant rose, an adaption of a wind rose calculation, was used to depict longer-term concentration and wind direction information, and thus, help in identifying potential air toxics source areas.

3.5 DATA MANAGEMENT

3.5.1 Introduction

The Data Management Subcommittee was formed during the planning stages for the project to provide a single point of contact for the collection, storage, and distribution of data. This was especially critical since six different project participants and contractors were to be reporting ambient data. The subcommittee initially consisted of one representative of each participant (EPA, NJDEP, NYSDEC, CSI, and UMDNJ) plus one representative from NJIT, which would be reporting data as a contractor for NJDEP. The subcommittee membership changed since its formation. The changes in membership reflected the changes in activities of the subcommittee as the focus of the project progressed from collection of data to use of the data.

3.5.2 Purpose

The original purpose of the Subcommittee was to establish a centralized operation for the collection, storage, and distribution of data generated by the SI/NJ UATAP. During the course of the project, two additional purposes were added: review of data submittals for data entry errors and other anomalies, and initial analysis of the project data.

3.5.3 Subcommittee Structure

The following were members of the subcommittee:

Rudolph K. Kapichak, EPA Region II (Chair)
Stan Stephansen, EPA Region II
Garry Boynton, NYSDEC
Phil Galvin, NYSDEC
Brian Lay, NYSDEC
Steve Quan, NJDEP
Cliff Weisel, UMDNJ (formerly of CSI)
John Oppenheimer, CSI
Barbara Kebbekus, NJIT
Joseph Bozzelli, NJIT

Linda Berrafato, UMDNJ, was a member while UMDNJ conducted sampling and analysis for the Piscataway and Sewaren sites.

3.5.4 Relation to Project Objectives

While this subcommittee did not directly fulfill any of the nine objectives of the project, its formatted data and data analysis serve assisted the subcommittees in fulfilling Objectives 1, 2, 3, 4, and 6.

3.5.5 Summary of Project Plan

The subcommittee began with two primary objectives. These were to design forms and collection methods for raw and reduced data generated by project participants, and to develop systems for storage and organization of data to facilitate use by the project participants.

The project participants were to use the forms to submit each quarter's air quality data for review within 45 days after the end of the calendar quarter. The project plan was changed to allow submittal on an annual basis because the participants needed longer than anticipated to review and properly format the vast amount of data they had collected.

Due to the participants' problems with reviewing and formatting the data, an additional review step was added to the plan. EPA Region II staff were to review the data for data entry errors and other anomalies. Erroneous or incomplete data were to be returned to the organization that submitted it. After the organization corrected the data, the subcommittee was to accept the data for processing into final reports.

3.5.6 Summary of Anticipated Outputs

This subcommittee's products were to be the initial quarterly data listings, and a final data summary. As noted, the subcommittee modified the plan to provide for review and release of the data on an annual basis. Additional data from EPA contractors, and data submitted late from participants, were to be produced as supplements to the two annual data sets. The data were to be made available on diskettes when authorized for distribution.

Additional products, generated as a result of the data analysis effort, included plots of the annual averages for selected analytes; and daily data plots for selected analytes, sites, and periods of sampling.

3.6 EXPOSURE AND HEALTH RISK ASSESSMENT

3.6.1 Introduction

The Exposure and Health Assessment Subcommittee was established to focus on exposure, hazard, and risk arising from exposure to the pollutants measured. This required reaching agreement on a systematic approach to examining and characterizing the health risk arising from the pollutants measured at each outdoor and indoor site.

3.6.2 Purpose

The subcommittee was to estimate the direct inhalation exposure to toxic substances measured in the ambient air and in a limited number of homes within the project area, to characterize potential health risks associated with long-term inhalation of these toxic substances in the study area, and to compare these risks to these resulting from such exposures in other urban centers.

3.6.3 Subcommittee Structure

The committee members, individuals appointed by each organization and representing a wide range of expertise, were as follows:

Chair:	Dr. Paul J. Lioy
Role:	Provide exposure assessment for use in risk assessment and participate in evaluation of risk.
NYSDOH:	Dr. John Hawley
Role:	Participate in conducting the risk assessment for the project, and provide dose-response factors for use in the analysis of carcinogens and non-carcinogens.

NJDEP: Ms. Joann Held
EPA Region II: Ms. Marian Olsen,
NYSDEC: Mr. Robert Majewski
Role: Participate in the risk assessment and provide background data on VOCs in other cities within the U.S.

G. Anders Carlson of the NYSDOH originally co-chaired the subcommittee with Dr. Lioy.

3.6.4 Relationship to Project Objectives

The work of the subcommittee was to satisfy Project Objectives 1 and 2:

Objective 1. Characterize air quality for selected volatile organic compounds (VOCs) for the purpose of doing an exposure assessment for various population, commercial, and industrial interfaces.

Objective 2. Characterize air quality for the parameters identified by EPA as high risk urban toxics for the purpose of using exposure assessment for comparison with other studies.

3.6.5 Summary of Project Plan

The work plan for the Exposure and Health Risk Assessment Subcommittee is composed of two major sections--exposure characterization and risk estimation. Completion of each involved achieving five major objectives:

1. Characterization of exposure at each site.
2. Comparisons of exposure with the selected background site.
3. Comparison of the SI/NJ values with similar information reported in the scientific literature.
4. Comparisons of the annual arithmetic means for the contaminants measured at each site.
5. Estimation of the health risks associated with the significant differences recorded between the urban SI/NJ UATAP sites and other urban background sites.

The exposure assessment was to be conducted using the following two approaches: Level 1, where an individual is assumed to spend the entire year outdoors or in environments only marginally affected by indoor sources; and Level 2, where each assessment takes into account the time spent indoors at the homes located near the outdoor sites. The homes were selected for sampling by the Indoor Air Subcommittee.

Both non-cancer and cancer risks were to be characterized. Toxicological dose-response data and risk factors were to be obtained from each governmental agency and summarized in a composite table for both the non-cancer and cancer hazards associated with substances selected for study. For the purposes of the SI/NJ UATAP, the risks were to be summed only for those compounds identified as having the same target organs or similar metabolic pathways.

Risk calculations were to be conducted for both Level 1 and Level 2 exposure estimates. The results from the risk analyses were to be compared among the project site locations, and with results for other urban locations.

3.6.6 Summary of Anticipated Outputs

An initial risk analysis (Level 1) was to be prepared to characterize risk to an individual maximally exposed to pollutants in the ambient air of the SI/NJ UATAP study area, and to suggest the compounds and intersite comparisons of greatest importance to the ongoing data analyses.

The Level 2 analysis, to be conducted after completion of the indoor air portion of the project, was to add to the Level 1 analysis the impacts of exposure to indoor air pollutants, and of variation in ambient air pollutant concentrations across the project area.

3.7 QUALITY ASSURANCE

3.7.1 Introduction

The Quality Assurance Subcommittee was formed in the initial stages of the project to oversee the quality assurance and quality control of the monitoring organizations providing data for the project. This was essential due to the variation in experience, organizational structure, and instrumentation available to each of these monitoring organizations. A change to require the inclusion of quality assurance concepts by all subcommittees, in addition to the requirements already in place for monitoring organizations, was effected midway through the project.

The responsibilities of the subcommittee included review of Quality Assurance Project Plans; conduct of performance audits, management system audits, collocation experiments; and quality assurance data reviews. During the course of the project, it became evident that the subcommittee would have to take on the responsibility of reviewing some raw data. This resulted in the timely discovery of errors and successful implementation of corrective action.

3.7.2 Purpose

The purpose of the subcommittee was to develop and implement the quality assurance program for the SI/NJ UATAP, assess and document the quality of the data generated in the project, and recommend corrective action.

3.7.3 Subcommittee Structure

The members of the subcommittee were as follows:

Marcus Kantz, EPA Region II (Chair)
Randall Coon, NYSDEC
Charles Pietarinen, NJDEP
John Oppenheimer, CSI
Barbara Kebbekus, NJIT
Clifford Weisel, UMDNJ

There were few changes in membership during the course of the project.

3.7.4 Relation to the Project Objectives

The subcommittee's work related directly to the first four objectives of the project, those concerning characterization and evaluation of indoor and outdoor air in the project area. Through the use of the methods enumerated in the subcommittee workplan and described in the subcommittee Quality Assurance Project Plan QAPjP), assessments of the quality of the indoor and outdoor air monitoring data were made.

The subcommittee was indirectly involved in the implementation of the last five project objectives through the requirement for and review of QAPjPs from each of the other subcommittees in the project. These QAPjPs required that every subcommittee identify and examine the significant choices affecting the quality of their work, and determine the appropriateness of their decisions. For example, the Modeling and Source Identification Subcommittee examined its modeling programs; and the Emission Inventory Subcommittee, its data-gathering methodology, to determine appropriateness for the intended uses.

3.7.5 Summary of Project Plan

The basic tenet of the subcommittee was that each organization involved in data collection and/or manipulation maintain primary responsibility for ensuring that the results of its work satisfy the needs of the project. However, to ensure a certain degree of consistency and to enhance overall confidence in the results, the subcommittee would oversee the data quality aspects of the organizations' operation.

The subcommittee determined that special external quality assurance measures would have to be taken in the SI/NJ UATAP project. This was because of the wide variation in equipment, experience, organizational structure, manpower, and objectives between the institutions participating in the project, as well as the experimental and state-of-the art technology that was to be used.

The subcommittee considered various special procedures in an attempt to address these challenges to acceptable data quality. The final list which was chosen in an effort to cover all phases of the project included the following:

Quality Assurance Project Plans	Specification of data quality objectives, methods of achieving these objectives, QA/QC measures to be implemented, personnel responsible for QA/QC, and a plan for taking corrective action.
Management Systems Audits	Audits of the hierarchy and plans of the data collecting organization.

Technical Systems Audits	Audits of the sampling and analytical procedures of the organization.
Performance Audits	Audits of analytical ability.
Collocation of sampling equipment	Locating different samplers at the same site for a specified period.
Extended Collocation Experiments	Multiple organizations sampling at the same place and time for several consecutive days, events called shootouts.

Detailed descriptions of these QA tools can be found in the Quality Assurance Subcommittee workplan in Volume VI.

3.7.6 Summary of Anticipated Outputs

The anticipated products of this subcommittee were the following:

1. Reviews and approvals of the Quality Assurance Project Plans submitted by each of the monitoring organizations and subcommittees.

2. Management and Technical System Audits of the organizations responsible for data collection.

3. Performance Audits of the organizations responsible for data analysis to determine the proficiency and accuracy of each organization.

4. Multi-day Collocation Experiment reports containing the data gathered and an explanation of the results.

5. Periodic review of pertinent data quality trends, presented at Steering Committee meetings, to determine if the project data objectives have been met.

6. Recommendations for corrective action to be taken.

7. Assessment of the acceptability of the data submitted for inclusion in the project data base.

8. Overall assessments of the quality and usefulness of the data and the validity of the data manipulations.

4. ACKNOWLEDGEMENT

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