United States
Environmental Protection
Agency

Region 2
902

EPA/902/R-93-001g
January 1993

EPA

Staten Island/New Jersey Urban Air Toxics Assessment Project Report

Volume VI
Part A

Appendices

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 VI. APPENDICES

PART A, EPA/902/R-93-001g
PART B, EPA/902/R-93-001h

TABLE OF CONTENTS

PART A

1. DESCRIPTION OF APPENDICES 1-1
2. AIR QUALITY HISTORY IN THE PROJECT AREA 2-1
3. AIR QUALITY MONITORING PRIOR TO THE INITIATION OF THE PROJECT 3-1
4. SUBCOMMITTEE WORKPLANS AND QUALITY ASSURANCE PLANS 4-1
5. MEMORANDUM ON FIELD TRIP TO METEOROLOGICAL SITES . . 5-1
6. SAMPLING SITE DESCRIPTION REPORTS 6-1
7. QUALITY ASSURANCE SUBCOMMITTEE REPORTS 7-1

PART B

8. NYSDEC VOCS QUALITY ASSURANCE REPORT 8-1
9. CSI VOCS QUALITY ASSURANCE REPORT 9-1
10. NJIT VOCS QUALITY ASSURANCE REPORT 10-1
11. PAPER ON EMISSIONS INVENTORY DEVELOPMENT FOR PUBLICLY-OWNED TREATMENT WORKS 11-1
12. SUPPORT DOCUMENTS FOR REFERENCE CONCENTRATIONS AND INHALATION UNIT RISK FACTORS FROM THE INTEGRATED RISK INFORMATION SYSTEM 12-1
13. SUPPORT DOCUMENTS FOR REFERENCE CONCENTRATIONS FROM THE NEW YORK STATE DEPARTMENT OF HEALTH . . 13-1
14. MEMORANDUM ON THE REFERENCE CONCENTRATION FOR CHROMIUM 14-1
15. MEMORANDUM ON THE REFERENCE CONCENTRATION FOR XYLENE 15-1
16. MEMORANDUM ON WEIGHT-OF-EVIDENCE CLASSIFICATIONS OF TETRACHLOROETHYLENE AND TRICHLOROETHYLENE . . 16-1
17. TOXICOLOGICAL SUMMARIES FOR CHEMICALS NOT INCLUDED IN THE QUANTITATIVE RISK ASSESSMENT FOR THE SI/NJ UATAP 17-1

1. DESCRIPTION OF APPENDICES

The descriptions of the air quality history and the preliminary monitoring done in the Staten Island/New Jersey area provide the background information which the reader needs to understand the development and design of the project.

The appendices include the following:

- the detailed Subcommittee Workplans and Quality Assurance Plans which guided the day-to-day progress of the work,
- the Quality Assurance reports from the organizations that did the air quality sampling and analysis,
- reports describing the siting and exposure of sampling instruments at the monitoring sites,
- a paper serving as background for development of the publicly owned treatment works emissions inventory for the project, and
- a paper discussing the preparation and characteristics of the aldehyde-specific cartridge used for sampling formaldehyde

2. AIR QUALITY HISTORY IN THE PROJECT AREA

The United States Environmental Protection Agency (U.S. EPA) has determined that significant amounts of airborne toxic substances may exist in large, densely populated or industrialized areas.

Problems and solutions relating to air toxics can vary significantly from area to area; therefore, the identification, investigation, and control of emissions of toxic substances must involve the government agencies responsible for protection of the environment in the affected areas, with the support and assistance of the federal government.

The Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP) resulted from the expressed concern of the public and the environmental protection agencies about the lack of an appropriate population exposure data base from which to determine whether or not the risks attributable to air toxics in the project area are unacceptably high as compared to other areas.

The odor/air pollution problem in Staten Island and parts of New Jersey also was instrumental in moving the U.S. EPA and the states to initiate this project.

The borough of Staten Island (Richmond County) is an island of about 60 square miles in New York harbor immediately to the east of New Jersey. Figure 1 is a map of the area around the Arthur Kill, the border between New York and New Jersey. Many of the sources of interest to this project are located here. Major industries, the Linden-Roselle sewage treatment plant, and the Fresh Kills landfill are indicated on the map because of their potential for emitting volatile toxic air pollutants and odorous substances which have an impact on Staten Island and adjacent areas of New Jersey.

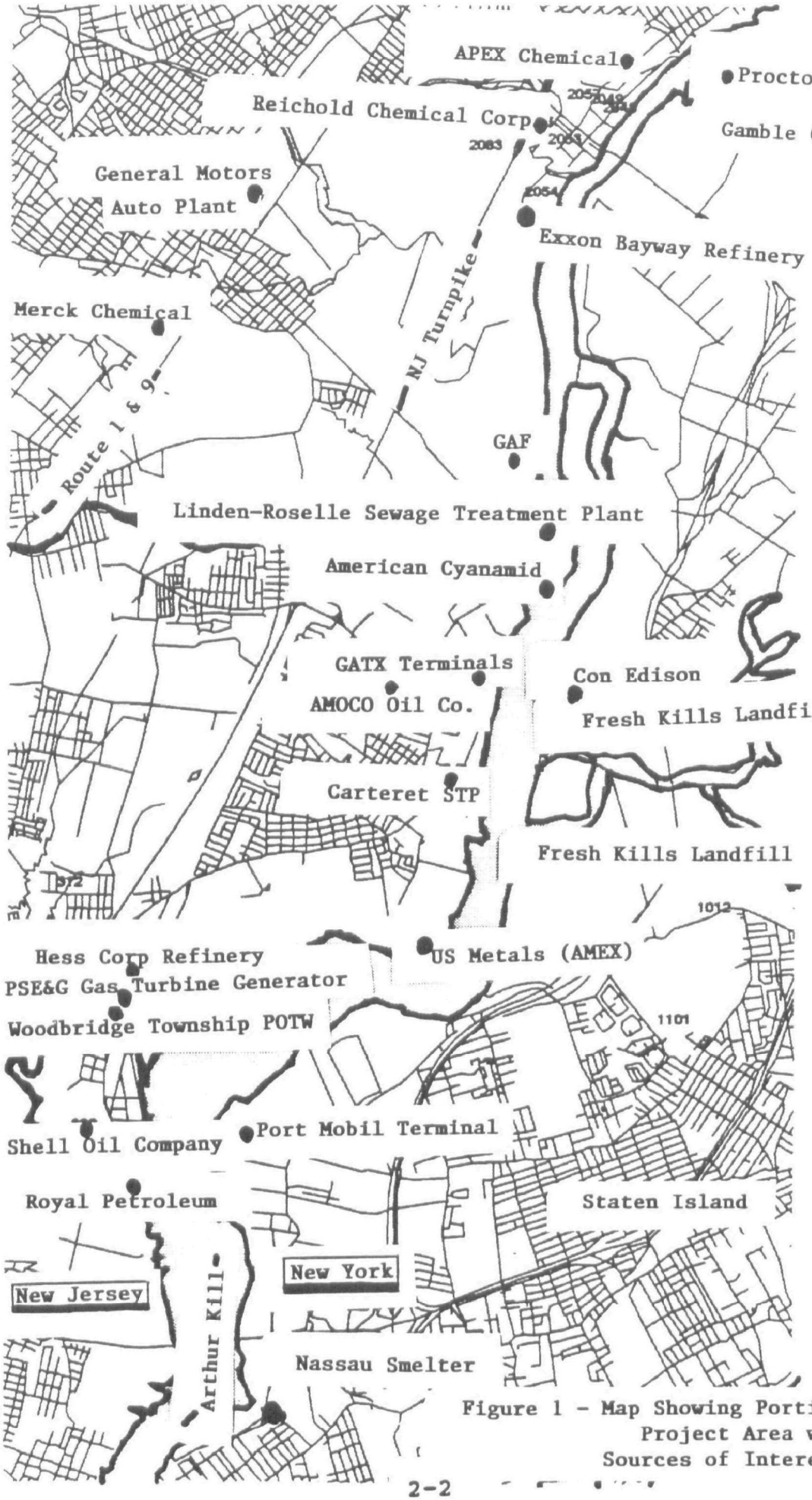


Figure 1 - Map Showing Portion of the Project Area with Sources of Interest

Staten Island, because of its low population density relative to other parts of New York City, has generally experienced lower concentrations of most of the "criteria" pollutants generated by major population centers. On the other hand, it is located near large industrial plants and the world's largest landfill. Therefore, many of the inhabitants have developed a high level of concern about the toxicity of their ambient air.

The concern that exposure to toxic chemicals released by industry in New Jersey and landfills on Staten Island may cause significant damage to health has been reinforced by repeated episodes involving malodorous substances.

One important aspect of the concern about noxious odors is the nature of the relationship between odor incidents and concurrent exposures to elevated concentrations of toxic substances. In general, unpleasant odor incidents are caused by substances which humans can detect at extremely low concentrations. The prevalence of malodorous events creates suspicion that releases of less-readily detectable substances, possibly toxic, also occur with regularity and that the levels of these substances can reach high concentrations before they are detected and stopped.

Preliminary studies by the New York City Department of Health and by The College of Staten Island found higher incidence of lung cancer in Staten Island, New York, and in Hudson and Middlesex Counties, New Jersey, than in surrounding areas.

The incident in December, 1984, at Bhopal, India which killed about 2000 people who lived next to a chemical plant, greatly increased the world's concern, including that of the public in Staten Island and New Jersey, about the potential for catastrophic events.

In view of these concerns one of the most important factors causing disquiet among the public has been the scarcity of data about both the short- and the long- term concentrations of toxic substances in the outdoor air it must breathe. Therefore, a strong demand developed for the application of modern measurement techniques over an extended period for the purpose of documenting the nature and extent of the toxic substances present in the ambient air of Staten Island and nearby New Jersey as compared to those found in other areas.

3. AIR QUALITY MONITORING PRIOR TO THE INITIATION OF THE PROJECT

In March of 1984 EPA, Region II requested that the EPA Emergency Response Team in Edison, New Jersey use the latest measurement techniques in an attempt to document the presence of toxic substances in the ambient atmosphere. They performed a one-week investigation throughout portions of New Jersey and Staten Island which identified about 30 chemicals near sources suspected of causing odor and toxics problems. They were not able to link conclusively the chemicals identified to any odors detected by the sampling team at any of the suspected sources. The investigation was seriously hampered by gusty wind conditions and the non-occurrence of serious odor events throughout its one-week duration, thereby emphasizing the need for a longer-term project.

In a related investigation later that year (September 1984), the EPA's National Enforcement Investigations Center (NEIC) visited locations identified as possible sources of odors. They identified liquid effluent from a process line at a chemical plant in New Jersey as a possible source of the "cat urine" odor which has often been the basis for complaints. The discharge of the offending liquid effluent into the sewage system has been eliminated as a result of this investigation. In addition to the current project, the following important actions, related to the air toxics problem in the area, should be noted.

In late 1985 EPA announced the Chemical Emergency Preparedness Program (CEPP). Over 1200 state, county, and local officials in the NY/NJ area were trained in CEPP implementation. A video tape lending library on chemical emergencies was established and a directory of Hazardous Materials Response Teams in Region II was distributed. In June, 1986, a presentation on CEPP was made at a seminar for business and industry sponsored by The Hazardous Materials Advisory Council of Union and Middlesex counties.

New Jersey's Toxic Catastrophe Prevention Act (TCPA) which was signed in 1986 is a major law which focuses on prevention of accidental releases of extremely hazardous substances (EHS). Facilities in New Jersey which handle any substances identified as extremely hazardous must submit a workplan which documents their assessment of risks associated with accidents and the management of the risks.

The New York State Department of Environmental Conservation (NYSDEC) developed a statewide air toxics program during the 1980's which was one of the first to control toxic substances through a source permitting process.

NYSDEC's Air Guide-1 established acceptable ambient air levels for selected toxics and air toxics monitoring program in 1982-1984 sampled for a limited number of air toxics at two stations in Staten Island.

The Arthur Kill Industrial Business Association (AKIBA) has endeavored to correlate odor reports and meteorological data for the purpose of identifying odor sources. AKIBA funded a study by The Research Corporation of New England (TRC) which analyzed meteorological data and odor reports to develop a methodology for tracking odor incidents to their source. The AKIBA report concluded, "Municipal odor sources (sewage and landfills) have the highest consistent intensity in the Arthur Kill region and often project into nearby communities." The report points 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. AKIBA has installed an odor hotline for use during odor episodes to alert industries to check their facilities for malfunctions when odor episodes occur.

New York City has held emergency preparedness drills on Staten Island with the involvement of several city agencies, hospitals and ambulance services to practice response to toxic chemical emergencies.

As a result of the state and federal concerns as evidenced above, the decision was made in 1986 by the States of New York and New Jersey and the United States Environmental Protection Agency to join forces in an investigation of the air toxics problem in parts of New Jersey and in Staten Island. The first meeting was held in October of 1986, at which time a workplan for the joint effort began to be developed. The talents brought to bear through this cooperative effort were strengthened significantly by the added participation of the University of Medicine and Dentistry of New Jersey, the College of Staten Island, and the New Jersey Institute of Technology.

4. SUBCOMMITTEE WORKPLANS AND QUALITY ASSURANCE PLANS

TABLE OF CONTENTS

4.0 SUBCOMMITTEE WORKPLANS AND QUALITY ASSURANCE PLANS
Table of Contents 4-1
List of Tables and Figures 4-2

4.1 Ambient Monitoring Workplan 4-4
4.1.1 Purpose 4-4
4.1.2 Objectives and Tasks 4-4
4.1.3 Implementation of Monitoring Systems 4-7
4.1.4 Attachments to Monitoring Workplan 4-8

4.2 Emissions Inventory Workplan 4-17
4.2.1 Introduction 4-17
4.2.2 Purpose (Project Objective # 5) 4-17
4.2.3 Background 4-17
4.2.4 Objectives and Tasks 4-18

4.3 Indoor Air Workplan 4-30
4.3.1 Background 4-30
4.3.2 Purpose 4-30
4.3.3 Objectives and Tasks 4-31

4.4 Modeling and Source Identification Workplan 4-35
4.4.1 Subcommittee Members 4-35
4.4.2 Purpose 4-35
4.4.3 Objectives and Tasks 4-35

4.5 Data Management Subcommittee Workplan 4-38
4.5.1 Subcommittee Members 4-38
4.5.2 Purpose 4-38
4.5.3 Objectives and Tasks 4-38
4.5.4 Data Management Quality Assurance Plan 4-41

4.6 Exposure and Health Assessment Workplan 4-46
4.6.1 Subcommittee Members 4-46
4.6.2 Purposes 4-46
4.6.3 Objectives and Tasks 4-46
4.6.4 Personnel 4-48
4.6.5 Quality Assurance Plan 4-63

4.7 Quality Assurance Subcommittee Workplan 4-65
4.7.1 Subcommittee Members 4-65
4.7.2 Purpose 4-65
4.7.3 Background 4-65
4.7.4 Objectives and Tasks 4-68
4.7.5 Internal Quality Assurance 4-69
4.7.6 Quality Assurance Plan 4-72

LIST OF TABLES and FIGURES

AMBIENT MONITORING WORKPLAN
Attachment 1...List of EPA "Urban Soup" chemicals 4-10

Attachment 2...Target list of chemicals to be sampled by the project participants 4-11

Attachment 3...List of chemicals to be sampled using canisters 4-12

Attachment 4...List of chemicals to be sampled using formaldehyde cartridges 4-13

Attachment 5...Map of monitoring sites and what classes of chemicals are sampled at each site 4-14

Attachment 6...List of chemicals and CAS numbers..(see Tables 3 and 4 in the Emission Inventory workplan)

Attachment 7a...Project clock: Entire project 4-15

Attachment 7b...Project clock: Sampling portion of project 4-16

EMISSIONS INVENTORY WORKPLAN
Figure 1...Emission Inventory Study Area Map 4-23

Figure 2...Emission inventory 2x2km grid map 4-24

Table 1.A..Review of the data base coverage for boilers and incinerators 4-25

Table 2....Emission inventory data fields presented in the unified data base for specific substances 4-26

Table 2.A..Sample printout of the unified data base 4-27

Table 3....Air toxics emission inventory point and area source substance list 4-28

Table 4....Air toxics emission inventory mobile sources substance list 4-29

EXPOSURE AND HEALTH ASSESSMENT WORKPLAN

Table I....Summary of available risk estimates (carcinogenic and non-carcinogenic) for potential chemicals that will be sampled during the SI/NJ Project 4-49

Table II...Summary of current NYSDOH, NJDEP and EPA risk information on chemicals analyzed during the NJ/SI Project 4-50

4.1 Ambient Monitoring Workplan

4.1.1 Purpose

To provide the project with the measurements of the concentrations of toxic pollutants that people are exposed to in the outdoor air.

4.1.2 Objectives and Tasks

OBJECTIVE A

Determine which air toxics should be targeted for sampling.

Task A1. List air toxics that have been identified in ambient air in previous studies.

Task A2. Determine which air toxics are considered as high priority for sampling in ambient air. Use EPA's Urban Toxic "Soup" list and other lists of carcinogens and acute toxics.

Task A2.1 Review information on odorous compounds to determine if compounds related to odor events can be identified.

OBJECTIVE B

Select feasible consistent methods for measuring toxics in the ambient air.

Task B1. Determine which air toxics identified in Objective A can be measured using state-of-the-art sampling and analysis methods.

Task B2. Review resources available to the project to determine which methods can be used

Task B2.1 Review sampling and analytical resources of participating organizations.

Task B2.2 Determine capabilities needed to monitor for air toxics identified in Objective A.

Task B2.3 Identify additional resources needed by participating organizations to measure air toxics selected by the project and what procurement efforts are needed. Use these resources to meet program goals as outlined by the project Management/Steering Committee, e.g., consistent use of a common sorbent and additional use of quality assurance (QA).

Task B3. Periodically review list of air toxics and methods to determine what additions or deletions should be made on the basis of the findings of the project, new literature or studies.

OBJECTIVE C

Determine the geographical extent of the project's sampling program, and the sites needed for statistically valid sampling of its ambient air.

Task C1. Determine the size of the airshed to be covered by the monitoring portion of the project.

Task C2. Determine the number of samplers needed for each class of substances to ensure proper representativeness over the whole domain of the project.

Task C3. In cooperation with the QA Subcommittee, establish siting criteria and guidelines for sampling sites.

OBJECTIVE D

Find representative sites.

Task D1. In cooperation with the QA Subcommittee, inspect potential sampling sites for conformance with the siting criteria and guidelines.

OBJECTIVE E

Implement sampling program.

Task E1. Carry out decisions made by the Management/Steering Committee, the Project Work Group and EPA following guidance from the Monitoring and QA Subcommittees as appropriate. See Appendix A [Section 4.1.3] for a listing of tasks by pollutant class for each organization in the project, as agreed to by the project participants.

OBJECTIVE F

Make information available to project participants and other users to facilitate verification of the sampling and analysis programs.

Task F1. All sampling and analysis organizations

* Provide EPA-Region II, AWMD with information on monitoring deployment, site changes, and lapses in sampling.

* In sampling Quarter 1, provide the Data Management Subcommittee with monthly reports on causes of loss of scheduled samples.

* Submit all air toxics and meteorological measurements to AWMD, EPA Region II in project format for Data Management Subcommittee. (See Data Management Subcommittee workplan for format. All

exceptions to project format must be cleared with the Data Management Subcommittee.)

OBJECTIVE G

Provide coordination of resource allocations and technical expertise for project participants.

Task G.1. **EPA-Region II, APB**

* Coordinate and track monitoring activities.

* Provide contract services where needed, esp. for volatile organic compounds (VOCs) and formaldehyde.

Task G.2. **EPA-Region II, MMB**

* Provide QA support including system audits, site inspections, performance evaluation samples. (See QA workplan for details.)

Task G.3. **EPA-RTP-EMSL**

* Perform statistical analysis of Tenax confirmation using canister data.

* Participate in project monitoring activities to support QA activities, such as shootouts, audits and sampler comparisons. (See EMSL memos in file for lists of assistance to be provided.)

Task G.4. **Monitoring Subcommittee**

* Meet periodically to review the operations and status of the monitoring networks. Report to the Project Work Group any delays in deployment, sampling or analysis problems.

* Review network deployment to assure proper coverage is maintained.

* Review, and recommend to the Project Work Group, changes to
  - methods used,
  - sampling frequency,
  - chemicals on project sampling list

for each method.

* Arrange for blank checks for canister sampling trains periodically to assess possible contamination. (Plan with advice from QA subcommittee and EPA-Region II.) Any corrective action should be planned by the QA subcommittee in cooperation with EPA-Region II, EPA-RTP-EMSL and the Monitoring Subcommittee.

* Assure that formaldehyde and canister samples are taken as planned, shipped and data received and reported by the project participants.

4.1.3 Implementation of Monitoring Systems

Task 1. VOC Sampling and Analysis
Task 1.1 - **NJDEP**
* Provide 2-tube Tenax sampling and analysis for 4 sites in NJ (once every 6 days [1/6]).

* Provide canister sampling and analysis from 2 NJIT sites (1/6). Ship a canister to EPA contractor monthly (1/30) from each site for confirmation analysis.

* Provide for pickup, delivery and deployment of canister sampling trains and canisters at 2 UMDNJ sites (1/18). The sampling at these sites may be done at a month per site as long as a 1/18 sampling frequency is maintained.

* Provide for preparation and analysis of Tenax tubes for NYSDEC or other sites as agreed to with EPA.

Task 1.2 - **NYSDEC**

* Provide for sampling and analysis using 2-tube Tenax at 4 sites or more - make arrangements for contractor with EPA Region II providing contract management services. Use NYSDEC's sampling systems and contractor's Tenax tubes.

* Purchase and deploy canister samplers and canisters, provide pickup, delivery so that canisters can be analyzed by EPA contractor (1/6 at two sites, 1/18 at other 4 sites).

* Provide for NYSDEC multiple sorbent at 6 sites (1/6). Sorbent will used at low (1 tube) and high (2 tubes) flow rates. Note: Sorbent is designated as "Envirochem" for use with Envirochem manual thermal desorber and as "ATD-50" for use with Automated Thermal Desorber.

* NYSDEC will run these two types of tubes in parallel at one site or more to prove equivalency between these methods.

* Purchase and deploy automated GCs at three sites for 4-8 chemicals from project list (hourly data).

Task 1.3 - **CSI**

* Provide for sampling and analysis of 2-tube Tenax from 3 sites (1/1).

* Deploy canister sampling train(s) supplied by EPA. Sample at each site (1/18) on 5 sample per month per site basis using monthly rotating schedule; pickup and return canisters to EPA for shipping to EPA contractor for analysis.

Task 1.4 - **U.S. EPA-Region II, AWMD**

* Assist NYSDEC with contract arrangements for Tenax prep and analysis.

* Contract for analysis of canisters.

* Procure canister sampling trains for CSI and NJDEP (UMDNJ) sites.

Task 1.5 - **U.S. EPA-Region II, MMB**

* Assist with shipping of canisters.

* Provide data from contractor for participants.

* Provide canister trains to CSI and NJDEP as procured by EPA-Region II, AWMD and as needed by CSI and NJDEP to fulfill Tasks 1.3 and 1.2. Track the use of these trains to assure recovery at the end of the project.

* Recommend methods for repair of malfunctioning canisters, as needed.

Task 2. - Formaldehyde Sampling and Analysis

Task 2.1 - **NJDEP**

* Provide for sampling and analysis of formaldehyde cartridges at two NJIT sites (1/6).

* Provide for parallel sampling using EPA formaldehyde cartridge at NJIT sites (1/6). Send cartridges to EPA lab for analysis.

* Procure sampling trains and use EPA formaldehyde cartridges at upwind site ("D"). Send cartridges to EPA lab for analysis.

Task 2.2 - **NYSDEC**

* Procure sampling trains and use EPA formaldehyde cartridges at two sites (1/6). Send cartridges to EPA lab for analysis.

Task 2.3 - **U.S. EPA-Region II, AWMD**

* Contract for preparation and analysis of formaldehyde cartridges.

Task 2.4 - **U.S. EPA-Region II, MMB**

* Hold cartridges for pickup by participants. Track number of cartridges received and allocated to participants.

Task 3. - Metals and BaP

Task 3.1 - **NJDEP**

* Provide for sampling and analysis of hi vol filters for metals and BaP for two sites (1/6).

* Provide for sampling and analysis of hi vol filters for metals and Bap for upwind site (1/6).

Task 3.2 - **NYSDEC**

* Provide for sampling and analysis of hi vol filters for metals and BaP for two sites (1/6).

* Provide for sampling of hi vol filters at two sites. Ship to EPA's RTP lab for analysis under the National Particulate Network program (1/12).

Task 4. - Wind
Task 4.1 - **NYSDEC**

* Procure wind equipment for 4 sites.

* Install, operate and collect data from wind equipment at sites.

Task 4.2 - **NJDEP**

* Collect wind data from Elizabeth Trailer (NJDEP, near site A).

* Acquire wind data from NWS site at Newark Airport.

4.1.4 Attachments to Monitoring Workplan

1. List of EPA "Urban Soup" Chemicals.

2. Target list of chemicals to be sampled by the project participants.

3. List of chemicals to be sampled using canisters

4. List of chemicals to be sampled using formaldehyde cartridges

5. Map of monitoring sites and what classes of chemicals are sampled at each site.

6. Chart with CAS numbers and synonyms for chemical names in sampling portion of project (in Emission Inventory workplan).

7. Project clocks: Entire project and sampling portion.

Attachment 1

Toxic Substances Common In Urban Areas That May Be Important Contributors To National Cancer Incidence

Chromium

Arsenic

Asbestos

Products of Incomplete Combustion

Formaldehyde

Benzene

Ethylene Oxide

Gasoline Vapors

Chloroform

Carbon Tetrachloride

Perchloroethylene

Trichloroethylene

Attachment 2

Attachment 2 lists the toxic substances which have been included the initial target list for the project. Others were added as they were found to be present in the ambient air at concentrations detectable using the available analytic methods. Some were not done if the methods could not detect or resolve them.

TOXIC SUBSTANCES MONITORED BY PROJECT

Halogenated Hydrocarbons

Chloromethane
Dichloromethane (Methylene Chloride)
Trichloromethane (Chloroform)
1,1,1-Trichloroethane
Tetrachloromethane (Carbon Tetrachloride)
Trichloroethylene
Tetrachloroethylene
Dibromochloromethane
Vinyl Chloride
1,2-Dichloroethane (Ethylene Dichloride)

Other Organic Compounds

Benzene
Toluene
Hexane
o-Xylene
Formaldehyde
Selected Carbonyl Compounds

Suspended Particulate Matter

Arsenic
Barium
Beryllium
Cadmium
Cobalt
Copper
Chromium
Iron
Manganese
Molybdenum
Nickel
Lead
Vandium
Zinc
B(a)P

Attachment 3

INITIAL TARGET COMPOUND LIST
for Contractors' VOC Canister Analysis

Vinyl Chloride (Chloroethene)
Chloromethane (Methyl Chloride)
Vinylidene Chloride (1,1-Dichloroethene)
Dichloromethane (Methylene Chloride)
1,2-Dichloroethane (Ethylene Dichloride)
Dibromochloromethane
1,2-Dibromoethane
Trichloromethane (Chloroform)
1,1,1-Trichloroethene (Methyl Chloroform)
Trichloroethene
Tetrachloromethane (Carbon Tetrachloride)
Tetrachloroethylene (Tetrachloroethene, Perchloroethylene)
1,1,2,2-Tetrachloroethane
Chlorobenzene
o-Dichlorobenzene
m-Dichlorobenzene
p-Dichlorobenzene
Benzene
Toluene
Ethyl Benzene
o-Xylene
m-Xylene
Styrene
Hexane
Octane
Nonane

Attachment 4

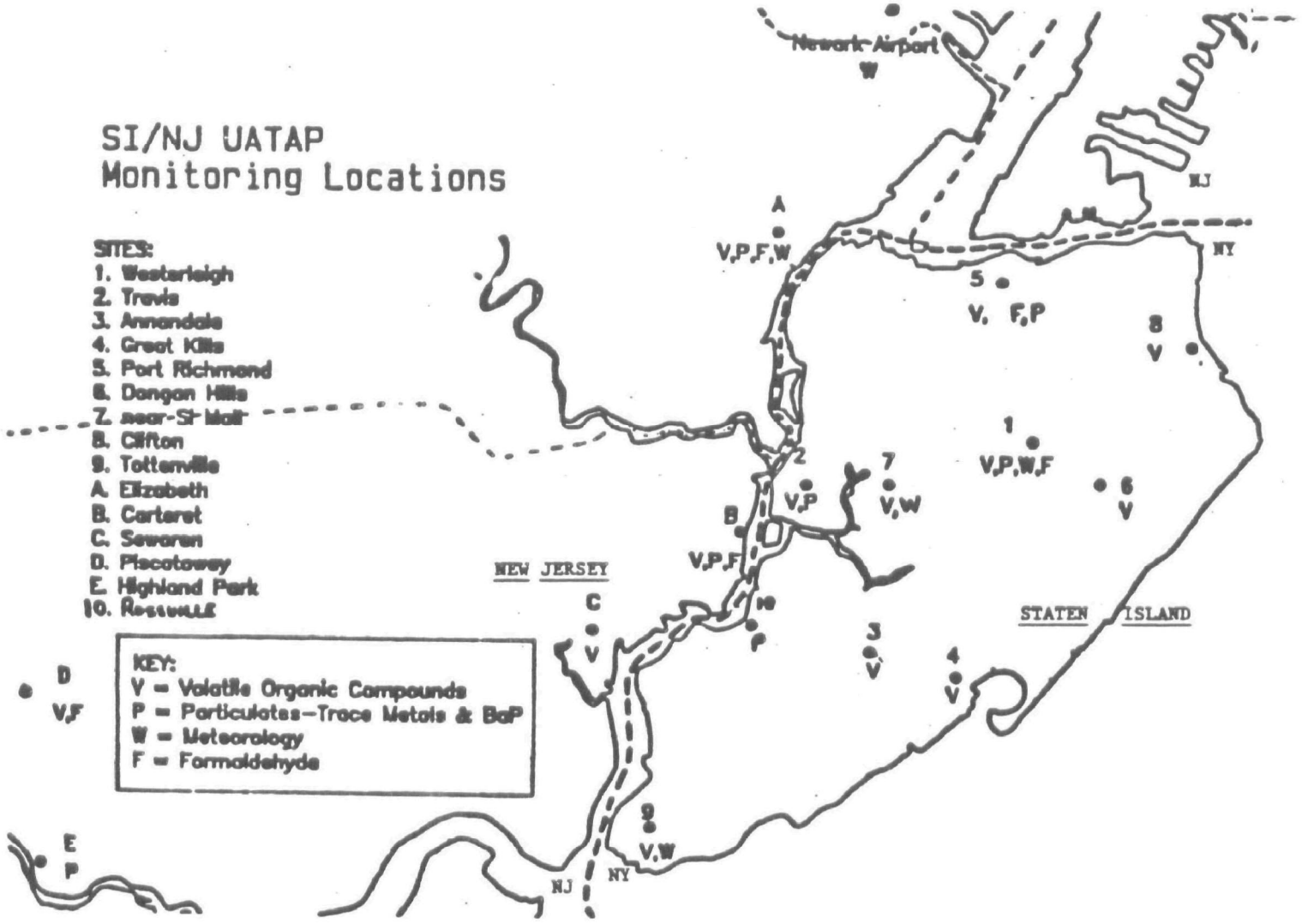
List of Chemicals to be Sampled Using Aldehyde Cartridge

Formaldehyde*
Acetaldehyde*
Acrolein*
Acetone*
Propionaldehyde
Crotonaldehyde
Butyraldehyde
Benzaldehyde
Isovaleraldehyde
Valeraldehyde
o-Tolualdehyde
m-Tolualdehyde
p-Tolualdehyde
Hexanaldehyde
2,5-Dimethylbenzaldehyde
x-Propionaldehyde
x-Butyraldehyde
x-Valeraldehyde
x-Dimethylbenzaldehyde
x-Acrolein
x-Hexanaldehyde
x-Acetaldehyde
Acrolein + x-Acrolein

Totals:
Formaldehyde
Other Carbonyls
Unknown Carbonyls

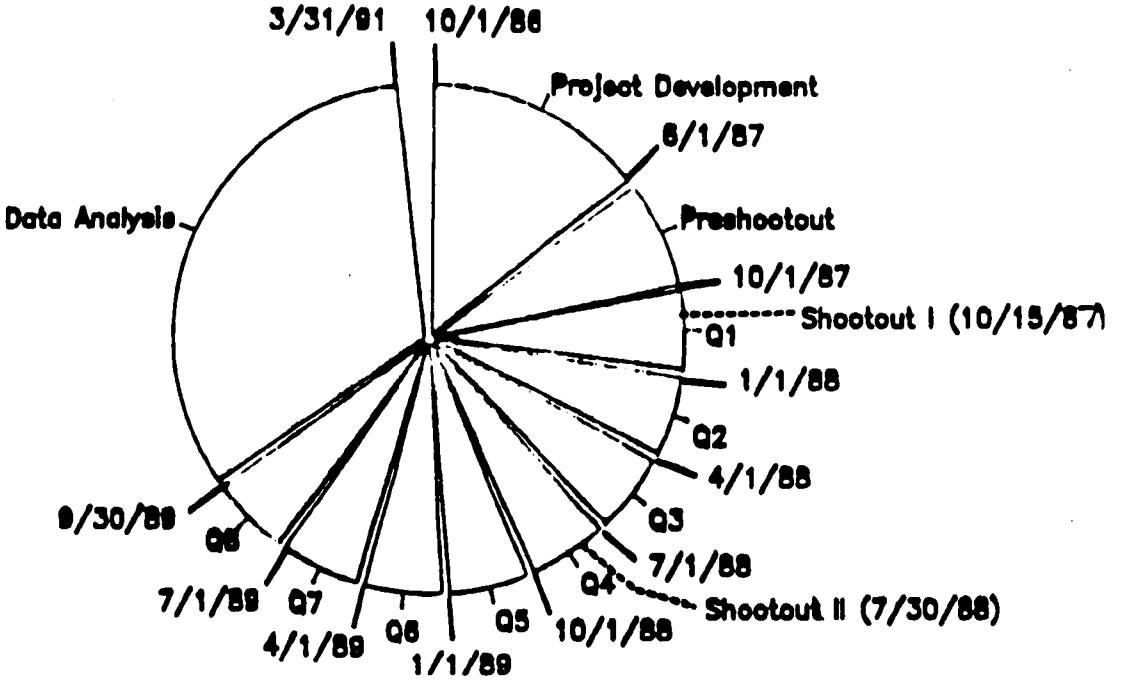
Total Carbonyls

***Due to laboratory problems, only these four Aldehydes were routinely reported.**


SI/NJ UATAP
Monitoring Locations
SITES:
1. Westerleigh
2. Travis
3. Annandale
4. Great Kills
5. Port Richmond
6. Dongan Hills
7. near-St Mair
8. Clifton
9. Tottenville
A. Elizabeth
B. Carteret
C. Sewaren
D. Piscataway
E. Highland Park
10. Rossville
KEY:
V = Volatile Organic Compounds
P = Particulates-Trace Metals & BaP
W = Meteorology
F = Formaldehyde
Newark Airport
W
A
V,P,F,W
NJ
NY
5
V, F,P
8
V
1
V,P,W,F
2
V,P
7
V,W
6
V
B
V,P,F
NEW JERSEY
C
V
10
P
3
V
4
V
STATEN ISLAND
D
V,F
9
V,W
E
P
NJ
NY

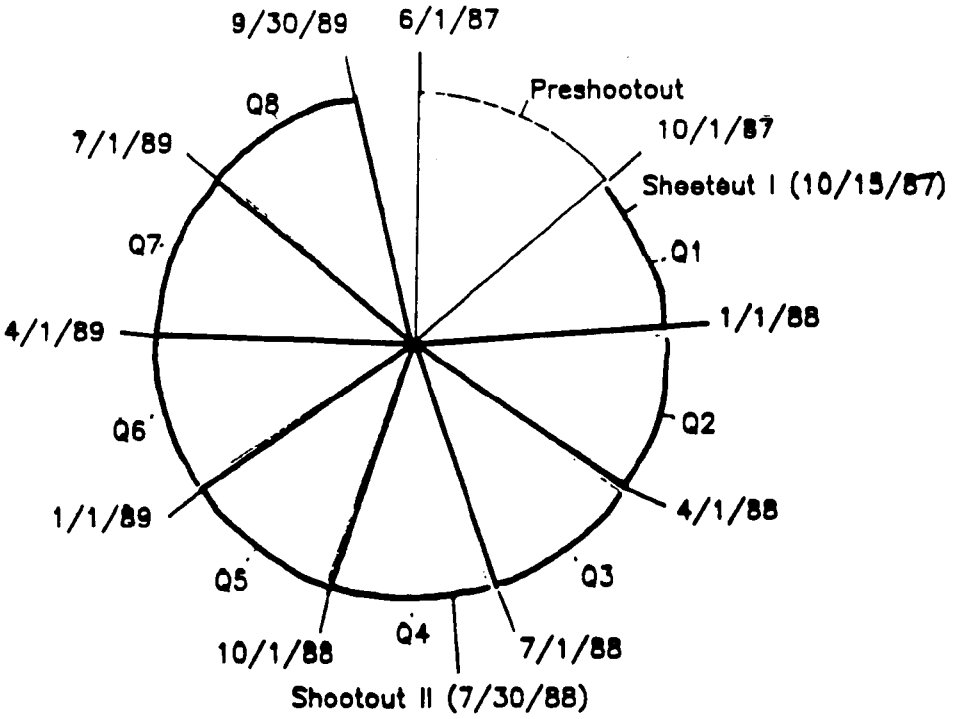
ATTACHMENT 7a

Staten Island/New Jersey
Urban Air Toxics Assessment Project
Clock of Activities



ATTACHMENT 7b

Staten Island/New Jersey
Urban Air Toxics Assessment Project
Clock of Activities



Data gathering period.

4.2 Emissions Inventory Workplan

4.2.1 Introduction

A. Project Name: Staten Island/New Jersey
Urban Air Toxics Assessment Project -
Subcommittee on Emission Inventory

B. Project Requested By: The United States Environmental Protection Agency - Region II

C. Date Of Request: September 1986

D. Subcommittee Members:
Roch Baamonde, U.S. EPA-AWM-APB
Thomas Ballou, NJDEP
John Filippelli, U.S. EPA-AWM-APB
Alfredo Forte, U.S. EPA-AWM-APB
Michael Kormanik, NYSDEC
Sam Lieblich, NYSDEC
David MacPherson, NYSDEC (retired)
Andrew Opperman, NJDEP, chair

4.2.2 Purpose (Project Objective # 5)

To develop an inventory of toxic emissions from sources which emit into the ambient atmosphere, including point, area, and mobile sources, so as to formulate hypotheses linking major contaminants to potential sources.

4.2.3 Background

The compilation of an air toxics emission inventory, including point, area, and mobile sources is one of the more resource-intensive objectives of the Urban Air Toxics Assessment Project. The foundation of the Project inventory is the existing databases of the New Jersey Department of Environmental Protection (NJDEP) and the New York State Department of Environmental Conservation (NYSDEC). The emission inventory effort of this Subcommittee will encompass only emissions into the ambient atmosphere. There is no intention to develop an indoor inventory. The quantitative estimates of emissions into the ambient environment will be presented in the context of "tons per year". There will be no attempt to detail information regarding: 1) peak environmental releases; 2) diurnal/weekly/seasonal variation; nor 3) continuous versus batch source operations. Upon special request, every effort will be made by the appropriate agency to provide detailed information on point source operations.

The available information is typically restricted to permitted point sources. Therefore, the development of a comprehensive inventory necessitates the generation of

information previously unknown or unavailable to the project participants. The objectives and tasks outlined on the following pages present the plan developed by this Subcommittee to provide the best information available within the limitations of the existing resources and to identify areas where additional information, and therefore resources, may be required. While the generation of contaminant-specific reports and other point source-related information will be the responsibility of NJDEP and NYSDEC, the members of the Subcommittee have agreed to a cooperative effort, thereby enlisting the support of the participating agencies, in the development and production of all final deliverables presented in this plan.

The project managers will be kept appraised of the Subcommittee's progress through frequent communications, including status reports presented at the Management/Steering Committee meetings. It is important to note, that from this Subcommittee's perspective communications are a "two-way street," i.e. we are information generators more so than users, and, therefore, will require external input from various groups within the project in order to optimize our efforts. Subsequently, we have identified several tasks that require coordination with other groups and those tasks will be given high priority.

While the Subcommittee expects to complete most of the tasks by the end of calendar year 1989, it fully anticipates its involvement in activities throughout the duration of the project.

4.2.4 Objectives and Tasks

Objective A: Establish the geographic area for which the inventory will be prepared, including all of Staten Island, NY, and Middlesex and Union counties, NJ.

Task A.1. Identify "major" point sources beyond the above-mentioned region, which may potentially impact the monitoring sites, in order to delineate the emission inventory study area.

Task A.2. Prepare a map of the recommended inventory region. (Figure 1)

Task A.3. Solicit comments from the Project Work Group.

Task A.4. Prepare final map of the inventory area for inclusion in final report.

Objective B: Define/describe the regulatory framework, databases, and applications of the existing inventories (1), and develop a unified data base.

Task B.1. Compare the regulatory requirements for boilers and incinerators, and evaluate the impact on the databases (2). (Table I.A)

Task B.2. Compare the regulatory requirements for other commercial, industrial and manufacturing point sources, and evaluate the impact on the databases (2). (Table 1.B - not attached)

Task B.3. Develop a unified data base using information from NJDEP's and NYSDEC's management systems, and present the data fields captured. (Table 2)

Task B.4. Identify the capabilities and limitations of the unified data base.

Task B.5. Prepare periodic updates and submit to the Management/ Steering Committee and Project Work Group for discussion and comment. Provide the results of Tasks B.1 through B.4 in the final report.

Objective C: Prepare and provide external reports for point sources.

Task C.1. Generate summary reports from the existing inventories (1) for point sources for the substances (Table 3) in the monitoring study. Prepare a VOC/county matrix (Table 5 - not included). The following sources are specifically mentioned due to their original inclusion under the area source category:

- hospital sterilizers
- industrial dry cleaning (SIC '72I8)
- landfills
- publicly owned treatment works (4)
- treatment, storage, and disposal facilities

Task C.2. Prepare and circulate for review a contaminant-specific report for point sources of chloroform. (3)

Task C.3. Provide a list of carcinogenic unit risk factors to the Exposure Assessment Subcommittee.

Task C.4. Prepare periodic updates and submit to the Management/ Steering Committee and Project Work Group for discussion and comment.

Objective D: Develop area source and mobile source inventory. (5)

Task D.1. Establish a compatible grid map for the mobile and area source inventories of New Jersey and New York. The grid cells will be 2 km X 2 km and will conform to the UTM grid tics on the USGS topographic maps. (Figure 2)

Task D.2. Compile area source inventory for the substances listed in Table 3 and assign emission values to each cell within the grid for the following categories:

- "area" oil heating
- "area" wood heating
- architectural coating
- auto refinishing
- cold degreasing
- consumer solvent use
- dry cleaning (SIC '7215 - coin operated)
  (SIC '7216 - commercial)
- gasoline distribution

Task D.3. Compile mobile source inventory for the substances listed in Table 4 and assign emission values to each cell within the grid.

Task D.4. Prepare periodic updates and submit to the Management/ Steering Committee and Project Work Group for discussion and comment.

Objective E: Enhance the developed emission inventory.

Task E.1. Evaluate the inventory for various data applications (modeling, risk evaluation) within 30 days of receipt of such workplans. (6)

Task E.2. Conduct a qualitative/quantitative microinventory within a radius of 1 km of each monitoring site.

Task E.3. Prepare microinventory summary report based on Task E.2.

Task E.4. Prepare selected contaminant-specific air emissions maps based on the findings of the comprehensive inventory. The format will be emission density maps based on the 2 km X 2 km grid.

TASK E.5. Prepare periodic updates and submit to the Management/ Steering Committee and Project Work Group for discussion and comment.

Objective F: Provide to the study a quality assurance assessment of the emission inventory.

TASK F.1. Engage in open dialogue with the identified potential data users (e.g. Modeling Group), communicating the types of information which can be provided, and gaining an understanding of the intended applications of the inventory.

TASK F.2. Prepare a comparison of the databases utilized to develop the emission inventory, including the capabilities and limitations of the information (Tasks B.1, B.2, and B.4).

TASK F.3. Assess the relative levels of precision, accuracy, representativeness, and completeness of the utilized databases. (The level of detail will be dependent upon the available resources.)

TASK F.4. The Subcommittee will conduct two case studies regarding New Jersey POTW emissions, generating emission estimates for comparison with NJDEP's inventory (Task C.I).

TASK F.5. The Subcommittee will conduct case studies regarding mobile source emissions, comparing population-based emission factors (NJDEP approach) versus county-wide VMT (vehicle miles travelled) - emission factor estimates.

TASK F.6. Through the performance of monitoring site micro-inventories the Subcommittee will identify potential "holes" in the point and area source coverage, and attempt to provide any missing information.

TASK F.7. The Toxic Chemical Release Inventory developed under SARA Title III, Section 313 (1987 and 1988) will be utilized for comparison with APEDS and SMS data, and can also provide information on "fugitive" emissions from stationary source facilities.

TASK F.8. U.S. EPA-Region II Air Compliance Branch (ACB) will conduct a detailed review of select facilities identified by the Subcommittee. The Subcommittee will develop a scope of work to be implemented by the ACB. This information will be compared with information from APEDS and SMS on point sources.

TASK F.9. Detailed documentation will be prepared. Periodic updates will be submitted to the Management/Steering Committee and Project Work Group for discussion and comment.

ALL INFORMATION WILL BE PROVIDED IN A FINAL REPORT.

NOTES:

(1). Existing Data Bases:

APEDS	- Air Pollution Enforcement Data System (NJDEP)
RTK	- Right To Know Environmental Survey-Part (NJDEP)
SMS	- Source Management System (NYSDEC)
NEDS	- National Emissions Data System (U.S. EPA)
TRI	- Toxic chemical Release Inventory (SARA Section 313)
ASES	- Area Source Emission System (NJDEP)
SIAIR	- Staten Island Area Source Inventory (NYSDEC)

(2) Will not include NEDS.

(3) Present to the Project Work Group and technical subcommittees for demonstration of the type of information available.

(4) EPA-Region II will provide POTW inventory for NYSDEC based on Baamonde R. C. and B. Martinovich (1987), "Report on Emissions Inventory Development for Volatile Organic Compounds from Publicly Owned Treatment Works in the New York and New Jersey Ozone Nonattainment Areas", paper presented at the APCA Specialty Conference for Ozone, Hartford, CT, November 17 - 19, 1987. EPA-Region II will also provide this information for sources in New Jersey for comparison with NJDEP's inventory, which is being developed independently.

(5) NJDEP's contribution is based upon a consulting contract. The emission estimates have been developed and the area source system (ASES) has been delivered. The Subcommittee will work with the estimates and apply quality assurance to as many or the source categories as possible.

(6) Must have input from the end users (i.e. the modeling group and the exposure assessment subcommittee).

FIGURE 1. STATEN ISLAND/NEW JERSEY URBAN AIR TOXICS ASSESSMENT PROJECT - EMISSION INVENTORY AREA

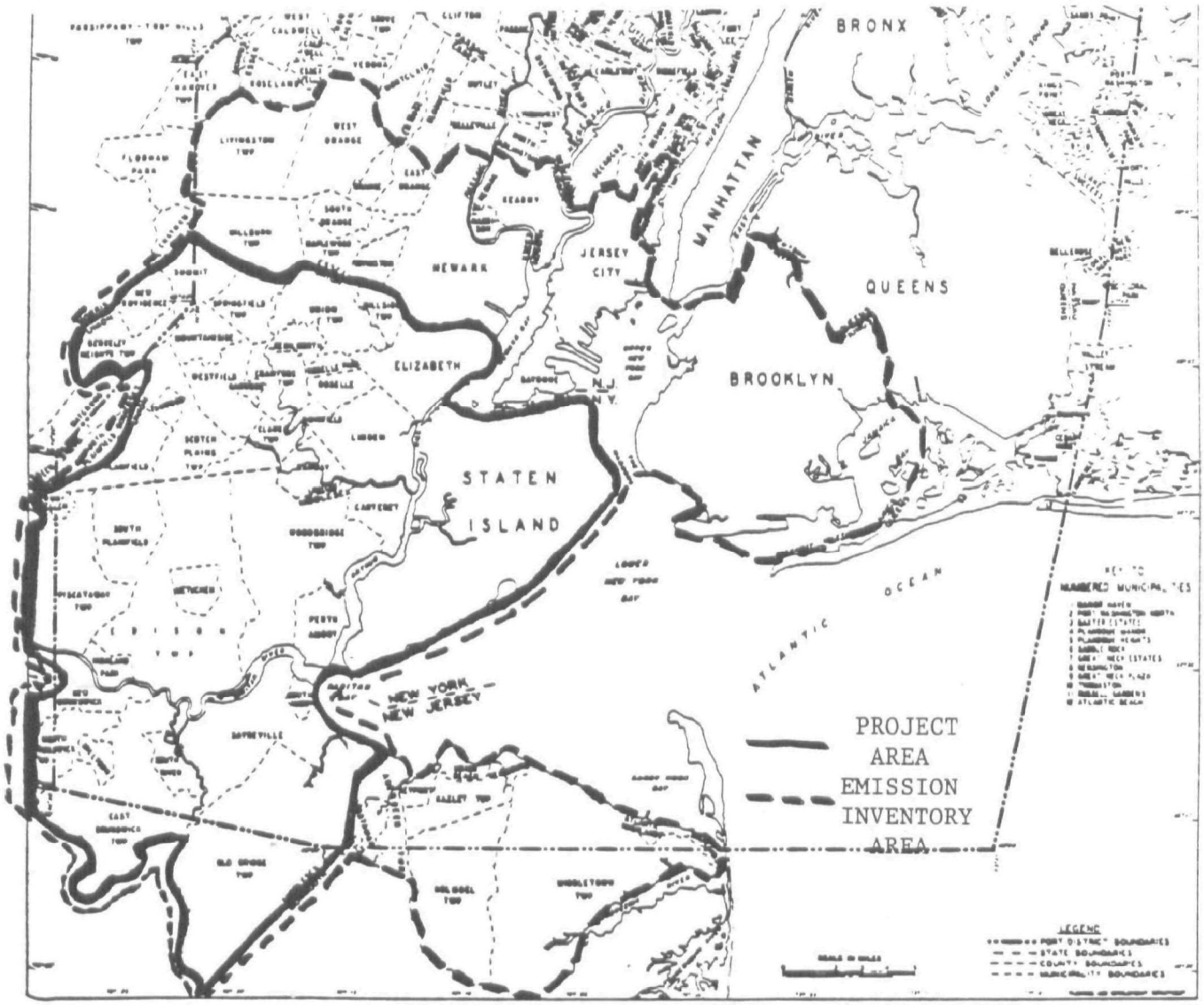


FIGURE 2

Emission Inventory 2km X 2KM Grid Map
with UTM Coordinates

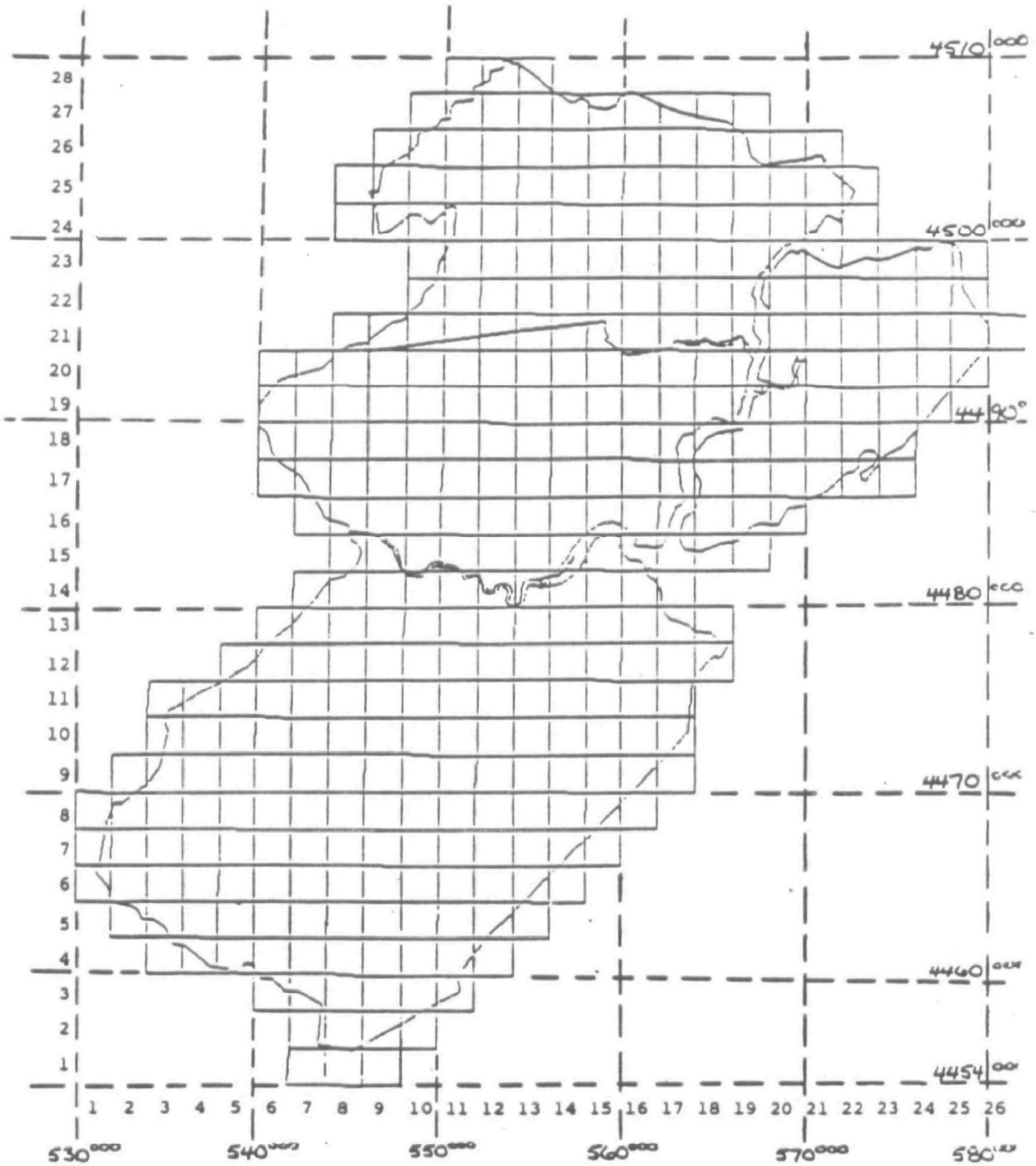


TABLE 1.A.

REVIEW OF THE DATA BASE COVERAGE FOR BOILERS (B) AND INCINERATORS (I)

	APEDS		RTK [1]	SMS	
	B	I		B	I
Specific Requirements	>1Mbtu/hr	All	N/A(2)	>1Mbtu/hr	All
Contaminants	Particulates NO2/SO2/CO/HC		EHSL(3)	Particulates NO2/SO2/CO/HC	
Facility Specific Information	Source-specific		Facility-specific	Source-specific	
UTM Coordinates	Y	Y	N	Y	Y
CAS # Reference	(4)	(4)	Y	Y	Y
SIC Code	Y	Y	Y	Y	Y
SCC #	Y	Y	Y	Y	Y
Grandfathered Sources	Y	Y	N/A	(5)	(5)
Emission Data Base	Actual Allowables		Actual/ Estimated	Actual Allowables	
Permit	≤5yr		N/A	≤5yr	

NOTES:

(1) RTK is a facility-specific data base and does not address boilers or incinerators individually; however, where they exist, they are covered in the total facility emissions
(2) "not applicable"
(3) EHSL - "Environmental Hazardous Substance List"
(4) cross-reference code system based on the 9th Edition Merck Index Monograph numbers
(5) source code cross referenced to the SCC

TABLE 2

Emission Inventory

Data Fields Presented in the Unified Data Base (1)
for Specific Substances

FACILITY NAME
STREET ADDRESS
CITY
ZIP CODE
UTM COORDINATES
- horizontal
- vertical
FACILITY-WIDE EMISSIONS

NOTES:
(1)The unified data base is in LOTUS 1-2-3 format. The data fields contain information captured from NJDEP's Air Pollution Enforcement Data System and NYSDEC's Source Management System.

See Sample Table 2.a. for a presentation of information for TRICHLOROETHYLENE. New Jersey facilities are listed by name with upper and lower case letters while New York facilities are listed in all upper case letters.

Table 2a
Sample Printout of the Unified Data Base

POLLUTANT NAME: **Benzene**

FACILITY NAME	STREET ADDRESS	CITY	ZIP CODE	UTM-H	UTM-V	FACILITY-WIDE EMISSIONS (tons/yr)
AKZO Chemie	Meadow Road	Edison	08817	547.5	4480.1	20.95
Hercules Inc.	Minisink & Cheesequake Rds	Sayreville	08859	555.6	4477.5	0.88
GATX Terminals	78 Lafayette St	Cartaret	07008	566.7	4492.7	0.05
American Home	567 Ridge Rd	Monmouth Jct	08852	536.1	4468.8	0.04
Merck & Company	126 E Lincoln Ave	Rahway	07065	562.4	4495.7	36.11
Reichhold Chemical	726 Rockfeller St	Elizabeth	07202	567.2	4498.7	0.04
Chevron Chemical	Summit Ave	Berkely Hgts	07922	547.0	4504.0	0.68
Nuodex Inc.	830 Magnolia Ave	Elizabeth	07202	567.3	4501.8	4.86
FRESH KILLS METHANE RECOVERY	1010 W. SERVICE RD & MULDOON	STATEN ISLAND	10314	568.1	4490.8	0.14

Table 2a
Sample Printout of the Unified Data Base
(Page 2)

POLLUTANT NAME: **Trichloroethylene**

FACILITY NAME	STREET ADDRESS	CITY	ZIP CODE	UTM-H	UTM-V	FACILITY-WIDE EMISSIONS (tons/yr)
Squibb & Sons	Georges Rd.	North Brunswick	08902	547.5	4480.1	56.94
Stolt Terminal	920 State St.	Perth Amboy	08862	561.3	4484.8	0.44
John B. Moore	Rt 9 @ Parkway	Sayreville	08872	559.4	4481.8	0.46
Engelhard Corp.	700 Blair Rd.	Cartaret	07008	562.8	4491.4	0.02
Marisol Inc.	125 Factory Lane	Middlesex	08846	540.9	4489.9	0.16
US Fuji Electric	240 Circle Dr. North	Piscataway	08854	543.9	4489.6	3.32
WCI Home Comfort	2170 Route 27	Edison	08818	552.2	4486.5	0.41
Emerson Quiet Cool	400 Woodbine Ave.	Woodbridge Twp.	07095	560.2	4493.3	0.50
South Brunswick POTW	Route 522 & Dayton-Jamesburg	Dayton	08810	541.8	4469.0	0.01
Teledyne Adams	1110 Springfield Ave.	Union	07083	559.0	4504.9	1.30
Elizabethtown Water Co. Hummocks Wellfield	Morris Ave. & Rt. 22	Union	07083	582.0	4517.7	0.22
Perk Chemical	217 South First St.	Elizabeth	07206	569.0	4499.0	0.93
Gibson Associates	90 Myrtle St.	Cranford	07016	559.7	4499.7	0.02
Elizabethtown Water Co. Charles St. Wells #1&2	Charles St.	Mountainside	07092	555.2	4502.6	0.40
Elizabethtown Water Co. Netherwood Wellfield	North Ave.	Plainfield	07061	549.2	4497.0	0.06
FRESH KILLS METHANE RECOVERY	1010 W. SERVICE RD. & MULDOON	STATEN ISLAND	10314	568.1	4490.8	0.15
ANTIQUE BRASS WORKS	290 RICHMOND AVE.	STATEN ISLAND	10301	577.7	4499.9	0.19

TABLE 3
AIR TOXICS EMISSION INVENTORY
POINT AND AREA SOURCE SUBSTANCE LIST

	CAS NUMBER
HALOGENATED HYDROCARBONS	
Tetrachloromethane (Carbon Tetrachloride)	56-23-5
Trichloromethane (Chloroform)	67-66-3
Dibromochloromethane	124-48-1
Ethylene Dibromide	106-93-4
1,2-Dichloroethane (Ethylene Dichloride)	107-06-2
Chloromethane (Methyl Chloride)	74-87-3
Dichlormethane (Methylene Chloride)	75-09-2
Tetrachloroethylene	127-18-4
1,1,1-Trichloroethane	71-55-6
Trichloroethylene	79-01-6
Vinyl Chloride	75-01-4
OTHER HYDROCARBONS	
Acetone	67-64-1
Benzene	71-43-2
1,3-Butadiene	106-99-0
n-Butyl alcohol	71-36-3
Ethylbenzene	100-41-4
Ethylene Oxide	75-21-8
Gasoline	8006-61-9
Hexane	110-54-3
Methyl ethyl ketone	78-93-3
Methyl isobutyl ketone	108-10-1
Styrene	100-42-5
Toluene	108-88-3
Xylene (mixed isomers)	1330-20-7
m-Xylene	108-38-3
o-Xylene	95-47-6
p-Xylene	106-42-3
SELECTED ALDEHYDES	
Acetaldehyde	75-07-0
Acrolein	107-02-8
Formaldehyde	50-00-0
HI-VOL SPECIES	
Arsenic & all compounds of arsenic	
Barium & all compounds of barium	
Benzo(a)pyrene	50-32-8
Beryllium & all compounds of beryllium	
Cadmium & all compounds of cadmium	
Chromium & all compounds of chromium	
Cobalt & all compounds of cobalt	
Copper & all compounds of copper	
Iron & all compounds of iron	
Lead & all compounds of lead	
Manganese & all compounds of manganese	
Molybdenum & all compounds of molybdenum	
Nickel & all compounds of nickel	
Vanadium & all compounds of vanadium	
Zinc & all compounds of zinc	

TABLE 4

AIR TOXICS EMISSION INVENTORY

MOBILE SOURCES SUBSTANCE LIST

TOXIC SUBSTANCE	CAS NUMBER
Benzene	71-43-2
Benzo(a)pyrene	50-32-8
1,3-Butadiene	106-99-0
Cadmium & all compounds of cadmium	
Ethylene Dibromide	106-93-4
Formaldehyde	50-00-0
Lead & all compounds of lead	
Nickel & all compounds of nickel	
Products of Incomplete Combustion/ Particulate Organic Matter (PICs/POMs)	
Toluene	108-88-3
Xylene (mixed isomers)	1330-20-7

4.3 Indoor Air Workplan

4.3.1 Background

The New Jersey/Staten Island area represents a highly industrialized and urbanized section of the United States. Many petrochemical industry facilities are located along the Arthur Kill. To address public concern about air quality and adverse health risks, the SI/NJ UATAP project is being conducted. The overall purpose of the project is to characterize the concentrations of several organic and inorganic compounds found in the ambient air and to evaluate the relative risk from inhalation exposure to these compounds. Ambient air sampling has been conducted at several sites in New York and New Jersey since 1988 to characterize exposure to air contaminants in this area.

Many hours of a person's day are spent inside the home. The ambient air is often the most important source of contaminants in indoor air. However, indoor sources can predominate in some circumstances. The indoor air portion of the SI/NJ UATAP project is designed to provide information on the relative importance of indoor air contaminant sources. Indoor air contaminant levels will be determined in four homes, concurrently with sampling of contaminant levels at nearby ambient monitoring stations. Tentative sampling locations are residences close to PS 26 in Travis on Staten Island and close to the police station in Carteret, New Jersey, and at the ambient monitoring sites in those locations. The residences will be selected as not atypical in terms of construction and observable sources of indoor air contaminants. Because there will be only a small number of sample locations, the data collected will not be representative in the sense of permitting extrapolation to the entire study area. Data obtained from this investigation will aid in characterizing the relative risks of indoor and outdoor exposure for those homes tested in the New Jersey/Staten Island area.

4.3.2 Purpose

Determine how nearly indoor air contaminant levels in houses near two of the project ambient air monitoring sites correspond to ambient levels at the monitoring stations. If there is a significant difference between indoor and ambient levels at either site, characterize the difference in terms of exposure for hypothetical residents of these houses.

4.3.3 Objectives and Tasks

Objective A

Select homes to be used in this study.

Task A.1. NYSDOH will canvas the areas door-to-door to seek volunteer homeowners. At least two homes in Staten Island and two homes in New Jersey will be identified for sampling.

Task A.2. Criteria for selection will be based on the following:

a) Criteria for ideal sampling location:

(i) residence is located within 1/2 mile of an outdoor air monitoring station presently used in this study.

(ii) At least half of the organic chemicals of interest (See Objective C) have been regularly detected at the outdoor air monitoring station.

(iii) residence has had no major heating oil spill occurrence and all minor leaks to oil storage tank have been repaired.

(iv) residence should not contain woodstove, kerosene space heater, or kerosene lamps.

(v) residence does not contain large amounts of paints, solvents, adhesives, etc. that may contribute to concentrations of the specified organic compounds.

(vi) residence should not be a mobile home.

(vii) residence should not contain urea-formaldehyde foam insulation.

(viii) residence is not located within 1/8th mile of a gasoline station, oil storage facility, propane storage and/or dispenser facility, dry cleaning business or any other business known to emit any of the organic chemicals selected for analysis in this project.

(ix) residence should be greater than 1/8th mile from a large parking facility, bus garage, airport or train station.

(x) occupants of residence do not smoke.

(xi) residence has a detached garage or no garage structure.

(xii) residence has not been remodeled in previous 12 months.

(xiii) residence should not have pressed wood furniture, upholstered furniture, carpeting or draperies purchased in the last 12 months.

(xiv) draperies and furniture coverings in the residence should not have been dry cleaned within the past six months; carpets should not have been professionally cleaned within past six months.

b) If a location cannot be found to meet all of the above criteria, the following criteria will apply:

(i) criteria i-vii must be met.

(ii) residents must agree not to smoke indoors 12 hours prior to sampling and during sampling.

(iii) in a residence with an attached garage, the garage should not be used to store chemicals, oil or gasoline.

(iv) if residence has been recently remodelled or new furniture, carpeting or draperies have been added in the past 12 months, the sample should be taken in a room away from the new installations/furnishings.

(v) If any draperies or furniture coverings have been dry cleaned or carpets commercially cleaned in the past 6 months, the sample should be taken in rooms where this had not been done.

Objective B

Collect indoor air samples in selected homes.

Task B.1 Prepare and distribute brief factsheet on the project and permission forms for homeowners. Obtain written permission from homeowner and provide to homeowner a list of conditions for sampling which they must agree to for the duration of the study.

Task B.2 Complete "Indoor Air Quality Residential Questionnaire" for each home. Complete "Daily Activity/Product Use Questionnaire" each day the home is sampled.

Task B.3 Place evacuated canisters in homes (first floor living space) with flow controller and timer set for a 12 hour sampling interval. Two consecutive 12-hour samples will be collected at a pre-determined hour every 12 days for eight months. Start and stop times will coincide with the outdoor air monitoring. Filled canisters will be transported to the New York State Department of Health Wadsworth Center for Laboratories and Research for analysis.

Task B.4 Conduct formaldehyde sampling simultaneously with canister sampling. Cartridges for formaldehyde will be obtained from and analyzed by EPA contract laboratory.

Objective C

Collect ambient air samples and meteorological data concurrently with indoor air samples.

TASK C.1 Conduct ambient air sampling utilizing the same methods (tasks B.3 and B.4) every 12 days at two ambient monitoring stations for eight months. This represents 18 days of sampling, each day composed of two 12-hour samples at two ambient air monitoring stations.

Task C.2 Install recording meteorological instruments at each ambient air monitoring station. Collect meteorological data for an eight month sampling period.

Objective D

Analyses - See attached methodology. [in project files]

Task D.1 Canisters: Analyze indoor and ambient air samples for the specified twelve volatile organic compounds. These compounds are:

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

Task D.2 Cartridges: Analyze cartridges for formaldehyde. Cartridges will be obtained from and analyzed by EPA consultant. Collection and analysis procedures obtained from EPA.

Objective E

Implement a quality control procedure to insure comparability and quality of the monitoring data.

Task E.1 Wadsworth Center for Laboratories and Research will undergo a "Shoot Out" with EPA's Edison Laboratory.

Task E.2 One canister will be treated as a field blank for every ten sample canisters, as the standard quality control practice. The house where the canister will be "exposed" will be changed on different sampling occasions.

Task E.3 On every third sampling day (36 calendar days) duplicate canisters will be collected and sent to EPA's Contract Laboratory for analysis.

Objective F

Prepare report summarizing data and drawing conclusions regarding indoor/outdoor contaminant levels.

Task F.1 Every three months, a status report will be issued by the Indoor Air Sub-group based on data collected over the previous quarter. Report will be distributed within 45 days of end of quarter. Status report will include a summary of analytical data regarding indoor and outdoor contaminant levels.

Task F.2 Within 45 days of the last sampling event, a final report will be prepared and distributed by the Indoor Air Sub-group that will present the data compiled over the period of the study and provide conclusions regarding that data.

4.4 Modeling and Source Identification Workplan

4.4.1 Subcommittee Members

Vito Pagnotti	-	NYSDEC
Joann Held	-	NJDEP
William Barrett	-	U.S. EPA
Raymond Werner	-	EPA, Chair

4.4.2 Purpose

TO PROVIDE THE PROJECT WITH THE CAPABILITY TO MAKE ESTIMATES OF THE RELATIONSHIP BETWEEN SOURCES AREAS AND RECEPTORS.

4.4.3 Objectives and Tasks

OBJECTIVE A

Identify and evaluate methods which can be used to relate source areas and receptors in the project area.

TASK A.1. List available methods and review the literature for applications similar to those needed for the project.

TASK A.2. Review the information collected in TASK A.1. to identify methods which may be useful for the project.

OBJECTIVE B

Identify the type, quality, and frequency of meteorological data needed to implement each of the methodologies chosen to relate ambient concentrations to possible source areas.

TASK B.1. Analyze, by 6/1/89, the appropriateness of existing monitors of meteorological data for project needs in terms of their locations, instrumentation and sampling geometry. (DEC, DEP, EPA)

TASK B.2. Determine the need for the acquisition of upper-air weather data.

TASK B.3. Obtain the data and establish the data bases in the appropriate format.

OBJECTIVE C

Identify possible source areas for air toxics using comparisons of wind speeds and directions with concurrent ambient concentrations.

TASK C.1. The Exposure and Health Assessment Subcommittee will identify and prioritize sites and time periods for which to generate wind roses and pollutant roses.

- o Data Management Subcommittee will provide to the Exposure and Health Assessment Subcommittee, by 8/1/89, tabulated summaries of all ambient monitoring data accepted by the Quality Assurance Subcommittee.

- o The Modeling and Source Identification Subcommittee, selects one to three candidates for trial modeling runs. Time period selection criteria will be clearly stated. Report results and recommendations for further work to Project Work Group or Management Steering Committee.

- o Exposure and Health Assessment Subcommittee provides prioritized list of sites and time periods by 4/90.

TASK C.2. Analyze ambient concentrations, wind and emissions data to identify probable source areas and to determine if elevated concentrations can be associated with specific wind and weather conditions or time of day, week or season. Time of day parameters will be utilized only if NYS is able to use its Gas Chromatographic Analyzers.

- o The Modeling Subcommittee will perform a trial run by 7/89.

TASK C.3. Prepare preliminary evaluation results and include proposed further work on modeling source-receptor relationships.

TASK C.4. DEC, DEP, and EPA perform remaining analyses as determined by the Management Steering Committee.

OBJECTIVE D

Identify possible source areas for air toxics using a surface trajectory model.

TASK D.1. The Exposure and Health Assessment Subcommittee will identify and select case studies for back trajectory analysis.

- o Exposure and Health Assessment Subcommittee provides prioritized list of sites and time periods by 10/89.

TASK D.2. Apply the trajectory model for each selected case.

- o The Modeling Subcommittee, with input from the Data Management Subcommittee and Monitoring Subcommittee, selects one to three candidates for trial modeling runs, to be performed by 7/89.

TASK D.3. Prepare preliminary reports evaluating results and including proposed further work using the trajectory model.

TASK D.4. DEC, DEP, and EPA perform remaining analyses as determined by the Management Steering Committee.

OBJECTIVE E

Develop strategies for evaluating odor episodes and, if possible, relate them to source areas and meteorological conditions.

TASK E.1. Develop a definition of an odor event/episode and criteria for their identification.

TASK E.2. Collect and review information relating to odor episodes, and their investigation. Sources of information include the AKIBA report and ISC data.

TASK E.3 DEC runs statistical correlations using information collected under E.2 with time of day, day of week and wind direction, to determine any patterns.

TASK E.4. Analyze meteorological conditions existing during odor episodes to determine if correlations between characteristics of the odor episodes and meteorological conditions can be identified.

4.5 Data Management Subcommittee Workplan

4.5.1 Subcommittee Members

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

4.5.2 Purpose

To establish a centralized operation for collection, storage and distribution of data generated by the Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP).

4.5.3 Objectives and Tasks

Objective A. Design forms and collection methods for raw and reduced data generated by project participants.

Task A.1. Design form for "Concentrations from Individual Two-tube Sorbent Samples."

Task A.2. Design form for "Concentrations from Individual Canister, Hi-vol and Aldehyde Cartridge Samples."

Task A.3. Design form for "Quarterly Data Report for All Sampling Methods."

Task A.4. Design form for "Monthly Sample Collection Report."

Task A.5. Develop standardized spreadsheets for input for all toxics data and prepare diskettes for use with IBM compatible personal computers.

Task A.6. Distribute a diskette containing spreadsheets and examples of their use to each participant.

Task A.7. Develop a schedule for transmission of air toxics monitoring data from the participants to the Data Management Subcommittee.

Task A.8. Develop a method of transmission of meteorological data (1).

Task A.9. Meet with participants performing indoor air monitoring to determine if revisions of the ambient air data forms and the reporting procedures are required to handle their data.

Note

(1) Meet with Monitoring Subcommittee and the Modeling Subcommittee to develop a consistent format and method of transmission for meteorological data.

Objective B. Develop systems for storage and organization of data to facilitate use by project participants.

Task B.1. Enter monitoring data in the master and duplicate diskette files.

Task B.2. Produce a hard copy file from data on diskettes.

Task B.3. Design layout for quarterly data listings (2).

Task B.4. Design layout for annual data listings (2) (3).

Task B.5. Design layout for final data report (2) (3).

Task B.6. Prepare quarterly data listings.

Task B.7. Prepare annual data listings.

Task B.8. Prepare final report incorporating quality assurance data.

Task B.9. Distribute listings and report to the project participants and others (4).

Task B.10. Establish master file of all data.

Notes

(2) Must have input from end users (i.e. Exposure Assessment Subcommittee and Modeling Subcommittee) of data on exactly what they require to be include in these reports.

(3) Must meet with Quality Assurance Subcommittee to finalize presentation of data from this group.

(4) Input is needed from the Management/Steering Committee to establish a comprehensive mailing list for data listings. This is of particular importance for persons or groups not directly involved in the project.

Objective C. Review data submittals for data entry errors and other anomalies and take action to correct errors.

Task C.1. Review data to verify that all required information has been entered and that all rules for entering data have been followed.

Task C.2. Check five to ten percent of the calculations of average concentrations.

Task C.3. If any systematic typing errors are found they are corrected.

Task C.4. In the case of other errors, the errors are noted and the data are returned to the originating organization for correction and resubmittal.

Task C.5. When a set of data satisfies the requirements of this Subcommittee, a copy of the data diskette(s) is(are) submitted to the Quality Assurance Subcommittee for its use and for verification that a Quality Assurance Report has been submitted for these data.

Objective D. Analyze the collected data.

Tasks will be developed in conjunction with Cliff Weisel.

4.5.4 Data Management Quality Assurance Plan

Project Name: Data Management for the Staten Island/New Jersey Urban Air Toxics Assessment Project

Responsible Agency: U.S. Environmental Protection Agency Region II

Project Officer's Signature/Date: _____

Project Officer's Name: Rudolph K. Kapichak, 2AWM-AP

Project QA Officer's Signature/Date: _____

Project QA Officer's Name: Marcus Kantz, 2ES-MM

Project Requested by: Conrad Simon, Director
Air and Waste Management Division, 2AWM

Dates of:

Request:	December 1986
Project initiation:	January 1987
Project termination:	September 1990 (projected)

Project Description

The Staten Island/New Jersey Urban Air Toxics Assessment Project is a two year study designed for the collection of ambient air concentration data on approximately 26 volatile organic compounds (VOC), 12 metals, benzo(a)pyrene B(a)P and formaldehyde. The Data Management Subcommittee (DMS) has the responsibility for receiving all of the monitoring data, performing basic rearrangement and review, and providing usable printouts.

Data are submitted by the five organizations listed below according to schedules listed in their workplan and in the DMS workplan:

New Jersey Institute of Technology (NJIT) - VOCs, metals, B(a)P, formaldehyde
College of Staten Island (CSI) - VOCs
New York State Department of Environmental Conservation (NYSDEC) - VOCs, metals, B(a)P
PEI Associates (PEI) - VOCs
ASRL/Northrup - formaldehyde

Data are submitted within 45 days after the end of each calendar quarter by NJIT, CSI, and NYSDEC. PEI submits data after analyzing each batch of approximately 12 samples. ASRL/Northrup submits data intermittently.

Data are submitted by NJIT, CSI and NYSDEC on diskettes using Lotus spreadsheets. The format for presenting the data was specifically designed for this Project. PEI and ASRL/Northrup are using their own formats; however, each enters the data into Lotus spreadsheets and submits these as well as printouts. Prior to the submittal of any data each organization is required to verify that all data being submitted has been correctly entered and follows all requirements of the data management plan for this project.

Upon the receipt of data from an organization, the DMS makes a backup copy of the data diskette(s). The data spreadsheets on the diskette(s) are then rearranged and merged combining all data in one spreadsheet. In the case of NYSDEC's VOC data, two columns are hidden at this point. These are the columns that contain data on the "Blank tubes", which are not included in data reports. This spreadsheet is then printed to a file and retrieved into WordPerfect 5.0. This facilitates the printing of these multi-page spreadsheets. It is at this point that extra blank lines are deleted and page breaks are inserted. The hiding of the "blank tube" columns and the "cleaning up" of the print files are the only editing performed by the DMS on the submitted data.

Before printing the spreadsheet, the DMS reviews the data to determine if all required information is entered and it is correct, that the rules for entering data have been followed, and, on a spot check basis, that average concentrations have been calculated correctly.

The first category involves checking to determine such things as: are the chemical and monitoring site correctly and clearly identified, have the minimum detection levels (MDL) been entered, and have all other requested information been supplied. In the case of systematic typing errors and the failure to enter site numbers, these will be corrected by the use of WordPerfect's Search and Replace feature. In the case of missing information, such as an MDL, the organization that submitted the data will be contacted and asked either to supply the information or to resubmit the entire diskette, depending on the number of errors that are found.

To verify that the rules for entering data have been followed, the data section of the spreadsheet is examined to verify that no concentration has been entered as zero or less than zero, that concentrations labeled as being less than the MDL are in fact one half of the MDL (as stipulated in the workplan) and that missing concentrations have been flagged to explain why they are missing. The discovery of any errors in this section will, in nearly every instance, require that the reporting organization submit a revised data diskette. One exception is if an error seems to be non-recurrent such as the discovery of

several negative concentrations. In this case the responsible agency will be contacted, and, if they, agree the concentrations will be revised as will any affected summary statistics. These values will be updated in all locations by both the Data Management Subcommittee and the responsible organization.

Approximately five to ten percent of the calculations for average concentrations are checked. If errors are discovered the diskette will be returned to the responsible organization for correction and resubmittal.

Once a satisfactory set of data is assembled, a copy of the data diskette(s) is sent to Avi Teitz of the QA Subcommittee for his records, use and verification that the responsible organization has submitted a QA report for the time period covered on the data diskettes.

Responsible Parties

Data Management Subcommittee Chair: Rudolph K. Kapichak, 2AWM-AP (212) 264-2058.

Members of the Data Management Subcommittee

Garry Boynton - NYSDEC - VOCs (518) 457-7454
Phil Galvin - NYSDEC - Metals, B(a)P (518) 457-3676
Brian Lay - NYSDEC - VOCs (518) 457-3676
Barbara Kebbekus - NJIT - VOCs, Formaldehyde (201) 596-3676
Joseph Bozzelli - NJIT - Metals (201) 596-3676
John Oppenheimer - CSI - VOCs - (718) 390-7994
Steve Quan - NJDEP - (609) 633-1110
Cliff Weisel - UMDNJ (201) 463-4536

Project Schedule

Date Requested:	December 1986
Date Initiated:	January 1987
First Data Submitted:	December 1987
First Data Listing (7/87-3/88):	July 1988
First Annual Data Listing (10/87-9/88):	August 1989
Second Annual Data Listing (10/88-9/89):	September 1990

Parameter Table

The tables showing the parameters are attached (Attachment I and II).

Data Quality Assessments

The representativeness and comparability of the data are ensured by the Monitoring and Quality Assurance Subcommittees. Completeness will be determined by the Exposure and Health and Quality Assurance Subcommittees. As the data are to be used for determining lifetime estimates of risk annual averages are required. These two subcommittees will determine the criteria for what constitutes a valid annual average.

Reporting

Two annual data listings will be prepared. One in November 1989 and second in January of 1990. The first will cover the period October 1987 through September 1988. The second will cover October 1988 through September 1989. These will include all available data from the participants for which quality assurance reports have been submitted to the Quality Assurance Subcommittee and for which all corrections requested by the Data Management Subcommittee have been made. Addenda will be issued for data that become available after the listings are released. The second listing will also include all PEI canister data and

ASRL/Northrup formaldehyde data. These listings will not include any data analysis.

Data Validation

Although data will be reviewed and either edited or returned to the originator for correction or verification, no data validation will be done by the Data Management Subcommittee.

Corrective Actions

Corrective actions will result from reviews of the data and requests by this subcommittee to the originator for revision for verification.

Reports

Reports will be issued in December of 1989 and January of 1990 and will present the previously described information.

4.6 Exposure and Health Assessment Workplan

4.6.1 Subcommittee Members

Paul J. Lioy, UMDNJ
John Hawley, NYSDOH
Joann Held, NJDEP
Marian Olsen, EPA
Robert Majewski, NYSDEC

4.6.2 Purposes

To estimate inhalation exposure from the toxic substances measured in the ambient air and in a limited number of homes within the project area, and to characterize potential health risks associated with long term inhalation exposure as compared to other urban centers.

4.6.3 Objectives and Tasks

1. Characterization of exposures at each site

   Task A. Review the quality-assured outdoor and indoor air monitoring data for each site provided to the Subcommittee and select the database to be employed in the exposure assessment.

   Task B. Perform statistical analyses on each yearly data set, and do intra-site and inter-site comparisons as necessary.

   Task C. Characterize average daily exposure of study area residents to measured substances.

   Task D. Compare outdoor exposures with indoor exposures.

2. Comparison of the measured concentrations at the target urban-commercial-industrial sites with the measured concentrations at the background residential site. The background location is upwind (for the prevailing wind directions) of the northeast industrial-commercial corridor that includes Staten Island and parts of New Jersey.

3. Comparison of measured air contaminant data for the study area with values reported in the scientific literature.

Task A. Assemble appropriate data from EPA and other sources.

Task B. Prepare tables comparing measured air contaminant levels to appropriate data from other published studies.

4. Examine the data to determine if there is a significant difference between the annual arithmetic mean concentrations of any measured compounds at different study sites and/or between the concentrations at a study site and concentrations frequently found in other urban environments.

Task A. Complete statistical analyses on data as necessary.

Task B. Compare with previously collected published information from other studies.

5. Characterize difference in health risk associated with any significant differences between exposure levels at study monitoring sites and the background site or other areas for which comparable data are available for both indoor and outdoor exposures.

Task A. Characterize differences in exposure.

Task B. Characterize differences in risk, using risk factors for carcinogens; and NOELS and inhalation Reference Doses (RfDs) for non-carcinogens.

Task C. Report results of Risk Assessments.

4.6.4 Personnel

Exposure Assessment and Statistical Analyses	Lead:	Paul J. Lioy Carol Bellizzi
Acquisition of Risk Factors	Lead:	John Hawley Marian Olsen
Risk Assessment	Lead:	Paul J. Lioy and Subcommittee
Acquisition and evaluation of toxic pollutant concentration data from other studies	Lead:	Joann Held

Table I.
Summary of Available Risk Estimates (Carcinogenic and Non-Carcinogenic) For Potential Chemicals That Will Be Sampled During the SI/NJ Project.

Compounds	Carcino-genic	Unit Risk	Non-Car-cinogenic	Reference Dose
Halogenated				
Hydrocarbons				
Chloromethane	No	-	Yes	
Methylene Chloride	Yes	EPA[a,b]/DOH[b]	Yes	
Chloroform	Yes	EPA[a]	Yes	EPA[a]
1,1,1-Trichloroethane	No	-	Yes	EPA[a]
Carbon Tetrachloride	Yes	EPA[a]	Yes	EPA[a,b]
Trichloroethylene	Yes	EPA[a,b]	Yes	EPA[a]
Tetrachloroethylene	Yes	EPA[a,b]	Yes	
Dibromochloromethane	?	?	Yes	EPA[a]
Vinyl Chloride	Yes	EPA[a,b]	Yes	EPA[a]
Ethylene Dichloride	Yes	EPA[a,b]	Yes	
Other Hydrocarbons				
Benzene	Yes	EPA[a,b]	Yes	
Toluene	No	-	Yes	
Hexane	No	-	Yes	EPA[a,b]
o-Xylene	No	-	Yes	
				EPA[a,b]
Selected Aldehydes				
Formaldehyde	Yes	EPA[b]/DOH[b]	Yes	
Acetaldehyde	Yes	EPA[a]	Yes	DOH[b]
Acrolein	No	-	Yes	
Hi-Vol Species				
Arsenic	Yes	EPA[a,b]/DOH[b]	Yes	
Barium	No	-	Yes	DOH[b]
Beryllium	Yes	EPA[b]/DOH[b]	Yes	EPA[a,b]
Cadmium	Yes	EPA[b]/DOH[b]	Yes	EPA[a]/DOH[b]
Cobalt	No	-	Yes	EPA[a,b]/DOH[a,b]
Copper	No	-	Yes	
Chromium	Yes	EPA[b]/DOH[b]	Yes	EPA[a,b]
Iron	No	-	Yes	EPA[a,b]/DOH[b]
Manganese	No	-	Yes	EPA[b]
Molybdenum	No	-	Yes	EPA[a]/DOH[b]

[a] Ingestion value available.
[b] Inhalation value available.

Table II. Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk[i] $(ug/m^3)^{-1}$	Calculated Exposure Equal to A Risk of 1 in a million[j] (ug/m^3)
Arsenic (inorganic)	7440-38-2						
NYSDOH			$1.1x10^{-4}$	$4x10^{-1}$		$3.2x10^{-3}$	$3.1x10^{-4}$
EPA[k]		A			50	$4.3x10^{-3}$	$2 \ x10^{-4}$
NJDEP						$4.3x10^{-3}$	
Barium	7440-39-3	NO DATA					
Benzo[a]pyrene	50-32-8						
NYSDOH						$6 \ x10^{-4}$	$2 \ x10^{-3}$
EPA		B2					
NJDEP						$1.7x10^{-3}$	
Beryllium	7440-39-3						
NYSDOH			$7.5x10^{-8}$	$2.6x10^{-4}$		$2.5x10^{-1}$	$4 \ x10^{-6}$
EPA		B2			8.4	$2.4x10^{-3}$	$4 \ x10^{-4}$
NJDEP							

Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk[i] $(ug/m^3)^{-1}$	Calculated Exposure Equal to A Risk of 1 in a million[j] (ug/m^3)
Cadmium	7440-43-9						
NYSDOH			4×10^{-5}	2×10^{-2}		2×10^{-3}	5×10^{-4}
EPA		B1			6.1	1.8×10^{-3}	6×10^{-4}
NJDEP						3.5×10^{-3}	
Chromium III	16065-83-1						
NYSDOH			4×10^{-5}	1.4×10^{-1}			
EPA							
NJDEP							
Chromium VI	7440-47-3						
NYSDOH			2.6×10^{-5}	9×10^{-2}		1.5×10^{-2}	7×10^{-5}
EPA		A			41	1.2×10^{-2}	8×10^{-5}
NJDEP						1.2×10^{-2}	
Cobalt		NO DATA					
Copper	7440-50-8	NO DATA					

Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk[i] $(ug/m^3)^{-1}$	Calculated Exposure Equal to K Risk of 1 in a million[j] (ug/m^3)
Nickel refinery dust	00-02-0						
NYSDOH							
EPA		A			0.84	2.4×10^{-4}	4×10^{-3}
NJDEP							
Nickel	7440-02-0						
NYSDOH			1.3×10^{-5}	4×10^{-2}			
EPA							
NJDEP							
Vanadium	7440-62-0						
NYSDOH			2.3×10^{-5}	8.0×10^{-2}			
EPA							
NJDEP							
Zinc phosphide	1314-84-7	NO DATA					
Chloromethane		NO DATA					

Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk[i] $(ug/m^3)^{-1}$	Calculated Exposure Equal to A Risk of 1 in a million[j] (ug/m^3)
Chloroform	67-66-3						
NYSDOH		B2			8.1×10^{-2}	2.3×10^{-5}	4.0×10^{-2}
EPA						2.3×10^{-5}	
NJDEP							
Carbon tetrachloride	56-23-5						
NYSDOH		B2			1.3×10^{-1}	1.5×10^{-5}	7×10^{-2}
EPA						1.5×10^{-5}	
NJDEP							
Dibromochloromethane	124-48-1	NO DATA					
Ethylene dichloride							
NYSDOH							
EPA						1.0×10^{-6}	
NJDEP							

Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] (mg/kg-day)$^{-1}$	Inhalation Unit Risk[i] (ug/m^3)$^{-1}$	Calculated Exposure Equal to A Risk of 1 in a million[j] (ug/m^3)
Benzene	71-43-2						
NYSDOH							
EPA		A			2.0×10^{-2}	8.3×10^{-6}	1×10^{-1}
NJDEP						8.3×10^{-6}	
Carbonyl-fluoride		NO DATA					
Hexane		NO DATA					
Toluene	108-88-3						
NYSDOH							
EPA		D					
NJDEP							
Xylenes	1330-20-7						
NYSDOH							
EPA		D					
NJDEP							

Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk[i] $(ug/m^3)^{-1}$	Calculated Exposure Equal to A Risk of 1 in a million[j] (ug/m^3)
Formaldehyde							
NYSDOH				30		1.7×10^{-5}	6×10^{-2}
EPA							
NJDEP						1.3×10^{-5}	
Iron		NO DATA					
Lead (inorganic)	7439-92-1	B2					
Manganese	7439-96-5						
NYSDOH			9×10^{-5}	3×10^{-1}			
EPA		D					
NJDEP							
Molybdenum		NO DATA					
Nickel subsulfide	12035-72-2						
NYSDOH						4.8×10^{-3}	2×10^{-4}
EPA					1.7	4.8×10^{-4}	2×10^{-3}
NJDEP						4.3×10^{-4}	

Summary of Current NYSDOH[a], NJDEP[b] and EPA[c] Risk Information on Chemicals Analyzed During NJ/SI Project.

Chemical	CAS Number[d]	EPA Weight of Evidence[e]	Inhalation RfD[f] (mg/kg-day)	NYSDOH Criterion[g] (ug/m^3)	Inhalation Slope[h] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk[i] $(ug/m^3)^{-1}$	Calculated Exposure Equal to A Risk of 1 in a million[j] (ug/m^3)
Methylene chloride							
NYSDOH							
EPA							
NJDEP						4.7×10^{-7}	
1,1,1-Trichloroethane	71-55-6						
NYSDOH							
EPA		D					
NJDEP							
Tetrachloroethylene	127-18-4	NO DATA					
Vinyl chloride		NO DATA					

FOOTNOTES - TABLE II

[a] Data provided by Dr. John Hawley of the New York State Department of Health from draft ambient air criteria documents being prepared by the Bureau of Toxic Substance Assessment.

[b] Data provided by Joann Held of the New Jersey Department of Environmental Protection.

[c] Data compiled using the Integrated Risk Information System developed and maintained by the Office of Health and Environmental Assessment of EPA's Office of Research and Development.

[d] **CAS Number**. Specific number assigned to each chemical by the Chemical Abstract Service.

[e] **EPA Weight of Evidence for Carcinogens.** The EPA Guidelines for Carcinogen Risk Assessment (51 FR 33992, September 24, 1986) provides the following classification system for evaluating carcinogens.

A - Human Carcinogen.

B1 - Probable human carcinogen, with limited evidence of carcinogenicity in humans.

B2 - Probable human carcinogen, with sufficient evidence of carcinogenicity in animals but inadequate evidence of carcinogenicity in humans.

C - Possible human carcinogen.

D - Not classifiable as to human carcinogenicity.

E - Evidence for non-carcinogenicity in humans.

[f] **Inhalation Reference Dose (RfD)**. An estimate with an uncertainty spanning perhaps an order of magnitude or greater, of a daily exposure to the human population (including sensitive populations) that is likely to be without an appreciable risk of deleterious systemic effects during a lifetime.

$$\text{Reference Dose} = \frac{\text{No Observed Adverse Effect Level}}{\text{Uncertainty Factor X Modifying Factor}}$$

Uncertainty Factors are assigned using the following method.

10-fold factor when extrapolating from valid experimental results in studies using prolonged exposure to average health humans. This factor is intended to account for the variation in sensitivity among the members of the human population and is referenced as "10H".

10-fold factor when extrapolating from valid results of long-term studies on experimental animals when results of studies of human exposure are not available or are inadequate. This factor is intended to account for the uncertainty involved in extrapolating from animal data to humans and is referenced as "10A".

10-fold factor when extrapolating from less than chronic results on experimental animals when there are no useful long-term human data. This factor is intended to account for the uncertainty involved in extrapolating from less than chronic No Observed Adverse Effect Levels (NOAELS) to chronic NOAELS and is referenced as "10S".

10-fold factor when deriving a RfD from the Lowest Observed Adverse Effect Levels (LOAELs), instead of the NOAEL. This factor is intended to account for the uncertainty involved in extrapolating from LOAELs to NOAELS and is referenced as "10L".

The factors are multiplied to determine the total uncertainty. The maximum uncertainty is 10,000 i.e., 10H X 10A X 10S X 10L.

Modifying Factors (MFs), based on professional judgement, are an additional uncertainty factor which is greater than zero and less than or equal to 10. The magnitude of the MF depends upon the professional assessment of the scientific uncertainties of the critical study and databases of other experimental studies on the chemical not explicitedly treated by the above uncertainty factors, for example, the completeness of the overall database of scientific evidence and the number of species tested. The default MF value is 1.

Reference: Dourson, M. L. and J. F. Stara, 1983. Regulatory Toxicology and Pharmacology 3:224-238.

The New York State Department of Health (NYSDOH) also generally follows this type of approach when developing

RfDs. The NYSDOH inhalation RfDs listed in Table II are specific for inhalation exposure and are based on draft criteria documents which evaluate the toxic potential of these compounds in ambient air. The RfD for cadmium represents a total absorbed dose from all routes of exposure.

NYSDOH Criterion. The New York State Department of Health Criterion is an ambient concentration presented in micrograms/m^3 that corresponds to an exposure at the inhalation RfD for a 70 kg person inhaling 20 m^3/day multiplied by the absorption fraction. The absorption fraction is a dimensionless number that is assumed to be 1 unless there is specific experimental data to indicate that it should be reduced.

The NYSDOH draft criterion for cadmium represents 20% of the RfD (total absorbed dose) after accounting for background exposure from food and water and assumes 50% absorption across the lung. The draft air criterion for formaldehyde is based on irritant effects following short-term exposure.

The **Inhalation Slope** (IS) is the slope of the linear relationship between the probability of an individual developing cancer and the amount of a chemical absorbed over a lifetime of 70 years expressed in terms of the average number of milligrams absorbed each day per kilogram of body weight.

The value of the slope is derived from animal laboratory data or human epidemiological data using conservative models (e.g., linearized multistage zero threshold model). These models provide an upper limit on human risk which is not likely to be exceeded or could be less.

Since the line passes through the origin, the slope is:

$$IS = \frac{\text{Probability}}{\frac{\text{mg}}{\text{kg-day}}}$$

The probability is expressed as a fraction, thus, a probability of 1 represents a complete certainty of cancer.

For inhalation exposures, it is convenient to express exposures in terms of the concentration of the chemical in the inhaled air. Therefore, it is desirable to calculate the probability of cancer corresponding to the lifetime inhalation of air containing a specified average

concentration of the chemical carcinogen. The **Unit Risk Value (URV)** is the probability of cancer corresponding to an exposure over a lifetime at an average concentration of 1 microgram per cubic meter of the chemical.

$$URV = \frac{\text{Probability}}{\text{ug/m}^3}$$

In making conversions between units; the Inhalation Slope is in terms of mg/kg-day and the URV is in terms of ug/m^3 it is convenient to have conversion factors.

The conversion factor assumes a 70 kg individual inhales an average of 20 m^3 per day. Therefore,

$$1 \frac{\text{mg}}{\text{kg-day}} \times 70 \frac{\text{kg}}{\text{person}} = 70 \frac{\text{mg}}{\text{person-day}}$$

$$70 \frac{\text{mg}}{\text{person-day}} \times 1{,}000 \frac{\text{ug}}{\text{mg}} = 70{,}000 \frac{\text{ug}}{\text{person-day}}$$

If the individual inhales 20 m^3 per day, then the amount of the chemical in the air which will result in the inhalation of 70,000 ug per day is:

$$70{,}000 \frac{\text{ug}}{\text{person-day}} \times 1 \frac{\text{person-day}}{20\ \text{m}^3} = 3{,}500 \frac{\text{ug}}{\text{m}^3}$$

In the absence of data to the contrary, a 100% absorption efficiency is assumed. If the absorption of the chemical from the air is known to be less than 100% efficient, then, an absorption factor equal to the fraction absorbed is required. If A is the fraction absorbed:

$$1 \frac{\text{mg}}{\text{kg-day}} = \frac{3500}{A} \frac{\text{ug}}{\text{m}^3}$$

Therefore, to convert from mg/kg-day to ug/m^3 when the absorption factor is A, multiply mg/kg-day by 3500/A.

$$\frac{\text{mg}}{\text{kg-day}} \times \frac{3{,}500}{A} = \frac{\text{ug}}{\text{m}^3}$$

The conversion factor between the Inhalation Slope (IS) and Unit Risk Value (URV) can be derived from the above calculations.

$$\frac{\text{Probability}}{\frac{3{,}500}{A} \times \frac{\text{mg}}{\text{kg-day}}} = \frac{\text{Probability}}{\frac{\text{ug}}{\text{m}^3}}$$

$$\frac{IS}{\frac{3{,}500}{A}} = IS \times (2.86 \times 10^{-4}) \times A = URV$$

$$IS \times 2.86 \times 10^{-4} \times A = URV$$

An estimate of the increased lifetime cancer risks to populations can be obtained from the following equation:

$$URV \times \frac{\text{ug}}{\text{m}^3} = \frac{\text{Number of possible cancers}}{\text{Population}}$$

The concentration which will potentially cause 1 cancer per million people exposed $(ug/m^3)_M$ is:

$$URV \times \left(\frac{\text{ug}}{\text{m}^3}\right)_M = \frac{1}{1{,}000{,}000}$$

$$\left(\frac{\text{ug}}{\text{m}^3}\right)_M = \frac{1}{1{,}000{,}000 \times URV}$$

k Sample Calculation

Given: IS = 50 for inorganic arsenic
A = 0.3

Calculation of URV and ug/m^3_M

$$URV = 50 \left(\frac{mg}{kg\text{-}day} \right)^{-1} \times (2.86 \times 10^{-4}) \times 0.3$$

$$= 4.3 \times 10^{-3} \ (ug/m^3)^{-1}$$

$$\left(\frac{ug}{m^3} \right)^{-1} = \frac{1}{4.3 \times 10^{-3} \times 1{,}000{,}000}$$

$$= 2 \times 10^{-4} \ ug/m^3$$

4.6.5 Quality Assurance Plan

Introduction

The Exposure and Health Assessment Subcommittee will be using data collected and analyzed by other members of the Staten Island/New Jersey Urban Air Toxics Assessment Project to make exposure assessments and risk calculations. It is assumed that all data received has passed through the quality assurance procedures of the individual organizations and subcommittees responsible for determining the validity of the values, but this will be verified before use. The quality assurance procedures will have three parts: A) verification that the data was transmitted correctly, B) documentation of the criteria and approaches for assessment and C) validation of the accuracy of computer calculations.

A) Verification of the data transmission

1) Scatter plots of the concentration of each compound will be prepared to check whether any values are vastly different from the mean. Outliers (>3σ) will be checked with previous quality assurance data to ensure they are measured concentrations.

2) Summary data will be calculated and compared with those used in written reports.

B. Documentation of criteria and approaches

1) Selection of database for exposure assessment at a specific site.

a) Compounds which are missing more than 50% of the data points during two quarters will not be included in the database for an annual exposure estimations. They may still be used for semi-annual or seasonal estimations.

b) Samples collected on the every sixth day collection cycle (every twelfth day for indoor samples) will be included in the data base for calculating the annual average. Averages of daily samples from the College of Staten Island sites will be compared with the truncated 6th day average at the same sites to determine if the annual mean and the 6th day mean are statistically different. This would identify larger uncertainties for the exposure assessment of specific compounds.

2) Calculation of annual statistics

The estimate of accuracy provided by the Quality Assurance subcommittee and the individual organizations will be used as one measure of the uncertainty in the exposure assessment.

3) Comparison with literature values

a) Literature values will only be used when the quality assured sample collection and analytical procedures are available for review.

b) Estimates of uncertainty in literature values will be included in any comparisons.

4) Health risk characterization

The estimates of the uncertainty in the health risk for each organization will be discussed in the report.

C. Validation of approaches

1) Exposure estimates

a) The indoor air values determined for this project and TEAM studies will be compared to determine where the SI/NJ UATAP indoor measurements fall within the distribution of indoor and personal values measured at the over 800 homes studied in TEAM. The methodology and QA of the TEAM data will be examined to assure comparabiity with SI/NJ UATAP study.

b) All computer algorithms will be verified by hand calculation to assure accuracy.

2) Health risk calculations

a) Inhalation RfD, when available, will be used by each organization; when an RfD is not available, NOEL or LOEL will be used. Appropriate estimates of uncertainty will be provided by committee members from each organization making risk calculations.

b) Uncertainty factors of 10-fold will be used to account for variations in sensitivity among people, extrapolation from animal data, extrapolation from chronic effects data, and when deriving a RfD from a LOEL.

4.7 Quality Assurance Subcommittee Workplan

4.7.1 Subcommittee Members

Clifford Weisel	-	UMDNJ
Charles Pietarinen	-	NJDEP
Garry Boynton	-	NYSDEC
John Oppenheimer	-	CSI
Marcus Kantz	-	U.S. EPA, Chair

4.7.2 Purpose

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.

4.7.3 Background

Quality Control (QC) may be understood as using internally applied measures to give confidence in the data being gathered. Typical quality control methods are periodic calibrations, duplicate checks, split samples, and spiked samples. Quality Assurance (QA), on the other hand, involves externally applied measures to ensure that the level of Quality Control used in a project is adequate for the task at hand. Quality Assurance methods that are often used include on-site systems surveys, independent performance audits, interlaboratory caparisons, and periodic evaluations of internal Quality Control data. In general, Quality Assurance activities are performed on a more occasional basis than Quality Control activities, and by a person outside of the normal day-to-day routine, using separate equipment and supplies.

In the SI/NJ UATAP, each individual monitoring organization and subcommittee has its own QA/QC procedures, aimed at providing quality data for its individual needs. The QA/QC needs of the project as a whole however, are different from the sum of the QA/QC measures exercised by the individual organizations and subcommittees participating in the project. Therefore, one of the primary responsibilities of the QA Subcommittee has been to develop and implement a QA program for the entire project, utilizing the contributors' plans, and augmenting them as necessary.

The Quality Assurance Subcommittee determined, from its inception, that the development of special and extra-ordinary quality assurance methods was needed in this project the following reasons:

1) The sampling and analysis of air matrices for volatile organics is a science still in its infancy. Modelling, construction of emission inventories, and assessment of risk from airborne exposure are also in a developmental stage. As a result, there is a degree of variability that is unavoidable. This variability is substantially greater than that found when assessing the criteria pollutants (CO, O_3, SO_2, NO_x, lead and particulates), for which Reference Methods have been validated and extensive study has been done.

2) Many different organization were to be involved in sampling and analysis of samples using their own equipment. As a result, there was no standardization of sampling and analysis equipment.

3) Some of the organizations involved in the study had no prior experience in volatile organic sampling or were evaluating new methods in sampling and analysis.

4) The data obtained from the different sites were to be compared against each other to assess trends. However, site responsibility was divided among the different organizations with only one organization per site. Therefore, variability between sites would be confounded by variability between organizations.

5) In many cases, sample analysis was to be conducted by personnel or institutions that were not involved in sampling. As a result, there would be less overlap and communication between those taking samples and those conducting the analysis. Additionally, there would be greater transportation of samples than would normally be the case.

The QA Subcommittee considered various special QA procedures in an attempt to account for these challenges to acceptable data quality. The final list 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 samples	Different samplers located at the same site.
Extended Collocation Experiments	Multiple organizations sampling at the same place and time for several consecutive days (a.k.a. "shootouts)

Detailed descriptions of these very important QA tools can be found in the attached Quality Assurance Project Plan for the QA Subcommittee.

4.7.4 Objectives and Tasks

Objective 1. Develop QA Program for Project

Part A. QA for each project subcommittee

Task 1.A.1. Require each subcommittee to submit a Quality Assurance Project Plan (QAPjP) addressing:

a. Quality Assurance needs
b. Data Quality Objectives
c. Quality Assurance Methods
d. Corrective Action to be taken

Part B. QA for each sampling/analysis institution

Task 1.B.1. Require a QAPjP from each organization addressing:

a. Standard Operating Procedures (SOPs) for sampling, custody and analysis
b. Quality control measures taken
c. Documentation, data reduction, and reporting

Task 1.B.2. Require each organization to participate in management audits and technical systems audits

Task 1.B.3. Require analysis of performance audit samples provided by EPA/AREAL

Task 1.B.4. Require collocation of samplers (including shootouts)

Task 1.B.5. Require quarterly review of data by each sampling/analytical institution

Part C. QA between sampling/analysis institutions

Task 1.C.1. Require overall project QAPjP

Task 1.C.2. Require shootouts

Task 1.C.3. Require benchmark methods

Objective 2. Implementation of QA for the Project

Part A. Overall project QA

Task 2.A.1. Write overall project QAPjP

Task 2.A.2. Review Subcommittee QAPjPs

Part B. Sampling/analysis QA for project

Task 2.B.1. Review all required QAPjPs including:

a. SOPs for sampling, analysis and custody
b. QA measures taken
c. Documentation, data reduction, and reporting

Task 2.B.2. Coordinate performance evaluations and review results

Task 2.B.3. Conduct management system audits and technical systems audits on each organization

Task 2.B.4. Conduct shootouts and report results

Task 2.B.5. Review and assess quarterly data review submitted by sampling/analysis institutions

Objective 3. Documentation of QA Assessments

Task 3.A.	Approved QAPjPs
Task 3.B.	Report periodically on audits and other QA measures
Task 3.C.	Prepare a final QA report

Objective 4. Corrective Action

Task 4.A.	Perform additional management systems audits and technical system audits
Task 4.B.	Arrange additional performance audits
Task 4.C.	Conduct additional shootouts and collocations

4.7.5 Internal Quality Assurance

Wind Measurements

This is provided by the National Weather Service for the Airport Stations we use, the NJDEP for the Flemington data, and NYSDEC for the three wind sites located on Staten Island.

Quality Assurance procedures include system and performance audits of instruments and recording systems.

Toxics Monitors

We expect that the air toxics data we use as input to pollution rose models and the selection of "priority" days for the surface trajectory model has undergone proper quality assurance procedures as administered by the Monitoring Management Branch of the Environmental Services Division. This includes quality assurance for the instruments as well as retrieved data.

Wind Instruments

Instrument Siting- The following principles are described in the Quality Assurance Handbook for Air Pollution Measurement Systems (Volume IV). In most cases they represent the ideal situation which of course doesn't exist in the real world. Nevertheless we have tried to follow these principles to the extent possible:

The primary objective of instrument siting is to place the instrument in a location where it can make precise measurements that are representative of the general state of the atmosphere in that area, consistent with the objectives of the data collection

program. Because most atmospheric properties change dramatically with height and surroundings, certain somewhat arbitrary conventions must be observed so that measurements can be compared.

"The standard exposure of wind instruments over level, open terrain is 10 meters above the ground" (World Meteorological Organization, 1971), however optimum measurement height may vary according to data needs. Open terrain is defined as an area where the horizontal distance between the instrument and any obstruction is at least ten times the height of the obstruction. An obstruction may be man made (such as a building) or natural (such as a tree). The wind instrument should be securely mounted on a mast that will not twist, rotate, or sway. If it is necessary to mount the wind instrument on the roof of a building, it should be mounted high enough to be out of the area in which the air flow is disturbed by the building. This is usually 1.5 times the height of the building above the roof so that it is out of the wake of the obstruction. This is not a good practice, however, and should only be resorted to when absolutely necessary. Sensor height and its height above the obstructions, as well as the character of nearby obstructions, should be documented.

Meteorological Towers

Towers should be located in an open,level area representative of the area under study. They should be of the open grid type of construction, typical of most radio and television broadcast towers. Enclosed towers, stacks, water storage tanks, grain elevators, cooling towers, and similar structures should not be used. (Mollo-Christensen, 1979). Towers must be rugged enough so that they may be safely climbed to install and service the instruments. Folding or collapsible towers that make the instruments available to be serviced or calibrated at the ground are desirable provided they are sufficiently rigid to hold the instruments in the proper orientation and attitude during normal weather conditions.

Wind instruments should be mounted above the top of the tower or on booms projecting horizontally out from the tower. If a boom is used it should support the sensor at a distance equal to twice the maximum diameter or diagonal of the tower away from the nearest point on the tower. The boom should project into the direction which provides the least distortion for the most important wind direction. For example, a boom mounted to the east of the tower will provide least distortion for north or south winds.

Station Siting

It is important that care be taken in selecting station location with respect to major man-made and topographic features such as cities, mountains, and large bodies of water. Some of these features are found within the project study area. Meteorological variables are obviously affected by the large scale surrounding features. The effect of cities has been studied extensively (Ito, 1972; Vukovich, 1971; U.S.PHS, 1961). Documented effects include a decrease in average wind speed, decrease in atmospheric stability, increase in turbulence, increase in temperature, and changes in precipitation patterns. These changes will obviously have an effect on the evaluation and interpretation of meteorological and air quality data taken in an urban area.

Almost any physical object has an effect on atmospheric motion. It is probably impossible to find a site that is completely free from obstruction (This was certainly the case with the meteorological towers for the project). This being the case, it is the responsibility of the person choosing a monitoring site to have in mind the area of interest. If the area is in a valley or sea coast, then the meteorological instruments should be in that valley or near the coast; not on a nearby hilltop or inland 30km at a more convenient airport site.

The meteorological sites for this project were chosen with the different physical features in mind. These sites are representative of the typical air flow regimes present on Staten Island. The Tottenville site is representative of sea-breeze flow from nearby Raritan Bay; the pump station site reflects flat terrain conditions; the Susan Wagner High School site is representative of hillier terrain.

4.7.6 Quality Assurance Plan

1. Project Name: SI/NJ Urban Air Toxics Study - Subcommittee on Quality Assurance

2. Project Requested By: The U.S. Environmental Protection Agency Region II

3. Date of Request: September 1986

4. Date of Project Initiation: January 1987

5. Project Directors: John Elston - NJDEP
   Donald Gower - NYSDEC
   Anders Carlson - NYSDOH
   John Oppenheimer - CSI
   Paul Lioy - UMDNJ
   Linda Berrafato - UMDNJ

6. Quality Assurance Officers: Marcus Kantz - U.S. EPA
   Garry Boynton - NYSDEC
   Anders Carlson - NYSDOH
   Clifford P. Weisel - CSI
   Paul Lioy - UMDNJ

7. Project Description:

A. Objective and Scope

The objectives of the SI/NJ Urban Air Toxics Study are to:

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 an exposure assessment for various types of commercial facilities and residences.

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

5. Perform 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 modelling.

7. Evaluate indoor air quality to identify possible sources.

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

9. Evaluate some general abatement strategies.

The project is being managed and coordinated through a number of Committees as follows:

Steering Committee

Work Group

Data Management Subcommittee	Monitoring Subcommittee
Emissions Inventory Subcommittee	Modeling Subcommittee
Quality Assurance Subcommittee	Indoor Air Subcommittee
Risk Assessment Subcommittee	

The objectives of this document are to present the coordinated Quality Assurance (QA) aspects of the combined projects of the various Subcommittees, Government Agencies and Departments, and Universities, as prepared by the QA Subcommittee. This document, when signed, will serve as the approval of the QA Subcommittee for the coordination and overall QA aspects of the project. This document does not address directly the plans of the individual institutions of the project, or of any other Subcommittee.

B. Data Usage

The QA measures described here will be used to assess the quality and appropriateness of the data and its use.

C. Objective of QA Activity

This project presented a unique QA challenge because of the wide variety of activities undertaken, such as: ambient air monitoring, emissions inventory, modelling, risk assessment, and indoor air. QA activities with respect to monitoring were singled out for special treatment. This is because the various participating organizations are not using standard sampling and analytical methods, or even the same methods. As a result, the QA Subcommittee, with cooperation from various EPA experts in North Carolina, has developed extraordinary QA procedures for the monitoring phase of the project. These methods will be used to compare and verify the different monitoring techniques and to try to determine the relative validity of the data points.

8. Schedule of Tasks and Products

The QA activities associated with each product will follow in sequence with the schedule that is part of each Subcommittees Workplan.

9. Project Organization and Responsibility

Each Subcommittee, and individual institutions under its jurisdiction in this project, will prepare a QA Project plan (QAPjP), which will clearly delineate the organization and responsibility for its QA activities. It is appropriate to include an abbreviated list of QA personnel and their areas of responsibility. They are as follows:

A. Emissions Inventory Subcommittee
Andy Opperman, NJDEP - QA contact

B. Risk Assessment Subcommittee
Paul Lioy, UMDNJ, - QA contact

C. Modelling Subcommittee
Al Forte, U.S. EPA, QA contact

D. Data Management Subcommittee
Rudolph Kapichak, U.S. EPA, - QA contact

E. Monitoring Subcommittee
Cliff Weisel - QA contact

Institutions Conducting Monitoring:

College of Staten Island
Clifford Weisel - Analysis
John Oppenheimer - Field

New Jersey Department of Environmental Protection
(Management Only)
Charles Pietarinen, Bureau of Air Monitoring, - Siting and Sampling
Eric Rau, Bureau of Environmental Laboratories, - Volatiles Analysis

New York State Department of Environmental Conservation
Garry Boynton, Bureau of Toxic Monitoring - Analysis
Caz Czarkowski, Region II, - Field

University of Medicine and Dentistry of New Jersey
Paul Lioy - Field and Analysis
Linda Berrafato - Field and Analysis

New York State Department of Health
Mark Knudsen - Field
Ken Aldous - Analysis

New Jersey Institute of Technology
Arthur Greenberg - Particulate Analysis
Barbara Kebbekus - Analysis
Joseph Bozzelli - Field

The QA Subcommittee, made up of representatives from the various organizations participating in the project, is as follows:

Clifford Weisel - CSI/UMDNJ
Linda Berrafato - UMDNJ
John Oppenheimer - CSI
Charles Pietarinen - NJDEP
Garry Boynton - NYSDEC
Marcus Kantz - EPA, Chair

10. Data Quality Requirements and Assessments

The Data Quality Objectives (DQOs) for this study have not been defined in quantitative terms. This, in part, represents acknowledgement by the managers in the various organizations that the methods and approaches being utilized are state-of-the-art methods that are not easily amenable to concrete limits or data quality criteria. Groups that are directly involved in sampling and analysis are fully expected to develop some degree of quantitative detection limits and data quality estimates for each analytical method used. These estimates should be submitted with the institution's QAPjPs, Standard Operating Procedures, and/or quarterly data submitals. Subcommittees and institutions not directly involved in sampling and analysis are expected to submit a written narrative identifying their Data Quality Objectives, significant QA decisions, and justifications or data in support of their decisions.

11.-13. Sampling, Analysis, Custody, and Calibration Procedures

These activities will be addressed in the QAPjPs of the individual organizations conducting these activities. Briefly, NYSDEC will sample at six sites on Staten Island. NJIT will sample for NJDEP at two sites in New Jersey. CSI will sample at three sites in Staten Island. NYSDOH will sample indoor air at two sites in the project area. Analysis of a sample will be done by the institution taking the sampling, with the exception of canister samples which will be done by an independent EPA contractor. All methods will follow SOPs contained in or references by the respective QAPjPs.

14. Documentation, Data Reduction, and Reporting

This will be handled in each organization's QAPjP. In addition, the Data Handling Subcommittee will cover the overall Study considerations.

15. Data Validation

All data will be considered valid unless they were subject to a known and documented problem in sampling or analysis. In other words, no data will be invalidated only because of apparent discrepancies or large variations. Each organization will validate its data according to its own SOPs. However, the QA Subcommittee will periodically review the data resulting from shootouts and other QA activities to determine whether any corrective action might be pursued. This is addressed in Section 18.

Each organization will be responsible for its own Data Validation, subject to the conditions described above. In addition, the Exposure Assessment Subcommittee will evaluate the usefulness of data for performing risk assessments, and the Modeling Subcommittee will evaluate the data for modelling purposes. However, it is the recommendation of this Subcommittee that valid data be used in entire blocks and that individual or small groups of data points not be eliminated.

16. Quality Assurance Activities

The QA activities of this project are broken down into two groups; that which involves sampling and analysis to obtain data; and that which takes existing data and processes the data to obtain some useful product. The QA activities involved in sampling and analysis will be discussed first.

The monitoring aspect of this project is unique in that it will utilize several different organizations using different primary sampling and analytical methods to try to characterize air quality at many diverse permanent sites. Each organization will

use the standard types of routine Quality Control (QC) procedures to maintain the internal consistency of the data. However, the question of Quality Assurance (QA) is much more difficult, since it involves assessing the data validity and consistency both within and between organizations.
Most monitoring projects utilize Performance Audits (PA) and Systems Audits (SA) as the main, if not only, QA activities. Since this Study encompasses so many organizations and so many different state-of-the-art methods, a wider range of QA activities will be needed to confirm the quality of the monitoring data. In addition to PAs and SAs, the participants will utilize "Shootouts", collocation of two benchmark methods, and collocation of individual samplers. Each of these QA activities is aimed at evaluating a specific part of the measurement process.

One of the greatest uncertainties in this project concerns sampling and analysis for volatile organic compounds. Originally, the organization intended to utilize a variety of different methods, as follows:

NYSDEC	Tube containing multiple adsorbents
NJDEP (NJIT)	Canisters
UMDNJ	Tenax tubes
CSI	Tenax tubes

In an effort to provide a measure of consistency between the different methods, organizations, and sites, all of the organizations have agreed to two specific methods in addition to their own methods, as follows (if different). These methods are Tenax tubes and Summa polished canister sampling. Even these methods are not designated as "Reference" or "Standard", since no such method exists. However, these two methods do represent the present state-of-the-art for sampling volatiles in ambient air. Through the use of these two benchmark methodologies, EPA and other organizations hope to gain not only a better understanding of air quality in the study region, but also the relative merits of various methods under extended, real world conditions.

An important aspect of the sampling for this project is in the selection of the monitoring sites consistent with the goals of the project yet in secure, serviceable locations. The participants agreed to utilize EPA's established SO_2 criteria for the volatile organics sampling. While it is agreed that "breathing zone" sites would be preferable, most sites would need to be placed on rooftops. It was agreed that every effort would be made to avoid the influence of rooftop vent emissions and of emissions from the roofs themselves.

A. Performance Audits (PAs)

PAs use externally prepared performance evaluation (PE) samples to assess the analytical capability of a given organization. Each organization in this Study is encouraged to obtain and utilize its own PE samples during development and debugging of its own methods. This will be reflected in the individual QAPjPs. In addition the subcommittee will arrange for the distribution of PE samples for as many different parts of the analytical scheme as are available. At present, it is anticipated that EPA/EMSL will spike tubes and canisters with volatile organics, disseminate particulate lead filters, and NBS urban dust filters. These should be analyzed at least once per year per organization. As soon as each organization comes on line, it is encouraged to request PE samples to use as internal QC checks. Once the systems are fully operational, additional sets will be available as true audit PE samples. EPA will also arrange EMSL/RTP flow audits for the high volume samplers which NYSDEC and NJDEP will use for at least one site per year. In addition, EPA Region II will perform flow audits on at least one sampler per state per year.

EMSL/RTP, ESD, and the QA Subcommittee will conduct on-site Technical Systems Audits during the first few months of the project, and most likely, at yearly intervals thereafter.

B. Systems Audits

A Systems Audit is a review of the total data production process of an organization. EPA Region II will perform at least one systems audit on each organization involved in this Study, with the possibility of a second if significant changes or increases in effort are recognized. These audits will follow protocols similar to those used by EPA in auditing the States' ambient air monitoring networks and will be reviewed by this Subcommittee. The results of the Shootouts and other QA activities will be covered by these audits. EPA will be assisted on each SA by a representative of one organization not being audited. It is expected that a University representative will assist on State audits, and vice versa. Audit results will include recommendations, as appropriate; corrective action will be tracked.

C. Use of Tenax Tubes and Summa Polished Canisters as Benchmarks

There is presently no method for collecting and analyzing volatile organics that is considered "Reference" or "Standard". However, there are two methods that are considered by most researchers at EPA and elsewhere to be relative benchmarks. The older of the two involves the collection of samples on Tenax sorbent in tubes. Tenax has been used for many years and has been found to be reasonably reliable when special precautions are taken to compensate for potential artifact formation and sample breakthrough. The main precaution is the use of Distributed Volumes, in which two or more tubes are exposed, side by side, at

different flow rates. The newer method involves the collection of samples in specially polished stainless steel canisters. There is not nearly as much experimental evidence concerning canister sampling, but it appears to be at least as reliable as the Tenax method. In an effort to improve the level of confidence associated with the data from this study, the QA Subcommittee agreed to utilize both of these methods as benchmark methods. Each primary site will utilize Tenax samplers every 6 days. These same sites will utilize the Summa polished stainless steel canisters at least every 18 days. The monitoring Subcommittee has prepared a chart to show the details of the number and frequencies of each type of sample for each organization.

At the present time, it is expected that the results of the Tenax sampling will be considered to be the primary sampling method, with the canister samples serving as checks on consistency etc. However, this may be modified, depending on the results of early sampling.

D. Multi-day Collocation Studies (Shootouts)

A Shootout is being defined here as a sampling event in which all of the organizations bring their sampling equipment to a single site at the same time and sample as they would normally. Its purpose is to offer a comparison of all the methods including the EPA canisters. The particular value of a Shootout is that it can be used to compare the entire measurement process, not just the sampling or analytical portion.

At present it is anticipated that at least one three day Shootout will be performed each year. It will be conducted at one of the permanent sites, will match the normal sampling schedule and will coincide with the EPA canister schedule. Should it prove unfeasible to conduct a Shootout at one of the sites, it will be done at the EPA Edison facility.

E. Additional QA activities

Sorbent sampling, while used for many years and in many types of projects, has many inherent difficulties. One potential problem involves the difficulty in choosing a suitable sampling rate and duration, since breakthrough may occur for different compounds at different rates. Another problem is the formation of artifacts by chemical reaction on the sorbent. A third possibility is "passive sampling" or the collection of additional materials with possible artifact formation all after gas flow through the cartridge has stopped. Each of the organizations sampling with sorbents will take special precautions to minimize and assess the occurrence of these problems. This will be addressed in detail in the individual QAPjPs. This document will, therefore, contain only a brief discussion of these techniques.

1. Distributive volume (DV) - This technique involves collocating two or more samplers but running them at different flow rates to assess the possibility of breakthrough. EPA EMSL/RTP recommends that all sorbent sampling, particularly when Tenax is the sorbent, include 4 different sampling rates at each site until and unless the data consistently show that this is not needed. The recommendation for this complete DV sampling is based on the assumption that the Tenax sampling would be the only sampling at a site and that each data point might be used individually. In this study however, neither assumption is valid. We will have a variety of samplers at each site and will be using them, essentially, to check each other. In addition, we will be using many more QA activities than in most studies, including the use of Shootouts and more frequent PE samples. Finally, we do not expect that the risk assessments will utilize individual data points but will, instead, examine trends from site to site and from time to time. As a result, the QA Subcommittee has determined that limited DV sampling is appropriate for this study. We will utilize "2-Tube Tenax", in which a pair of samplers are run side-by-side at different flow rates, with the agreement that this protocol may be modified, depending on early results.

2. Duplicate Samples - Duplicate samples will be taken for all methods although fewer will be taken for particulates or for canister samples because multiple analyses can be performed on the initial sample. For example, duplicate filter strips are analyzed for metals, and second analyses can be taken from the canister gas sample. Duplicates will be used with other methods to assess precision.

3. Adjusted Sampling Times - It was strongly desired that all sampling for this Study correspond exactly to the midnight to midnight schedule followed in the States' particulate network. However, integrity of the organic samples has proven to be a much greater concern. In order to allow field personnel to service samplers immediately before and after each sampling period, all non-particulate sampling will begin and end at 10 AM local time $\pm$1 hour. Particulate sampling will continue to follow the midnight to midnight regimen of the national networks.

There is still some uncertainty concerning the acceptability of leaving volatile samples unattended for many hours after sampling, even if the samplers are capped. NYSDEC presently plans not to service samplers on weekend days. The potential effects this might have on collected samples is being investigated.

Project activities that do not require sampling and analysis will also be required to complete a QAPjP. The reasons for this are that Quality Assurance responsibilities are not strictly limited to the sphere of sampling and analysis. For example, the Risk Assessment Subcommittee must make decisions that will affect the

quality and integrity of their contributions to the project. Decisions will be made regarding the applicability and usefulness of the data received with respect to the risk assessment models being used, the accuracy of these risk assessment models, and the degree of uncertainty that can be tolerated in making conclusions based upon the data. Similar Quality Assurance issues apply to greater or lesser degrees to the other Subcommittees in this Study. As a result, each Subcommittee must outline in its QAPjP the areas where the decisions affecting the quality of its work are being made, the criteria for making these decisions, and how these decisions are assessed. The Quality Assurance Subcommittee offers its support to the other Subcommittees to identify the areas where important QA issues need to be addressed.

18. Corrective Action

Each individual organization will address this issue in its QAPjP. In addition, the QA Subcommittee will review the quarterly data reports and will recommend corrective actions, or at least more extensive QA or Quality Control activities. These recommendations will be based, in part, upon review of the comparisons between organizations' data and the results of the Tenax and Canister analyses, as well as the results of the PAs, SAs, the Shootouts, and any other QA data that is available. It is expected that the recommended Corrective Actions would consist of increased frequency of QA activities such as calibrations, duplicate samples, collocated samples, etc.

19. Reports

Data reports will be prepared by the Data Management Subcommittee. This Subcommittee may produce occasional QA reports in consultation with the Data Management Subcommittee.

5. MEMORANDUM ON FIELD TRIP TO METEOROLOGICAL SITES

Field Visit to Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP) Meteorological Sites

William J. Barrett, Meteorologist
Impact Assessment Section, AWM-AP

Addressees

On June 1,1989, I visited four of the meteorological sites used for the SI/NJ UATAP. I was accompanied by Michael Steineger (NYSDEC-Region 2) on my tour of the three Staten Island sites. The purpose of the visit was to determine the acceptability of meteorological data collected at the three Staten Island meteorological monitoring sites and the New Jersey Department of Environmental Protection trailer, Elizabeth, New Jersey. The sites visited included:

1) Susan Wagner High School, Site #1;
2) Richmond Hill Road Pumping Station, Site #7;
3) Tottenville Fire Station, Site #9;
4) NJDEP trailer, Exit 13, New Jersey Turnpike

Summary of Sites

1. Susan Wagner High School - This site merits final approval. It ranks highest of all the wind sites in terms of exposure, with very few obstructions. The instrument height is approximately 125 feet above the ground. Terrain is hilly with Todt Hill to the east, dropping off to the west.

2. Richmond Hill Road Pumping Station - This site will also supply acceptable data. Although some obstructions are rather close (by textbook siting standards) to the instruments, the prevailing wind of southwest through northwest is unobstructed. The data received should be representative of the sampling location. Instrument height is approximately 40-50 feet above ground level, terrain is generally flat with the Arthur Kill landfill to the southwest and a swamp to the northwest. Michael Steineger said he will raise the tower site at this site by 10 feet in mid July.

3. Tottenville Fire Station - This site is also approved. Several obstructions are within optimum distances defined by traditional siting criteria, but they are generally not in the direction of the prevailing wind. The instrument is mounted in the most exposed area of the roof. The instruments are located approximately 65 feet above ground level, terrain is flat, Raritan Bay is located one half mile from the site.

4. NJDEP Elizabeth Trailer - The tower, by visual inspection, may be inclined at an angle of 5-10 degrees from the vertical. In addition, this site features the highest number of obstructions close to the instruments. Consequently, this is not a site of choice. We will rely more on Newark Airport wind data to

characterize wind patterns typical of this general region. The instruments are situated 25 feet above ground level, terrain is flat.

5. Newark Airport, National Weather Service - I was unable to visit this site, but will make the assumption that the data meets Weather Service Quality Assurance standards, thus, it will be suitable for project needs.

Summary

Of the four sites visited, the three Staten Island sites are recommended for approval to the Modeling and Source Identification Subcommittee. Data from the NJDEP Elizabeth Trailer site will be used only to perform comparisons with data from the approved sites. Unless written comments are received by July 15 which oppose this, these sites will become the approved meteorological sites.

Addressees:

Vito Pagnotti, NYSDEC
Joann Held, NJDEP
Mike Steineger, NYSDEC, Region 2

cc: D. Gower, NYSDEC
M. Kormanik, NYSDEC, Region 2
C. Pietarinen, NJDEP
A. Opperman, NJDEP
C. Weisel, NMDNJ
J. Hawley, NYSDOH

bcc: E. Ferrand, 2AWM
M. Kantz, 2ES-MM
R. Werner, AWM-AP
W. Lamason, MD-15, AQMD, OAQPS
R. Kapichak, 2AWM-AP
R. Kelly, 2AWM-AP
A. Forte, 2AWM-AP
R. Baamonde, 2AWM-AP
M. Gonzales, 2AWM-AP

6. SAMPLING SITE DESCRIPTION REPORTS

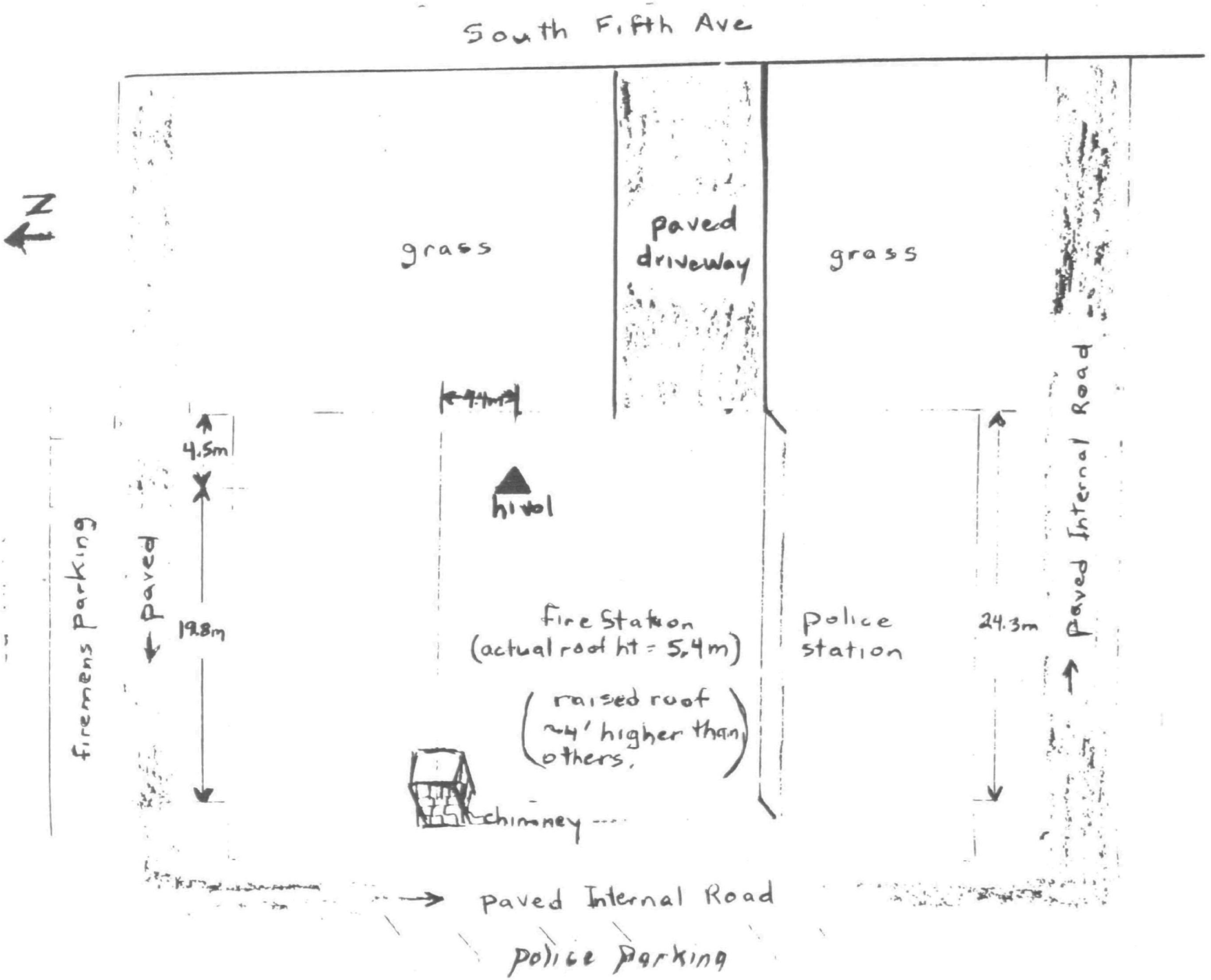
STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - New Jersey
2. City - Highland Park
3. County / Section - Middlesex County /NE NJ
4. Site Code - NJ site E
5. Site Address - Highland Park Fire House
   S. Fifth Ave
6. Names of Nearest Intersecting Streets - Mansfield St.
   and Graham St.
7. Pollutants Monitored at this Site - Metals, Extractable organics, BaP, SO_2 and NO_2
8. Date Inspected - 12/30/88
9. Outstanding Landmarks - On uppermost roof of the Highland Park Firehouse. Chimney is 20 m West of the hivol inlet and may have a slight impact on samples. This site is intended as a background metals site. It is located in a non-industrial, non commercial area of a small suburban town.

NJ Site E Highland Park Firehouse

V4/89 50

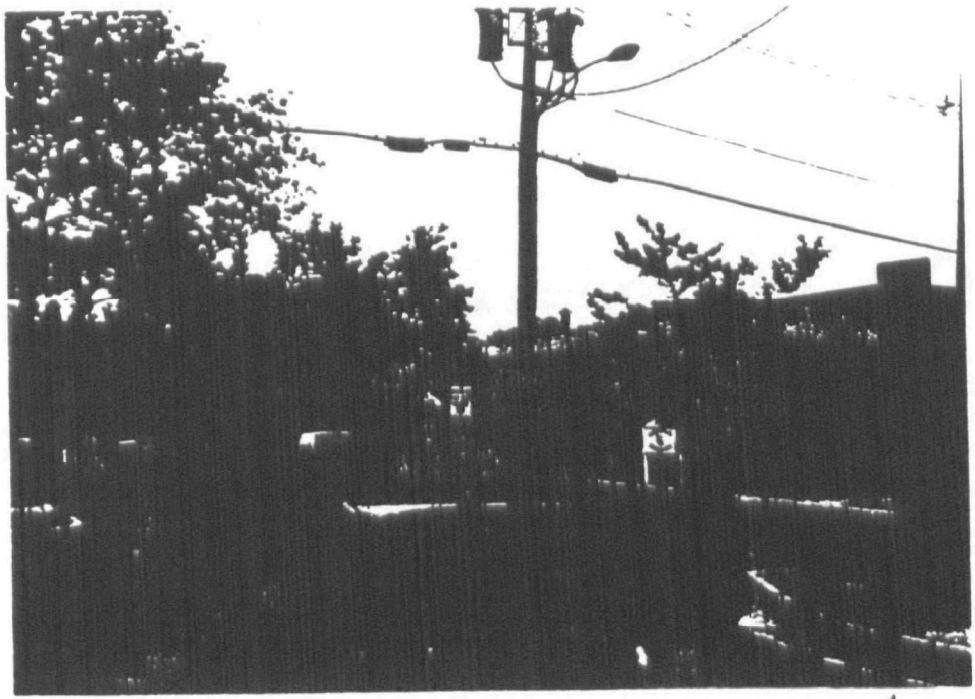


6- 3

HIGHLAND PARK
NEW BRUNSWICK
Johnsons Pond
Donaldson Park
RARITAN
CANAL
Rutgers
Douglass College
Rutgers College of Agriculture
Agriculture Station
Lawrence Brook
Berdines Corners
Hamilton Sch.
High Sch.
St Pauls Sch.
Twp Sch.
Theological Seminary
Rutgers University
Sewage Disposal
Pumphouse
Standpipe
Radio Tower (WCTC)
College Bridge
Whitney Pond
Interchange No. 9
Weston Mill Pond
Mill
Brook
Penn Tracks
Central
Cedar Lane
Sutton's Lane
Boro Bdy
City Bdy
Canal
Delaware and Raritan Canal
Haven Homes
Parkway
Water
UTm
East 548.81
North 4482.88
1970 Revision

New Jersey Site E
Highland Park Firehouse

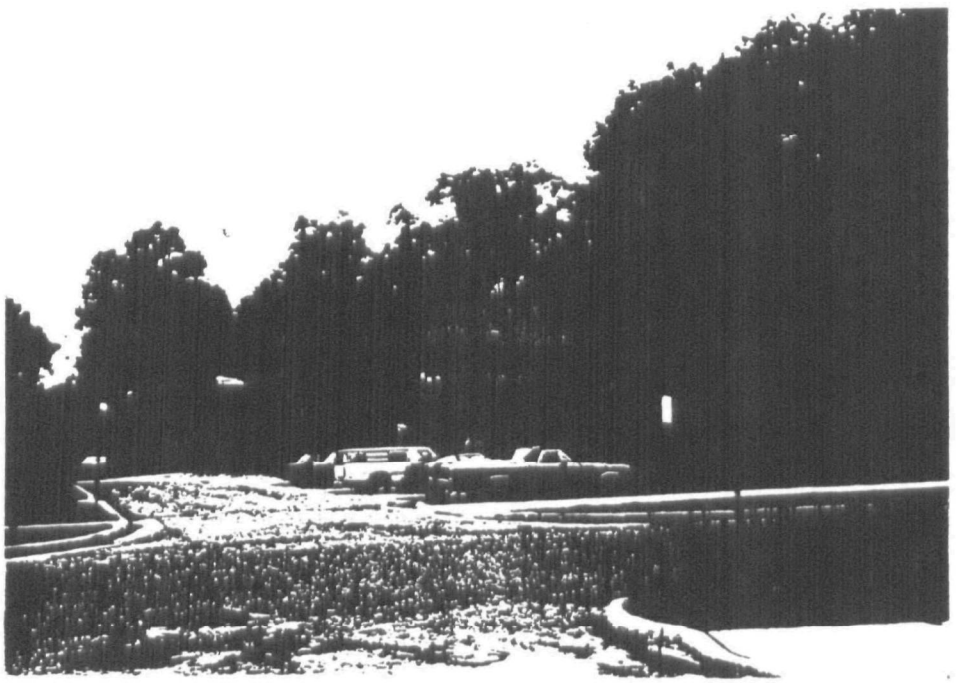
North 7/87



East 7/87

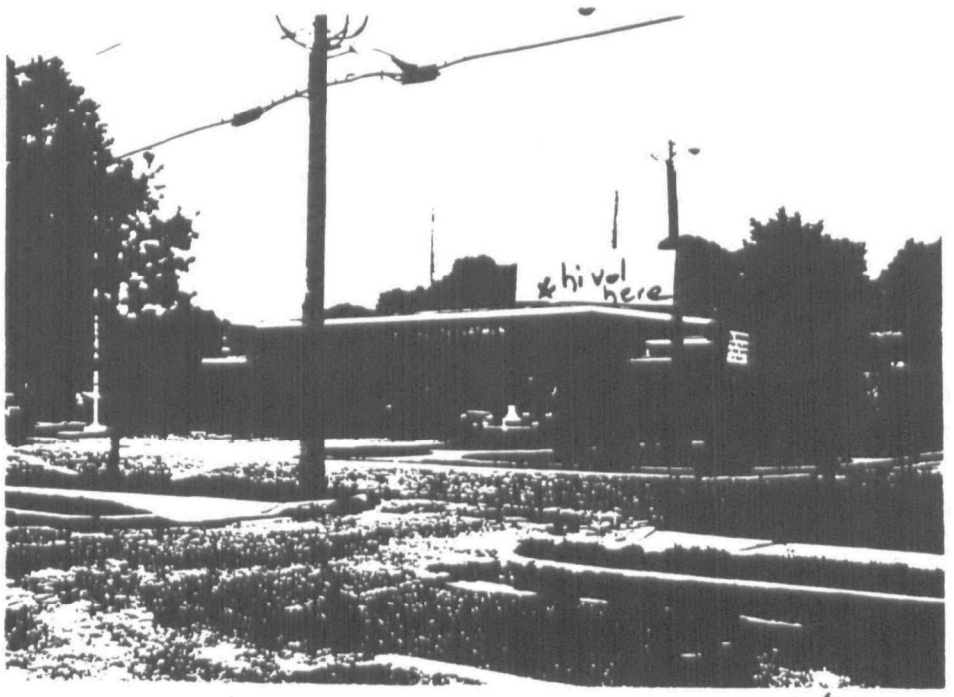
New Jersey Site E
Highland Park Firehouse

South



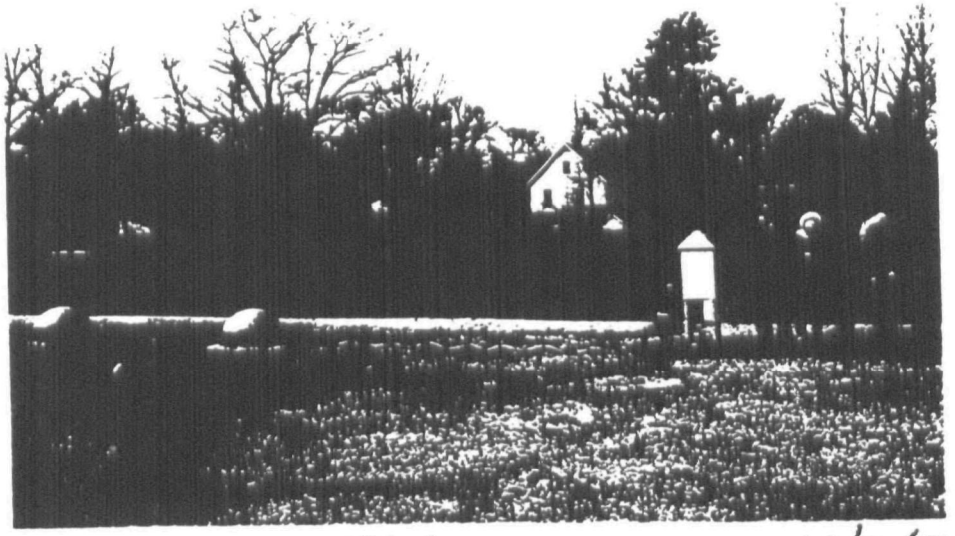
West

NJ Site E
Highland Park Firehouse



4/87

Front view of Site



NW 12/30/88

Hivol on Rooftop

Note: Chimney is not nearby

SITE CLASSIFICATION

1. Dominating Influence of site

   Area _____

   Mobile _____

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	100' All directions
Commercial	1/4 mi, NW → NE
Industrial	
Mobile	
Other (describe) _____	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban residential,

NE

E

SE park, river, college campus

S , park, river, college campus

SW

W

NW

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Names of Roadways (near to site first)

Type (check one)	Fifth Ave	Benner	Mansfield St						
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway									
Local Street or Road	✓	✓	✓						
Traffic Activity (complete as applicable)									
1 *Distance of roadway from air intake (ft)	70'	~250'	~400'						
2 Direction of roadway from air inlet (8 pts)	E	N	S						
3 Composition of roadway	asph	asph	asph						
4 Number of traffic lanes	2	2	2						
5 Average daily traffic (estimate)	<1K	<1K	<1K						
6 Average vehicle speed (estimate, mph)	25	25	25						
7 Traffic is 1 or 2 way (1 or 2)	2	2	2						
8 Number of parking lanes	0								
9 Are parking lanes used for traffic part of day? (yes, no)	NO	NO	NO						
10 Roadway paved (yes, no)	Y	Y	Y						
11 Is dust visibly re-entrained? (yes, no)	N	N	N						
12 Does roadway have curb? (yes, no)	Y	Y	Y						
13 Does dust collect near edges? (yes, no)	N	N	N						

*Identify property if more than one

Topography

1 The general characteristics of the terrain over a 2 mile radius from the site are (check one):

✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Raritan River			

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site
Chimney		WNW	20 m

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service Newark

   ____ Airport Weather Service

   ____ Site Weather Station

   ✓ Other (specify)

   ____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates Zone 548.81 East 4482.88 North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP (Metals)	Environ Chem	Portable GC
1. Location (top of building, ground level, other specify)				top		
2. If on building, give height (M)				5.4		
width (M)				19.7		
depth (M)				24.3		
3. Horizontal distance from supporting structure (M)				N/A		
4. Vertical distance above supporting structure (M)				N/A	N/A	
5. Height of probe above ground (M)				6.7		
6. Distance from trees (M)				720		
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	N/A			21.7		
8. Horizontal distance from nearest parking lot (M)	N/A					
9. Horizontal distance from walls, parapets, penthouses, etc. (M)		N/A	N/A	N/A		
10. Distance from obstacles, such as buildings			N/A	N/A		
11. Distance from furnace or incineration flues (M)		N/A	N/A	29.3 blue		
12. Unrestricted air flow				Y		
13. Located in paved area or vegetative ground cover				Y		
14. Roof Composition				tar & stone		

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Extractable organics BaP + NO_3 + SO_3

Sampler Type	VOCs: Tenax	VOCs: Canister	VOCs: Portable GC	Carbonyls: NDPH	Metals: Hi-vol
Instrument Manufacturer					GMW
Date Sampling Began					11/88
Sampling Frequency					1/6 days

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection NJDEP field personnel

2. Individual's name _____

3. Phone Number _____

4. Agency analyzing samples NJIT

5. Individual's Name Dr Greenburg (extractable org. + BaP)
   Dr Bozelli (metals) Dr. Kebbecus (SO_3^- + NO_3)

6. Phone number _____

7. Reports of data are made to (Agency Name) New Jersey Department of Environmental Protection → United States Environmental Protection Agency

8. Individual's Name Charles Pietarinen (NJDEP); Rudy Kapichak (USEPA)

9. Phone number 609-633-7648 ; 212-264-2517

SITE EVALUATION

Site Identification number NJ Site E

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 12/30/887

Date of report 1/4/88

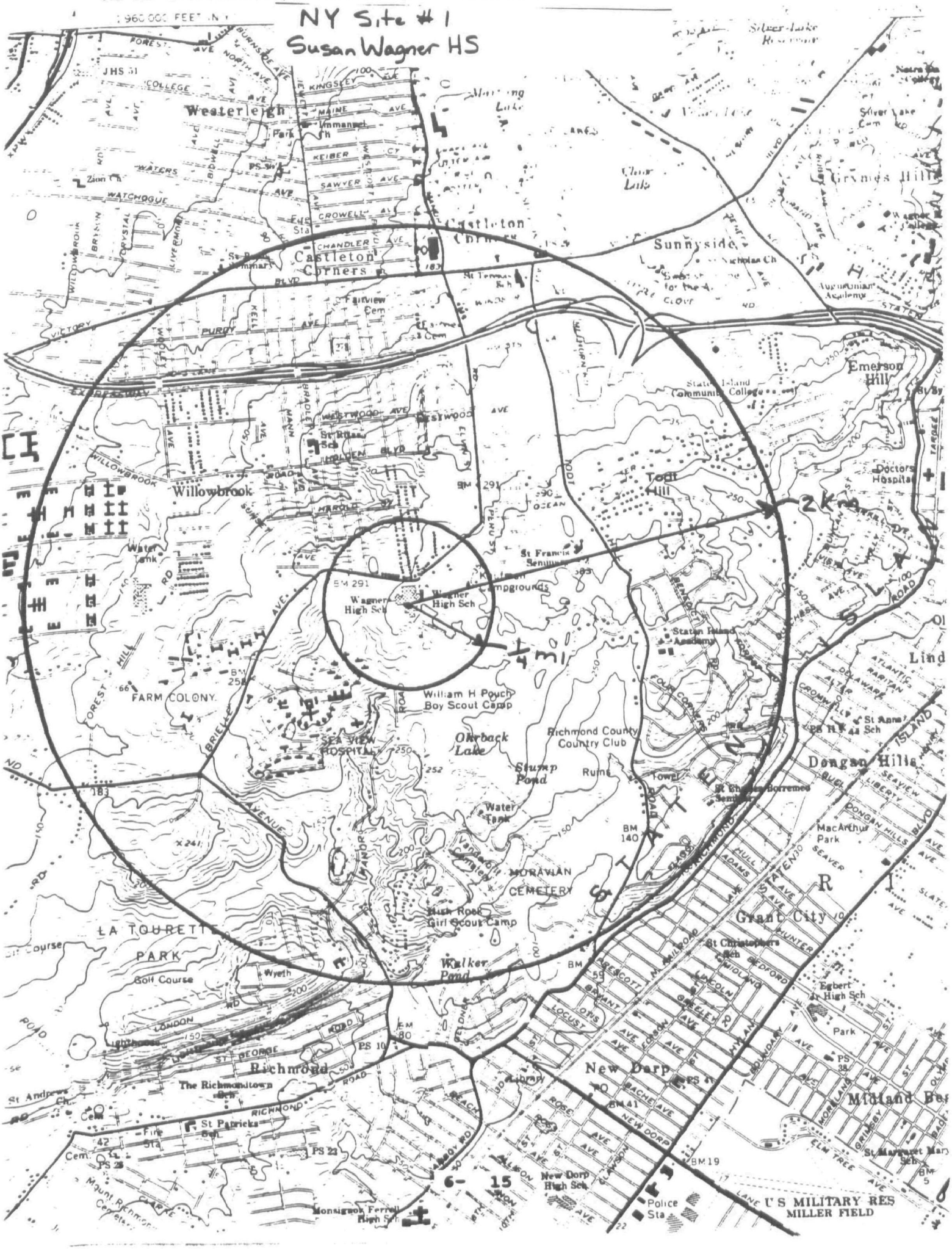
Signatures of Evaluators

Comments Chimney located 20 m west of the hi vol may have a slight impact on the samples. Otherwise this site meets the siting criteria agreed upon by EPA and should provide representative data for a non-industrial suburban community.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

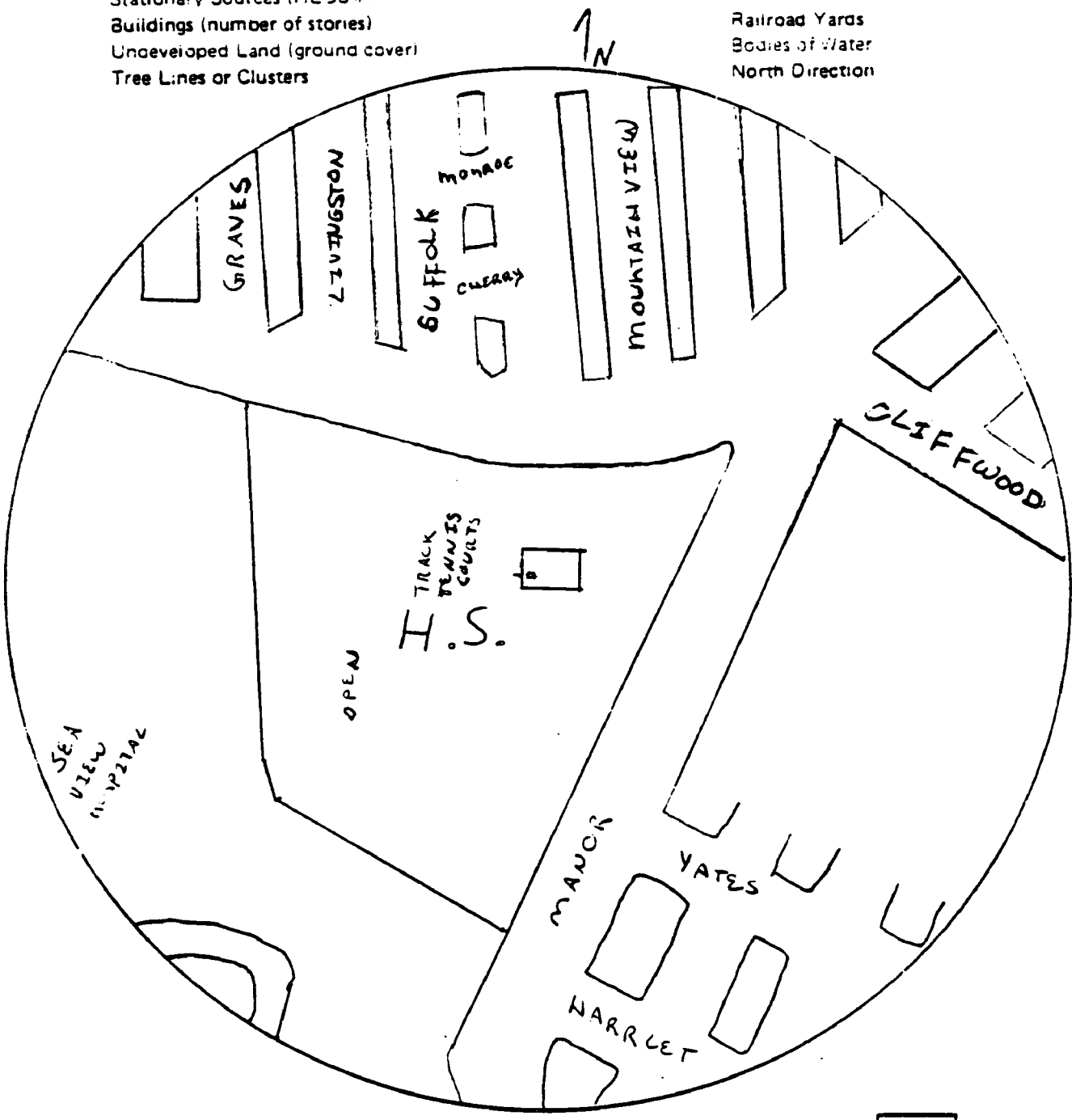
1. State - NEW YORK
2. City - STATEN ISLAND
3. County / Section - RICHMOND COUNTY, CENTRAL STATEN ISLAND
4. Site Code - New York SITE # 1
5. Site Address - SUSAN WAGNER HIGH SCHOOL
6. Names of Nearest Intersecting Streets - Brielle and Manor Streets
7. Pollutants Monitored at this Site - VOC's using Tenax, Envirochem, and portable GC. Metals with high-vol.
8. Date Inspected - 10/20/87
9. Outstanding Landmarks - Located on Roof of Susan Wagner High School.


NY Site #1
Susan Wagner HS
Westerleigh
Castleton Corners
Willowbrook
Todt Hill
Emerson Hill
Sunnyside
Wagner High Sch
St Francis Seminary
Campgrounds
FARM COLONY
William H Pouch Boy Scout Camp
SEA VIEW HOSPITAL
Richmond County Country Club
Oakback Lake
Swamp Pond
Water Tank
MORAVIAN CEMETERY
High Rock Girl Scout Camp
Walker Pond
LA TOURETTE PARK
Golf Course
Richmond
The Richmondtown Sch
St Patricks Cath
Mount Richmond Cemetery
Monsignor Ferrell High Sch
New Dorp
New Dorp High Sch
Grant City
Midland Beach
Dongan Hills
MacArthur Park
Egbert Jr High Sch
St Christophers Sch
Police Sta
U S MILITARY RES
MILLER FIELD
1/4 mi
2 km
6- 15

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable. [ ]

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS #)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters

Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction



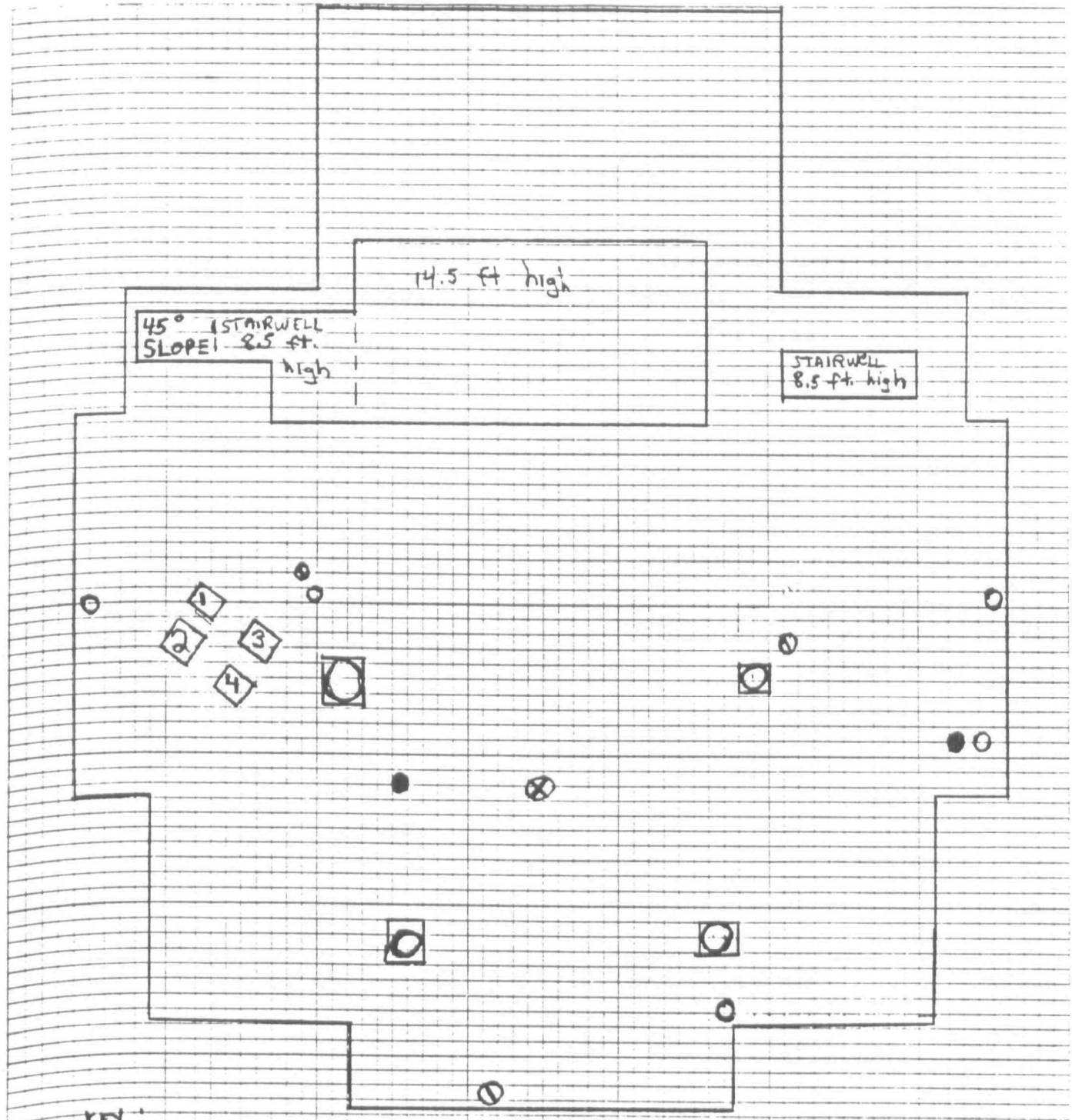
16. Attach separate sheet of labeled photographs G [ ]

17. UTM Coordinates, Zone 18 East 573916 North 4494200

or latitude and longitude 40° 35' 74° 07' G [ ]

R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
[ ] – Blocks are reserved for site evaluation only

SUSAN WAGNER H.S. ROOF



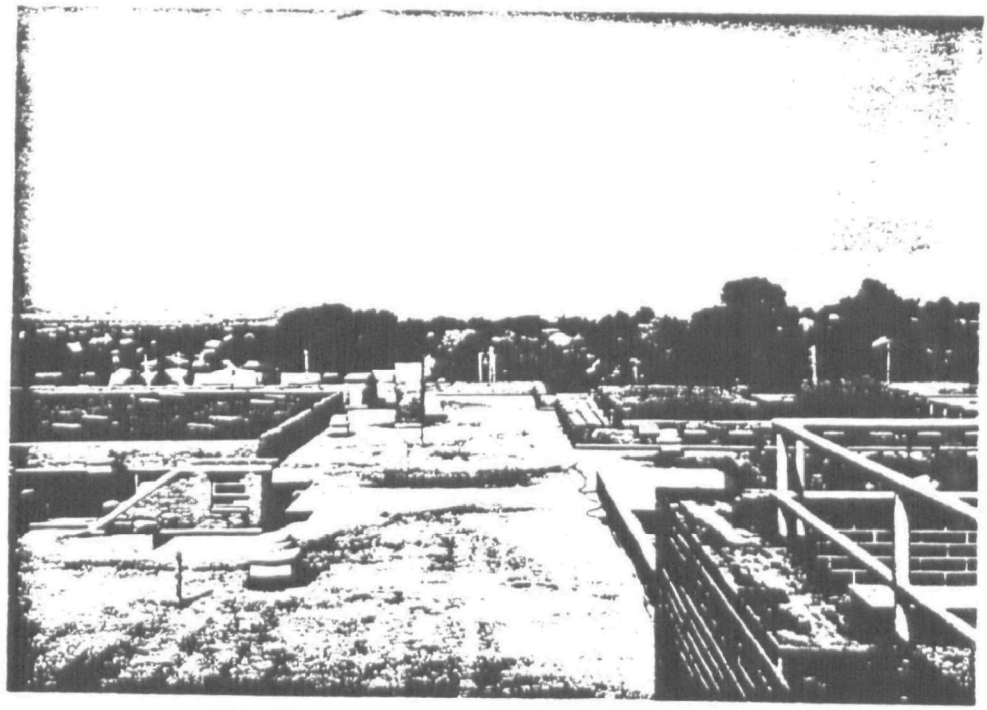
KEY:

- AIR HANDLER
- SEWER VENT
- STAINLESS STEEL LAB STORAGE CLOSET VENT
- GLASS LAB SINK VENT
- BATHROOM VENT

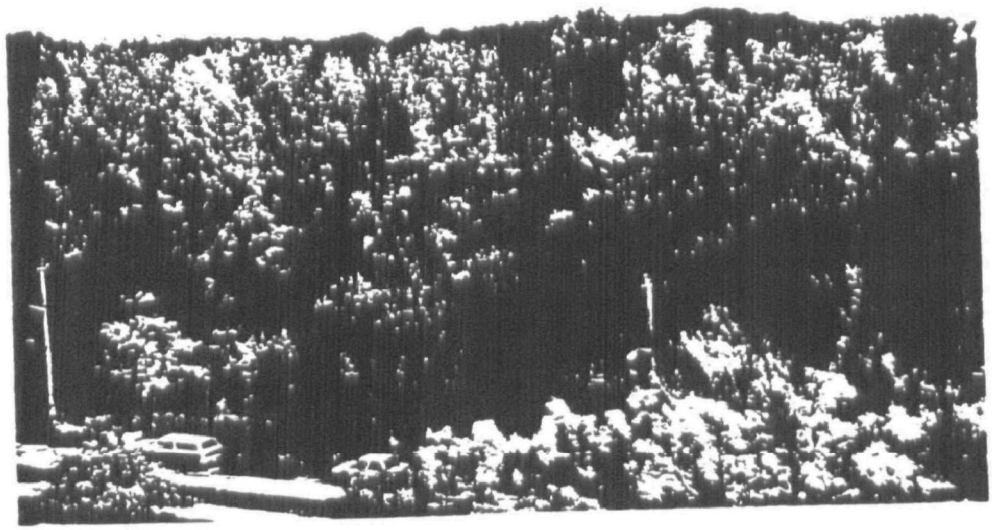
1 - NYDEC ENVIROCHEM
2 NYDOH POROPAK
3 NYDEC TENAX
4 NYDEC HI-VOL

1 inch = 6 meters

SUSAN WAGNER H.S.
STATEN ISLAND, N.Y



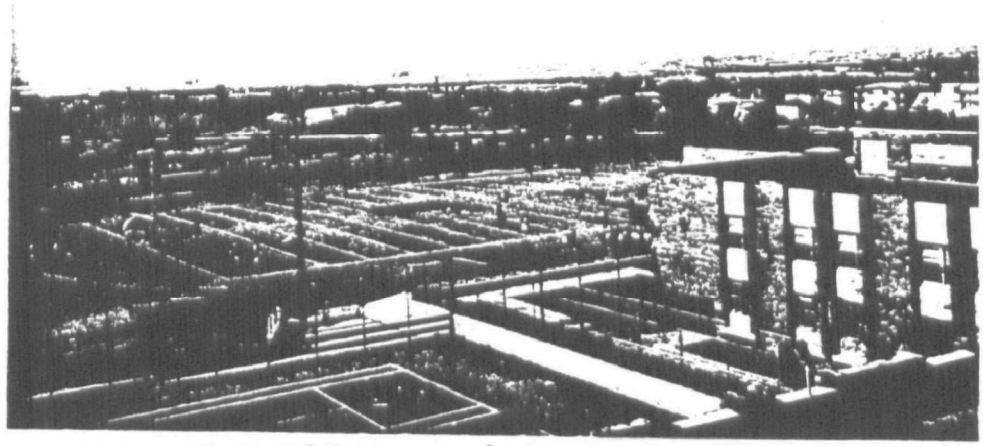
NORTH



EAST

SUSAN WAGNER H.S.
S.I. N.Y.

NORTHWEST

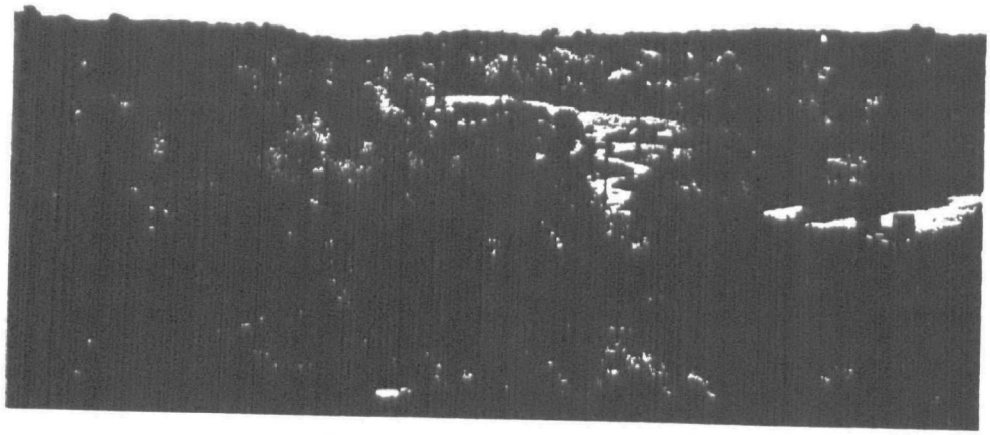


NOTE TANK FARMS IN BACKGROUND

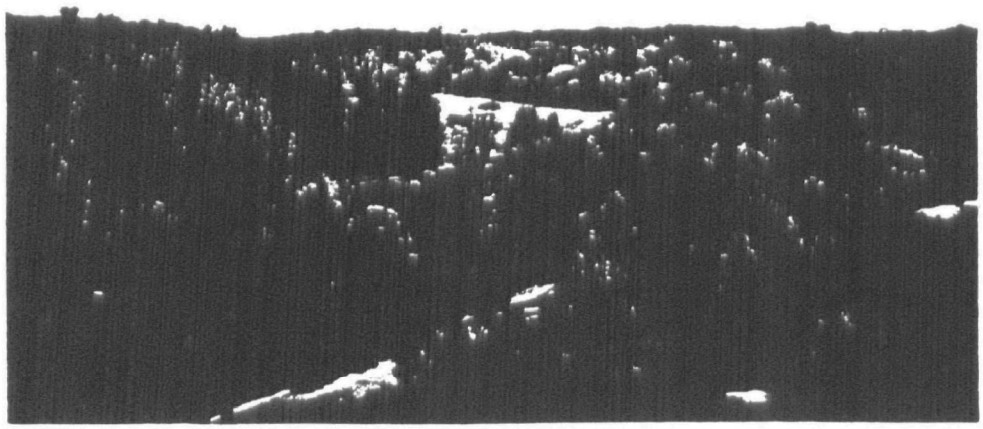
WEST

NOTE TANK FARMS.

SUSAN WAGNER H.S.
STATEN ISLAND, N.Y.C.

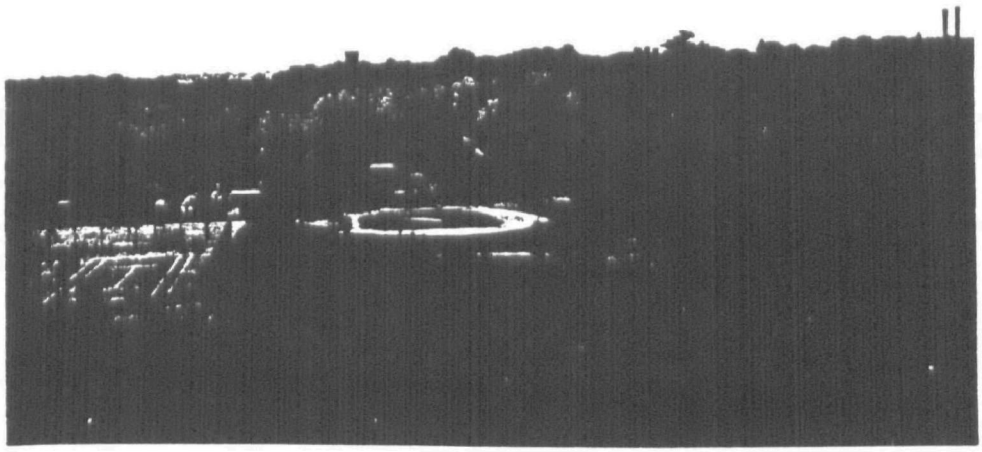


SOUTH EAST



SOUTH

SUSAN WAGNER H.S.
STATEN ISLAND, N.Y.C.



SOUTHWEST

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   ✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
ONE OF THE Highest points ON THE ISLAND			

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site

SITE CLASSIFICATION

1. Dominating Influence of site

   Area VOC'S FROM TANK FARMS NW, AUTO TRAFFIC FROM METRO HIGHWAYS,

   Mobile _____

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	NORTH, SOUTHEAST
Commercial	
Industrial	
Mobile	
Other (describe) PLAYING FIELDS / FOREST	EAST, SOUTH, SOUTHWEST, NW

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N RESIDENTIAL COMMERCIAL

NE RESIDENTIAL, COMMERCIAL

E RESIDENTIAL

SE RESIDENTIAL, COUNTRY CLUB

S RESIDENTIAL, PARK

SW SEAVIEW HOSPITAL, PARK

W RESIDENTIAL, TANK FARMS (INDUSTRIAL)

NW RESIDENTIAL, TANK FARMS (INDUSTRIAL)

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Names of Roadways (nearest to site first)

Type (check one)	MANOR Rd.	Rockland Ave							
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway									
Local Street or Road	✓								
Traffic Activity: (complete as applicable)									
1. *Distance of roadway from air intake(ft)	N200								
2. Direction of roadway from air inlet (8 pts)	EAST								
3. Composition of roadway	ASPH								
4. Number of traffic lanes	2								
5. Average daily traffic (estimate)	4K	11K							
6. Average vehicle speed (estimate, mph)	30								
7. Traffic is 1 or 2 way (1 or 2)	2								
8. Number of parking lanes	0								
9. Are parking lanes used for traffic part of day? (yes,no)	N/A								
10. Roadway paved (yes, no)	YES								
11. Is dust visibly re-entrained? (yes, no)	NO								
12. Does roadway have curb? (yes, no)	YES + NO								
13. Does dust collect near edges? (yes, no)	YES								

*Identify probe if more than one.

Meteorology and Climatology

1. Source of representative meteorological data (check one):
   - ✓ National Weather Service, NEWARK AIRPORT
   - ____ Airport Weather Service
   - ____ Site Weather Station
   - ✓ Other (specify) WIND STATION - 12187
   - ____ Not available
2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.
3. UTM Coordinates, Zone 18 East 568000 North 4505000
   or Latitude and Longitude ____ ____
4. Location of representative meteorological station from monitoring site.
   Distance 12 km. Direction 330°

Probe Siting

ANALYZER TYPE:

Information Topic	Tenax	Canister	DNPH	TSP	Enviro Chem	Portable GC
1. Location (top of building, ground level, other specify)	TOP			TOP	TOP	TOP
2. If on building, give height (M)	18.8			18.8	18.8	18.8
see MAP width (M)						
see MAP depth (M)						
3. Horizontal distance from supporting structure (M)	N/A			N/A	N/A	N/A
4. Vertical distance above supporting structure (M)	2			1.2	1.2	1
5. Height of probe above ground (M)	20.0			20.0	200	21
6. Distance from trees (M)	720			720	720	720
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	~80			~80	~80	~80
8. Horizontal distance from nearest parking lot (M)	8			8	8	8
9. Horizontal distance from walls, parapets, penthouses, etc. (M)	6m	N/A	N/A	6m	6m	16
10. Distance from obstacles, such as buildings	N/A		N/A	N/A	N/A	N/A
11. Distance from furnace or incineration flues (M)	100m	N/A	N/A	100m	100m	100m
12. Unrestricted air flow	Yes			Yes	Yes	Yes
13. Located in paved area or vegetative ground cover	Yes			Yes	Yes	Yes
14. Roof Composition 1/4" layer of gravel on hard undersurface						

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs: Tenax	VOCs: Canister	VOCs: Portable GC	Carbonyls: NDPH	Metals: Hi-vol	Enviro-Chem
Instrument Manufacturer	NYDEC		XONTECH SCENTOR		NYDOH	NYDEC
Date Sampling Began	10/87		7/87		4/87	7/87
Sampling Frequency	1/6		CONT		1/6	1/6

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYDEC)

2. Individual's name MIKE STEINEGER

3. Phone Number (718)-482-4944

4. Agency analyzing samples NYDEC, NEW YORK DEPARTMENT OF HEALTH (NYDOH), UNIVERSITY OF MEDICINE AND DENTISTRY OF NEW JERSEY (UMDNJ)

5. Individual's Name DON GOWER(NYDEC), Anders Carlson (NYDOH), LINDA Bentivoglio (UMDNJ)

6. Phone number 518-457-3676 (NYDEC), 518-474-4987 (NYDOH), 201-463-4536 (UMDNJ)

7. Reports of data are made to (Agency Name) NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION → UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

8. Individual's Name Don Gower (NYDEC), Rudy Kapichak (USEPA)

9. Phone number 518-457-3676 (NYDEC), 212-264-2517 (USEPA)

SITE EVALUATION

Site Identification number NEW YORK SITE # 1

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 10/20/87

Date of report 2/26/88

Signatures of Evaluators

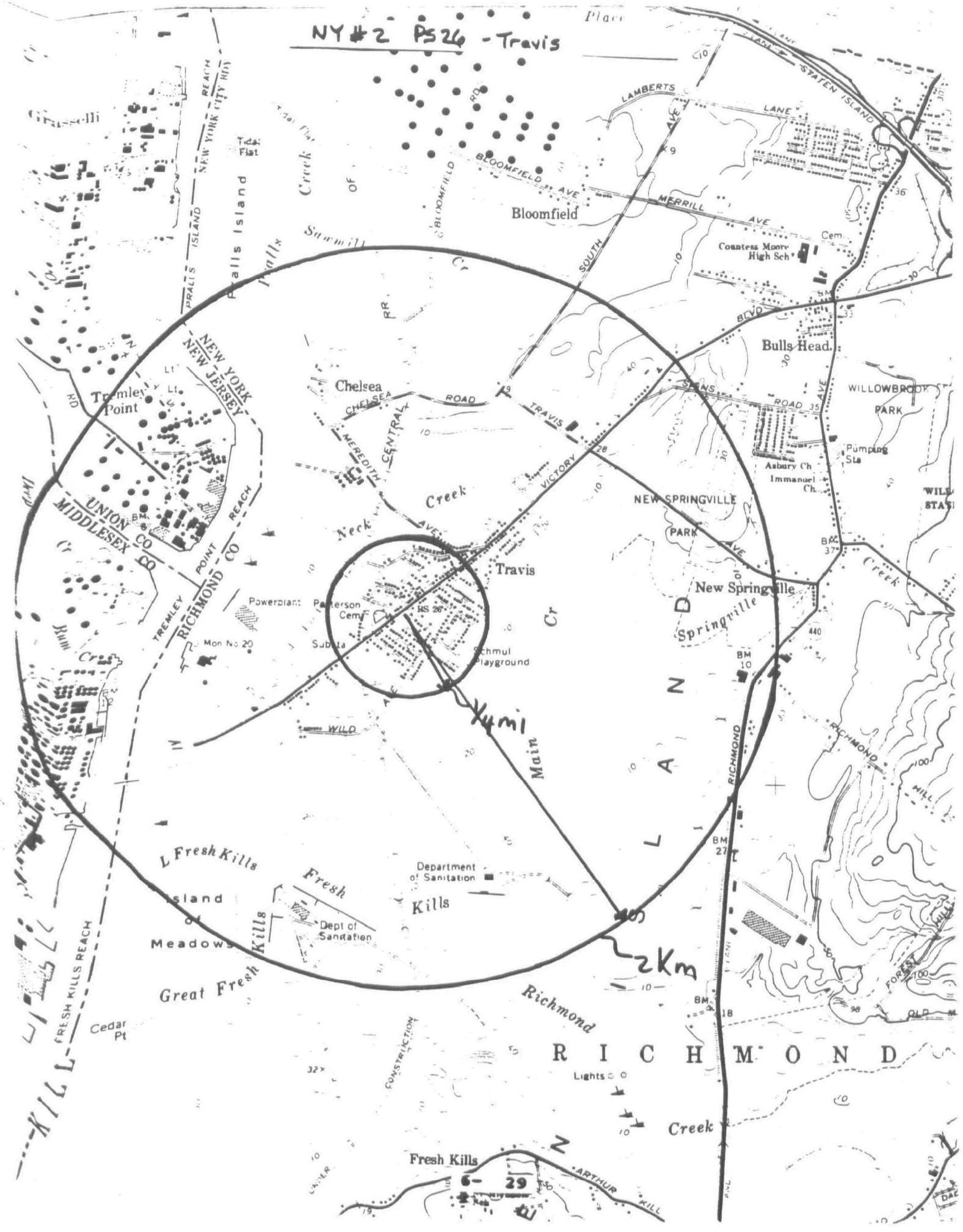
Avraham Teitz

Comments

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

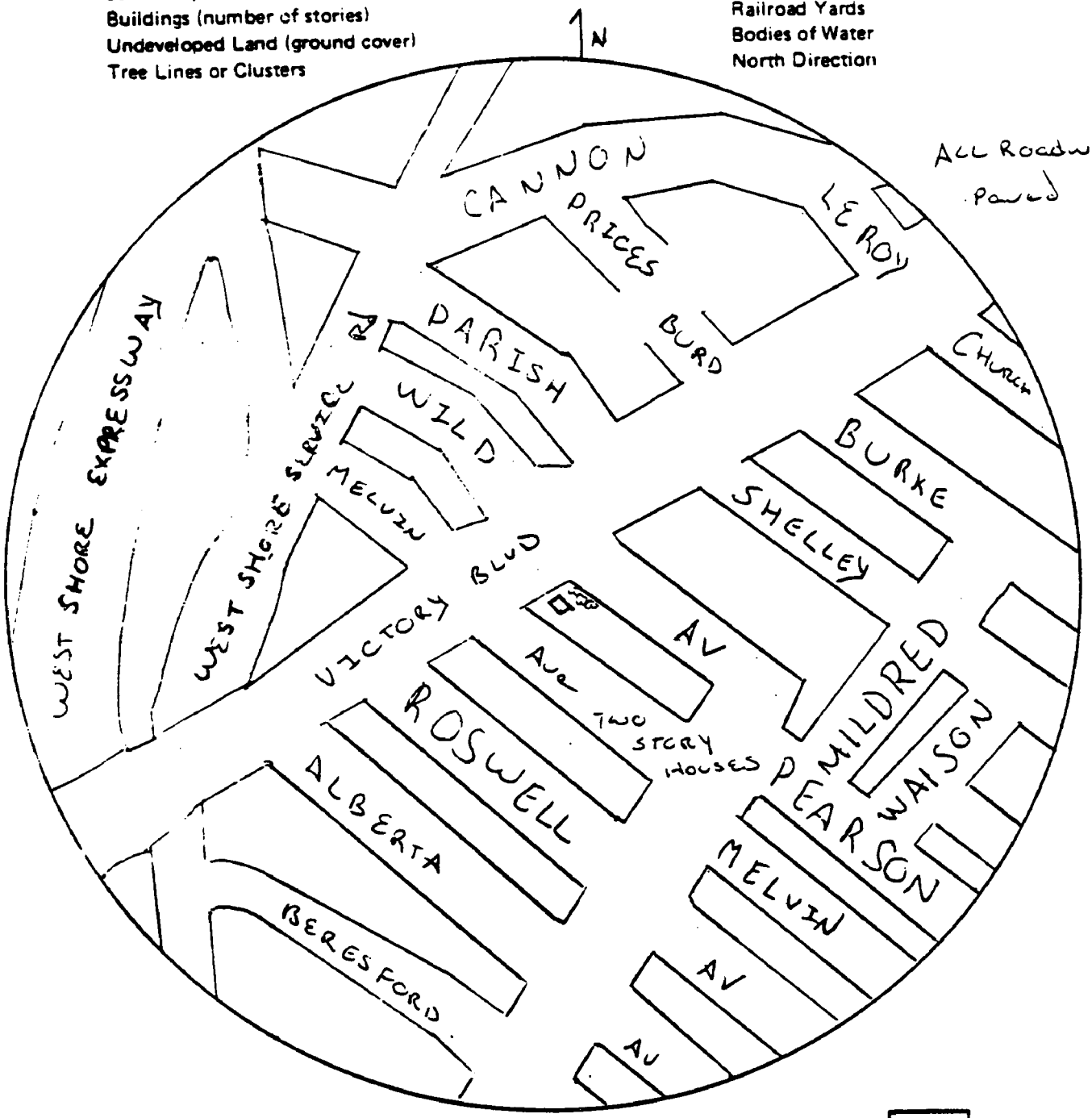
1. State - NEW YORK
2. City - STATEN ISLAND
3. County / Section - RICHMOND COUNTY, TRAVIS SECTION
4. Site Code - NEW YORK SITE #2
5. Site Address - PS 26
   408 VICTORY BLVD.
6. Names of Nearest Intersecting Streets - MELVIN AND WILD STREETS
7. Pollutants Monitored at this Site - VOC's using Envirochem and POROPAK SAMPLERS. METALS USING A HIGH-VOL SAMPLER.
8. Date Inspected - 10/21/88
9. Outstanding Landmarks - LOCATED ON ROOF OF PS 26


NY #2 PS26 - Travis
Bloomfield
Bulls Head
Chelsea
Tremley Point
Travis
New Springville
Fresh Kills
Great Fresh Kills
Island of Meadows
Richmond
RICHMOND
Creek
Main
Neck Creek
Springville
Cedar Pt
Arthur Kill
Department of Sanitation
Dept of Sanitation
Powerplant
Patterson Cemy
Schmul Playground
Countess Moore High Sch
Pumping Sta
Asbury Ch
Immanuel Ch
WILLOWBROOK PARK
NEW SPRINGVILLE PARK
Lights
Mon No 20
Sub 18
4mi
2Km
6-29

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable.

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS #)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters

Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction



16. Attach separate sheet of labeled photographs G ☐

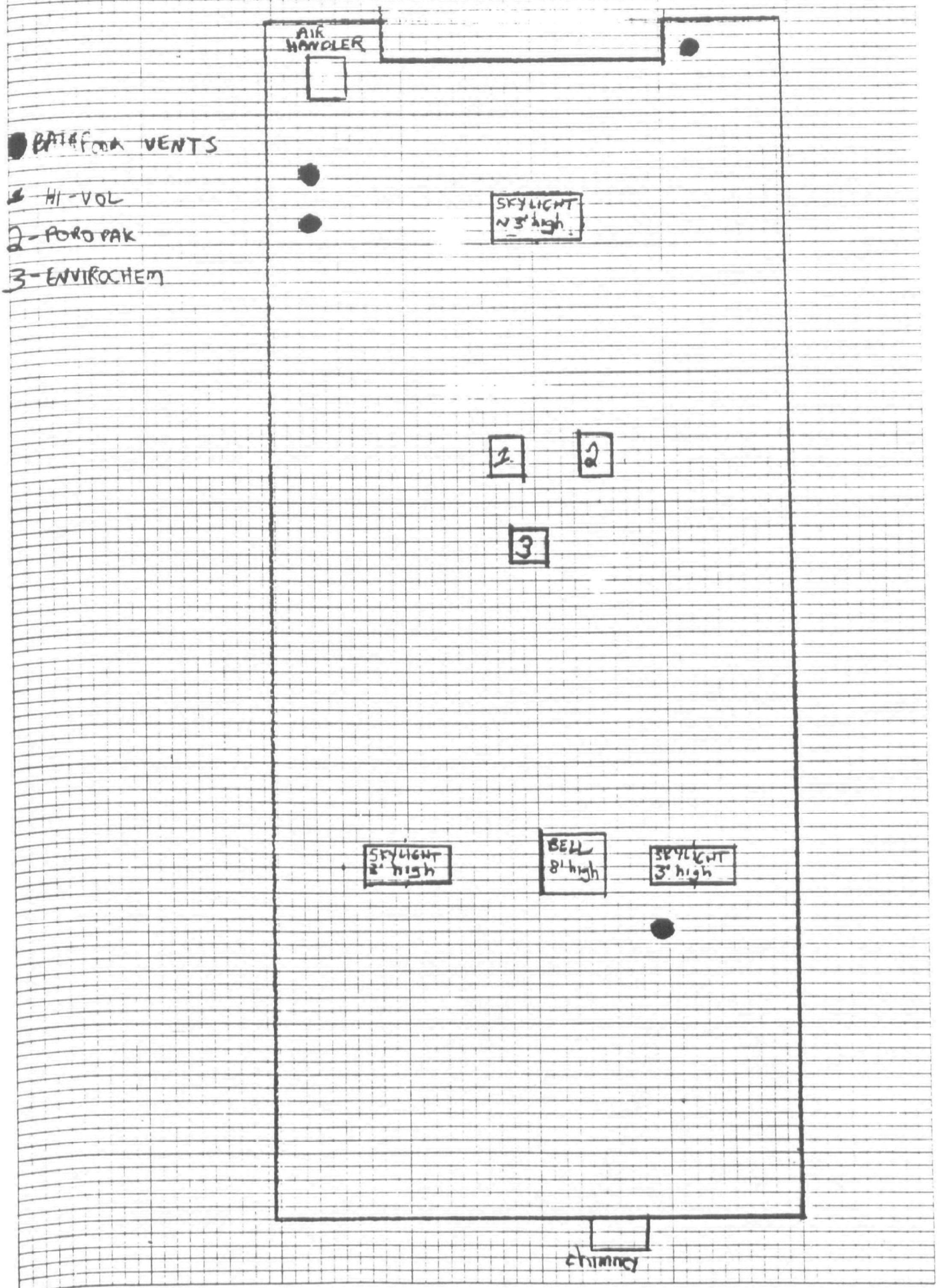
17. UTM Coordinates, Zone 18 East 568470 North 4493430

or latitude and longitude 40° 35' 74° 11' G ☐

R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
☐ – Blocks are reserved for site evaluation only

P.S. 96 - VERNON BLVD.

N

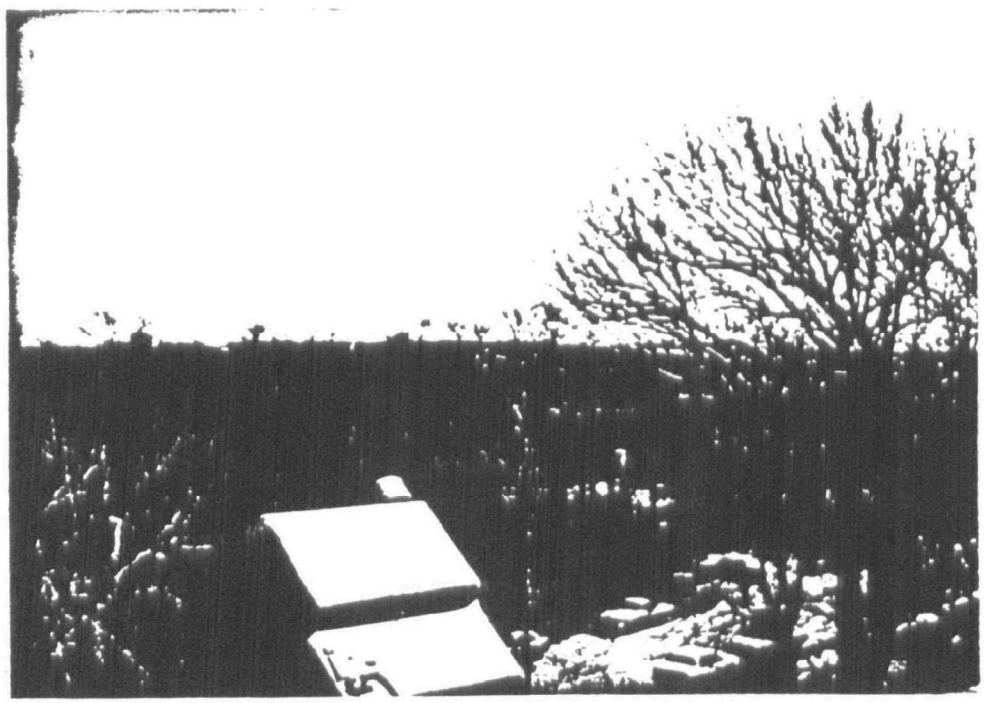


SCALE: 1 inch = 4 meters

PARAPET HT = 2.5 FT

P S - 26
4108 Victory Blvd
Staten Island, NY

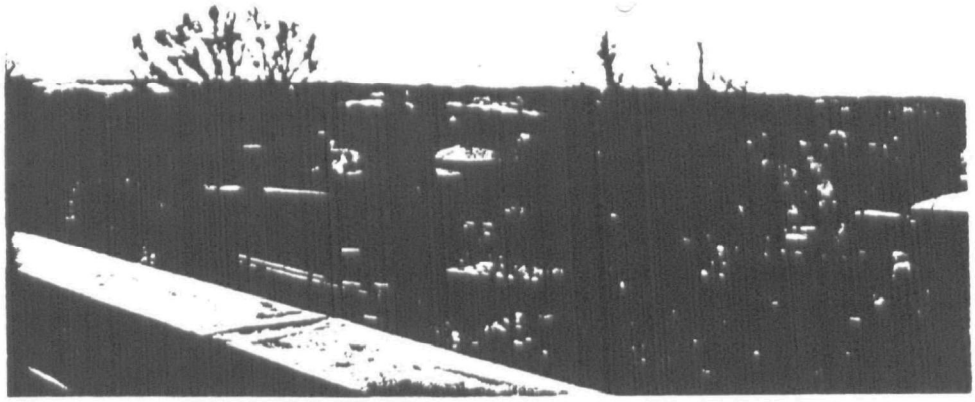
North



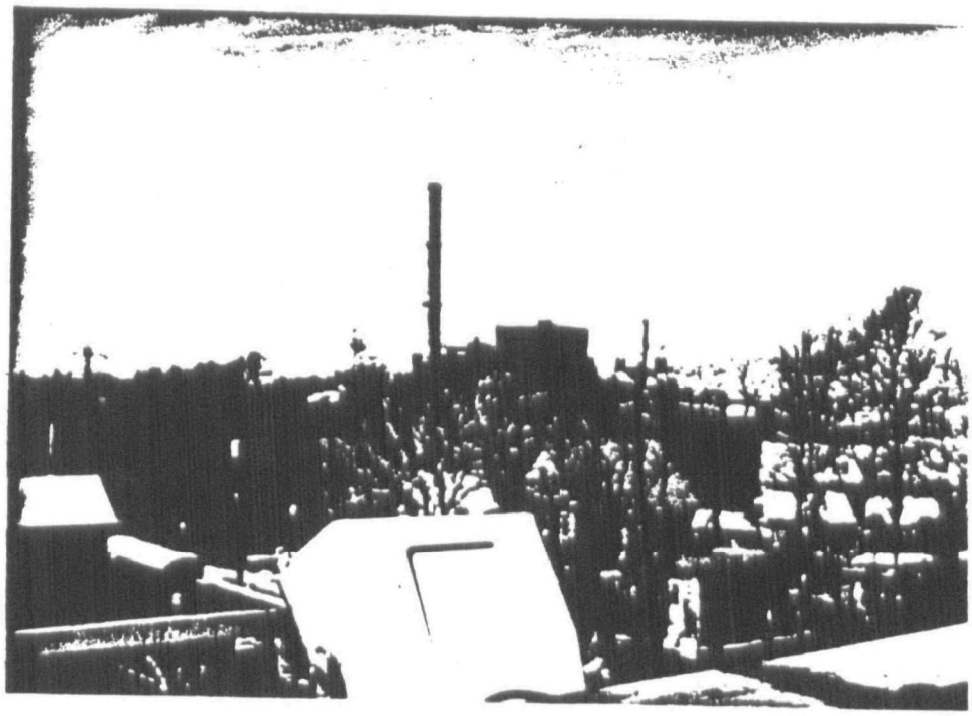
East

PS-26

PS26
4108 Victory Blvd
Staten Island, NY

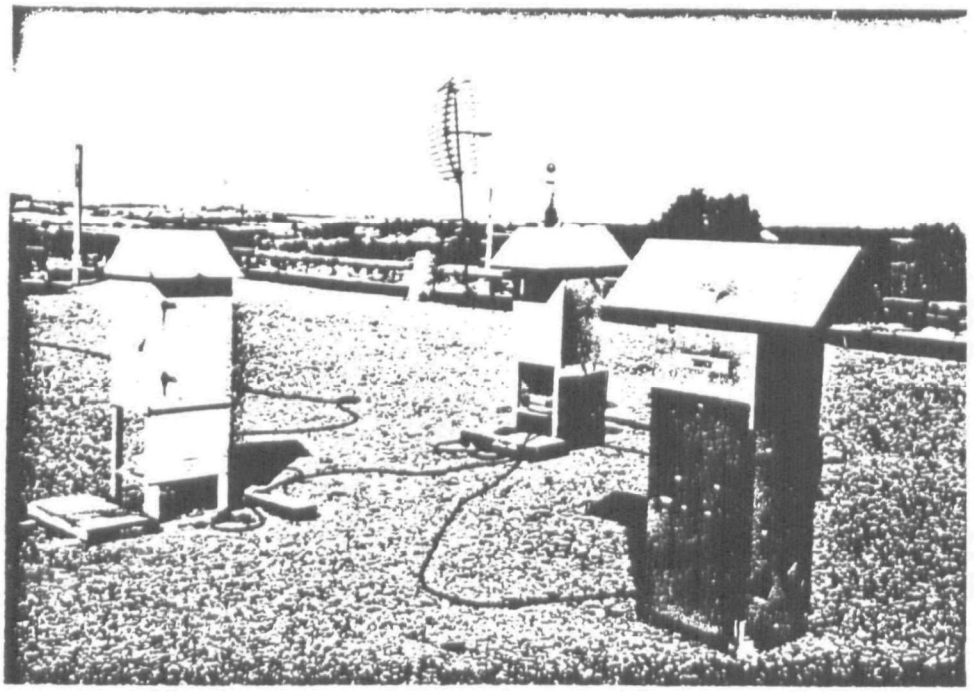


South



West

PS 26
MONITOR
SET UP



Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   ✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
FRESH KILLS CREEK		E-SE-S	< 2 km
ARTHUR KILL		WEST	< 2 km

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site
FRESH KILLS LANDFILL		S + SW	3/4 mile

SITE CLASSIFICATION

1. Dominating Influence of site

Area Fresh Kills Landfill

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	N, E, S, NW
Commercial	
Industrial	West
Mobile	
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N West Shore Expressway

NE Residential

E Residential, Wildlife Refuge

SE Residential, Wildlife Refuge, Fresh Kills Creek

S West Shore Expressway, Fresh Kills Creek, Sewage Disposal

SW Fresh Kills Land Fill

W Con. Edison (Industrial), Arthur Kill Commercial

NW Arthur Kill

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Type (check one)	Names of Roadways (nearest to site first): VICTORY BLVD	MELVIN AVE.	WILD AVE	WEST SHORE EXPWY					
Arterial Highway									
Expressway				✓					
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway									
Local Street or Road	✓	✓	✓						
Traffic Activity: (complete as applicable)									
1. *Distance of roadway from air intake(ft)	91	112	113	400					
2. Direction of roadway from air inlet (8 pts)	NW	SW	NE						
3. Composition of roadway	asph	asph	asph	asph					
4. Number of traffic lanes	2	2	2	3					
5. Average daily traffic (estimate)	5K	1K	<1K	94K					
6. Average vehicle speed (estimate, mph)	35	25	<25	55					
7. Traffic is 1 or 2 way (1 or 2)	2	2	2	2					
8. Number of parking lanes	0	2	2	0					
9. Are parking lanes used for traffic part of day? (yes,no)	N/A	NO	NO	NO					
10. Roadway paved (yes, no)	Yes	Yes	Yes	Yes					
11. Is dust visibly re-entrained? (yes, no)	NO	NO	NO	NO					
12. Does roadway have curb? (yes, no)	Yes	Yes	Yes	NO					
13 Does dust collect near edges? (yes, no)	Yes	Yes	Yes	NO					

*Identify probe, if more than one.

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service NEWARK AIRPORT

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Paraflex	Canister	DNPH	TSP	Enviro chem	Portable GC
1. Location (top of building, ground level, other specify)	TOP			TOP	TOP	
2. If on building, give height (M)	12m			12m	12m	
see MAP width (M)						
depth (M)						
3. Horizontal distance from supporting structure (M)	N/A			N/A	N/A	
4. Vertical distance above supporting structure (M)	N/A			N/A	N/A	
5. Height of probe above ground (M)	13.2m			13.2m	13.2m	
6. Distance from trees (M)	>20m			>20m	>20m	
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	28.5			26.5	27	
8. Horizontal distance from nearest parking lot (M)	~25			~25	~25	
9. Horizontal distance from walls, parapets, penthouses, etc. (M)		N/A	N/A			
10. Distance from obstacles, such as buildings	N/A		N/A	N/A	N/A	
11. Distance from furnace or incineration flues (M)		N/A	N/A	N/A		
12. Unrestricted air flow	YES			YES	YES	
13. Located in paved area or vegetative ground cover	YES			YES	YES	
14. Roof Composition - GRAVEL W/ TAR						

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	Poropak	VOCs Canister	VOCs Portable GC	Carbonyls NDPH	Metals Hi-vol	ENVIRO-CHEM
Instrument Manufacturer					GMW	NYDEC, [illegible]
Date Sampling Began					4/87	7/87
Sampling Frequency					1/6	1/6

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection NEW YORK DEPT. OF ENVIRONMENTAL CONSERVATION (NYDEC

2. Individual's name Don Gower

3. Phone Number (518) 457-3676

4. Agency analyzing samples METALS HI-VOL - NYS DEPT OF HEALTH (NYSDOH), ENVIROCHEM - NYDEC, POROPAC

5. Individual's Name DON GOWER (NYDEC), Anders Carlson (NYDOH)

6. Phone number 518-457-3676 (NYDEC) 518-474-4986 (NYDOH)

7. Reports of data are made to (Agency Name) NEW YORK DEPT. OF ENVIRONMENTAL CONSERVATION → UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

8. Individual's Name DON GOWER (NYDEC), RUDY KAPICHAK (USEPA)

9. Phone number 518-457-3676 212-264-2517

SITE EVALUATION

Site Identification number NEW YORK SITE #2

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 10/22/87

Date of report 2/25/88

Signatures of Evaluators

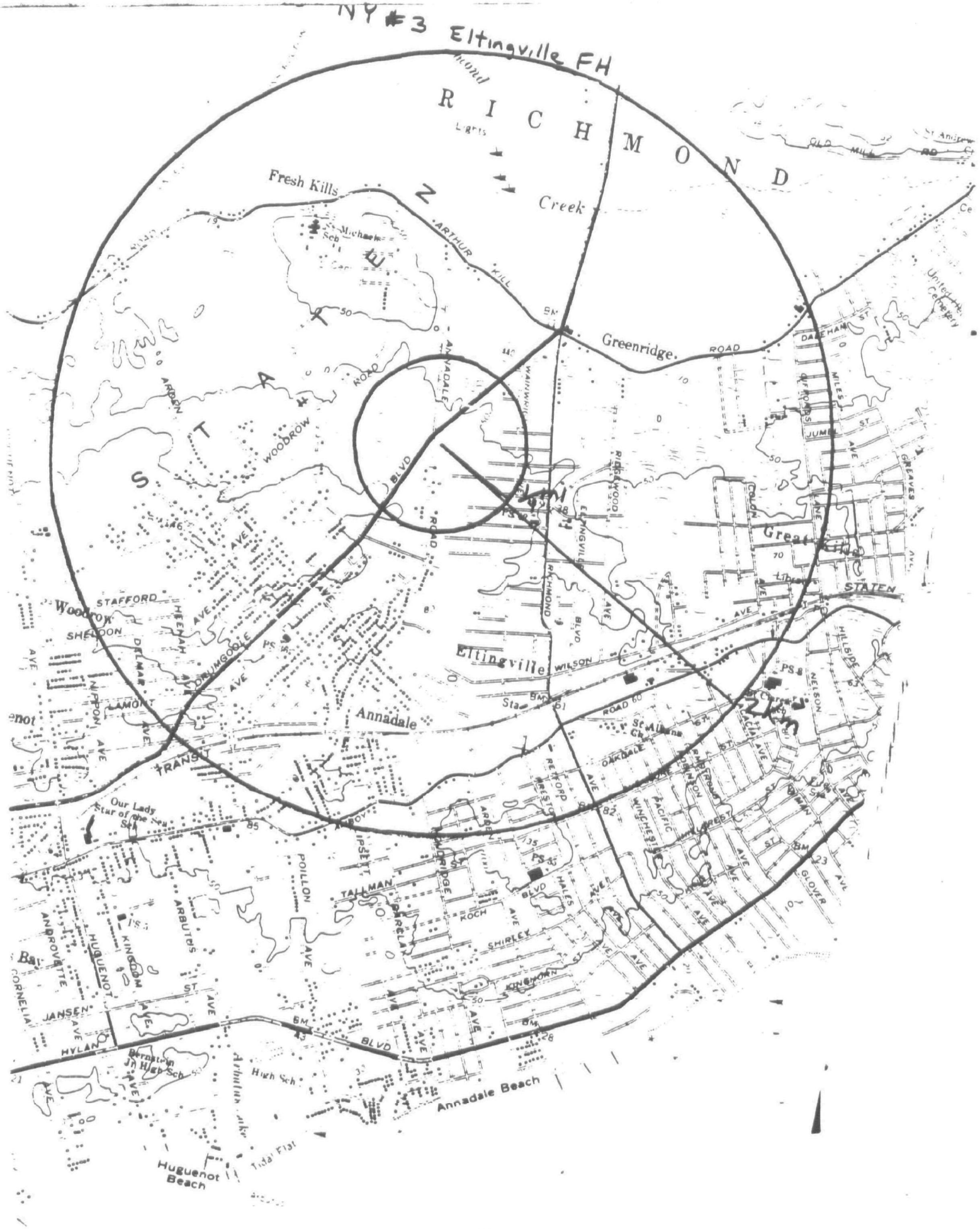
Avraham Teitz

Comments This site reflects the status at the time of the report. Subsequent changes at the site; i.e. Auto-GC, TENAX, WEATHER STATION, AND CANISTERS will be incorporated into this report after installation.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

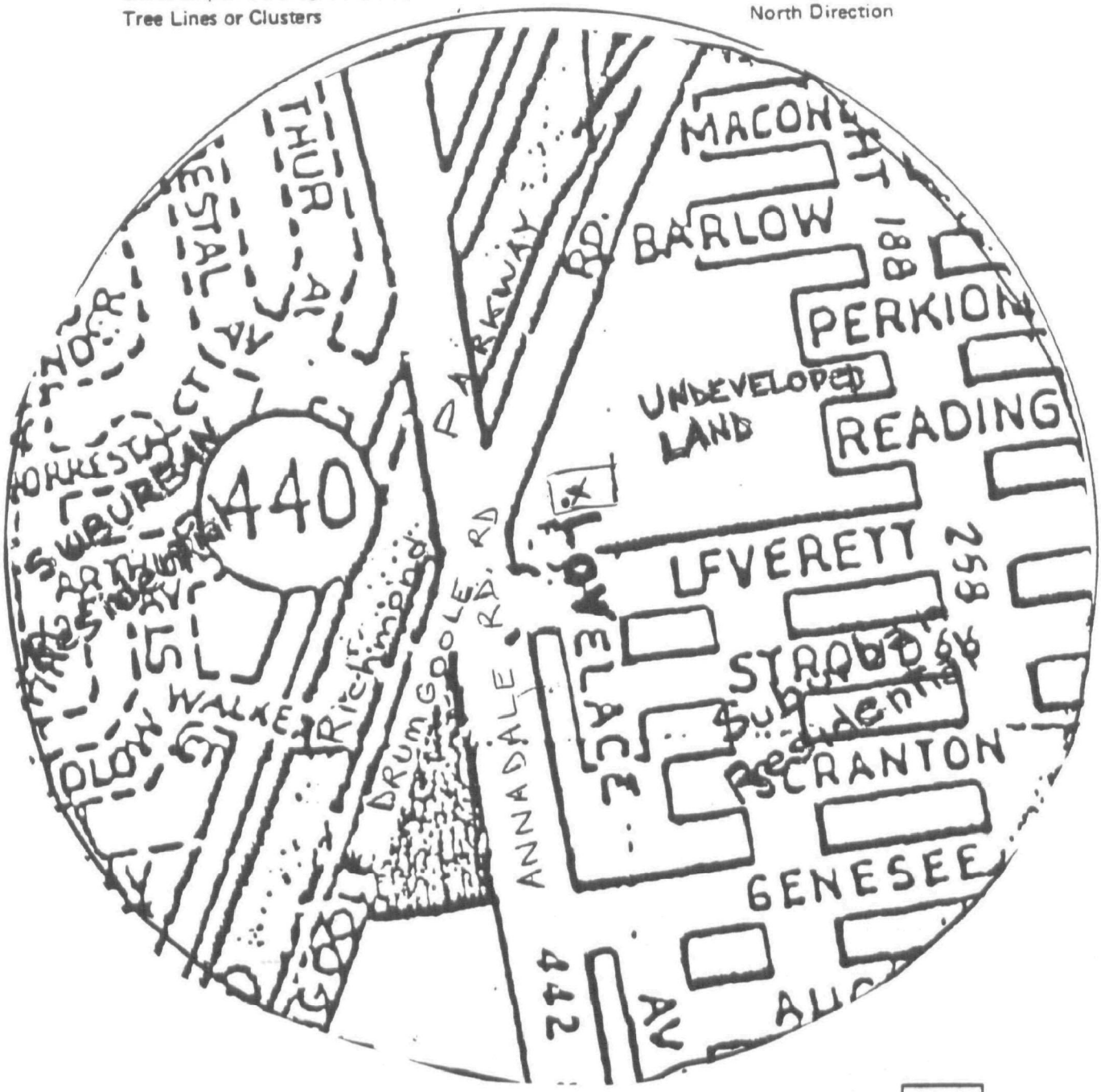
1. State - New York
2. City - Staten Island, N.Y.C.
3. County / Section - Richmond / Eltingville
4. Site Code - NY site #3
5. Site Address - Eltingville Firehouse
   Annadale Road, Eltingville New York
6. Names of Nearest Intersecting Streets - Leverett Avenue and Drumgoole Road
7. Pollutants Monitored at this Site - VOC's
8. Date Inspected - 11/23/87
9. Outstanding Landmarks - Located on Newer Firehouse Rooftop near the end of the Richmond Parkway. Has view of the Fresh Kills Landfill to the north and northwest.


NY #3 Eltingville FH
RICHMOND
Fresh Kills
Creek
ARTHUR KILL
Greenridge
ROAD
WOODROW
ROAD
ARDEN
ANNADALE
BLVD
RICHMOND
AVE
Great Kills
STATEN
Eltingville
WILSON
Annadale
TRANSIT
Our Lady Star of the Sea
POILLON
TALLMAN
KOCH
SHIRLEY
HYLAN
BLVD
Annadale Beach
Huguenot Beach
Tidal Flat
High Sch
Jr High Sch
ARBUTUS
HUGUENOT
JANSEN
OAKDALE
RICHMOND
ROAD
PS
Sta
BM

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable. [ ]

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters

Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction

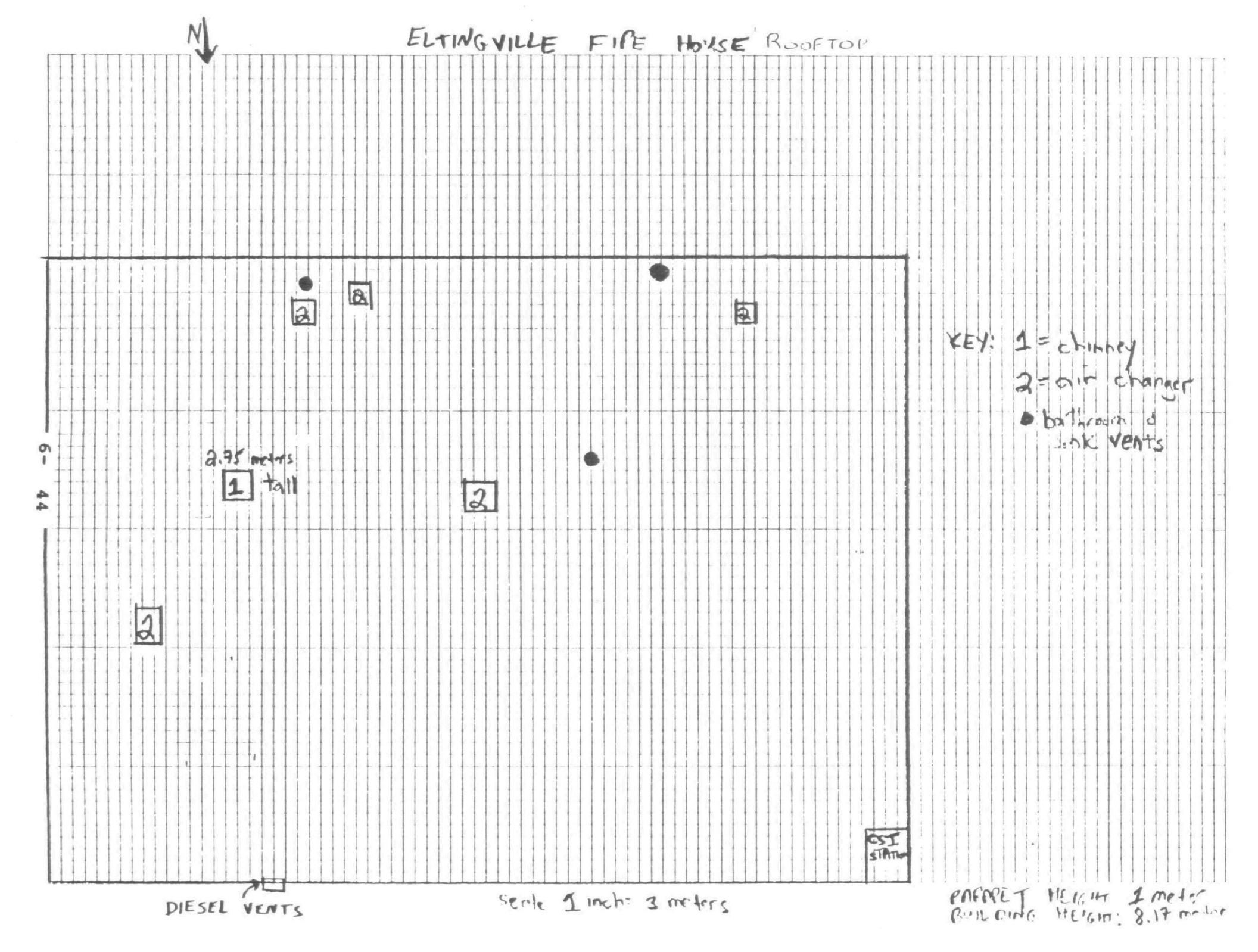


16. Attach separate sheet of labeled photographs G [ ]

17. UTM Coordinates, Zone _____ East _____ North _____

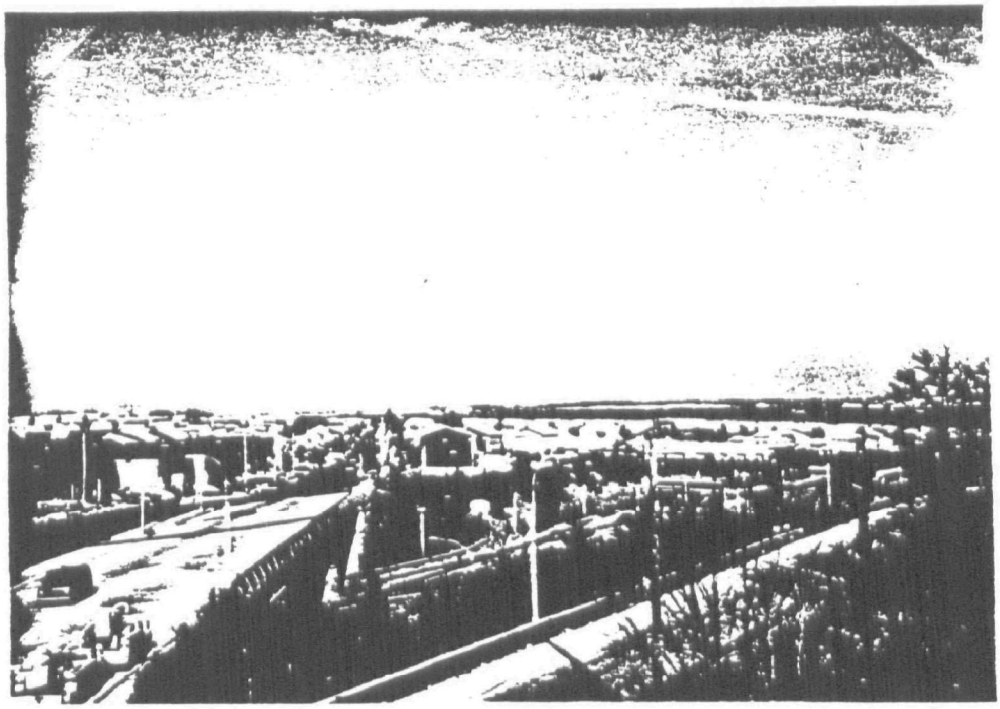
or latitude and longitude _____ _____ G [ ]

R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
[ ] – Blocks are reserved for site evaluation only

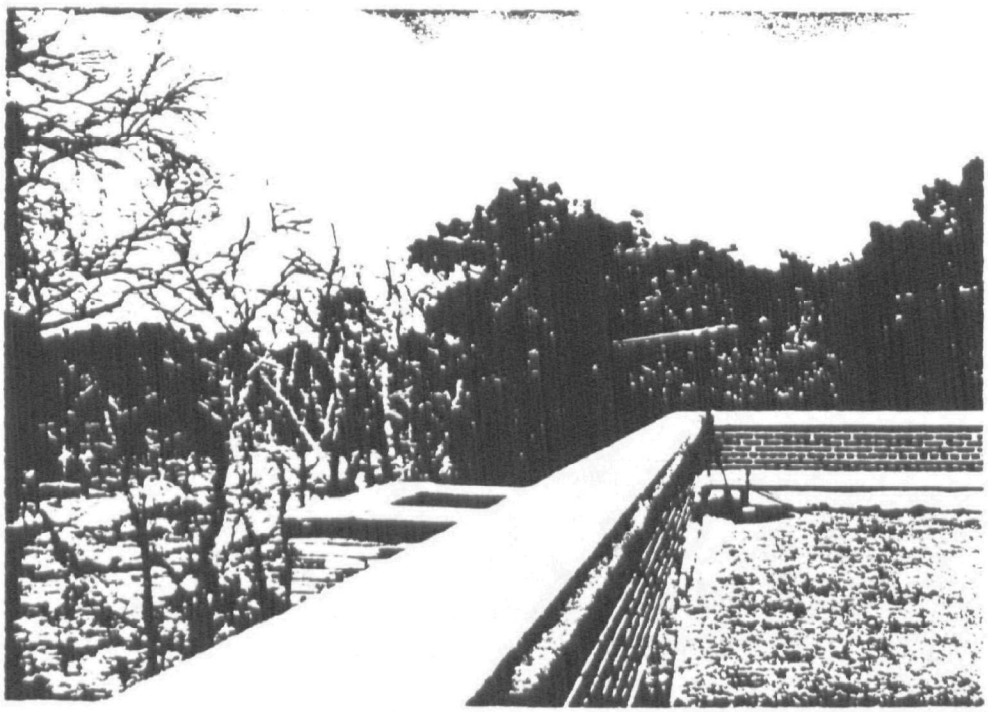

N
ELTINGVILLE FIRE HOUSE ROOFTOP
KEY: 1 = chimney
2 = air changer
• bathroom & sink vents
2.75 meters tall
DIESEL VENTS
OSI STATION
Scale 1 inch: 3 meters
PARAPET HEIGHT 1 meter
BUILDING HEIGHT: 8.17 meter
9-44

C51
Site

Eltingville Firehouse
Annadale Road
Eltingville Staten Island NY



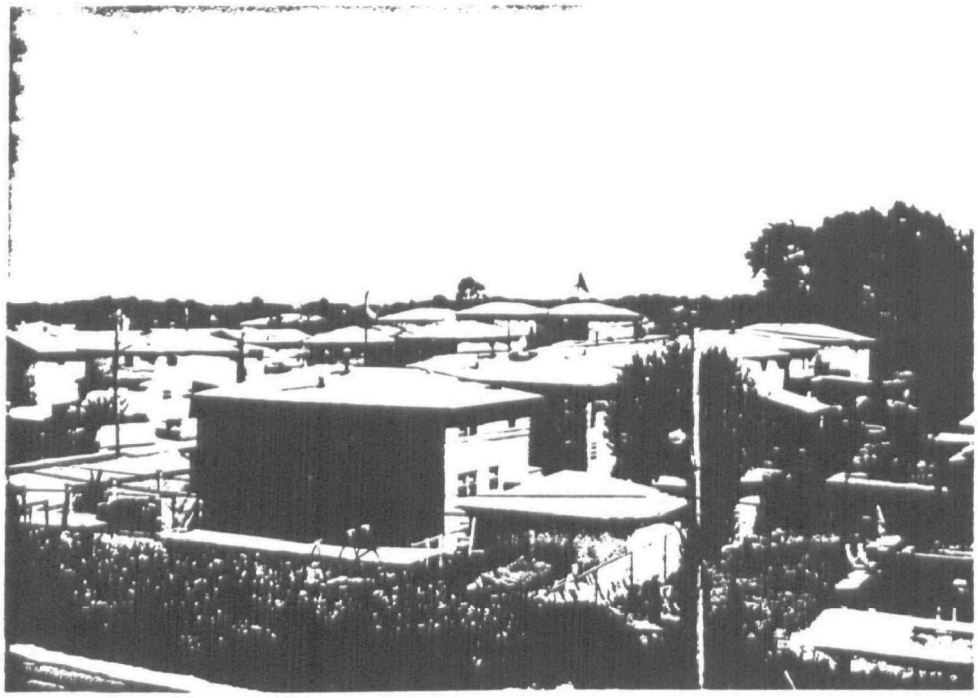
North



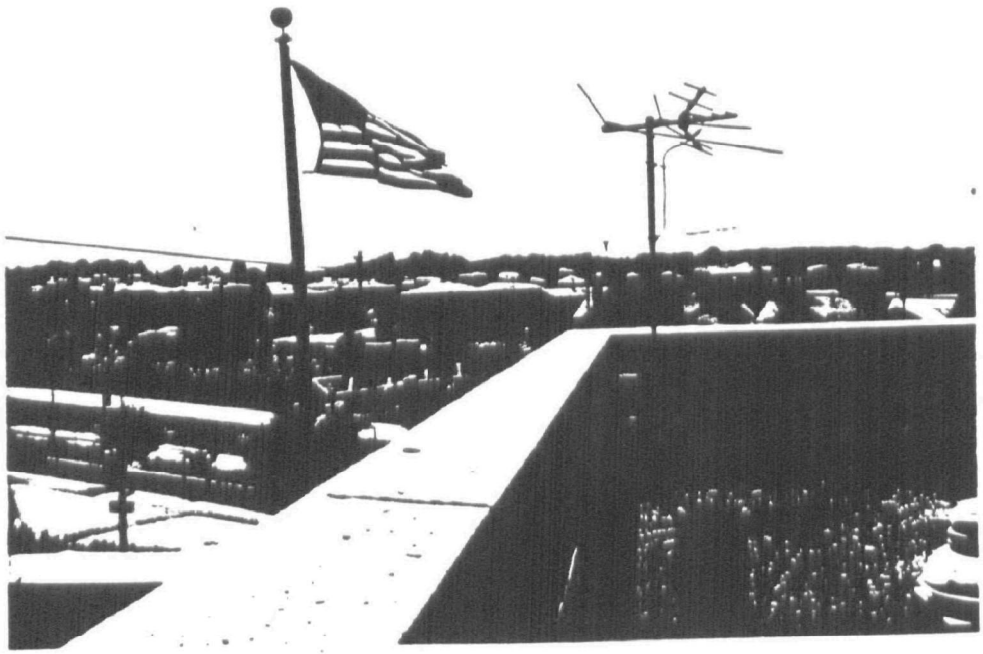
East

CSI

Eltingville Firehouse
Annadale Rd
Eltingville, Staten Island NY



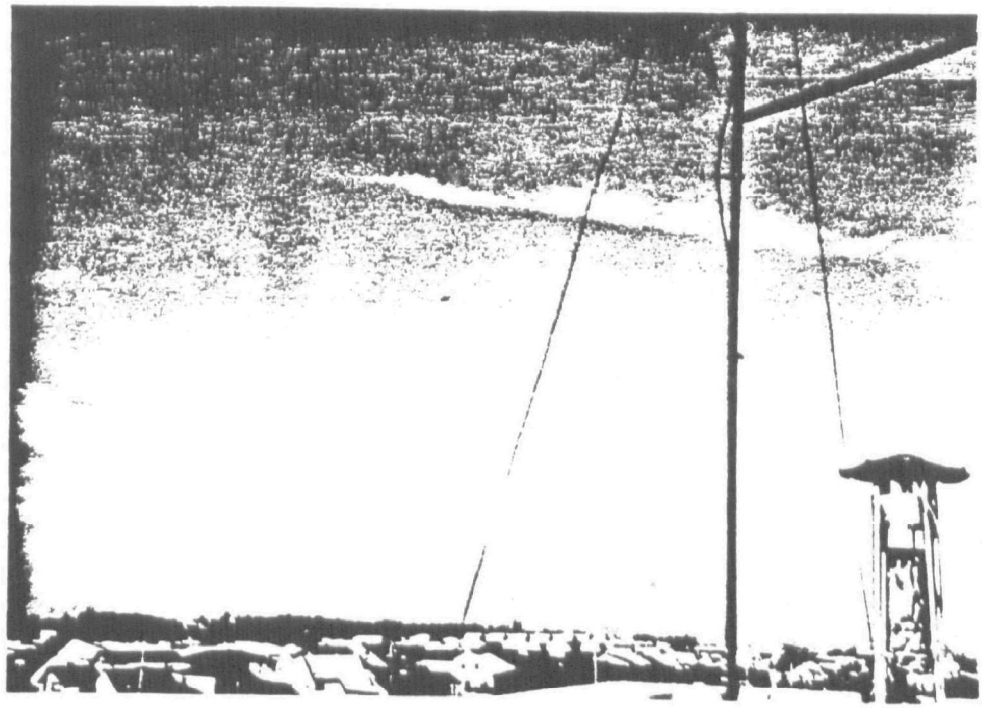
South East



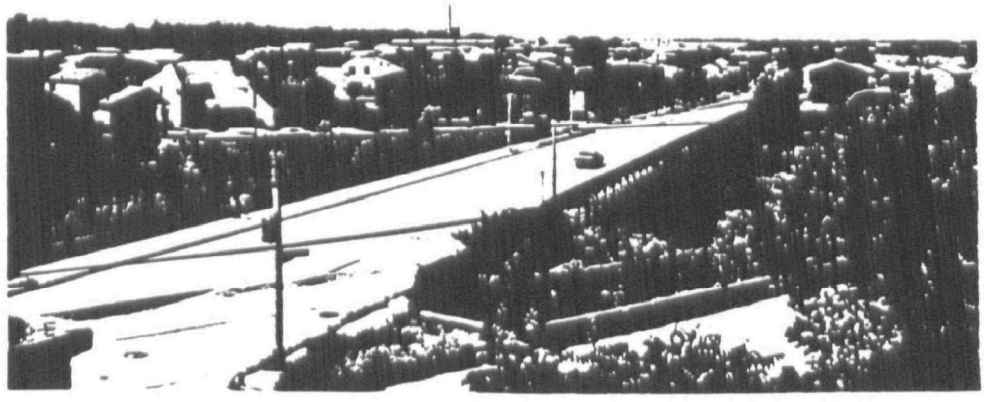
SouthWest

CS!
site

Eltingville Firehouse
Annadale Road
Eltingville, Staten Island NY

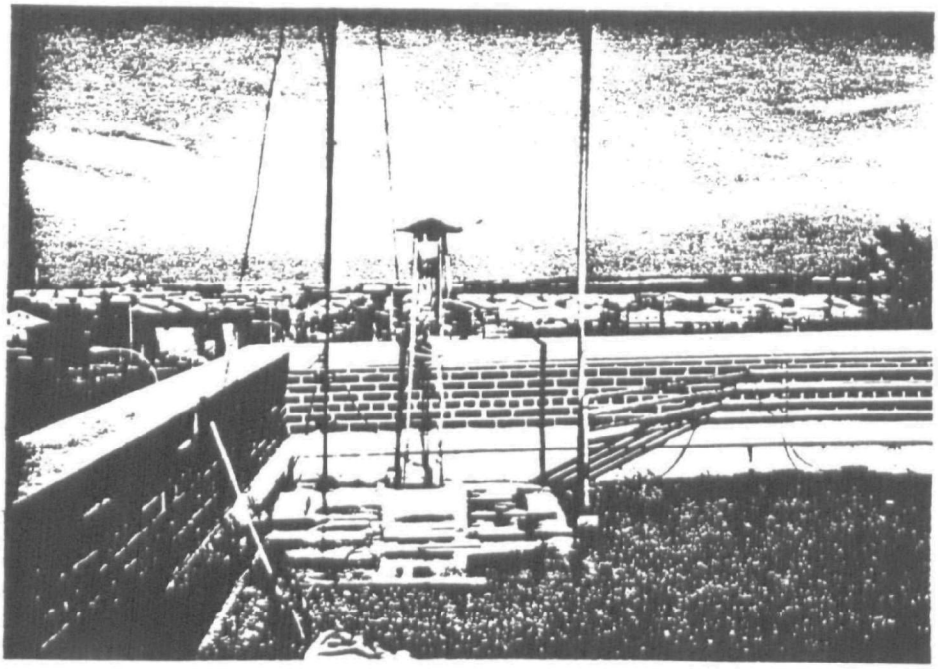


West



North, West

Eltingville Firehouse
Annandale Road
Eltingville, Staten Island, New York



CSI TenAx monitor on roof of Firehouse

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

_____ Smooth, ___✓___ Rolling, _____ Rough

2. Topographic features that influence the site:

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Fresh Kills Landfill		N → W	½ mi

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site
Diesel Vents on Firehouse	~15 ft high	W	15 meters

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOCs

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	All directions - 200' - 1/4 mi.
Commercial	N→NE - 1/4 mile
Industrial	
Mobile Richmond Pkwy	N → SW,
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Richmond Parkway, Fresh Kills Landfill, Staten Island Mall-commercia

NE Suburban-Residential, Staten Island Mall-commercial

E " Residential, Undeveloped Land

SE " Residential

S " Residential

SW Richmond Parkway, Suburban Residential

W Fresh Kills Landfill, Suburban Residential, Richmond Pkwy

NW Suburban Residential, Fresh Kills Landfill, Con Ed

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Names of Roadways (nearest to site first)

Type (check one)	Richmond Pkwy	Annadale Rd	Drumgoole Rd E	Leverett Ave					
Arterial Highway									
Expressway									
Freeway									
Parkway	✓								
Major Street or Highway									
Through Street or Highway		✓	✓						
Local Street or Road				✓					
Traffic Activity: (complete as applicable)									
1. *Distance of roadway from air intake(ft)	200	43	50	105					
2. Direction of roadway from air inlet (8 pts)	W	W	N	SE					
3. Composition of roadway	tar →			→					
4. Number of traffic lanes	4	2	1	2					
5. Average daily traffic (estimate)			low	low					
6. Average vehicle speed (estimate, mph)	50	35	30	15					
7. Traffic is 1 or 2 way (1 or 2)	2	2	1	2					
8. Number of parking lanes	0	1	0	2					
9. Are parking lanes used for traffic part of day? (yes,no)	N/A	No	N/A	No					
10. Roadway paved (yes, no)	yes	yes	yes	yes					
11. Is dust visibly re-entrained? (yes, no)	No	→		→					
12. Does roadway have curb? (yes, no)	Yes	→		→					
13 Does dust collect near edges? (yes, no)									

*Identify probe, if more than one.

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service NEWARK AIRPORT

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Enviro Chem	Portable GC
1. Location (top of building, ground level, other specify)	roof	roof				
2. If on building, give height (M)	8.2	8.2				
width (M)	15.8	15.8				
depth (M)	21.8	21.8				
3. Horizontal distance from supporting structure (M)	N/A	N/A				
4. Vertical distance above supporting structure (M)	1.8	1.5				
5. Height of probe above ground (M)	10.0	9.7				
6. Distance from trees (M)	>20	>20				
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	13 m	13 m				
8. Horizontal distance from nearest parking lot (M)	N/A	N/A				
9. Horizontal distance from walls, parapets, penthouses, etc. (M) parapet only 1' high	N/A	N/A				
10. Distance from obstacles, such as buildings	N/A	N/A				
11. Distance from furnace or incineration flues (M)	18 m	18 m				
12. Unrestricted air flow	Yes	Yes				
13. Located in paved area or vegetative ground cover	Yes	Yes				
14. Roof Composition	Tar + Gravel	Tar + Gravel				

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	CSI	Anderson			
Date Sampling Began	9/87	12/87			
Sampling Frequency	Daily	1/18 days			

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection College of Staten Island (CSI)

2. Individual's name Dr. Clifford Weisel

3. Phone Number 718-390-7994

4. Agency analyzing samples CSI. (Tenax) and PEI Associates (canister)

5. Individual's Name Dr. Clifford Weisel (CSI) and Bill Jess (PEI)

6. Phone number 718-482-4944 (CSI) and 513-782-4700 (PEI)

7. Reports of data are made to (Agency Name) UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

8. Individual's Name Rudy Kapichak

9. Phone number 212-264-2517

SITE EVALUATION

Site Identification number NY site #3

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 11/23/87

Date of report 2/25/88

Signatures of Evaluators

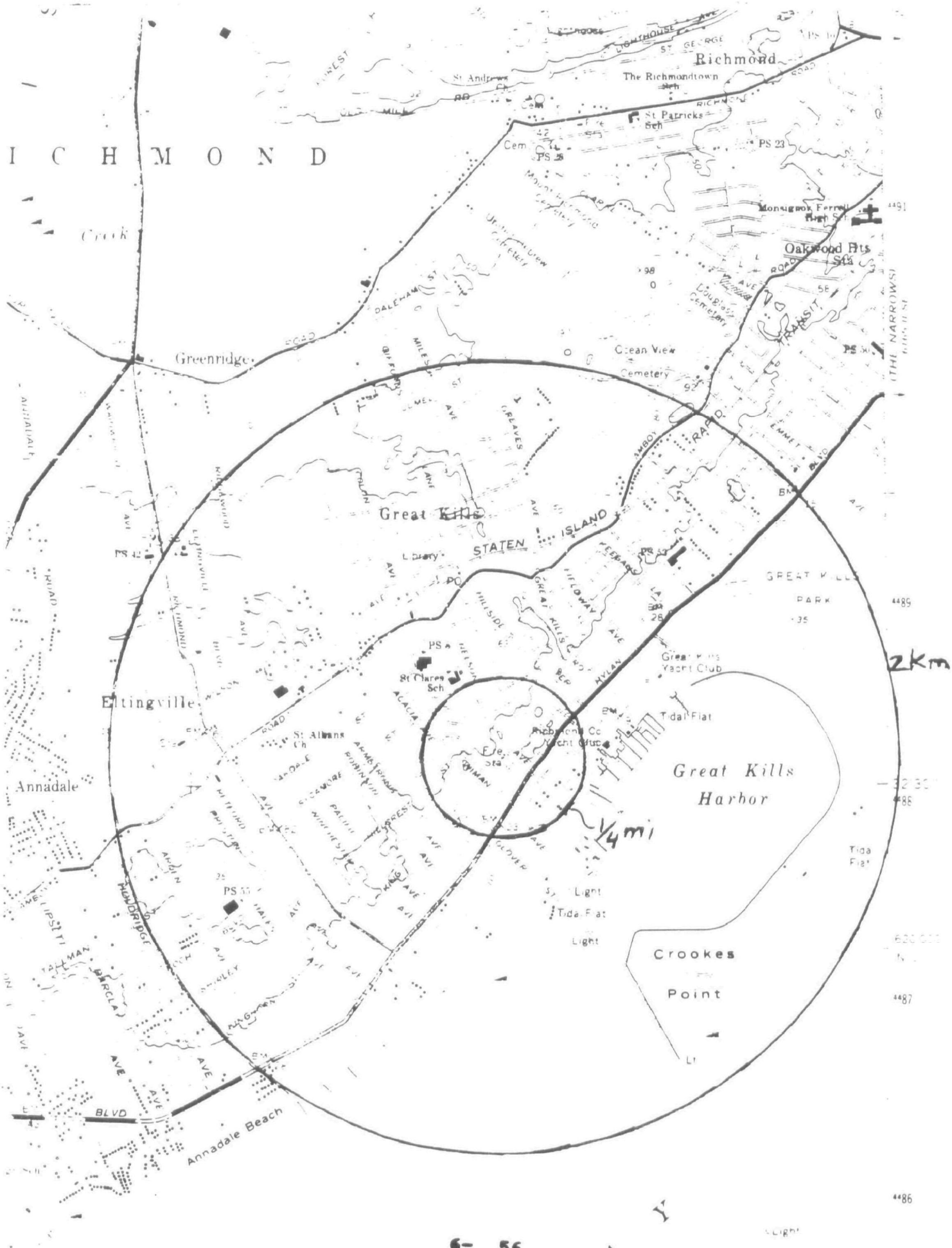
Suzanne Jacquett

Comments This firehouse pumps diesel every 3 days and gasoline everyday. . . About 50 gal.(diesel) and 400 gal.(gasoline) are pumped monthly. Firemen said they will notify people when they pump. This site is also very windy and is within view and sometimes smell of the landfill. Samplers are positioned far from diesel vents and chimney to avoid any interferences.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

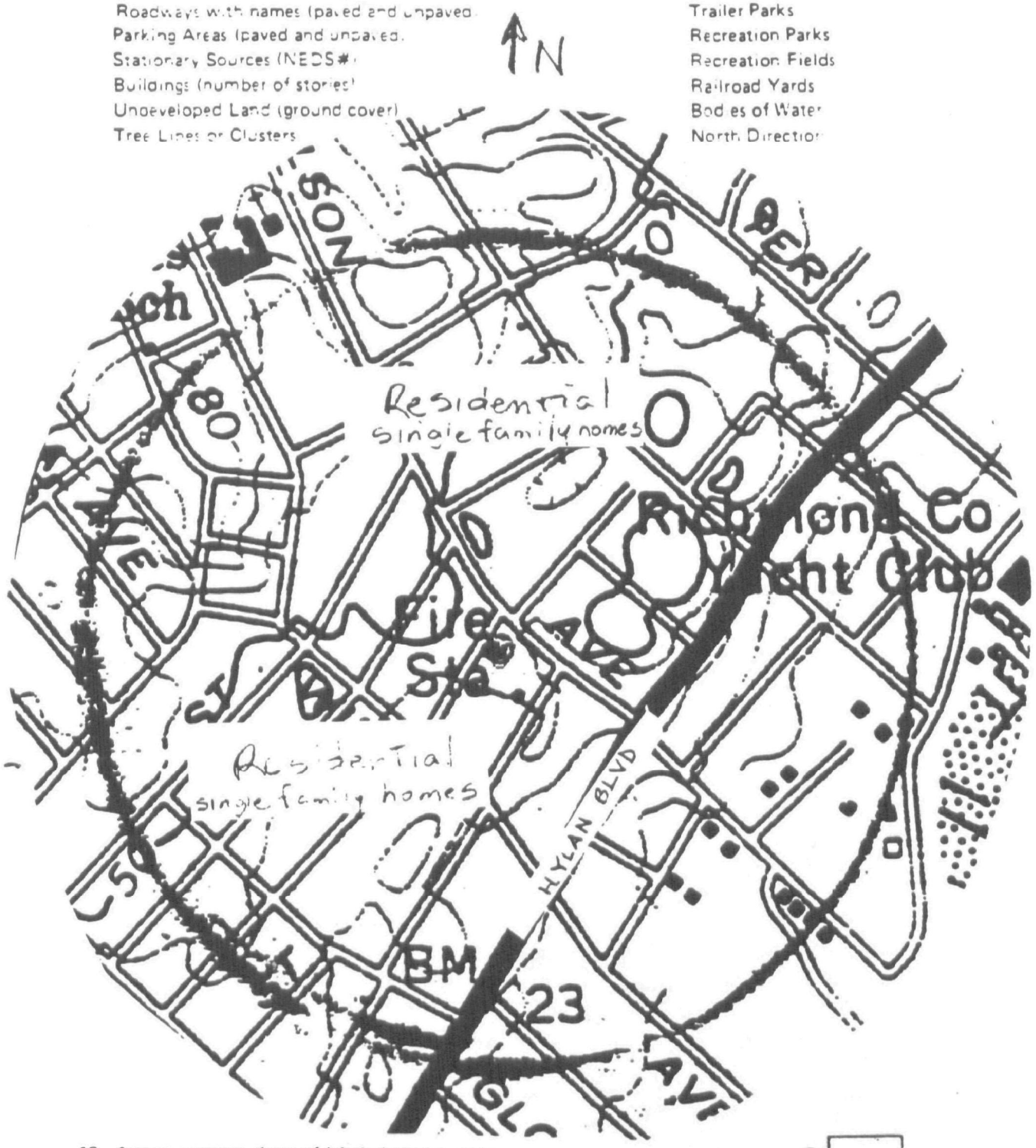
SITE INFORMATION

1. State - New York
2. City - Staten Island, NYC
3. County / Section - Richmond / Great Kills
4. Site Code - NY site # 4
5. Site Address - Great Kills Firehouse
   Nelson Avenue
6. Names of Nearest Intersecting Streets - Presley Street and Driggs Street
7. Pollutants Monitored at this Site - VOC's · ATD 50, canister
8. Date Inspected -
9. Outstanding Landmarks - Older Firehouse within an older residential area near Hylan Blvd in Great Kills, Staten Island.


I C H M O N D
Richmond
The Richmondtown
St Andrews
St Patricks Sch
PS 23
Oakwood Hts Sta
Greenridge
Ocean View Cemetery
Great Kills
STATEN ISLAND
Great Kills Harbor
Great Kills Yacht Club
Tidal Flat
Eltingville
Annadale
St Clares Sch
St Albans Ch
PS 42
PS 50
PS 51
Crookes Point
Annadale Beach
2km
1/4mi
6- 56

15 Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, where an immediate area information is needed. Include the following information on the drawing where applicable

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters
Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction

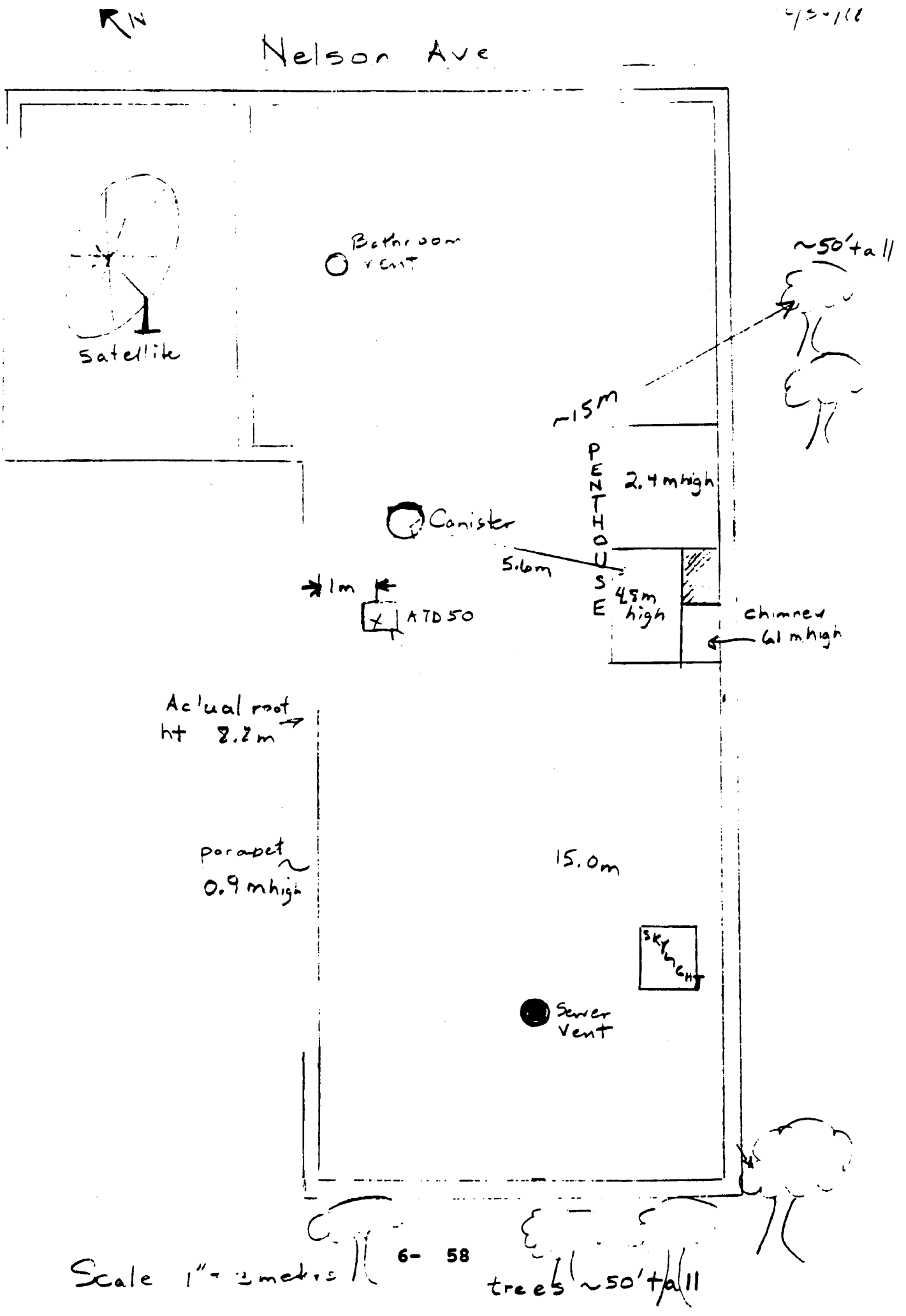


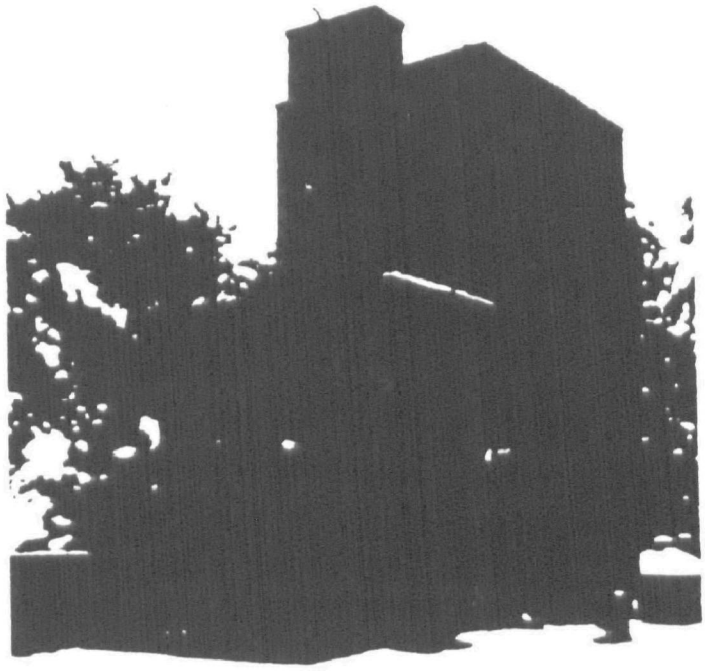
16 Attach separate sheet of labeled photographs G

17. UTM Coordinates, Zone _____ East 572.17 North 4488.41

or latitude and longitude 74° 05' 53" 40° 32' 34" G

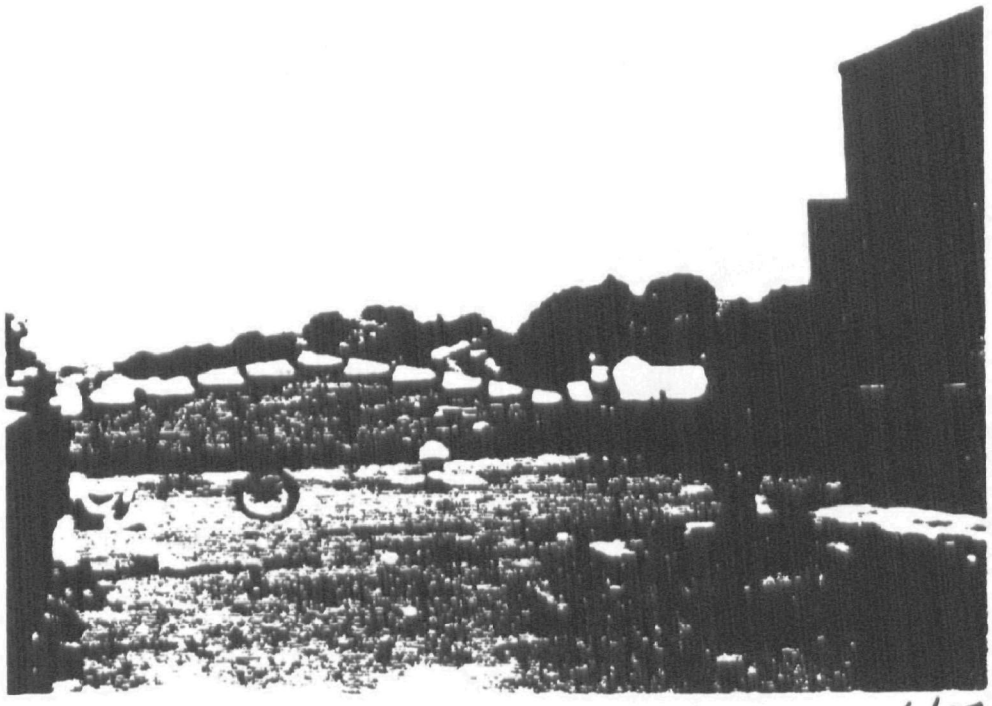
* . R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
– Blocks are reserved for site evaluation only


IN
Nelson Ave
Satellite
Bathroom vent
~50' tall
~15m
PENTHOUSE
2.4 m high
Canister
5.6m
1m
ATD 50
4.5m high
chimney
6.1 m high
Actual roof ht 8.2m
parapet ~ 0.9 m high
15.0m
SKYLIGHT
Sewer Vent
trees ~50' tall
Scale 1" = 2 metres



Penthouse on Roof
located SSE of monitor

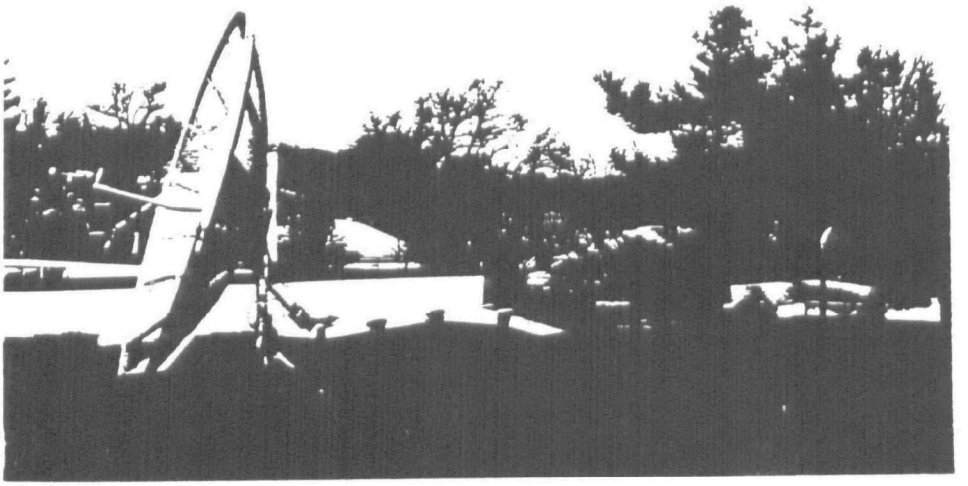
6/87



Proposed monitor location

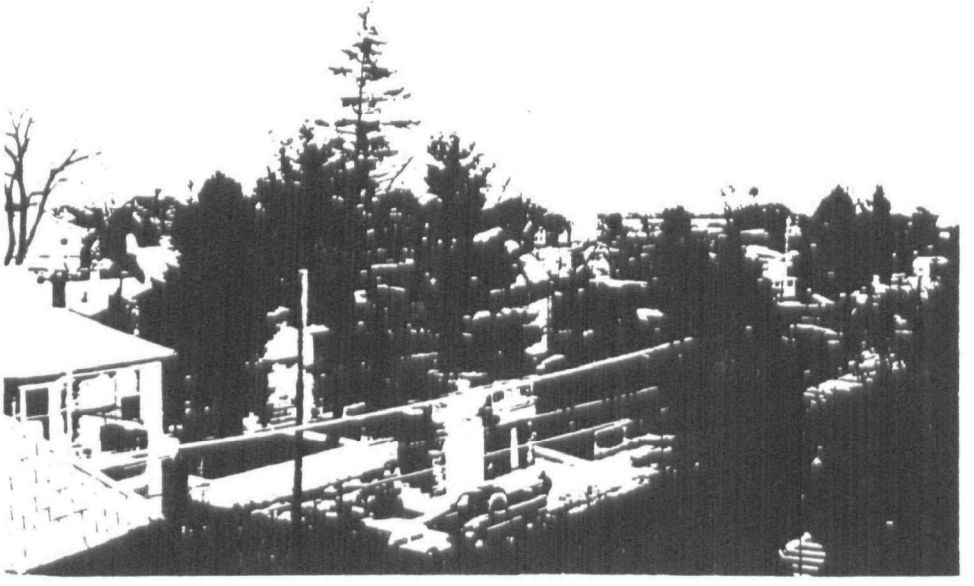
6/87

Great Kills Firehouse NY #7
Great Kills NY #4



North

12/30/88

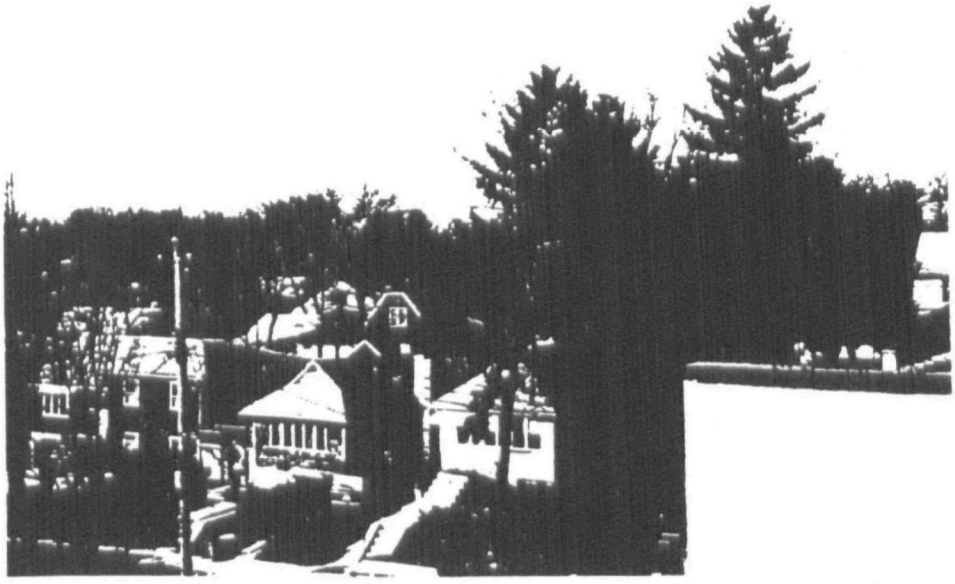


East

12/30/88

NY Site #4 Great Kills Firehouse
Great Kills, NY

South 12/30/88



West 12/30/88

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOCs

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	0 - 1/4 mi
Commercial	100' - 1/4 mi
Industrial	
Mobile (Highway)	~1/8 mi - 1/4 mi
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban residential,

NE , commercial, harbor

E , commercial,

SE ,

S ,

SW

W

NW , commercial

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Type (check one)	Names of Roadways (nearest to site first)									
	Nelson Ave	Driggs ST	Presley ST	Hylan Blvd	Florence St					
Arterial Highway										
Expressway										
Freeway										
Parkway										
Major Street or Highway				✓						
Through Street or Highway	✓									
Local Street or Road		✓	✓		✓					
Traffic Activity (complete as applicable)										
1 *Distance of roadway from air intake (ft)	92'	90'	150'	800'	125'					
2 Direction of roadway from air inlet (8 pts)	NNE	NW	ESE	SE	NNE					
3. Composition of roadway	asph	asph	asph	asph	asph					
4 Number of traffic lanes	2	2	2.	4	2					
5 Average daily traffic (estimate)	3K	<1K	<1K		<1K					
6 Average vehicle speed (estimate, mph)	30	25	25	~~40~~	25					
7 Traffic is 1 or 2 way (1 or 2)	2	2	2	2	2					
8 Number of parking lanes	0	2	2	2	2					
9 Are parking lanes used for traffic part of day? (yes,no)	N/A			Y	N					
10 Roadway paved (yes, no)	Y	Y	Y	Y	Y					
11 Is dust visibly re-entrained? (yes, no)	N	N	N	N	N					
12 Does roadway have curb? (yes, no)	Y	Y	Y	Y	Y					
13 Does dust collect near edges? (yes, no)	N/A	N/A	N/A	N/A	N/A					

* Identify proximity if more than one

Topography

1 The general characteristics of the terrain over a 2 mile radius from the site are (check one):

_____ Smooth, _____ Rolling, _____ Rough

2 Topographic features that influence the site

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Great Kills Harbor		ENE → SW	¼ mi

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site
Trees			
Penthouse 16' higher than roof	8'x8'x16'	ESE	18.5'

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   _____ National Weather Service

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	ATD 50 Enviro Chem	Portable GC
1. Location (top of building ground level, other specify)					top	
2. If on building, give height (M)		8.8m			8.8m	
width (M)						
depth (M)						
3. Horizontal distance from supporting structure (M)		N/A			N/A	
4. Vertical distance above supporting structure (M)		N/A			N/A	
5. Height of probe above ground (M)		9.8m			10.3m	
6. Distance from trees (M)		15.0			15.0	
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	N/A	98			98	
8. Horizontal distance from nearest parking lot (M)	N/A	N/A			N/A	
9. Horizontal distance from walls, parapets, penthouses, etc. (M)		2.0m	N/A	N/A	1.0m	
10. Distance from obstacles, such as buildings			N/A			
11. Distance from furnace or incineration flues (M) ~		7	N/A	N/A	7.0	
12. Unrestricted air flow		Y			Y	
13. Located in paved area or vegetative ground cover		N/A			N/A	
14. Roof Composition						

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

	VOCs			Carbonyls	Metals
Sampler Type	ATD 50	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	Wedding	Anderson			
Date Sampling Began	8/31/88	6/88			
Sampling Frequency	1/6	1/18			

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection New York State Department of Environmental Conservation (NYSDEC)

2. Individual's name Mike Steinacher

3. Phone Number 718-482-4875

4. Agency analyzing samples NYSDEC (ATD-50); PEI Associates (canister)

5. Individual's Name Garry Boynton (ATD-50); Bill Jess

6. Phone number 518-457-3676 (DEC) ; 513-782-4700 (PEI)

7. Reports of data are made to (Agency Name) US Environmental Protection Agency (USEPA) and NYSDEC

8. Individual's Name Rudy Kapichak (EPA) ; Don Gower (NYSDEC)

9. Phone number 212-264-2517 ; 518-457-3676

SITE EVALUATION

Site Identification number NY Site #4

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 12/30/88

Date of report 1/27/89

Signatures of Evaluators

Comments

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

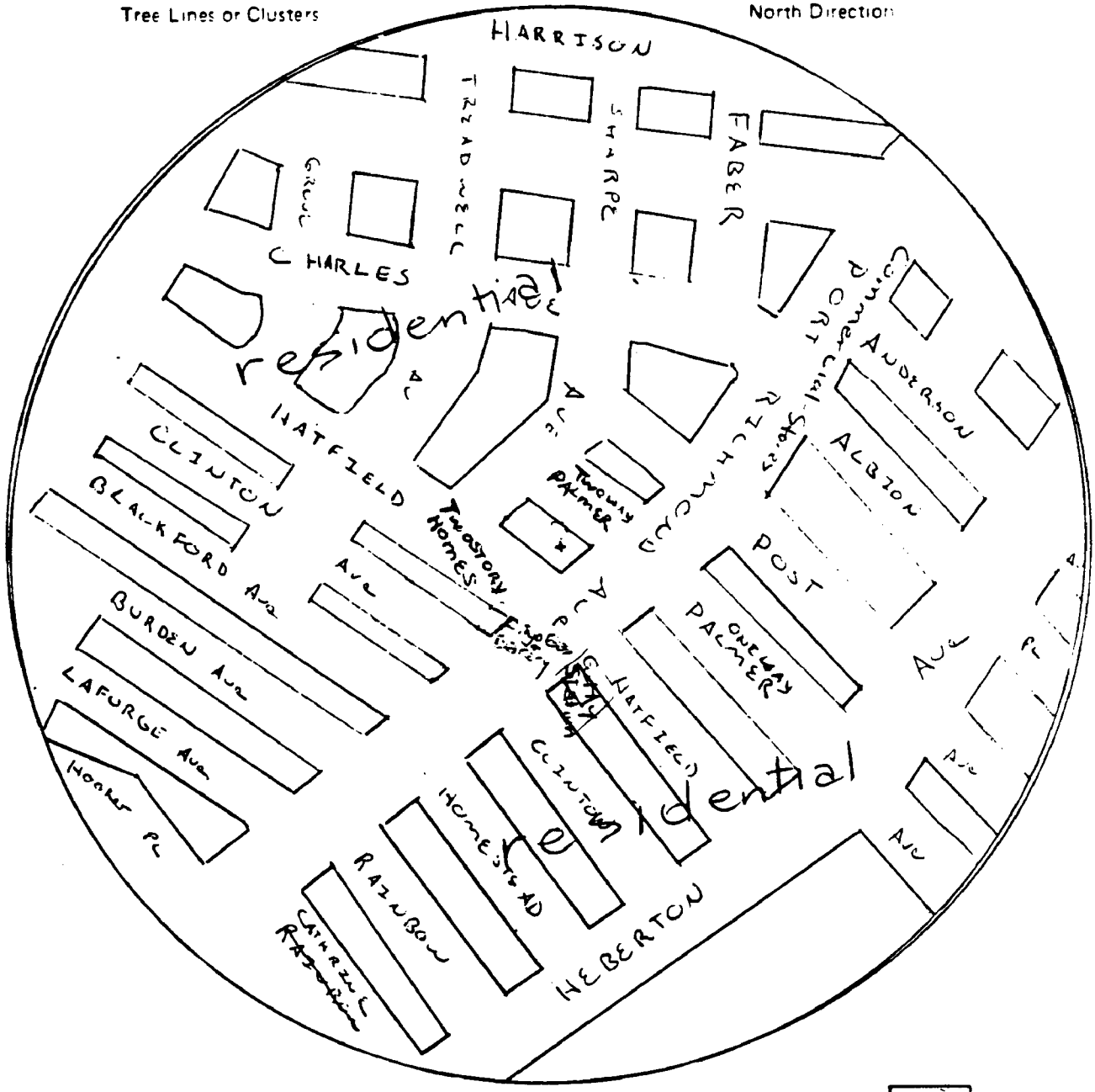
1. State - New York
2. City - Staten Island, N.Y.C.
3. County / Section - Richmond / Port Richmond
4. Site Code - NY #5
5. Site Address - Port Richmond Post Office
   Port Richmond Ave
6. Names of Nearest Intersecting Streets - Hatfield Place and Palmer Avenue
7. Pollutants Monitored at this Site - VOCs
8. Date Inspected - 10/22/87
9. Outstanding Landmarks - Located on the roof of a single story Post office in Northern Staten Island near the Bayonne Bridge. It is on the main street in Port Richmond in a residential neighborhood. It provides coverage of the portion Staten Island North of the SI Expressway.

NY site #5
Pt Richmond P.O.
NEWARK
Light
Lights
City Park
Fire Sta
Tidal Flat
Yacht Club
Holy Family Academy
PS 12
YMCA
CENTRAL RR OF NEW JERSEY
SOUTH REACH
BAYONNE
C RR OF NJ
Port Johnson
Sewage Disposal
Bergen Point
Playground
Ruins
2Km
NEW JERSEY
NEW YORK
VAN
STATEN ISLAND
KILL VAN KULL
HUDSON C
RICHMOND
BERGEN PT EAST REACH
BERGEN POINT WEST REACH
Shooters Island
NEW YORK CITY BDY
SHOOTERS ISLAND REACH
BAYONNE TOLL BRIDGE
Kill
RAPID
TRANSIT
Mariners Harbor
STATEN ISLAND
Elm Park
Port Richmond
Fountain Cem
ISLAND
RICHMOND
Graniteville
Granderville
BARON HIRSCH CEMETERY
JHS 51
Westerleigh
Brooks Lake
Mortling Lake
St Peters Cem
Armory
CLOVE LAKES PARK
Clove Lake
Castleton Corners
St Paul Seminary
Fairview Cem
SCHMITZER
6-69

15. Sketch a map to document the environment within a ½ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters

Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction



N

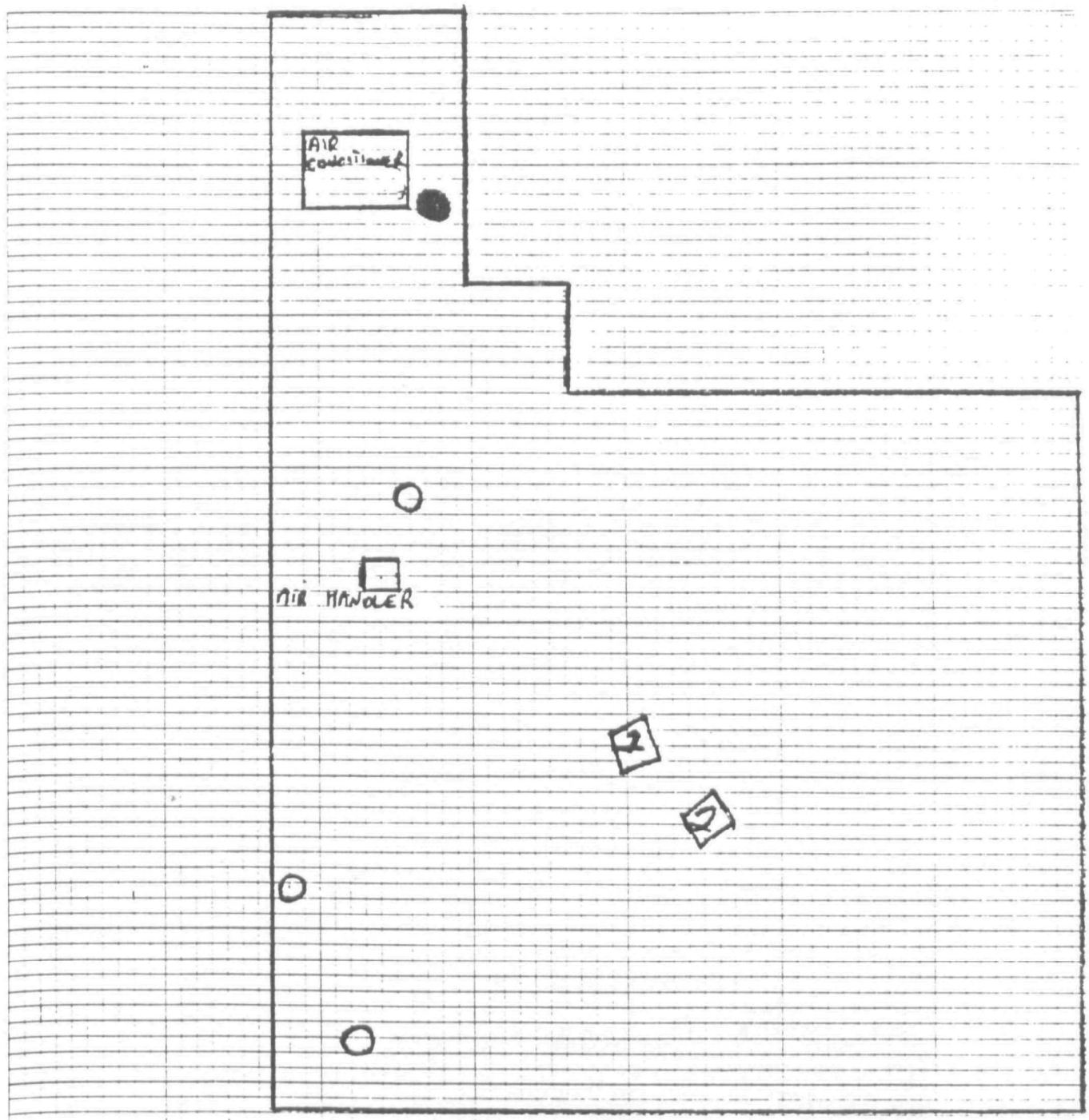
16. Attach separate sheet of labeled photographs G [ ]

17. UTM Coordinates, Zone 18 East 572970 North 4498150

or latitude and longitude 40° 37' 59" 74° 08 14" G [ ]

* - R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
[ ] – Blocks are reserved for site evaluation only

PORT RICHMOND POST OFFICE



O BATHROOM VENTS

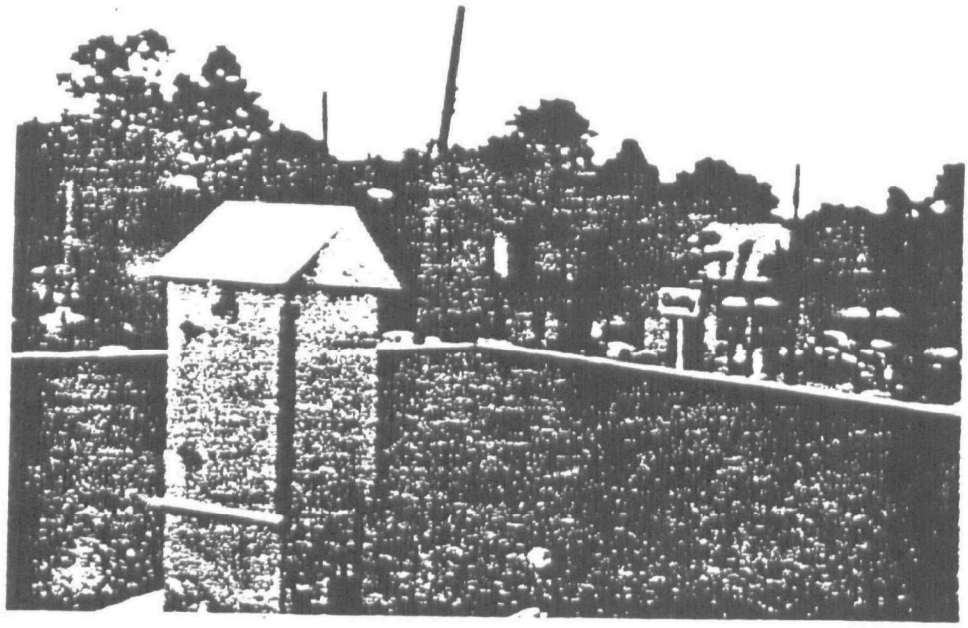
● CHIMNEY

1 ENVIROCHEM MONITOR

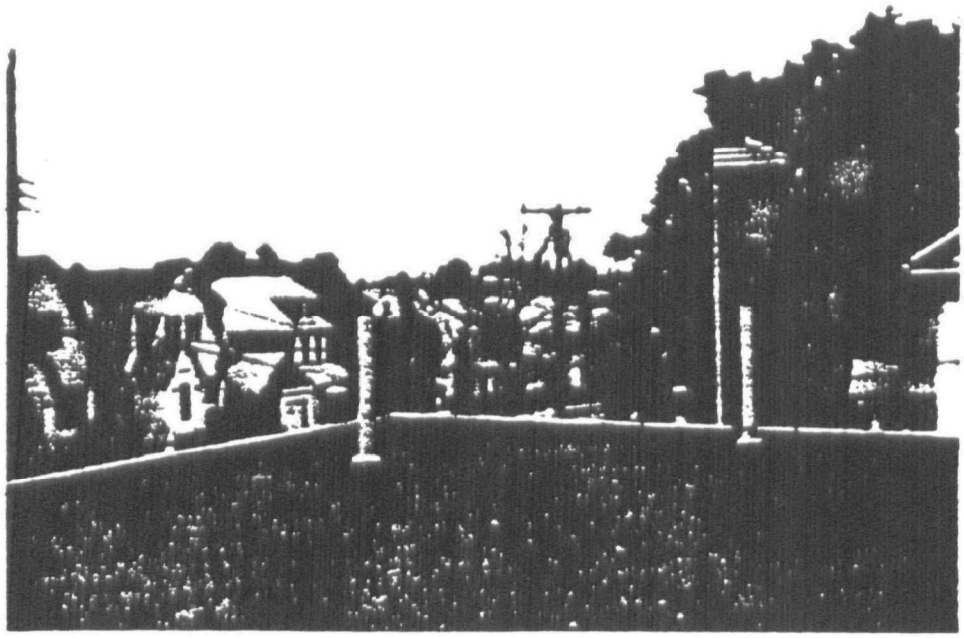
2 HI-VOL

SCALE: 4 meters = 1 inch

Staten Island, NY



South



West

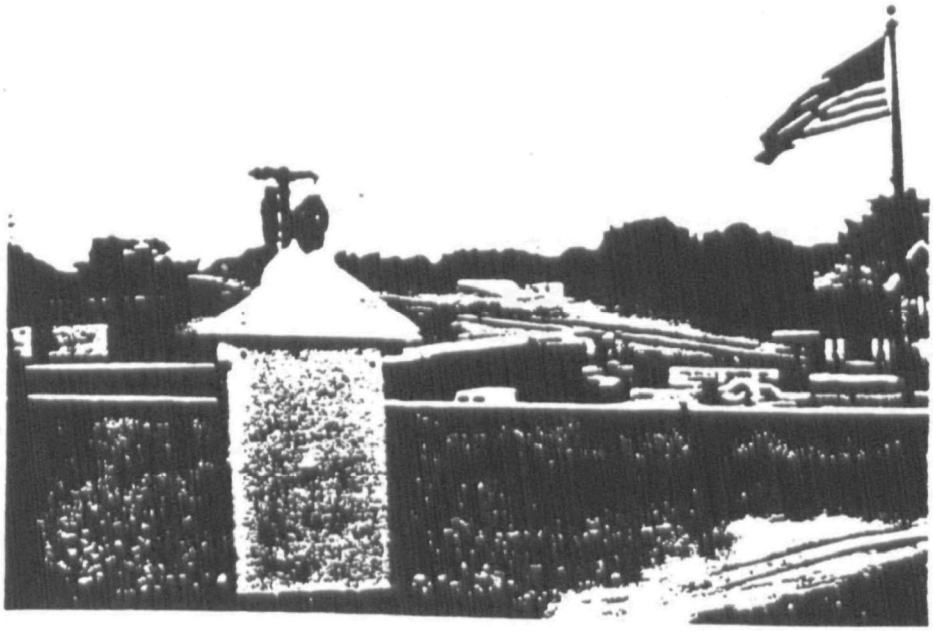
9/15/86 ✓

Port Richmond P.O.
Staten Island, NY

33468005SF01

6/24/86

North



East 6- 73

9/15/86

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   ✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Kill Van Kull		NW to NE	<2km

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site
Getty Gas Station	5 pumps	SSW	50m.
Citgo Gas Station	3 pumps	SW	32m
Bakery	Small local	SW	~70m

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOCs

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	All directions ~30' → ¼ mi
Commercial-(Light)	NE + SW
Industrial	
Mobile	
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Residential, Commercial, Kill Van Kull

NE Residential, Commercial, Kill Van Kull

E Residential, Commercial

SE Residential,

S Residential,

SW Residential, Commercial

W Residential, Commercial

NW Residential, Commercial, Kill Van Kull

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Type (check one)	Names of Roadways (nearest to site first): Port Richmond Ave	Hatfield Pl	Palmer Ave						
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway	✓								
Local Street or Road		✓	✓						
Traffic Activity: (complete as applicable)									
1. *Distance of roadway from air intake(ft)	70	47	>65						
2. Direction of roadway from air inlet (8 pts)	SE	SSW	NE						
3. Composition of roadway	Aspn →								
4. Number of traffic lanes	2	1	1/2						
5. Average daily traffic (estimate)	10K	1K	1K						
6. Average vehicle speed (estimate, mph)	35	>25	>25						
7. Traffic is 1 or 2 way (1 or 2)	2	1	1/2*						
8. Number of parking lanes	1	2	2						
9. Are parking lanes used for traffic part of day? (yes,no)	No →								
10. Roadway paved (yes, no)	Yes →								
11. Is dust visibly re-entrained? (yes, no)	No →								
12. Does roadway have curb? (yes, no)	Yes →								
13 Does dust collect near edges? (yes, no)	Yes →								

*Identify probe, if more than one.

* Traffic changes from 1 to 2 way on Palmer as it crosses Port Richmond Ave.

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   _____ National Weather Service

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Enviro Chem	Portable GC
1. Location (top of building, ground level, other specify)	roof	roof			roof	
2. If on building, give height (M)						
width (M)						
depth (M)						
3. Horizontal distance from supporting structure (M)						
4. Vertical distance above supporting structure (M)						
5. Height of probe above ground (M)		1.5m			1.0m	
6. Distance from trees (M)						
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)						
8. Horizontal distance from nearest parking lot (M)	N/A	N/A			N/A	
9. Horizontal distance from walls, parapets, penthouses, etc. (M)						
10. Distance from obstacles, such as buildings						
11. Distance from furnace or incineration flues (M)						
12. Unrestricted air flow	Yes	Yes			Yes	
13. Located in paved area or vegetative ground cover	Yes	Yes			Yes	
14. Roof Composition ¼" layer of small stones mixed with flaky black material, over a tar roof (No bubbles present on roof)						

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals	Enviro-Chem
	Tenax	EPA Canister	Portable GC	NDPH	Hi-vol	
Instrument Manufacturer	NYDEC	Anderson			NAMS/ SLAMS Hi-vol	NYDEC
Date Sampling Began	10/87	Not running yet.				2/87
Sampling Frequency	1/6 days	1/18 days				1/6 days

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection New York State Department of Environmental Conservation (NYSDEC)

2. Individual's name Mike Steineger

3. Phone Number 718-482-4875

4. Agency analyzing samples College of Staten Island (Tenax), Envirochem (New York State Dep't of Environmental Conservation)

5. Individual's Name _____

6. Phone number _____

7. Reports of data are made to (Agency Name) US Environmental Protection Agency (USEPA)

8. Individual's Name Rudy Kapichak

9. Phone number 212-264-2517

SITE EVALUATION

Site Identification number NY State #5

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 10/22/87

Date of report 2/26/88

Signatures of Evaluators

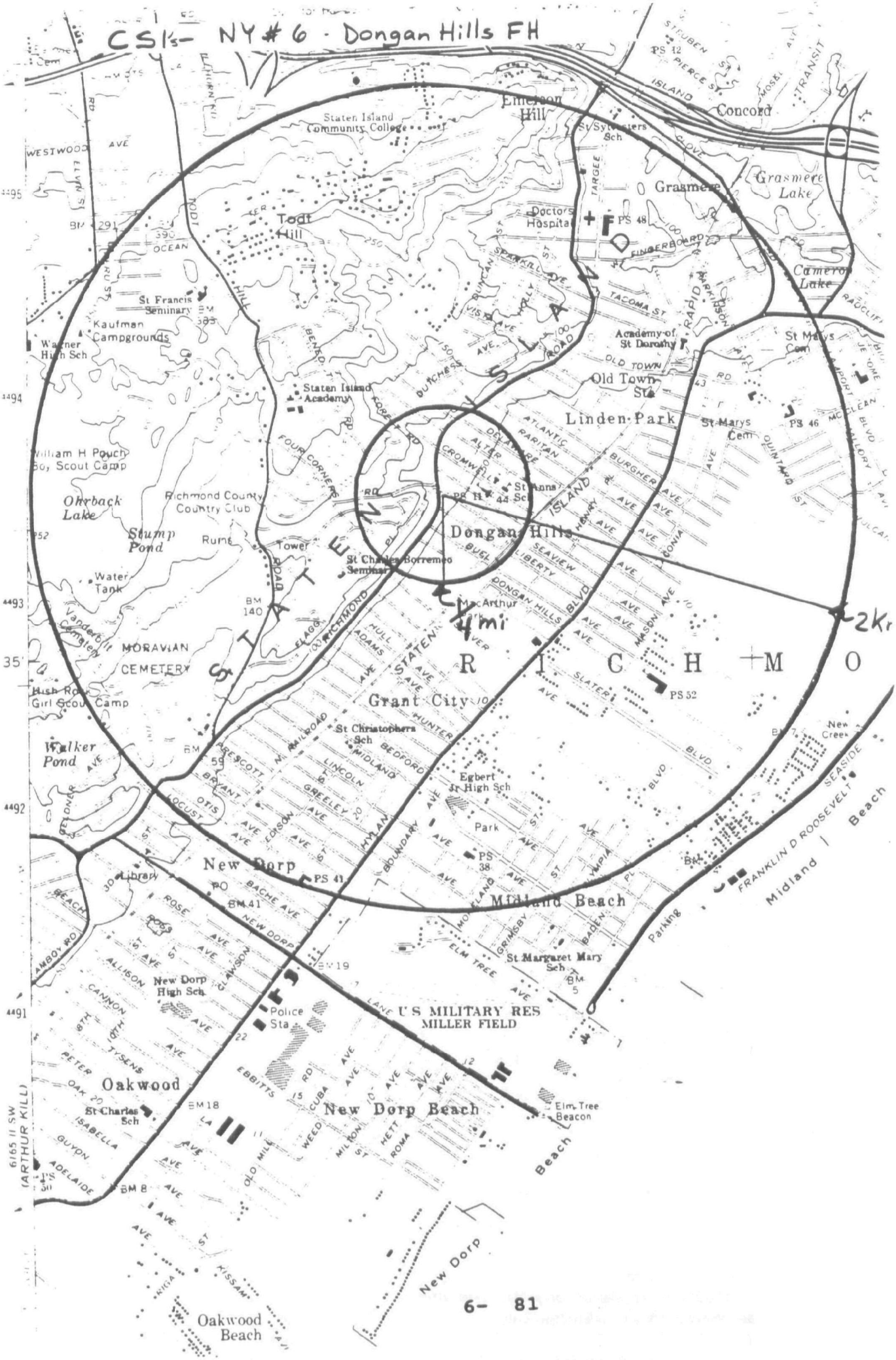
Sue Jacquett

Comments This site meets siting criteria and should provide coverage of the Northern Section of Staten Island near the Bayonne Bridge. The Tenax monitor was installed after our site visit. This, an update of this report will be forthcoming after our next visit.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

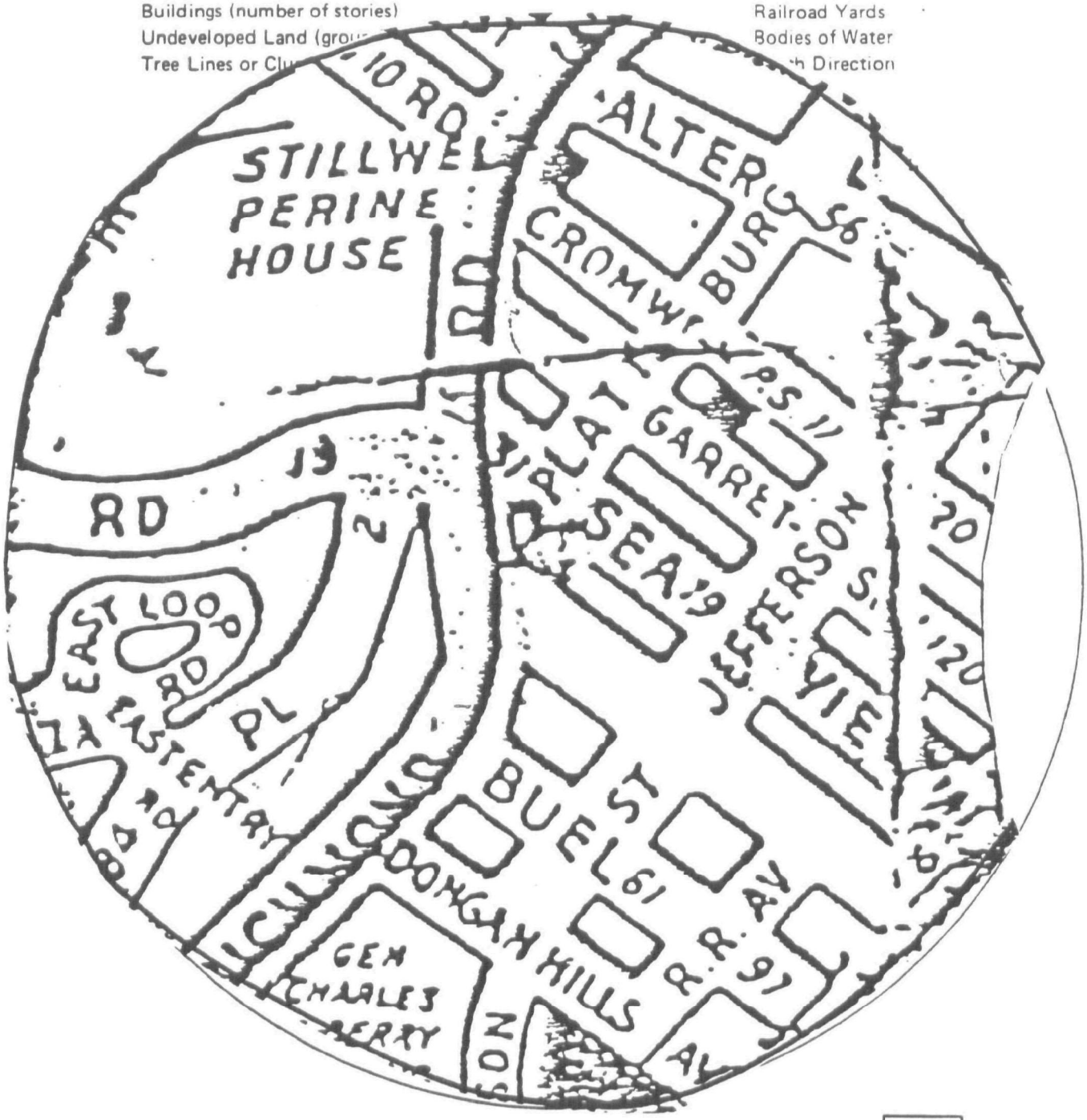
1. State - New York
2. City - Staten Island, N.Y.C.
3. County / Section - Richmond / Dongan Hills
4. Site Code - NY site # 6
5. Site Address - Dongan Hills Firehouse
   Richmond Road
6. Names of Nearest Intersecting Streets - Seaview Ave.,
   Four Corners Rd.
7. Pollutants Monitored at this Site - VOCs
8. Date Inspected - 11/23/87
9. Outstanding Landmarks - Older Firehouse with steep rise
   to the West. located in the Northeast portion of S.I.


CS 1/3 - NY #6 - Dongan Hills FH
Emerson Hill
Staten Island Community College
Concord
Grasmere
Grasmere Lake
Todt Hill
Doctors Hospital
PS 48
Cameron Lake
St Francis Seminary
Kaufman Campgrounds
Wagner High Sch
Academy of St Dorothy
St Marys Cem
Old Town
Staten Island Academy
Linden Park
PS 46
William H Pouch Sc, Scout Camp
Richmond County Country Club
Ohrback Lake
Stump Pond
Ruins
Tower
St Charles Borromeo Seminary
St Anna's Sch
Dongan Hills
Water Tank
MacArthur Park
1/4mi
2Km
MORAVIAN CEMETERY
Vanderbilt Cemetery
High Rock Girl Scout Camp
Grant City
PS 52
Walker Pond
St Christophers Sch
Egbert Jr High Sch
New Creek
New Dorp
PS 41
Library
PO
Park
PS 38
Midland Beach
Midland Beach
Parking
New Dorp High Sch
Police Sta
St Margaret Mary Sch
U S MILITARY RES
MILLER FIELD
Oakwood
St Charles Sch
New Dorp Beach
Elm Tree Beacon
Oakwood Beach
New Dorp
6165 II SW
(ARTHUR KILL)
6- 81

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable. [ ]

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS #)
Buildings (number of stories)
Undeveloped Land (grou...
Tree Lines or Clu...

Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
...h Direction



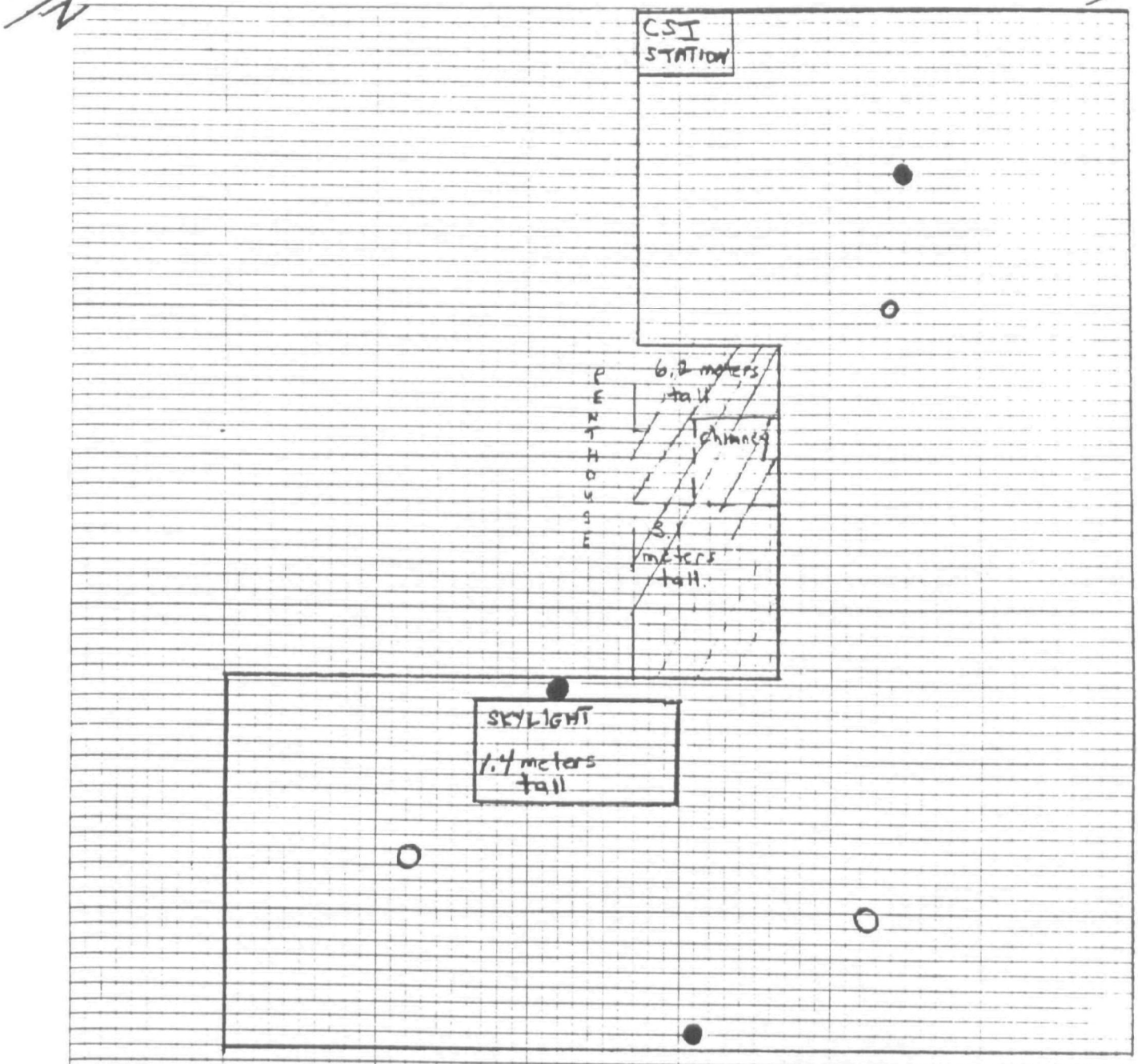
16. Attach separate sheet of labeled photographs G [ ]

17. UTM Coordinates, Zone _____ East _____ North _____

or latitude and longitude _____ _____ G [ ]

* - R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
[ ] – Blocks are reserved for site evaluation only

FOUR CORNERS FIRE HOUSE



KEY: ● sewer VENTS

○ bathroom and sink vents

PARAPET HEIGHT = 1.1 meters
ROOF HEIGHT = [illegible] meters

scale 1inch = 3 meters

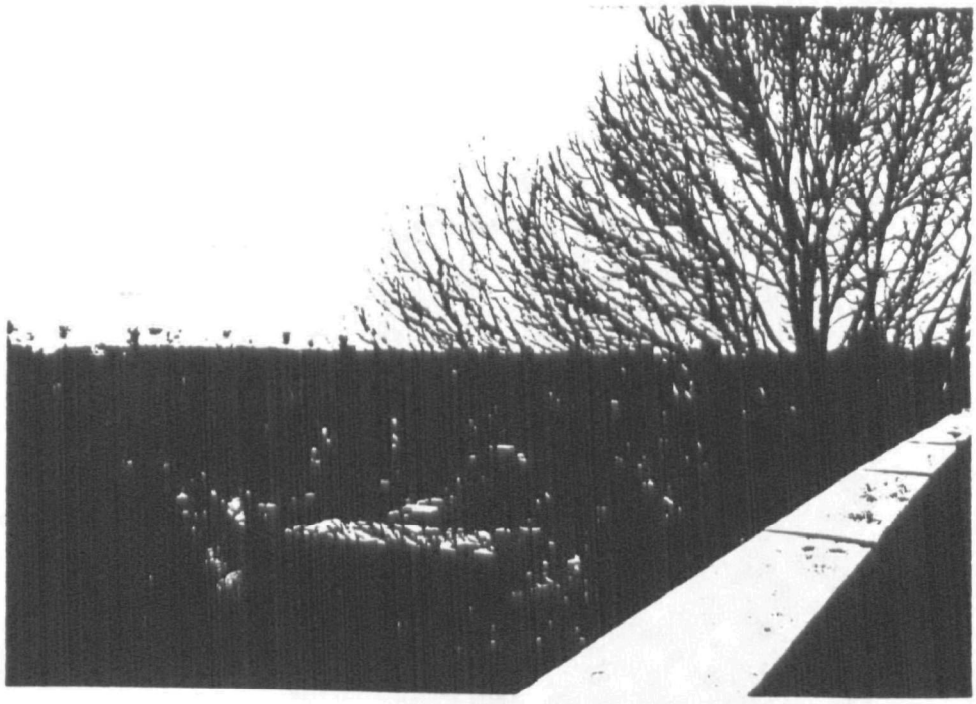
Dongan Hills Firehouse
Richmond Rd
Dongan Hills, SI, NY

North

East

Dongan Hills Firehouse
Richmond Rd
Dongan Hills SI NY

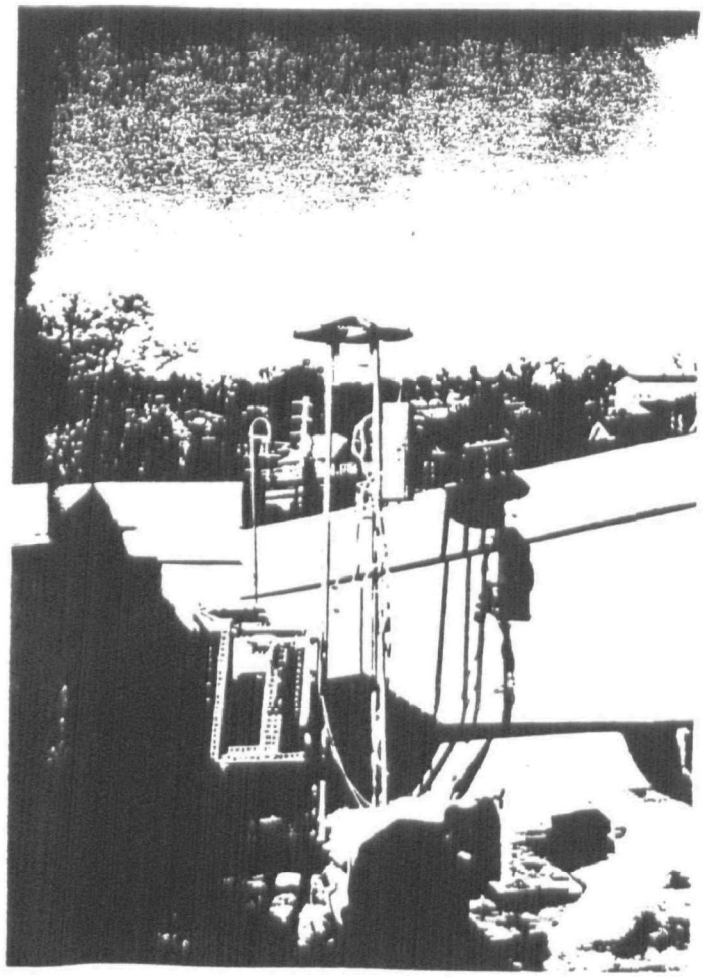
North East



South 6- 85

Dongan Hills Firehouse
Richmond Rd
Dongan Hills SI NY

West



Canister and Tenax monitors on corner of roof of the Dongan Hill Firehouse

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

_____ Smooth, _____ Rolling, ___✓___ Rough

2. Topographic features that influence the site:

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Atlantic Ocean		E, SE	~2.5 Km
Steep Rise		W	~ 400-500 ft

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site
Tree	~40'	SE	20 m

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site
Gas Station		NNE	1/4 mile
Dry Cleaner		N	300-400 ft.

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOCs

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	All directions 100' → 1/4 mi
Commercial (Small Businesses)	N, S, SW 50' → 1/4 mi
Industrial	
Mobile Richmond Rd	W, N, S, SW 30' → 1/4 mi
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban, Residential, Commercial

NE Suburban Residential

E Suburban Residential, Atlantic Ocean

SE Suburban Residential

S Suburban Residential, Commercial

SW Suburban Residential, Commercial

W Suburban Residential

NW Suburban Residential

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Names of Roadways (nearest to site first)

Type: (check one)	Richmond Rd.	Seaview Ave.	Four Corners Rd.	Flagg Pl.					
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway	✓								
Through Street or Highway			✓						
Local Street or Road		✓		✓					
Traffic Activity: (complete as applicable)									
1. *Distance of roadway from air intake(ft)	30'	65'	130'	165					
2. Direction of roadway from air inlet (8 pts)	W	NE	NW	W					
3. Composition of roadway	tar →								
4. Number of traffic lanes	2	1	1	1					
5. Average daily traffic (estimate)									
6. Average vehicle speed (estimate, mph)	40	25	25	25					
7. Traffic is 1 or 2 way (1 or 2)	2	1	1						
8. Number of parking lanes	2	2	1	0					
9. Are parking lanes used for traffic part of day? (yes,no)	No	No	No	N/A					
10. Roadway paved (yes, no)	yes →								
11. Is dust visibly re-entrained? (yes, no)	No →								
12. Does roadway have curb? (yes, no)	yes →								
13 Does dust collect near edges? (yes, no)	yes →								

*Identify probe, if more than one.

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service NEWARK AIRPORT

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

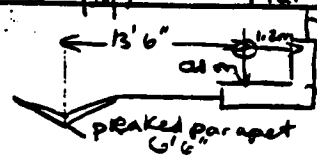
4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Enviro Chem	Portable GC
1. Location (top of building, ground level, other specify)	roof	roof				
2. If on building, give height (M)	8.6	8.6				
width (M)						
depth (M)						
3. Horizontal distance from supporting structure (M)	N/A	N/A				
4. Vertical distance above supporting structure (M)	1.8m	1.5				
5. Height of probe above ground (M)	10.4m	10.1m				
6. Distance from trees (M)	>20m	>20m				
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	9m	9m				
8. Horizontal distance from nearest parking lot (M)	N/A	N/A				
9. Horizontal distance from walls, parapets, penthouses, etc. (M) parapet ht 1.3m to 2.m	0.9m	0.9m			-	
10. Distance from obstacles, such as buildings	N/A	N/A				
11. Distance from furnace or incineration flues (M)	7m	7m				
12. Unrestricted air flow	Yes	Yes				
13. Located in paved area or vegetative ground cover	Yes	Yes				
14. Roof Composition (roof was lumpy)	Tar	Tar				

* Corner monitoring setup



MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	CSI	Anderson			
Date Sampling Began	9/87	1/88			
Sampling Frequency	Daily	1/8 days			

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection College of Staten Island (CSI)
2. Individual's name Dr. Clifford Weisel
3. Phone Number 718-390-7994
4. Agency analyzing samples CSI - (Tenax) and PEI Assoc. (canister)
5. Individual's Name Dr. Clifford Weisel (CSI) and Bill Jess (PEI)
6. Phone number 718-390-7994 (CSI) and 513-782-4764 (PEI)
7. Reports of data are made to (Agency Name) U.S. Environmental Protection Agency
8. Individual's Name Rudy Kapichak
9. Phone number 212-264-2551

SITE EVALUATION

Site Identification number NY site #6

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 11/23/87

Date of report 2/25/88

Signatures of Evaluators

Suzanne Jacquett

Comments This site has a very complicated parapet and penthouse structure; but, with the moniters placed in the SW corner of the roof, where it is, it should give good coverage of the area of SI east of the ridge.

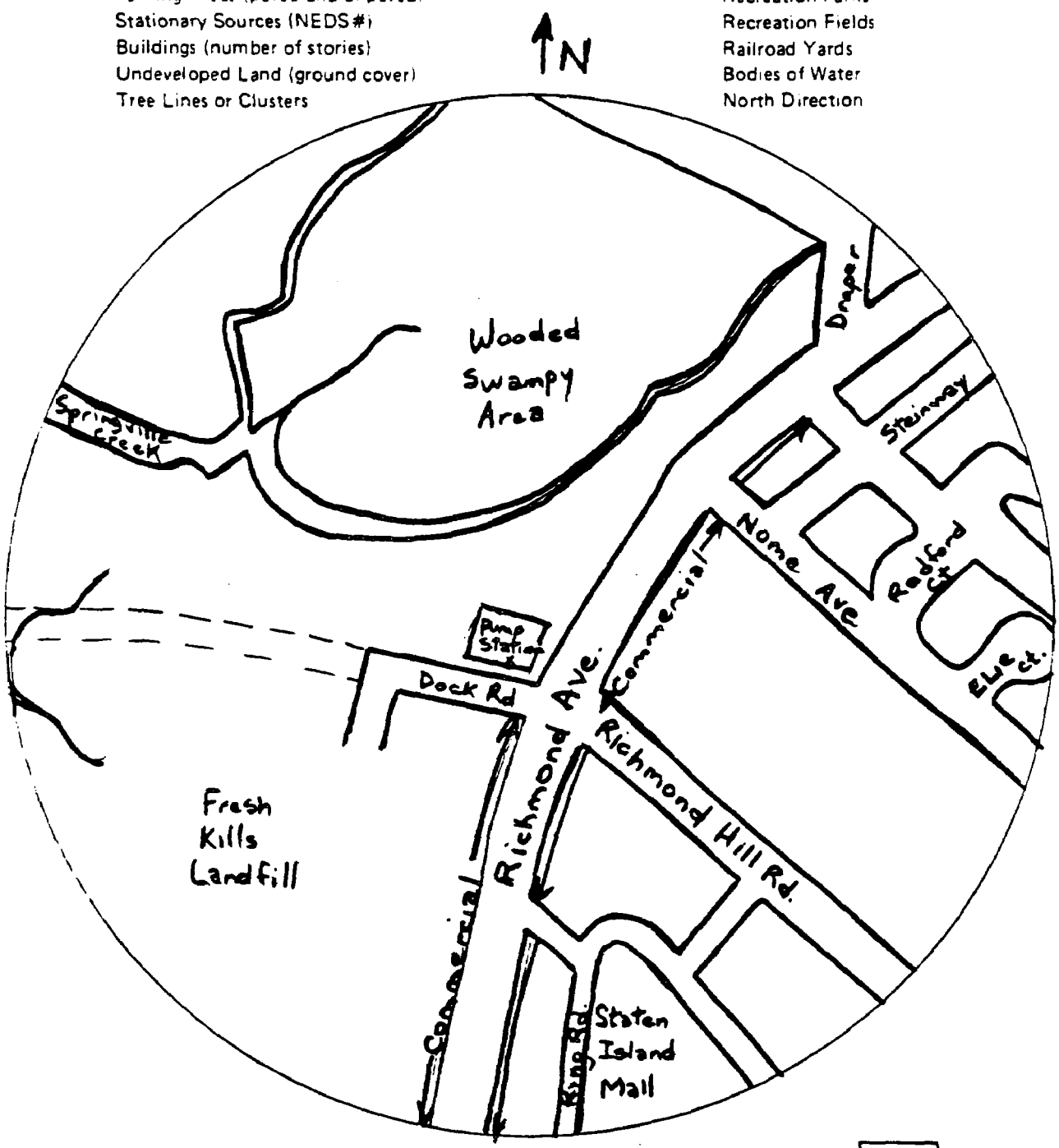
STATEN ISLAND/ NORTHEASTERN NEW JERSEY URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - New York
2. City - Staten Island, NYC
3. County / Section - Richmond /
4. Site Code - NY Site #7
5. Site Address - NYC DEP Pump Station
   Richmond Avenue
6. Names of Nearest Intersecting Streets -
   Richmond Hill Road
7. Pollutants Monitored at this Site - VOC's using ATD Tubes, + Canisters, Auto GC's (proposed), Met station
8. Date Inspected - 12/30/87
9. Outstanding Landmarks - This site is access from the Staten Island Mall and downwind of the Fresh Kills Landfill.

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable.

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters
Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction



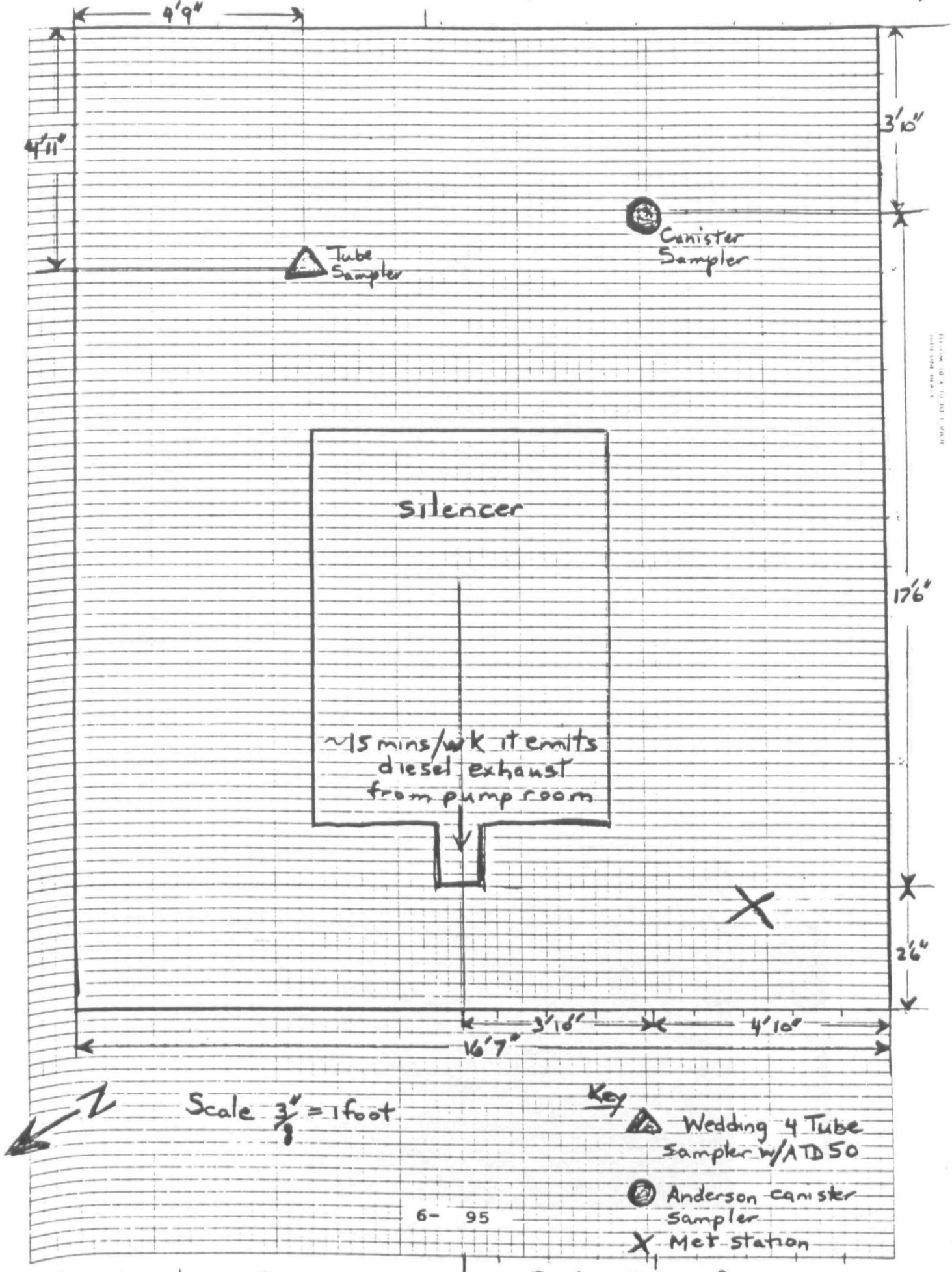
16. Attach separate sheet of labeled photographs G

17. UTM Coordinates, Zone _____ East 570.5 North 4493.15

or latitude and longitude 74° 10' 05" 40° 35' 21" G

R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
– Blocks are reserved for site evaluation only

NY Site #7 Pump House Near SI Mall 1/4/88



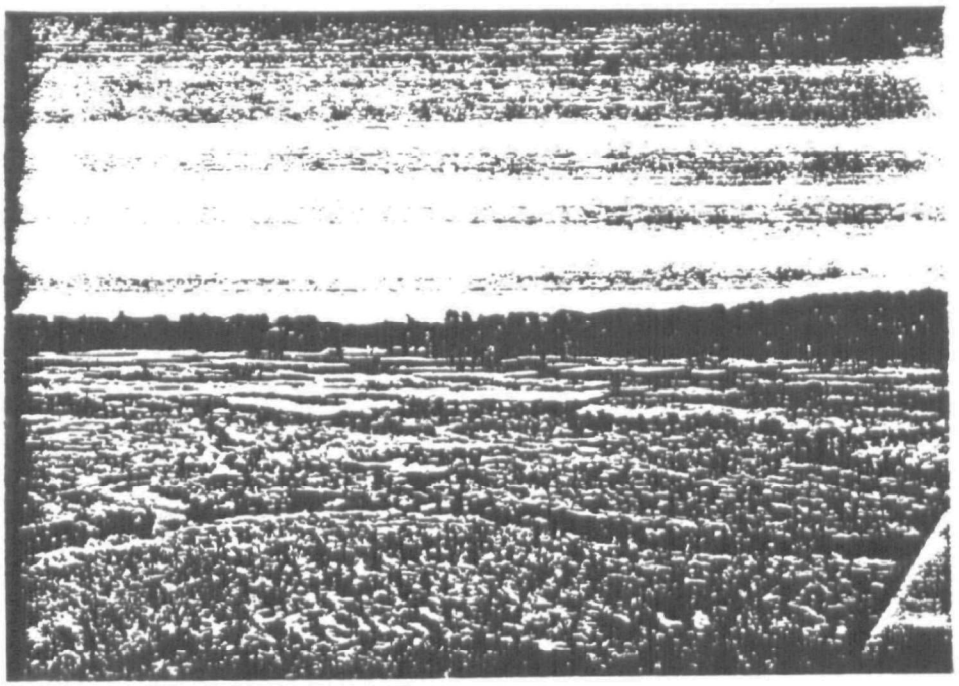
6- 95

Sampler Layout on Uppermost Roof of the Pumphouse

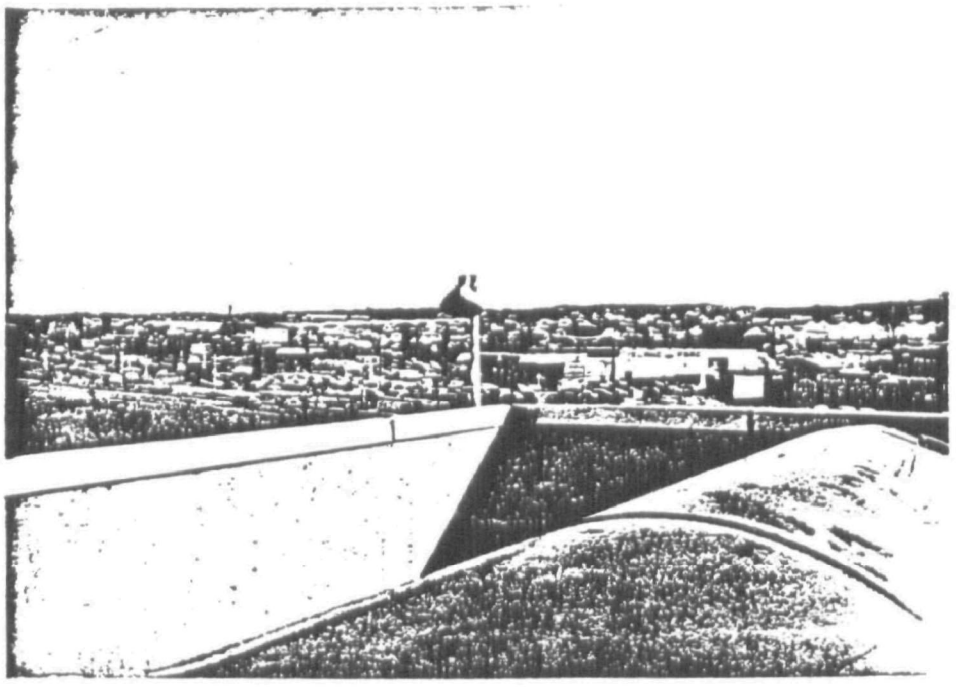
NY site #7

#7 4/88

Staten Island Pump House near SI Mall
Richmond Ave + Richmond Hill Rd.



North

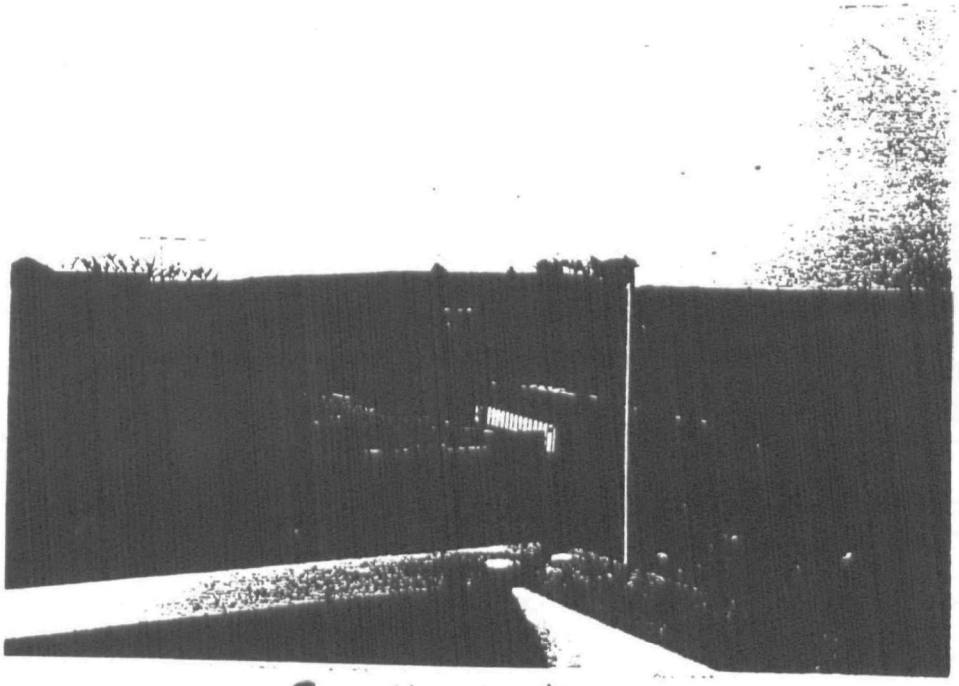


North East

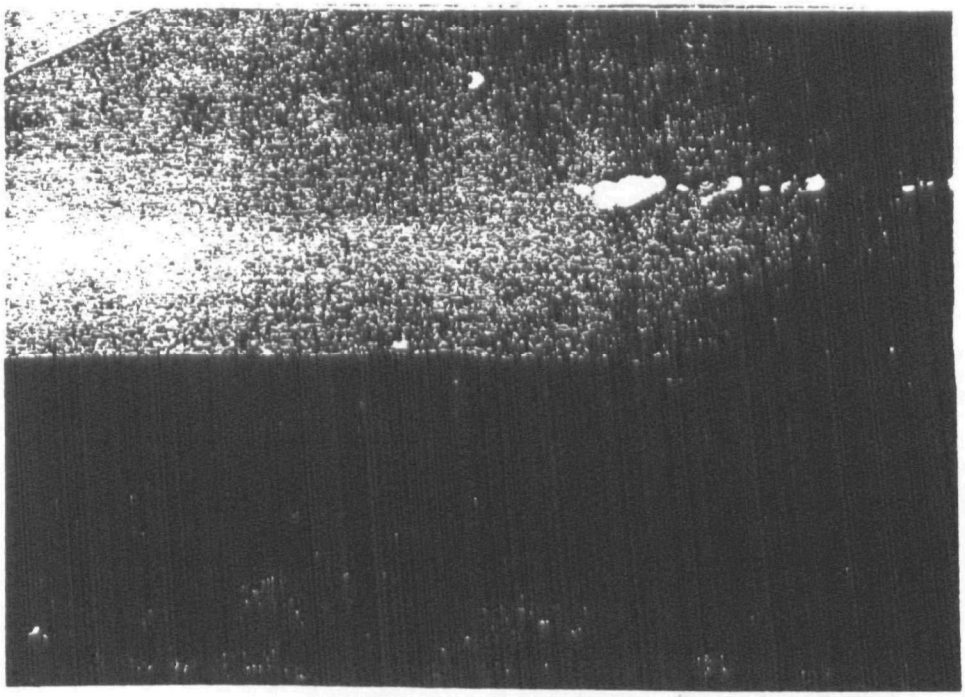
NY Site #7

1108

Staten Island Pump House near SI Mall
Richmond Ave + Richmond Hill Rd.



South West

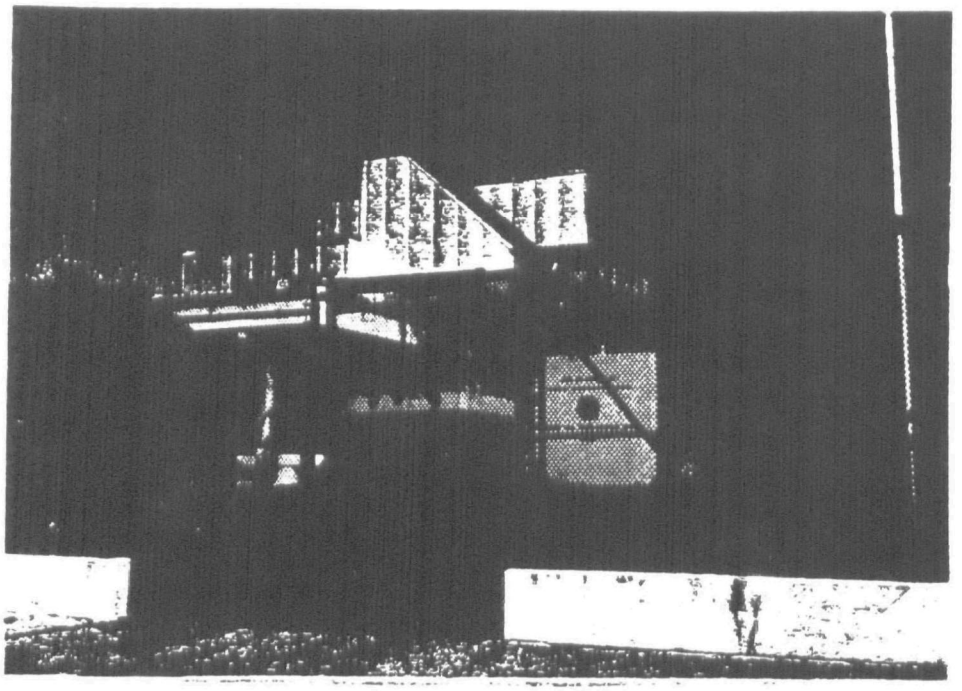


West

NY Site #7

Staten Island Pump House near SI Mall
Richmond Ave and Richmond Hill Rd.

4/88 #7



View of Pumphouse from Ground.

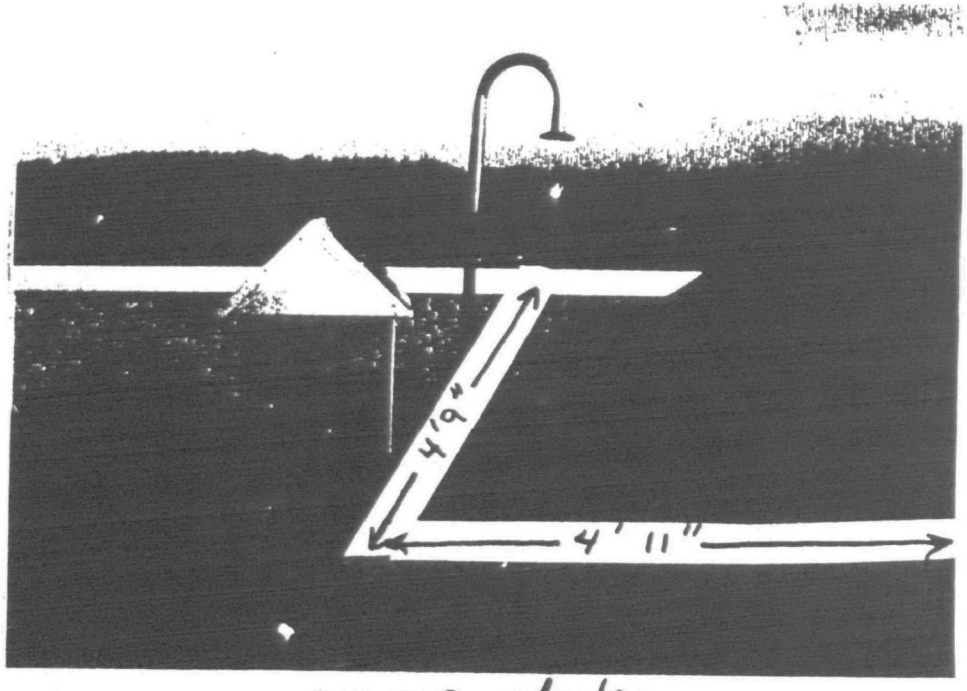
Met Station at Western corner of roof.

NYS Site #7

Pump House Near SI Mall

Richmond Hill Rd and Richmond Ave

BEFORE 12/30/88



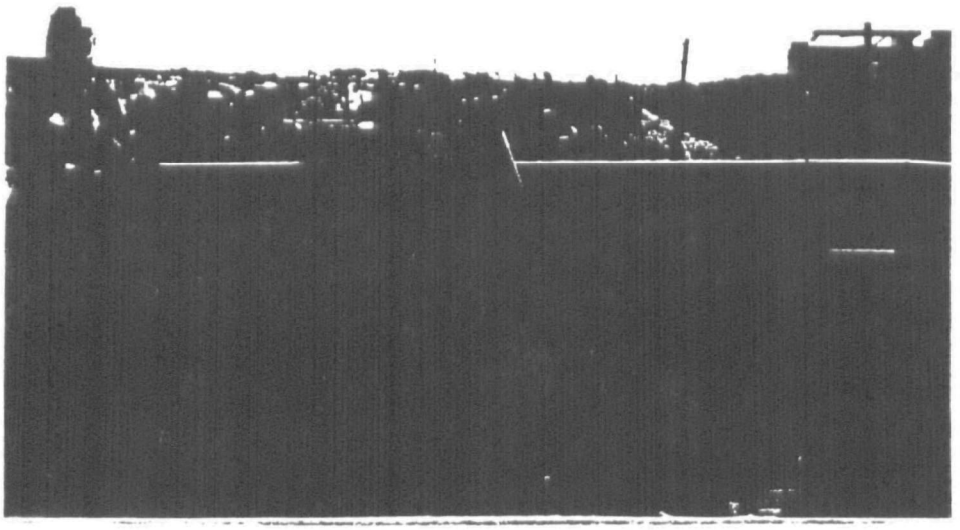
AFTER 12/30/88

Comparison of the positions of the Tube sampler on site initially upon inspection, and after the inspection.

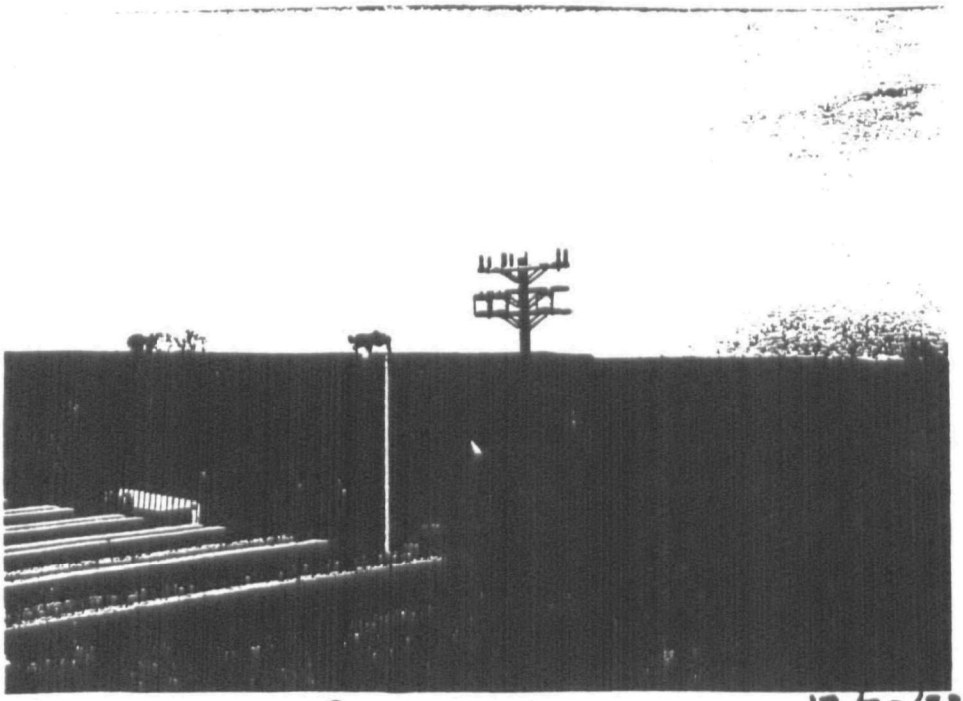
Note; that the sampler's inlet was too close to nearby walls and is actually lower than the wall. EPA repositioned the monitor with DEC that day and recommended that the monitor also be raised 1 foot higher.

NYSDEC #7
Pump House

12/30/88



Relative Positions of Tube sampler and Canister Sampler After Inspection.



Southwest 12/30/88

Note: Height of Landfill now, as compared to former photo from 4/88

#7

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOC's

Mobile _____

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	~1000 ft - ¼ mi E, NE, SE
Commercial	~200 ft - ¼ mi NE → S
Industrial	_____
Mobile	~150 ft - ¼ mi E, S, NE
Other (describe) Fresh Kills Landfill	~200 ft - ¼ mi W, NW, N
Staten Island Mall	¼ mi SSE

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban Residential, Swamp, Springville Creek, Wildlife Refuge

NE " , Commercial, Springville Creek, Willowbrook Park

E " , Commercial, Richmond Ave

SE " , Staten Island Mall

S Richmond Ave (3-4 lanes ea. direction), Staten Island Mall, commercial

SW Fresh Kills Landfill

W Fresh Kills Landfill

NW Swamp, Main Creek, William Davis Wildlife Refuge, Springville Creek

Mobile Source Worksheet

Mobile Sources that may influence the Site

Names of Roadways (nearest to site first)

Type (check one)	Richmond Ave	Richmond Hill Rd.							
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway	✓	✓							
Through Street or Highway									
Local Street or Road									
Traffic Activity (complete as applicable)									
1 *Distance of roadway from air intake (ft)	165'	270'							
2 Direction of roadway from air inlet (8 pts)	E	SE							
3 Composition of roadway	4sph	0sph							
4 Number of traffic lanes	8	2							
5 Average daily traffic (estimate)									
6 Average vehicle speed (estimate, mph)	40	30							
7 Traffic is 1 or 2 way (1 or 2)	2	2							
8 Number of parking lanes	0	1							
9 Are parking lanes used for traffic part of day? (yes,no)	NA	NA							
10 Roadway paved (yes, no)	yes	yes							
11 Is dust visibly re-entrained? (yes, no)	No	No							
12 Does roadway have curb? (yes, no)	yes	yes							
13 Does dust collect near edges? (yes, no)	yes	yes							

*Identify probe if more than one.

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Landfill		SSW→W	

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site
Fresh Kills Landfill	See map	SSW→W	See map
Richmond Ave. Traffic	8 lanes wide	E (but road is actually NE→S)	164 ft.
Pumphouse Wastewater (can smell it although operator claims no leaks)			

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   _____ National Weather Service

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

ngtas of 12/88

Information Topic	Tenax	Canister	DNPH	TSP	Environ Chem	Portable GC	ATD-50 Tubes	Met Tower
1. Location (top of building, ground level, other specify)		roof				roof	roof	roof
2. If on building, give height (M)		6.0				6.0	6.0	6.0
width (M)		5.0				5.0	5.0	5.0
depth (M)		7.3				7.3	7.3	7.3
3. Horizontal distance from supporting structure (M)		N/A				N/A	N/A	N/A
4. Vertical distance above supporting structure (M)		N/A				N/A	N/A	N/A
5. Height of probe above ground (M) Canister probe = 1.5m Tube sampler = 1.0m		7.5				? ?	7.0m	3.0
6. Distance from trees (M)		NA				N/A	N/A	N/A
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)		15 m				15 m	15 m	N/A
8. Horizontal distance from nearest parking lot (M)		N/A				N/A	N/A	N/A
9. Horizontal distance from walls, parapets, penthouses, etc. (M) ht. of parapet = 3'5" = 1.0m		1.2m				?	1.5m	
10. Distance from obstacles, such as buildings								
11. Distance from furnace or incineration flues (M) Diesel exhaust pipe		4.5m					4.3m	N/A
12. Unrestricted air flow		Y				?	No	←
13. Located in paved area or vegetative ground cover		Y				Y	Y	N/A
14. Roof Composition painted concrete		✓				✓	✓	✓

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs ATD-50	VOCs Canister	VOCs Portable GC	Carbonyls NDPH	Metals Hi-vol	Met Station
Instrument Manufacturer	Wedding	Sierra Anderson				Climatroni
Date Sampling Began	9/30/88	9/88	not as of 12/30/88			9/30/88
Sampling Frequency	1/6	1/6				*

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection New York State Department of Environmental Conservation (NYSDEC)
2. Individual's name Mike Steineger
3. Phone Number (718) 482-4944
4. Agency analyzing samples NYSDEC (grad. Sorbent + ATD-50); PEI Associates (Canister)
5. Individual's Name Garry Boynton (DEC); Bill Jess
6. Phone number 518-457-7454 ; 513-782-4700
7. Reports of data are made to (Agency Name) NYSDEC → US Environmental Protection Agency (USEPA)
8. Individual's Name Don Gower (NYSDEC) → Rudy Kapichak (USEPA)
9. Phone number 518-457-3676 (NYSDEC), 212-264-2517 (USEPA)

* Met data stored on data logger and sent to Albany Monthly

#7

SITE EVALUATION

Site Identification number NY#7

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 12/30/88

Date of report 1/4/89

Signatures of Evaluators

Suzanne Jacquett

Comments - Monitors should be raised at least 1 foot so that the sample inlet will be higher than the parapet wall.

- Sewage odor was present at time of inspection although DEP officials claim no leaks are present.
- Muffler system, for diesel engines inside pumphouse, is located on the roof and is run for less than an hour each week. This muffler contains an 8" diameter exhaust pipe. The operator's log should note when this system is turned on, especially on sampling days.
- Met tower presently is approx. 6 ± ft higher than the parapet. It needs to be evaluated by the meteorological monitoring team as to whether it should be raised.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - NEW YORK
2. City - STATEN ISLAND, NEW YORK
3. County / Section - Richmond County, CLIFTON SECTION
4. Site Code - NEW YORK SITE #8
5. Site Address - Bailey-Seton Hospital
   Tompkins Ave,
   Staten Island, NY.
6. Names of Nearest Intersecting Streets - Vanderbilt and Tompkins Avenues.
7. Pollutants Monitored at this Site - VOC's with CANISTER AND TENAX SAMPLERS
8. Date Inspected - 11/12/88
9. Outstanding Landmarks - ON GRASS NEAR HELICOPTER LANDING PAD IN BACK OF HOSPITAL COMPLEX

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable. [ ]

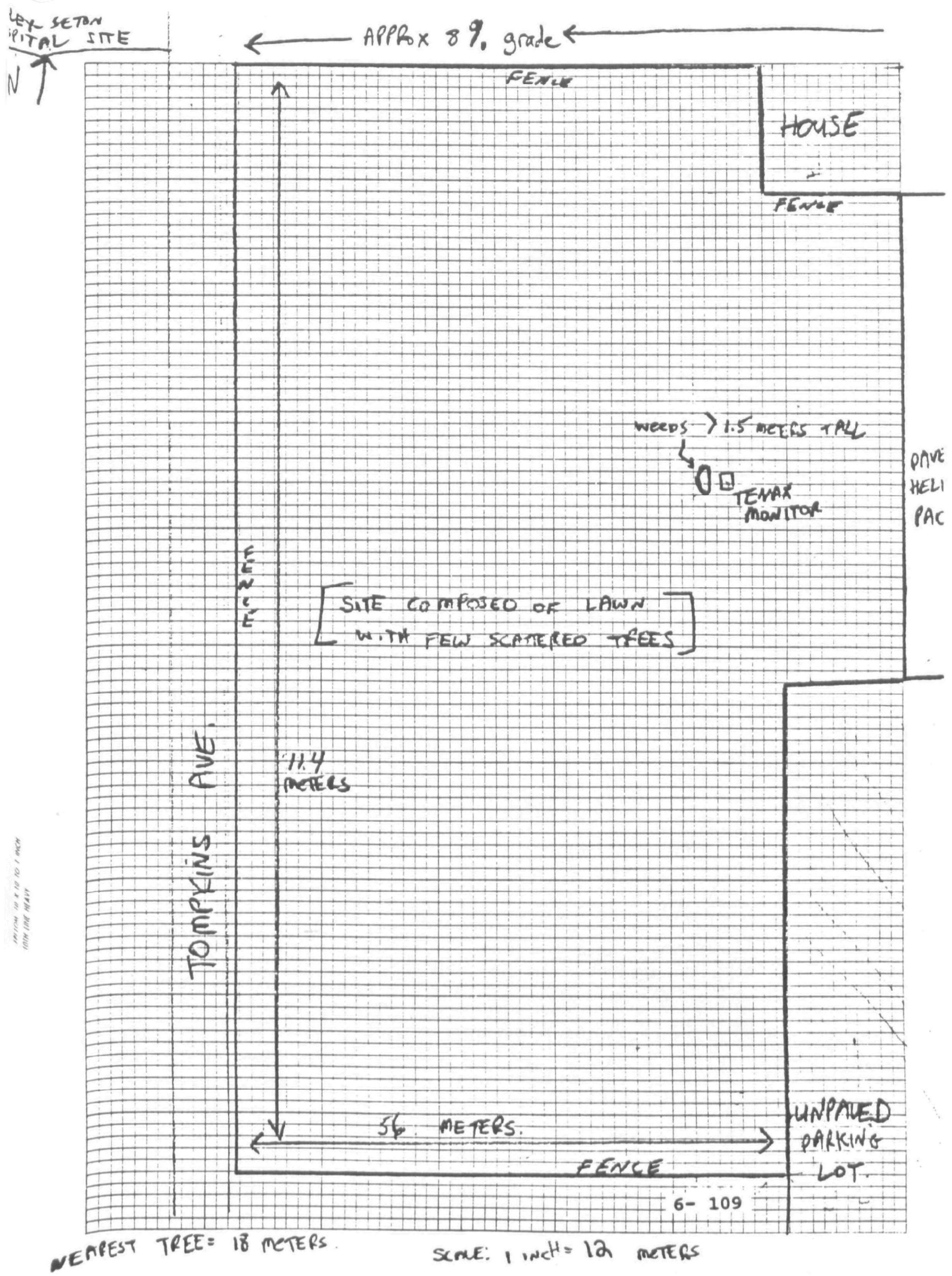
NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters
Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction

16. Attach separate sheet of labeled photographs G [ ]

17. UTM Coordinates, Zone _____ East _____ North _____

or latitude and longitude _____ _____ G [ ]

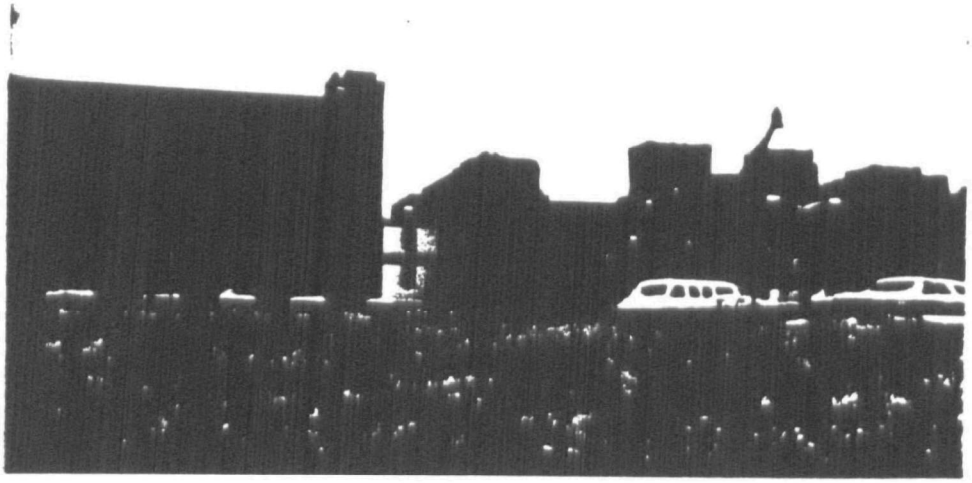
* - R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
[ ] – Blocks are reserved for site evaluation only


LEX SETON
PITAL SITE
N
APPROX 8% grade
FENCE
HOUSE
FENCE
WEEDS > 1.5 METERS TALL
TEMAX MONITOR
PAVE
HELI
PAC
FENCE
SITE COMPOSED OF LAWN
WITH FEW SCATTERED TREES
TOMPKINS AVE.
11.4 METERS
56 METERS.
UNPAVED PARKING LOT.
FENCE
6- 109
NEAREST TREE = 18 METERS
SCALE: 1 INCH = 12 METERS

Bailey Seton Hospital

Staten Island, NY

North

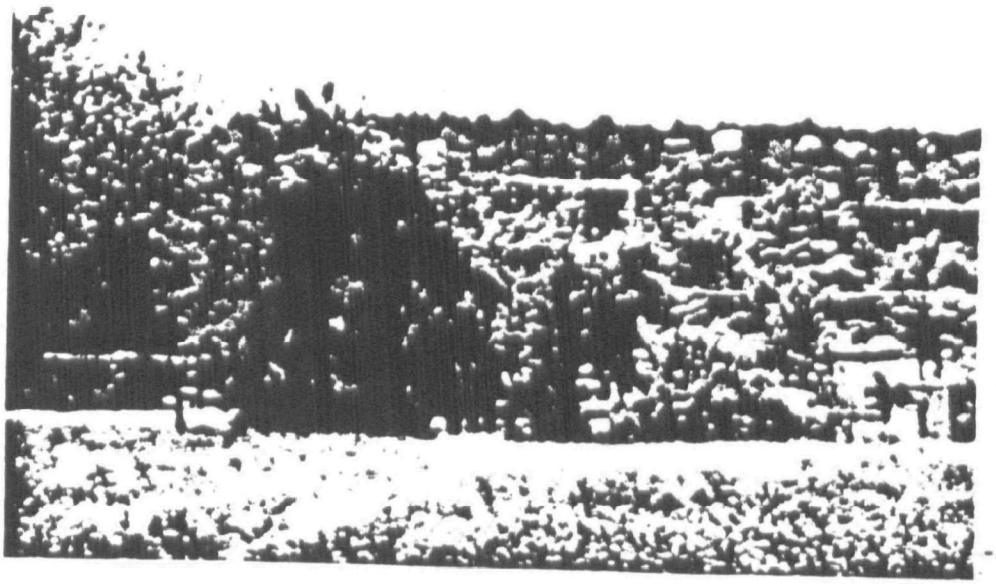


East

Bailey Seton Hospital

Staten Island, NY

South



West

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   _____ Smooth, ✓ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Grymes Hill	<100 ft	WEST	1/4 - 1/2 mile
The NARRows		EAST	1/4 mile

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site
TREE	~17 FEET TALL	SW	18m
WEEDS	4.5 FEET TALL	W	1.2 m

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site
HELICOPTER		EAST	30m

SITE CLASSIFICATION

1. Dominating Influence of site

Area _____

Mobile _____

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	~ 300' in all directions except E & SE
Commercial	~ 1/4 mile NE, E, NW
Industrial	
Mobile	
Other (describe) Hospital Housing Project	E, SE

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N SUBURBAN RESIDENTIAL

NE SUBURBAN RESIDENTIAL, COMMERCIAL, THE NARROWS

E HOSPITAL, THE NARROWS

SE HOSPITAL, THE NARROWS, SUBURBAN RESIDENTIAL

S SUBURBAN RESIDENTIAL

SW SUBURBAN RESIDENTIAL, COMMERCIAL

W HOUSING PROJECT

NW URBAN RESIDENTIAL, SUBURBAN RESIDENTIAL

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Type (check one)	Names of Roadways (nearest to site first): TOMPKINS AVE.	VANDERBILT AVE.							
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway	✓								
Local Street or Road		✓							
Traffic Activity: (complete as applicable)									
1. *Distance of roadway from air intake(ft)	170								
2. Direction of roadway from air inlet (8 pts)	W	S							
3. Composition of roadway	TAR	TAR							
4. Number of traffic lanes	2	2							
5. Average daily traffic (estimate)									
6. Average vehicle speed (estimate, mph)	35	35							
7. Traffic is 1 or 2 way (1 or 2)	2	2							
8. Number of parking lanes	0								
9. Are parking lanes used for traffic part of day? (yes,no)	N/A								
10. Roadway paved (yes, no)	Y	Y							
11. Is dust visibly re-entrained? (yes, no)	N	N							
12. Does roadway have curb? (yes, no)	Y	Y							
13 Does dust collect near edges? (yes, no)	Y	Y							

*Identify probe, if more than one.

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service, NEWARK AIRPORT

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	CSI Tenax	CSI Canister	EPA DNPH	EPA TSP	EPA Enviro Chem	EPA Portable GC
1. Location (top of building, ground level, other specify)	GRND	GRND				
2. If on building, give height (M)	N/A	N/A				
width (M)	N/A	N/A				
depth (M)	N/A	N/A				
3. Horizontal distance from supporting structure (M)	N/A	N/A				
4. Vertical distance above supporting structure (M)	N/A	N/A			N/A	
5. Height of probe above ground (M)	1.8m	1.3m				
6. Distance from trees (M)	18m	18m				
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	48m	48m				
8. Horizontal distance from nearest parking lot (M)	24m	24m				
9. Horizontal distance from walls, parapets, penthouses, etc. (M)	N/A	N/A	N/A	N/A		
10. Distance from obstacles, such as buildings	60m	60m	N/A			
11. Distance from furnace or incineration flues (M)	N/A	N/A	N/A	N/A		
12. Unrestricted air flow	YES	YES				
13. Located in paved area or vegetative ground cover	YES	YES				
14. Roof Composition	N/A	N/A				

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	CSI	Anderson			
Date Sampling Began	6/87	2/88			
Sampling Frequency	1/1	1/18			

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection College of Staten Island (CSI)

2. Individual's name Dr. Clifford Weisel

3. Phone Number 718-390-7994

4. Agency analyzing samples TENAX-CSI, CANISTER-PEI

5. Individual's Name Dr. Clifford Weisel (CSI), Bill Jess (PEI)

6. Phone number 718-390-7994 (CSI), 513-782-4764

7. Reports of data are made to (Agency Name) NY DEPT. OF HEALTH → US EPA

8. Individual's Name ANDERS CARLSON (NYDOH), RUOY KAPICHAK (USEPA)

9. Phone number 518-474-4987 (NYDOH), 212-264-2551 (USEPA)

SITE EVALUATION

Site Identification number NY STATE SITE # 8

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 11/12/87

Date of report 2/25/88

Signatures of Evaluators

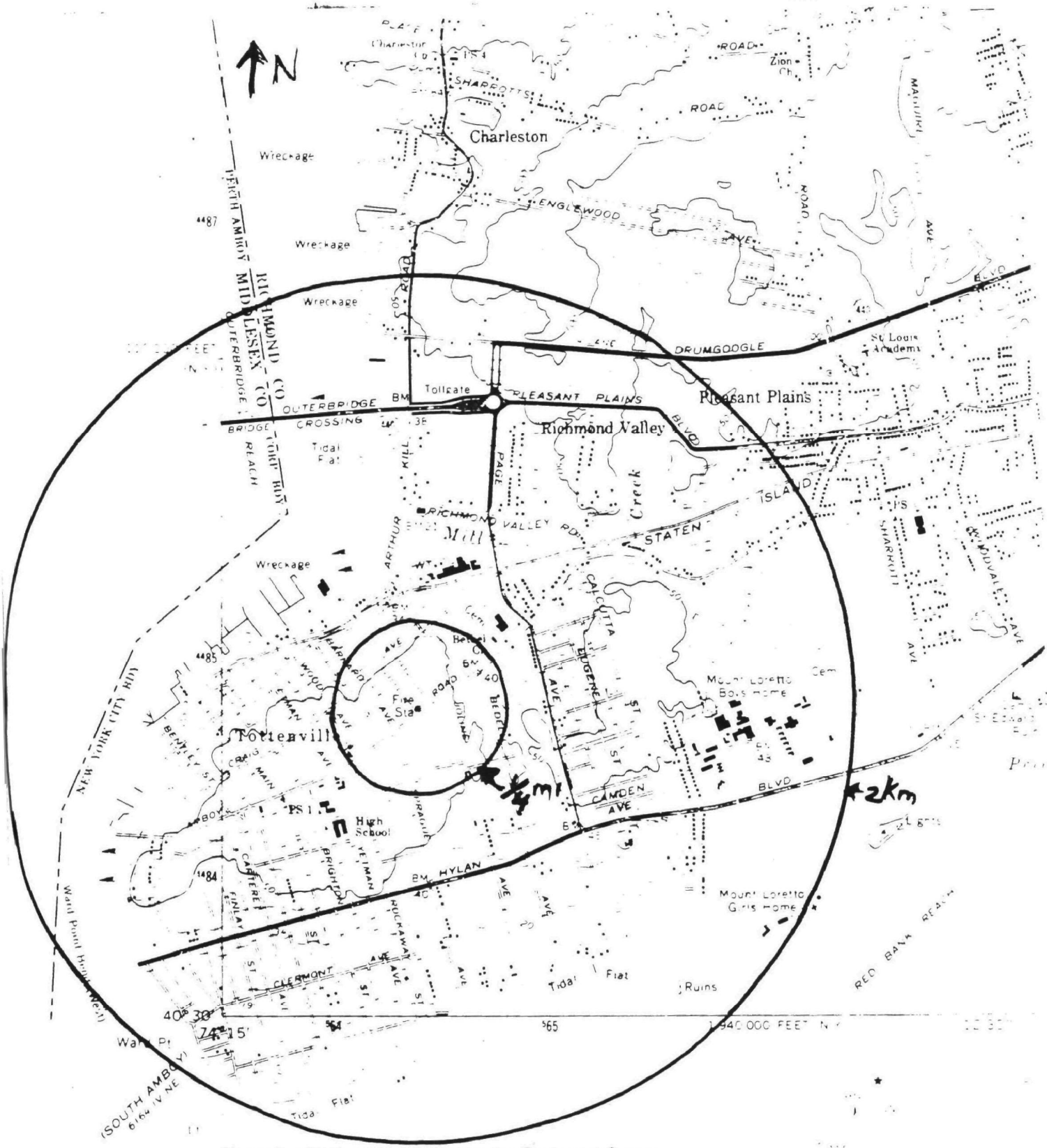
Avraham Teitz

Comments THE SITE IS W A LARGE GRASSY AREA AT GROUND LEVEL, THERE IS LITTLE TO NO PEDESTRIAN TRAFFIC AT THE MONITOR.

STATEN ISLAND, NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - New York
2. City - Staten Island, NYC
3. County / Section - Richmond / Tottenville
4. Site Code - NY site # 9
5. Site Address - Tottenville Firehouse
   Amboy Road
6. Names of Nearest Intersecting Strects - Brehaut Ave. + Barnard Ave.
7. Pollutants Monitored at this Site - VOC's using 2-Tube TexasTenax, Canisters and ATD 50 Tubes. WS/WD also measured.
8. Date Inspected - 5/20/88 and 12/30/88
9. Outstanding Landmarks - Old Firehouse within an older residential area in the South west portion of Staten Island near the Outerbridge Crossing.



Mapped, edited, and published by the Geological Survey
Revised in cooperation with New York Department of Transportation

Control by USGS, USC&GS, and USCE

Planimetry by photogrammetric methods from aerial photographs and from USC&GS Charts T-5105, T-5106, T-5107, T-5108, T-5109, T-5110, and T-8540. Topography, in New York, by photogrammetric methods from aerial photographs taken 1954. Field checked 1955. Topography, in New Jersey, by planetable surveys 1955. Revised from aerial photographs taken 1966. Field checked 1966

Selected hydrographic data compiled from USC&GS Charts 285 (1966), 286 (1966), and 369 (1967). This information is not intended for navigational purposes

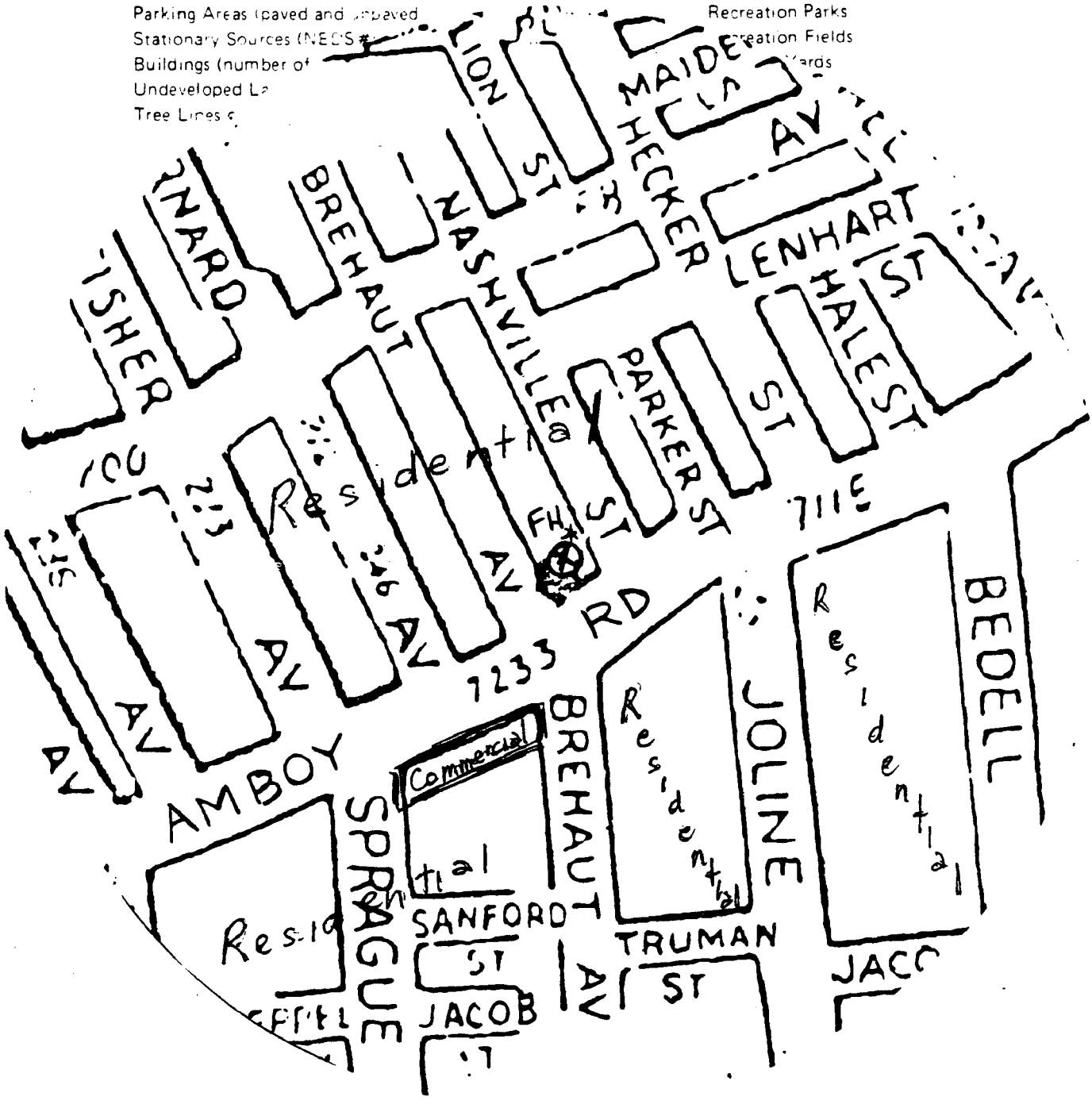
Polyconic projection. 1927 North American datum. 10 000-foot grids based on New York coordinate system, Long Island zone, and New Jersey coordinate system, 1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

6- 119

15. Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, when only immediate area information is needed. Include the following information on the drawing where applicable

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS #)
Buildings (number of stories)
Undeveloped Land
Tree Lines

Residences
Trailer Parks
Recreation Parks
Recreation Fields
Yards



16. Attach separate sheet of labeled photographs G

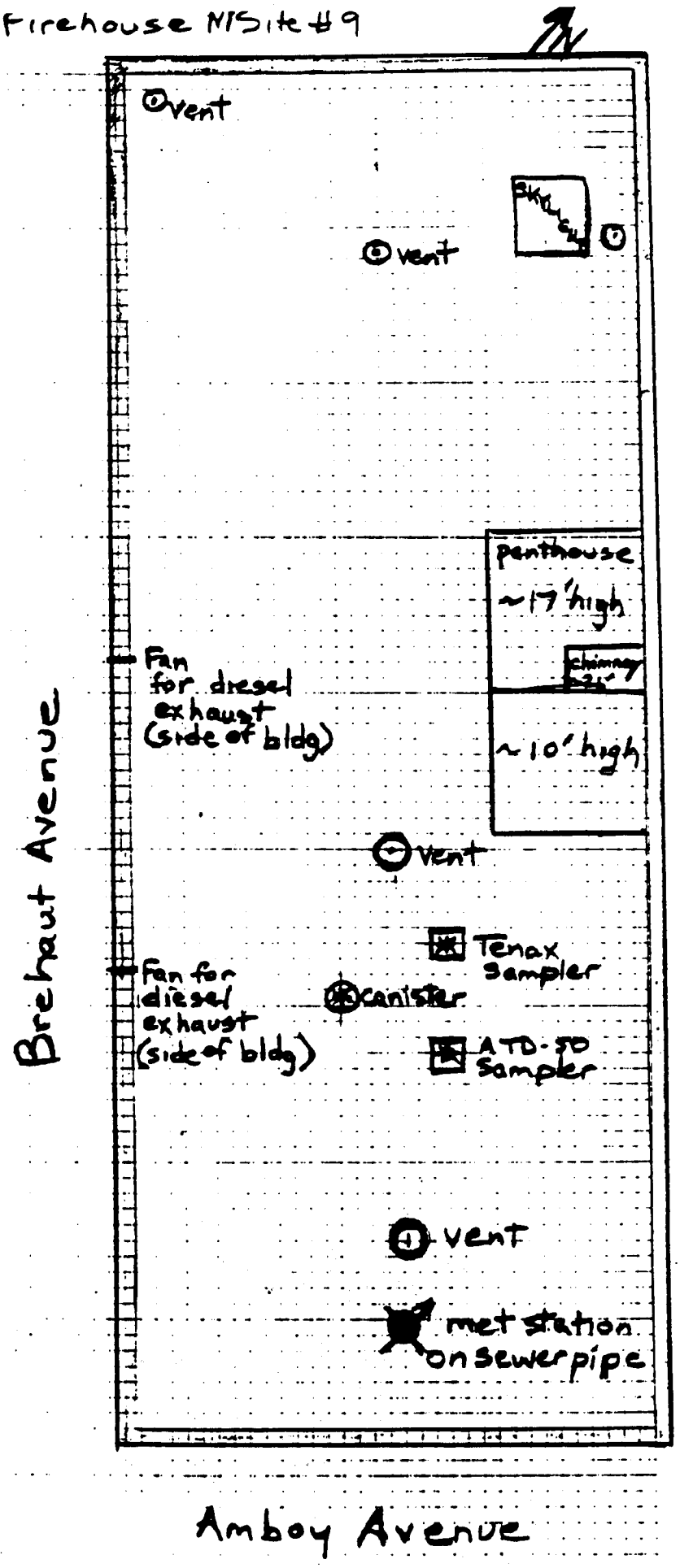
17. UTM Coordinates, Zone _____ East 564.46 North 4434.73

or latitude and longitude 74° 15' 28" 40° 30' 46" G

R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
– Blocks are reserved for site evaluation only

Tottenville Firehouse NY Site #9

Tottenville
Firehouse
NY Site #9



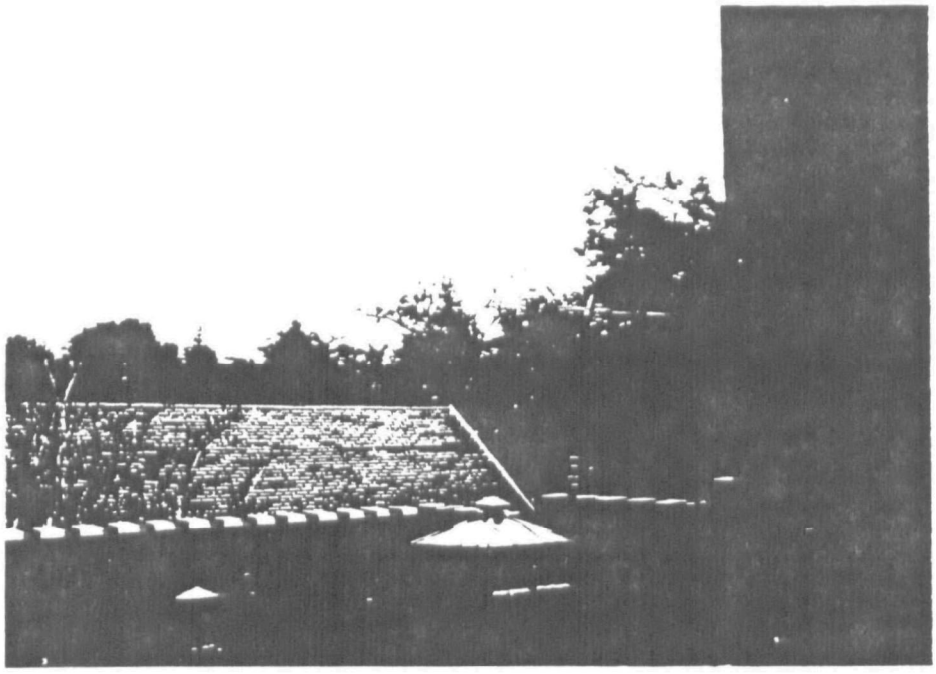
Parapet ht. = 3' = 0.9m

Bldg ht = 28'6" = 8.7 m

Scale 1" = 3 meters

NY site # 9
Tottenville Firehouse
Amboy Rd & Brehaut Ave.

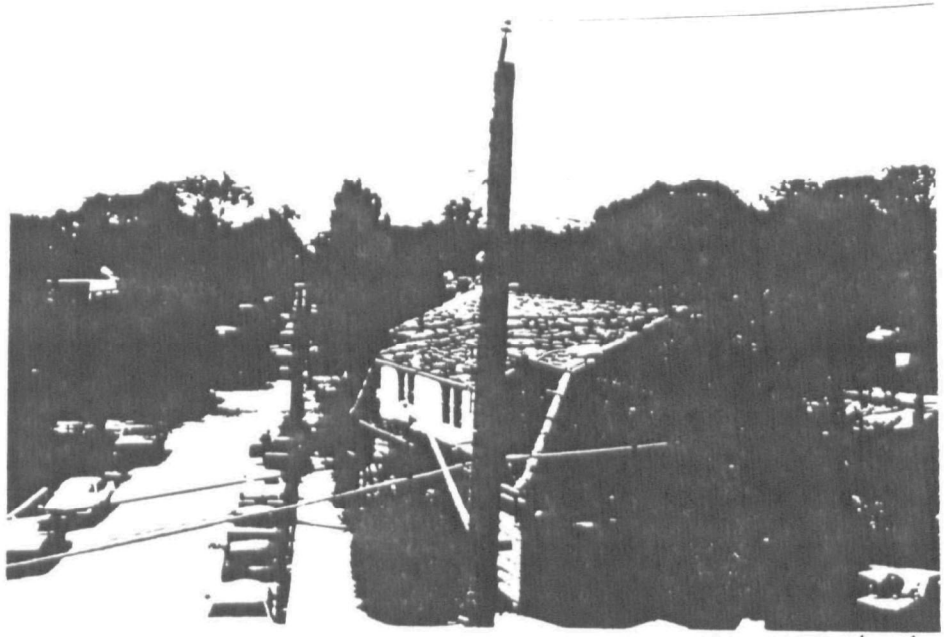
5188



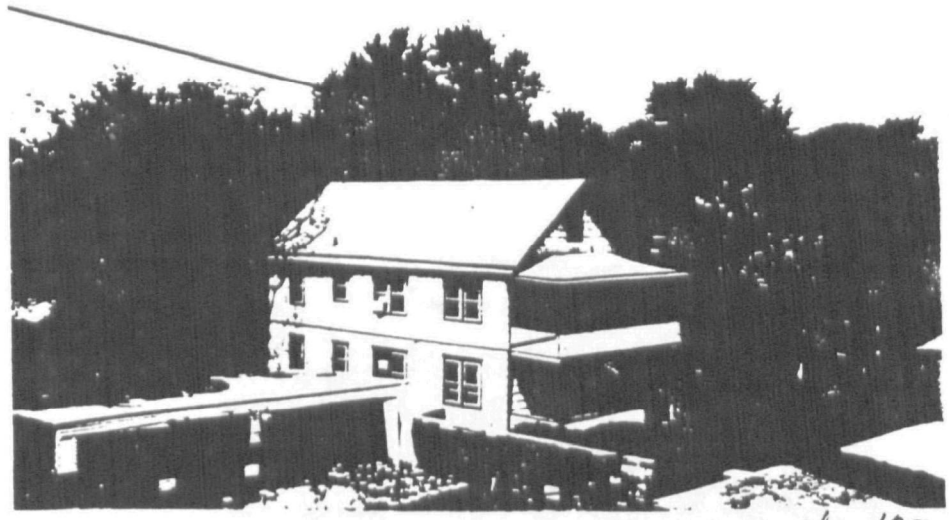
North

East

NY Site #9
Tottenville Firehouse
Amboy Rd + Brehaut Ave



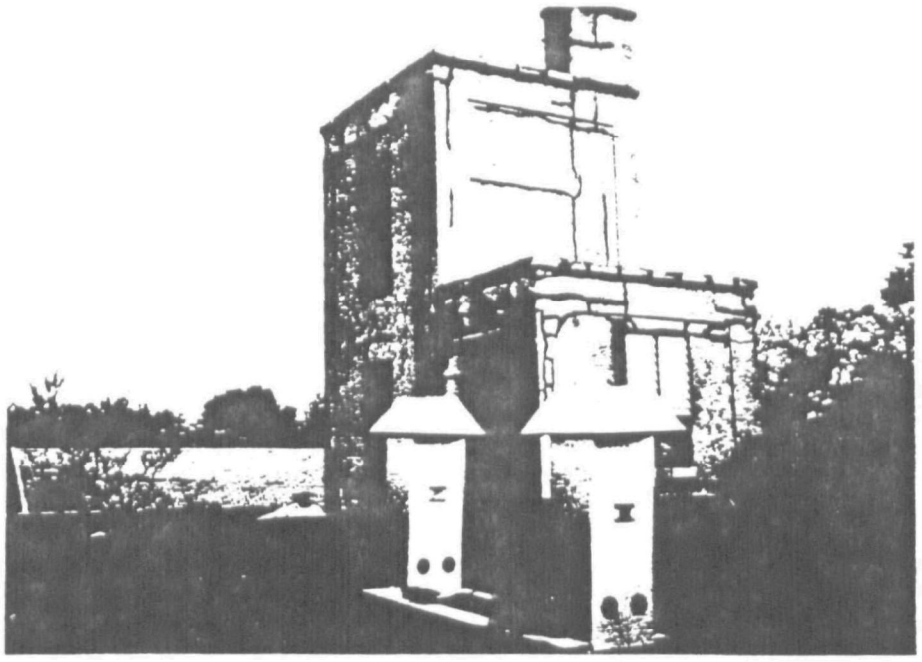
South 5/ /88



West 5/ /88

NY Site #9
Tottenville Firehouse
Bruchaut Ave + Amboy Rd.

5/88

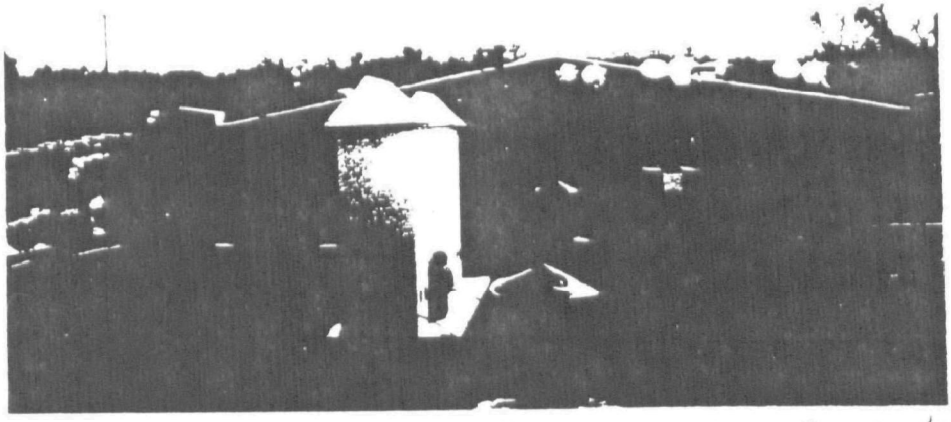


View of monitors on roof facing North.

Meteorological Station and Tenax and Envirochem Samplers on the roof.

Tottenville FH - NY #9
Amboy Rd
Tottenville, NY

12/30/88



Roof Set-up, facing South East, as of 12/30/88
Includes: Met tower, canister sampler,
ATD-50 tube sampler + Tenax tube sampler.

SITE CLASSIFICATION

1. Dominating Influence of site

   Area VOC's

   Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN:	DISTANCE AND DIRECTION FROM SITE
Residential	all directions
Commercial Deli, Plumbing + Heating, Video + Hardware stores	SW - 20 m
Industrial	
Mobile	
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N — Suburban Residential

NE

E

SE

S

SW

W

NW — Residential

Mobile Source Worksheet

Type of Roadway	Name of Roadways nearest to station: Amboy Ave	Brehaut St
Arterial Highway		
Expressway		
Freeway		
Parkway		
Major Street or Highway		
Through Street or Highway	✓	
Local Street or Road		✓
Traffic Activity (complete as applicable):		
1 *Distance of roadway from air intake (ft)	123m	11.0m
2 Direction of roadway from air inlet (8 pts)	E	SW
3 Composition of roadway	asph	asph
4 Number of traffic lanes	2	2
5 Average daily traffic (estimate)		K1K
6 Average vehicle speed (estimate, mph)	30	25
7 Traffic is 1 or 2 way (1 or 2)	2	2
8 Number of parking lanes	0	2
9 Are parking lanes used for traffic part of day? (yes,no)	no	no
10 Roadway paved (yes, no)	Y	Y
11 Is dust visible or re-entrained? (yes, no)	N/A	N/A
12 Does roadway have curbs? (yes, no)	Y	Y
13 Does dust collect near edges? (yes, no	N/A	N/A

* Identify if other than one

Topography

1 The general characteristics of the terrain over a 2 mile radius from the site are (check one):

✓ Smooth _____ Rolling, _____ Rough

2 Topographic features that influence the site

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Arthur Kill		NW	½ mi
Raritan Bay		South	¾ mi

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site
Penthouse	HT = 17' = 5.2m area 3m x 3m	N	6.5m*
Tree	30' = 9.1m	NE	12 meters
			* From canister

See Roof Map for other distances

* In order to meet the rule that obstacles should be 2x the ht. difference between the obstacle + probe inlet this monitor should actually be 7.4 m from the penthouse; however based on predominant wind dir. (SW + NW) + the size of the penthouse an allowance was made to the rule.

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site
Diesel Oil near ground	1½" OD pipe	SW	~4m (on side of bldg) below roof level
Small Hardware store (rents tanks exchanges propane tanks)		SW	20 m
Does not refill tanks		SW	
Fans for diesel fume startups		SW	4m + 8m

Meteorology and Climatology

1 Source of representative meteorological data (check one)

_____ National Weather Service

_____ Airport Weather Service

_____ Site Weather Station

✓ Other (specify)

_____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3 UTM Coordinates, Zone _____ East _____ North _____

or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	ATD 50 Grad. Sorbent	Portable GC	Met tower
1. Location (top of building, ground level, other specify)	roof	roof			roof		
2. If on building, give height (M)	8.7	8.7			8.7		
width (M)	10m	10m			10m		
depth (M)	26m	26m			26m		
3. Horizontal distance from supporting structure (M)	N/A	N/A			N/A		
4. Vertical distance above supporting structure (M)	N/A	N/A			N/A		
5. Height of probe above ground (M)	9.8	10.2			9.8		5m
6. Distance from trees (M)	>20m	>20m			>20m		>20m
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	17 in	17m			17m		
8. Horizontal distance from nearest parking lot (M)	N/A	N/A			N/A		
9. Horizontal distance from walls, parapets, penthouses, etc. (M)	5.9	4.0			5.9m		
10. Distance from obstacles, such as buildings	N/A	N/A			N/A		
11. Distance from furnace or incineration flues (M)	6.0m	8.0m			8.0m		
12. Unrestricted air flow	Yes	Yes			Yes		
13. Located in paved area or vegetative ground cover	Yes	Yes			Yes		
14. Roof Composition old tar paper	✓	✓			✓		

canister = 4'10" = 1.5m above roof
Tube samplers = 3'6" = 1.1m
parapet 3'

met = 15' above roof

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals	Met Station
	Tenax	Canister	ATD 50 grad. sorbent	NDPH	Hi-vol	
Instrument Manufacturer	Wedding + Assoc	Sierra Anderson	Wedding + Assoc.			Climatronics WS WD Temp, relt Shoriz
Date Sampling Began	5/3/88	7/88	grad. sorbent 10/87 ATD-50 9/88			
Sampling Frequency	1/6		1/6			*

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection New York State Department of Environmental Conservation (NYSDEC)
2. Individual's name Mike Steineger
3. Phone Number 718-482-4875
4. Agency analyzing samples New York State Department of Environmental Conservation (ATD-50); PEI Associates (Canister)
5. Individual's Name Garry Boynton (DEC); Bill Jess (PEI)
6. Phone number 518-457-7454; (513)782-4700
7. Reports of data are made to (Agency Name) NYSDEC and USEPA
8. Individual's Name Don Gower (NYSDEC); Rudy Kapichak (USEPA)
9. Phone number 518-457-3676; 212-264-2517

* met data stored on data logger + sent to Albany Monthly

Site #9

SITE EVALUATION

Site Identification number [illegible]

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 12/ /88 and 5/ /88

Date of report 1/ /89

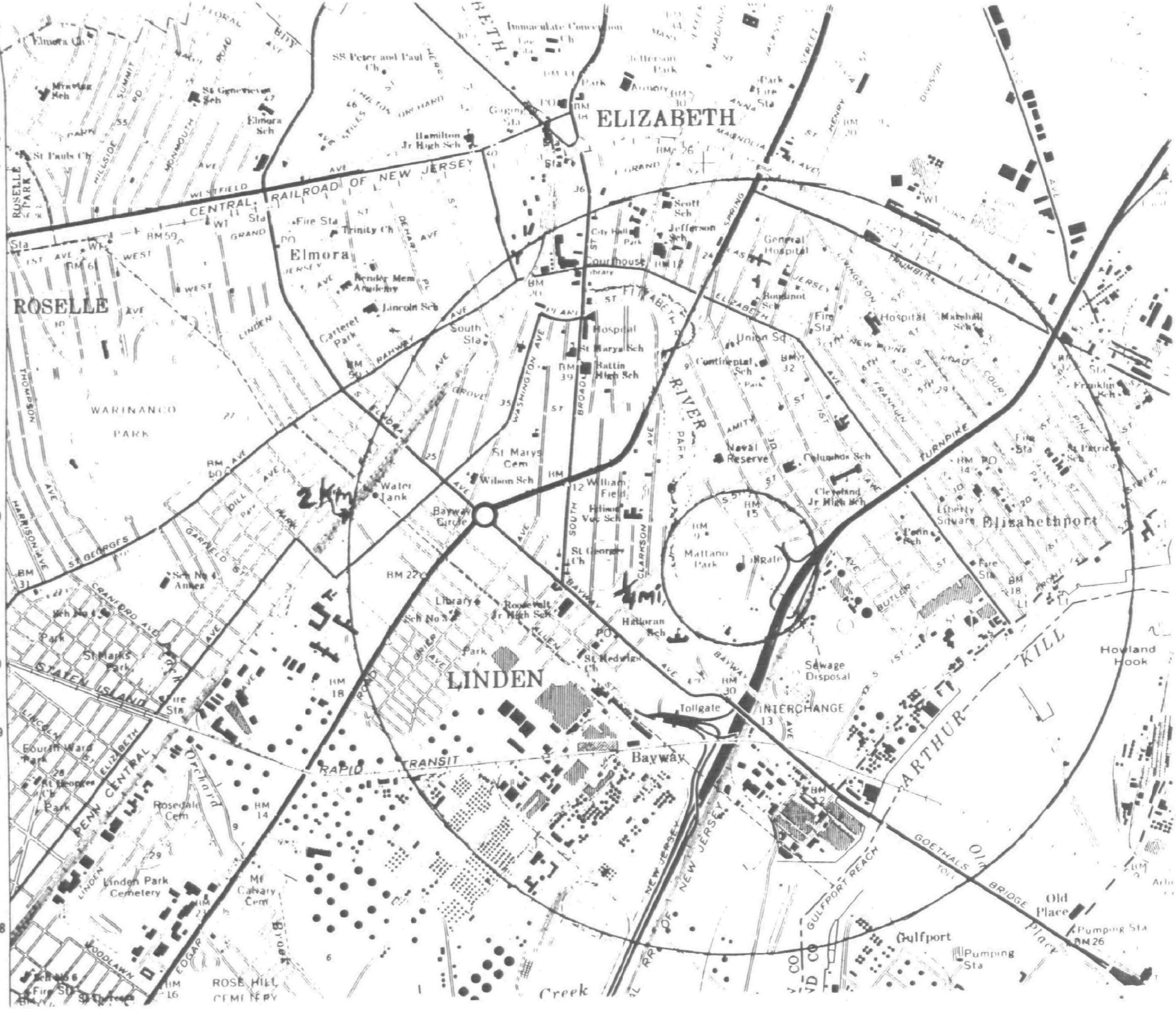
Signatures of Evaluators

Comments

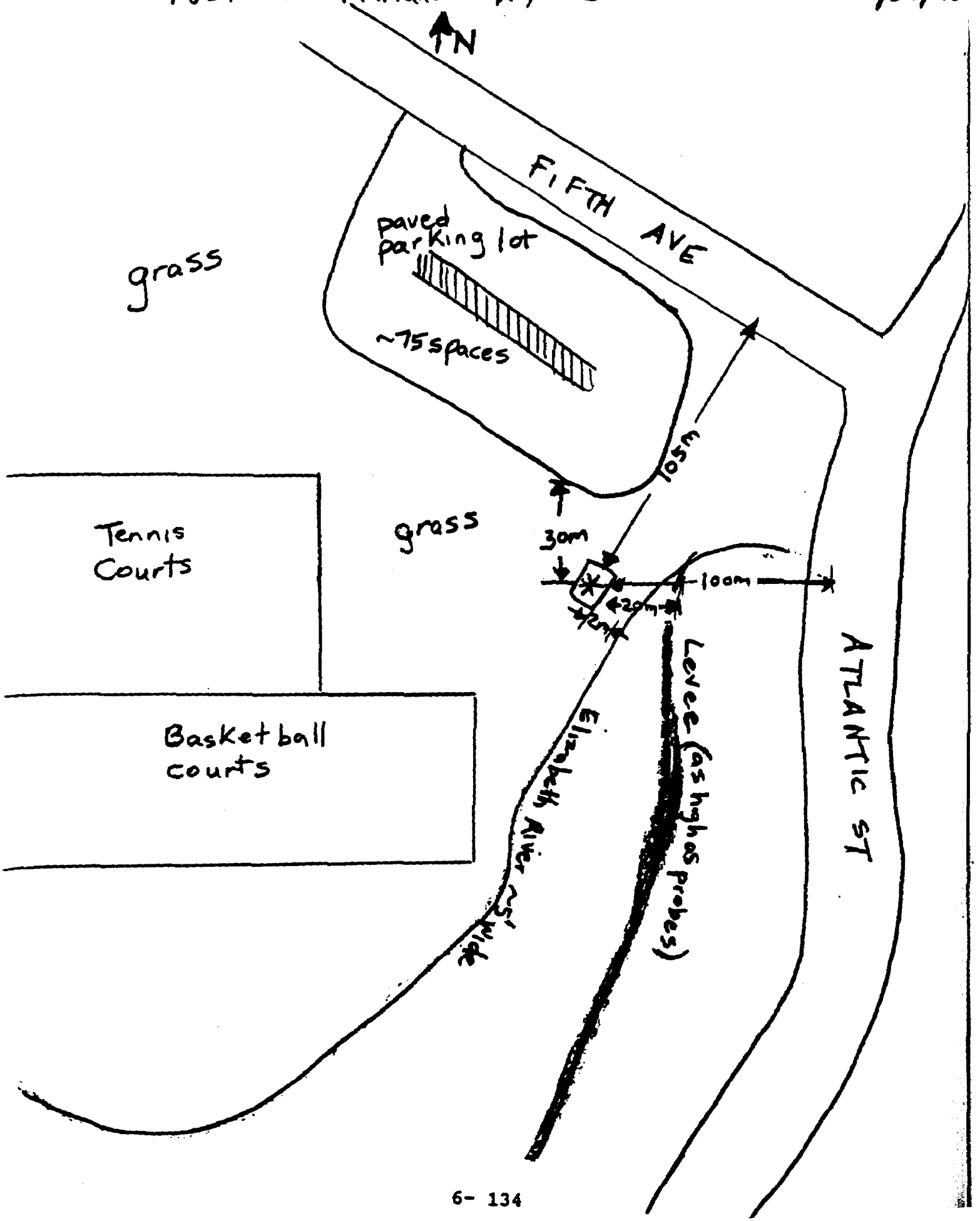
STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - New Jersey
2. City - Elizabeth
3. County / Section - Union / NE New Jersey
4. Site Code - NJ Site A
5. Site Address - Mattano Park
6. Names of Nearest Intersecting Streets - Atlantic and 5th Av
7. Pollutants Monitored at this Site - VOC's and Carbonyls using Tenax, canisters and DNPH cartridges + metals, B(a)P and extractable organics using a hi vol
8. Date Inspected - 12/30/88
9. Outstanding Landmarks - Located inside a cage on ground level near the levee at the eastern edge of the Park. This site is located in an urban + suburban residential neighborhood Northof exit 13 of the NJ Turnpike.

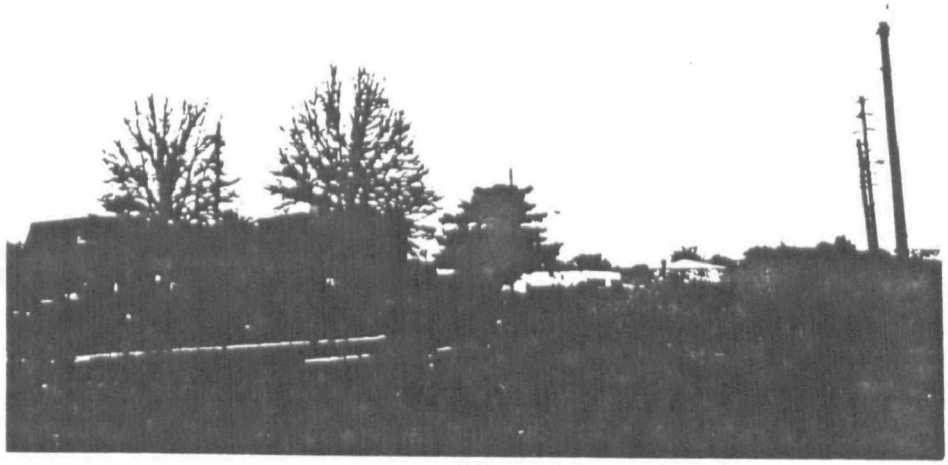

ELIZABETH
ROSELLE
Elmora
LINDEN
Elizabethport
Bayway
Hoyland Hook
Gulfport
Old Place
CENTRAL RAILROAD OF NEW JERSEY
RAPID TRANSIT
PENN CENTRAL
STATEN ISLAND
ARTHUR KILL
NEW JERSEY
WARINANCO PARK
Rosehill Cem
Linden Park Cemetery
Mt Calvary Cem
ROSE HILL CEMETERY
Creek
Interchange 13
Tollgate
Sewage Disposal
Pumping Sta
Water Tank
Hospital
Courthouse
Fire Sta
Jr High Sch
Sch
Park
Cem
Ch
Library
Armory
Naval Reserve
Mallano Park
Liberty Square
Penn Sch
Columbus Sch
Cleveland Jr High Sch
Roosevelt Jr High Sch
Halloran Sch
Rattin High Sch
Lincoln Sch
Jefferson Sch
Scott Sch
Continental Sch
Franklin Sch
Bunnell Sch
Marshall Sch
Wilson Sch
Fourth Ward Park
St Marks Park
Carteret Park
Grove
Broad
Elizabeth
Union Sq
Turnpike
Gulfport Reach
Goethals Bridge
Old Place Bridge
2Km
4mi
660 000 FEET (N J)
6- 133

NJSite A Mattano Park, Elizabeth NJ 12/30/88



NJ Site A
Mattano Park
Elizabeth NJ

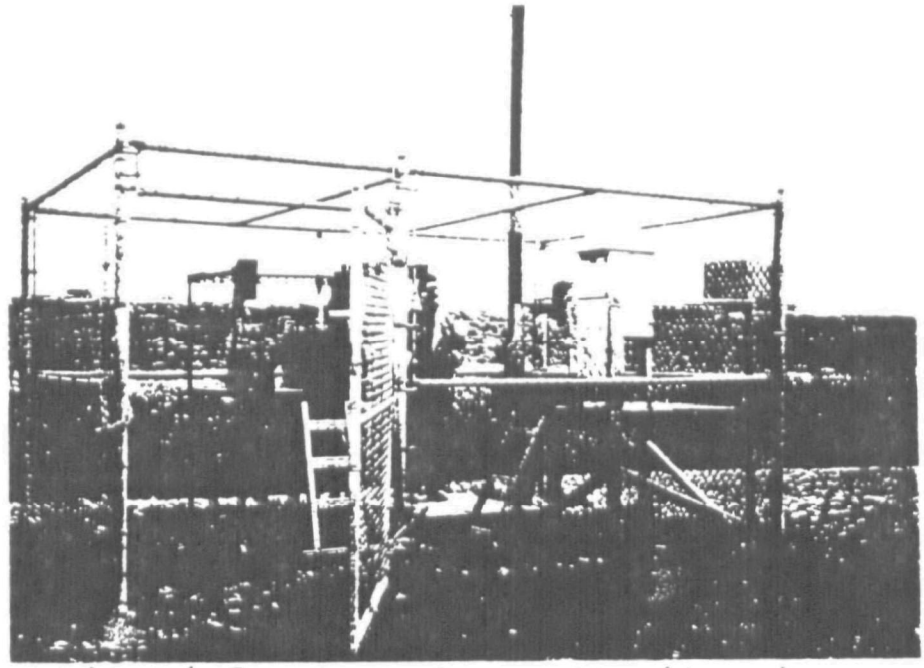
12/30/88



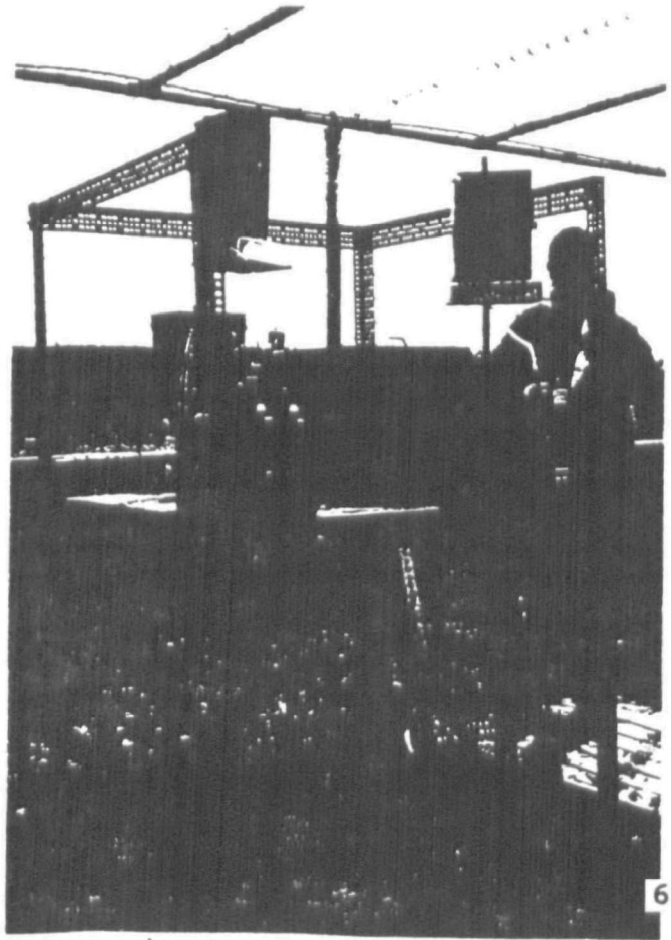
North East

NJ Site A
Mattano Park
Elizabeth NJ

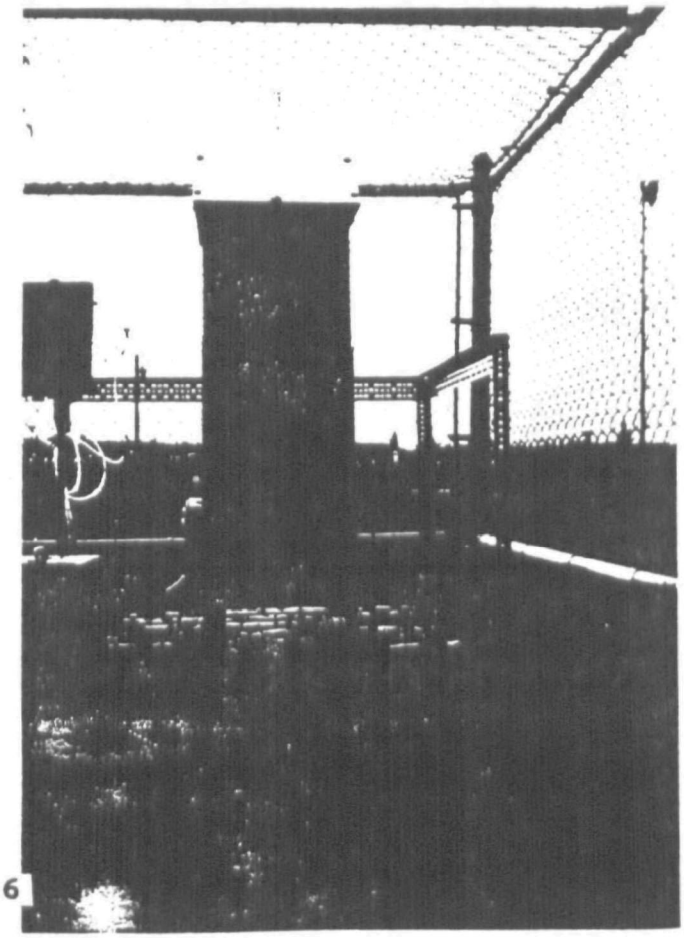
12/30/9



NJDEP's Cage set-up At this site



NJIT's Canister + Tenax Samplers

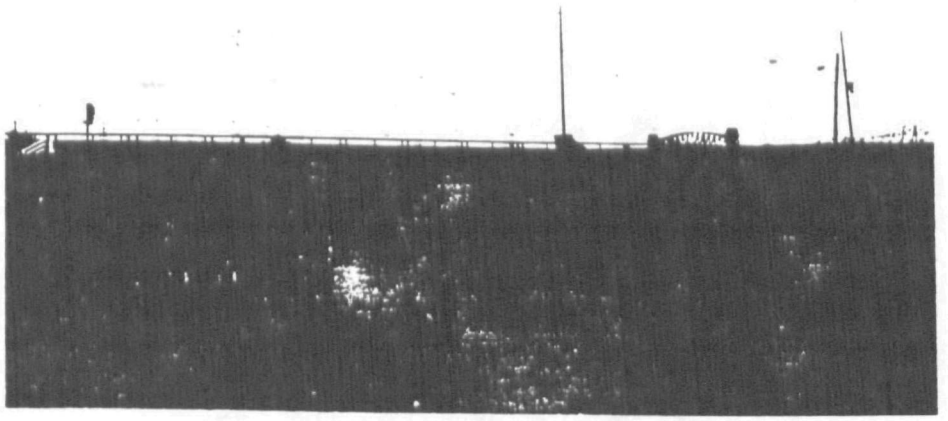


Aldehyde sampler + Hivol

12/30/88

NJ Site A
Mattano Park
Elizabeth NJ

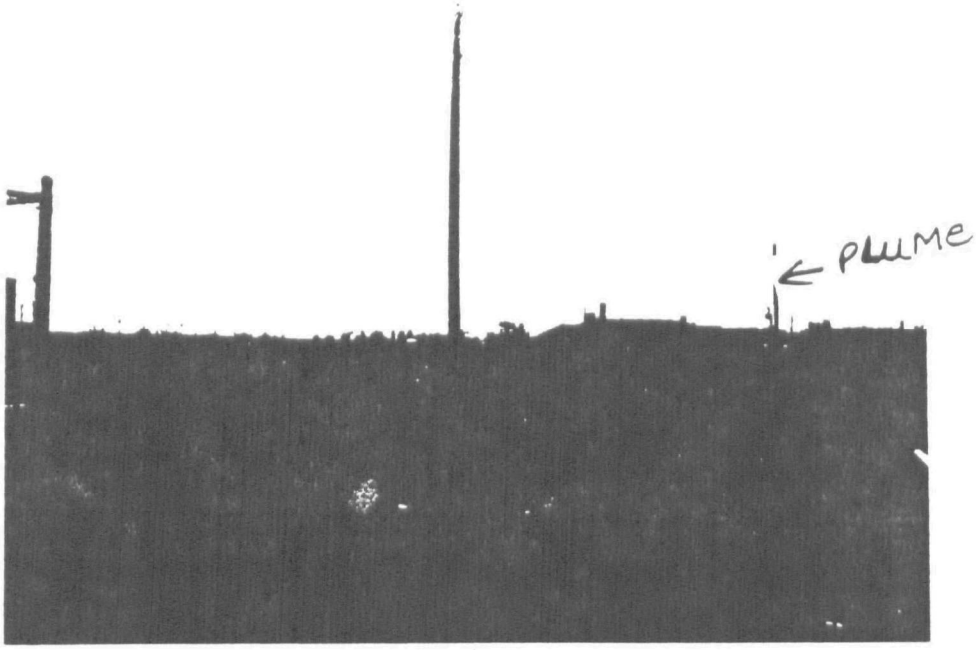
North



East
Toward NJ Turnpike

NJ Site A
Mattano Park
Elizabeth, NJ

12/30/88

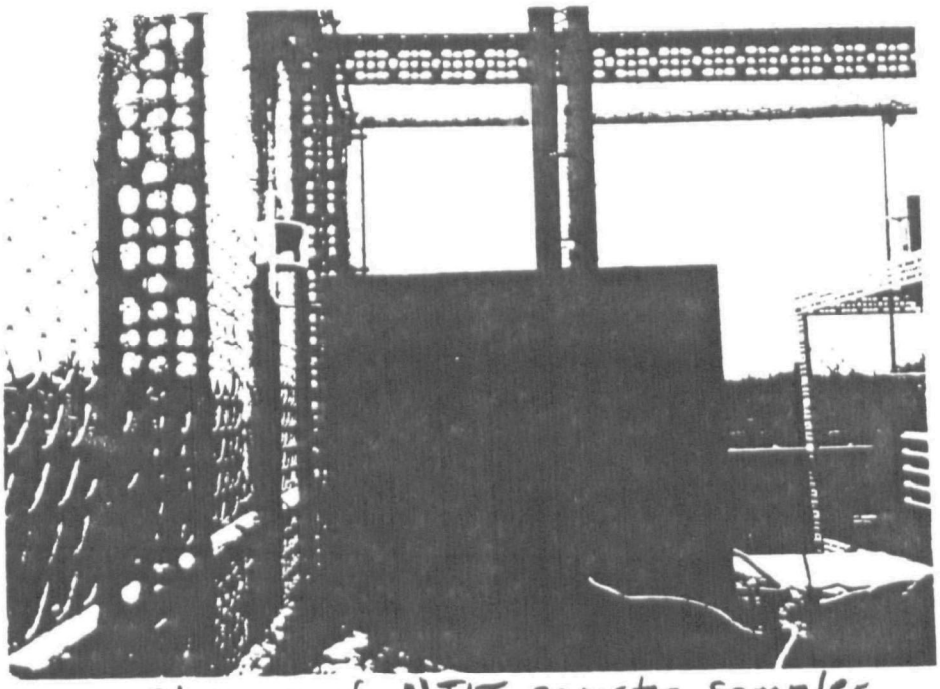


South
Note: Plume in background from Exxon

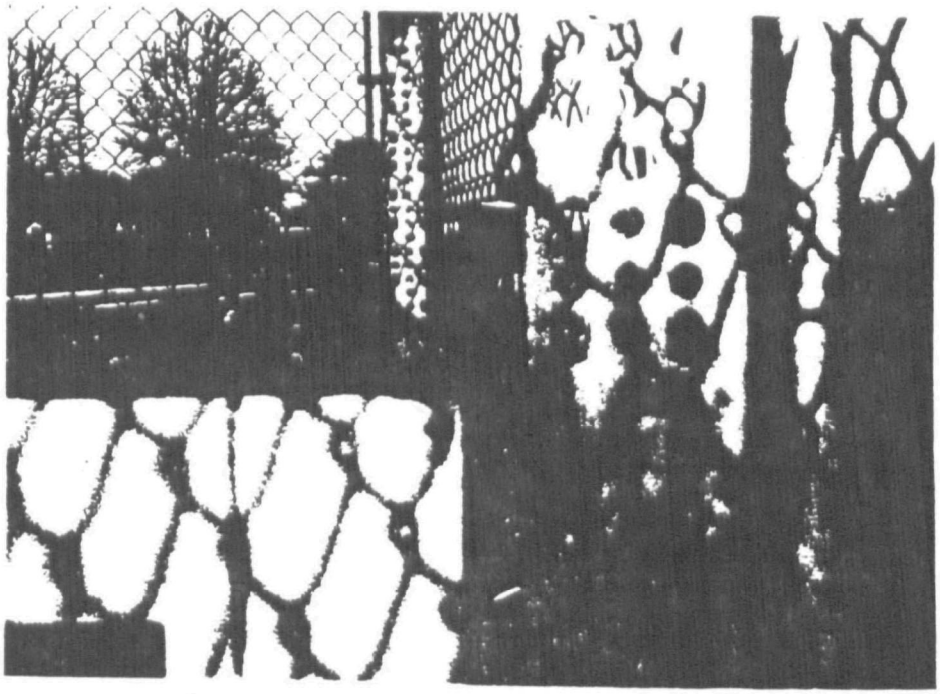
West

NJ Site A
Mattano Park
Elizabeth NJ

12/30/88



Closeup of NJIT canister sampler



Side view of Canister Sampler

Note: Can covering sample probe is very close to the samplers walls (See comments on last page)

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOC's

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	500' ft N
Commercial	
Industrial	¼ mi E → WSW
Mobile NJ Turnpike	¼ mi E → SSE
Other (describe) Park - Ballfield, Tennis + Basketball	0 ft-⅛ mi SW → NNW

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N suburban residential, Recreational

NE suburban residential, urban res, NJ TP

E NJTP, industrial, urban res.

SE NJTP, industrial

S industrial, commercial, NJTP Exit 13,

SW recreational, industrial, Rt. 278, NJTP, urban res.

W ↓, urban residential, commercial

NW ↓, urban residential, commercial.

Mobile Source Worksheet

Mobile Sources that may Influence this Site

Names of Roadways (nearest to site first)

Type (check one)	NJ TP	Rt 278	5th Ave	Atlantic St					
Arterial Highway	✓								
Expressway		✓							
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway				✓					
Local Street or Road			✓						
Traffic Activity (complete as applicable)									
1 *Distance of roadway from air intake (ft)	4000'	5000'	320'	305'					
2 Direction of roadway from air inlet (8 pts)	E	SW	E	SE					
3 Composition of roadway	asph	asph	asph	asph					
4 Number of traffic lanes	12	4	2	2					
5 Average daily traffic (estimate)	126K	44K							
6 Average vehicle speed (estimate, mph)	60	55-80	25	30					
7 Traffic is 1 or 2 way (1 or 2)	2	2	2	2					
8 Number of parking lanes	0	0	1	0					
9 Are parking lanes used for traffic part of day? (yes,no)	N	N	N	N					
10 Roadway paved (yes, no)	Y	Y	Y	Y					
11 Is dust visibly reentrained? (yes, no)	N	N	N	N					
12 Does roadway have curb? (yes, no)	N	N	Y	Y					
13 Does dust collect near edges? (yes, no)									

* Indicate if property is more than one

Topography

1 The general characteristics of the terrain over a 2 mile radius from the site are (check one)

✓ Smooth, _____ Rolling, _____ Rough

2 Topographic features that influence the site

(Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Levee	Level with the top of the monitors	ESE	50'
Elizabeth River	5' wide	ESE	~6'

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC sources)

Description	Size	Direction from Site	Distance from Site
Parked cars in lot	75 cars	N	90'
NJTP	12 lanes	E	~3/4 mi
DOT road repair bldg.		NE	1/4 mi
Elizabeth River	5' wide	E	~6'

Meteorology and Climatology

1 Source of representative meteorological data (check one)

- ✓ National Weather Service Newark
- ____ Airport Weather Service
- ____ Site Weather Station
- ____ Other (specify) Elizabeth Trailer met. station WS + WD
- ____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone 567.08 East 4499.98 North _____

or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Environ chem	Portable GC
1. Location (top of building, ground level, other specify)	on platform		on ground			
2. If on building, give platform height (M)	← 2.5 m →					
width (M)						
depth (M)						
3. Horizontal distance from supporting structure (M)						
4. Vertical distance above supporting structure (M)					N/A	
5. Height of probe above ground (M)		1.6		2.1		
6. Distance from trees (M)	>20m	>20m	>20m	>20m		
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	←	100 m		→		
8. Horizontal distance from nearest parking lot (M) *	←	30 m		→		
9. Horizontal distance from walls, parapets, penthouses, etc. (M)	N/A	N/A	N/A	N/A		
10. Distance from obstacles, such as buildings			N/A			
11. Distance from furnace or incineration flues (M)	N/A	N/A	N/A	N/A		
12. Unrestricted air flow						
13. Located in paved area or vegetative ground cover	Y	Y	Y	Y		
14. Roof Composition	N/A	N/A	N/A	N/A		

* Lot holds ~75 cars

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	DNPH	Hi-vol
Instrument Manufacturer	NJIT	NJIT		NJIT	GMW 2000
Date Sampling Began					
Sampling Frequency	1/6	1/6		1/6	1/6

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection New Jersey Institute of Technology
2. Individual's name _____
3. Phone Number _____
4. Agency analyzing samples New Jersey Institute of Technology
   Dr Barbara Kebbekus (SO_2 + NO_2)
5. Individual's Name Dr Greenburg (extractable org. + BaP); Dr Bozzelli (metals)
6. Phone number _____
7. Reports of data are made to (Agency Name) New Jersey Department of Environmental Protection → US Environmental Protection Agency
8. Individual's Name Charles Pietarinen (NJDEP); Rudy Kapichak (EPA)
9. Phone number 609-633-7648 ; 212-264-2517

SITE EVALUATION

Site Identification number NJ site A

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 12/30/88

Date of report 1/5/89

Signatures of Evaluators

Suzanne Jacquett

Comments This site meets the criteria accepted by EPA and the monitoring committee. Although the levee is nearby, the monitors have been placed on raised platforms so that the probe inlets are at least level with the levee 50' to the east. Airflow is not restricted in general. However, at present the canister probe is bent as follows in figure 1 and should probably be bent as shown in figure 2:

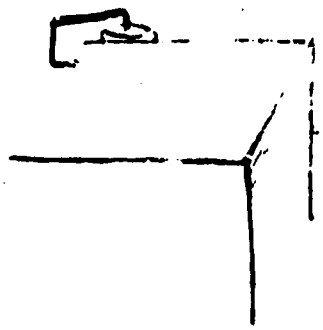


figure 1

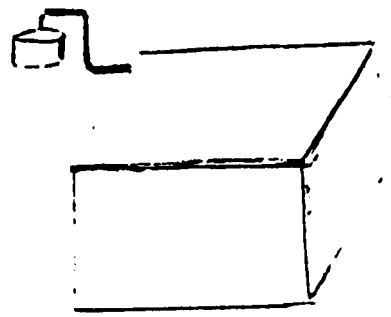


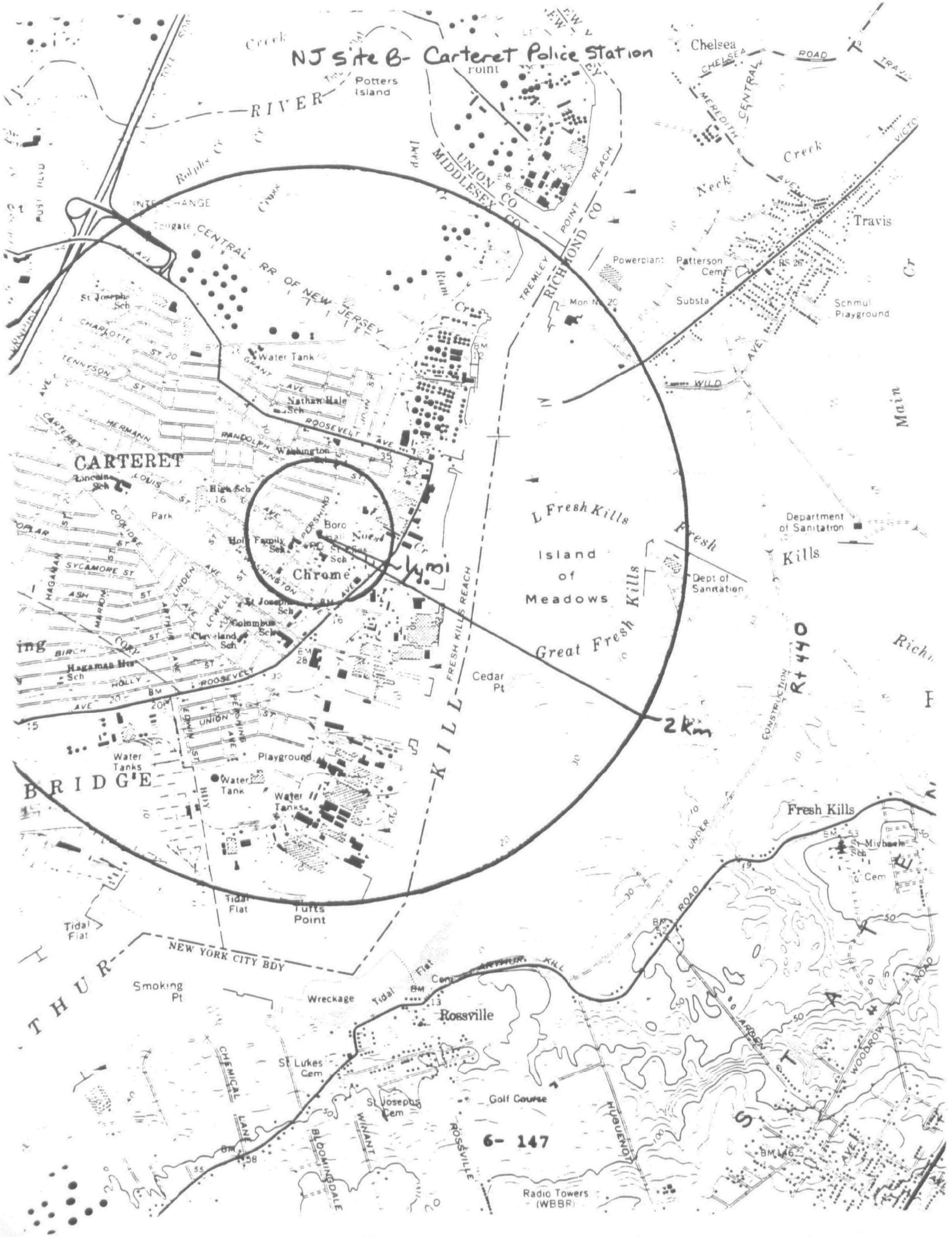
figure 2

moving the probe to this position will probably give NJIT a more representative airflow. At present the airflow is partially restricted by the walls of the sampler. (See photos within). NJIT should contact EPA if they have any questions.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

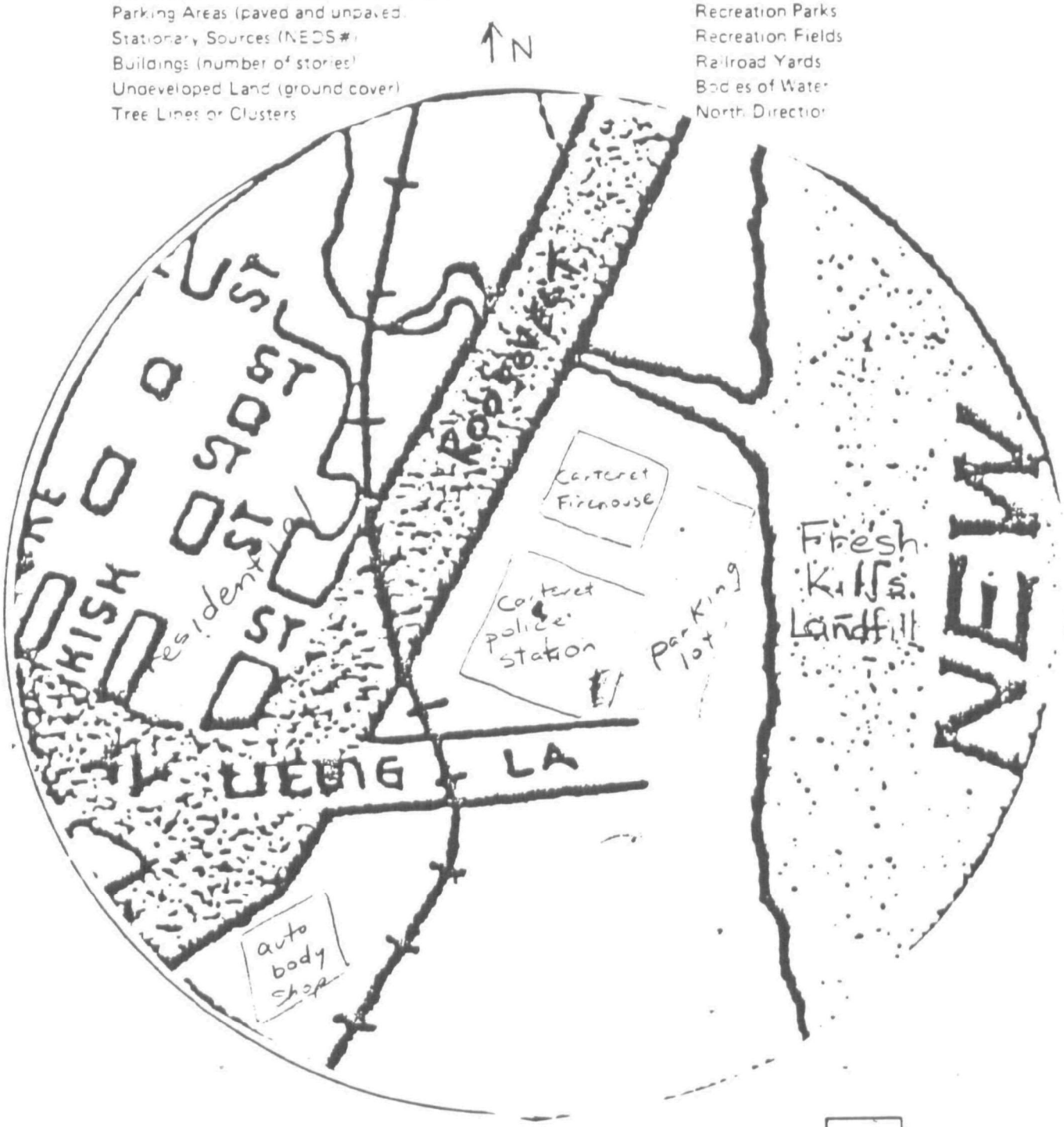
SITE INFORMATION

1. State - New Jersey
2. City - Carteret
3. County / Section - Middlesex County
4. Site Code - New Jersey Site B
5. Site Address - Cartaret Police Department
   230 Roosevelt Avenue
6. Names of Nearest Intersecting Streets - Roosevelt and Liebig Ave.
7. Pollutants Monitored at this Site - VOC's and carbonyls using Tenax, canister, and DNPH samplers.
8. Date Inspected - 11/4/87
9. Outstanding Landmarks - Located on Police Dept. Roof about 1/4 mile northwest of the Fresh Kills landfill in Staten Island, New York


NJ Site B- Carteret Police Station
CARTERET
Chrome
Island of Meadows
Great Fresh Kills
Fresh Kills
Cedar Pt
Tuffs Point
Tidal Flat
Smoking Pt
Rossville
Golf Course
Radio Towers (WBBR)
Water Tanks
Playground
Water Tank
Boro Hall
Nathan Hale Sch
Washington Sch
Lincoln Sch
High Sch
Holy Family Sch
St Joseph Sch
Columbus Sch
Cleveland Sch
Hagaman Hts Sch
St Lukes Cem
St Josephs Cem
Department of Sanitation
Dept of Sanitation
Travis
Schmul Playground
Patterson Cemy
Powerplant
Substa
Chelsea
Potters Island
Point
Wreckage
Tidal Flat
Cem
6- 147
2 Km
R+ 440
NEW YORK CITY BDY
RIVER
Creek
Neck
Main
Kills
KILL
FRESH KILLS REACH
TREMLEY POINT REACH
UNION CO
MIDDLESEX CO
RICHMOND CO
CENTRAL RR OF NEW JERSEY
ROOSEVELT AVE
WILD AVE
CHEMICAL LANE
BLOOMINGDALE
WINANT
HUGUENOT
WOODROW
ARTHUR KILL
CONSTRUCTION
ROAD

15 Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale, where only immediate area information is needed. Include the following information on the drawing where applicable

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters
Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction



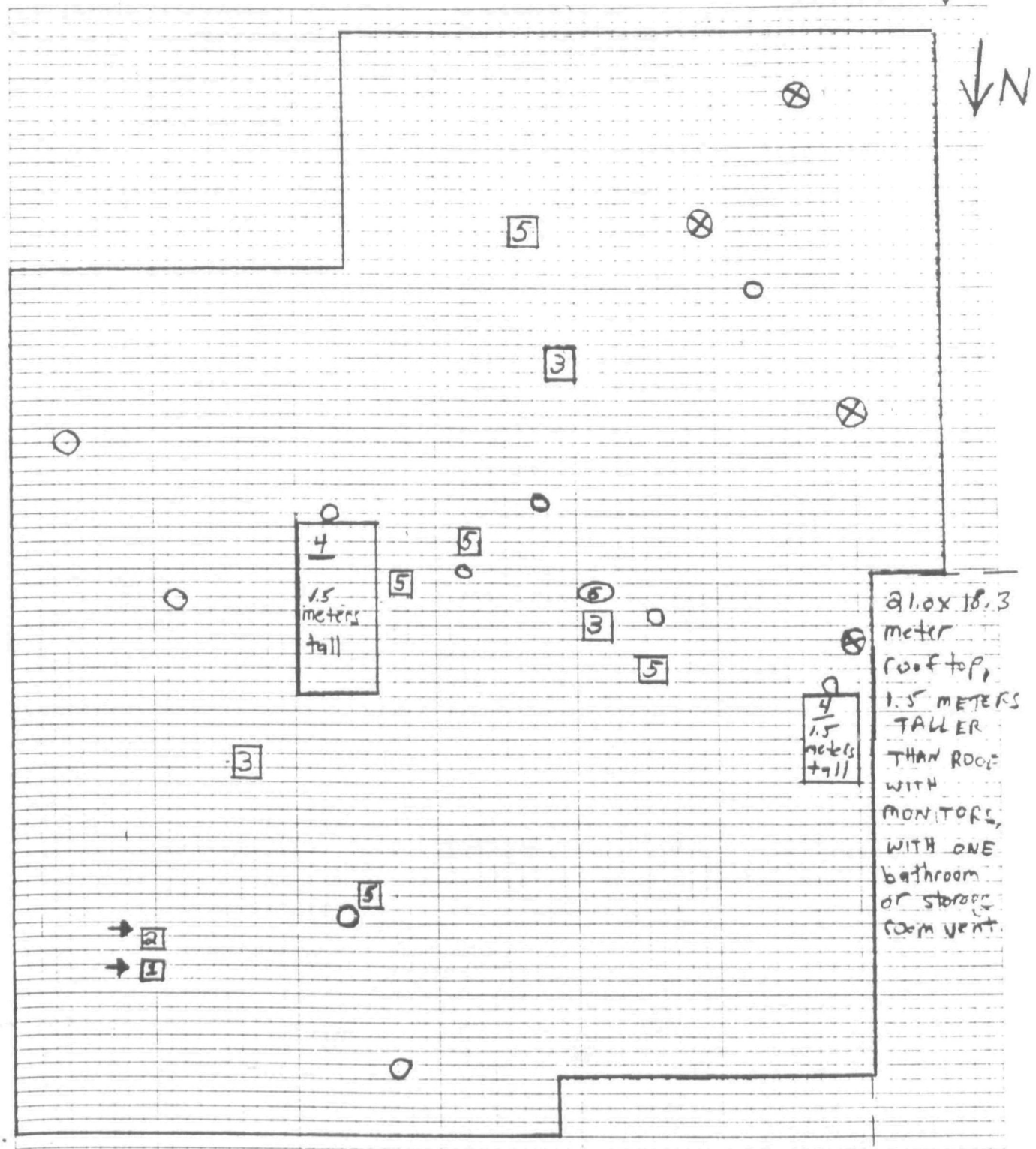
16 Attach separate sheet of labeled photographs G

17. UTM Coordinates, Zone _____ East _____ North _____

or latitude and longitude _____ _____ G

R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
– Blocks are reserved for site evaluation only

CHATFIELD POLICE HEADQUARTERS - ROOF MAP - (5 meters = 1 inch)



KEY

1 hi-vol
2 NOIT APPARATUS
3 SKYLIGHT
4 AIR CONDITIONER
5 AIR HANDLER
6 AIR INTAKE VENT

○ bathroom AND storage vents
⊗ chimney AND boiler VENTS

6- 149

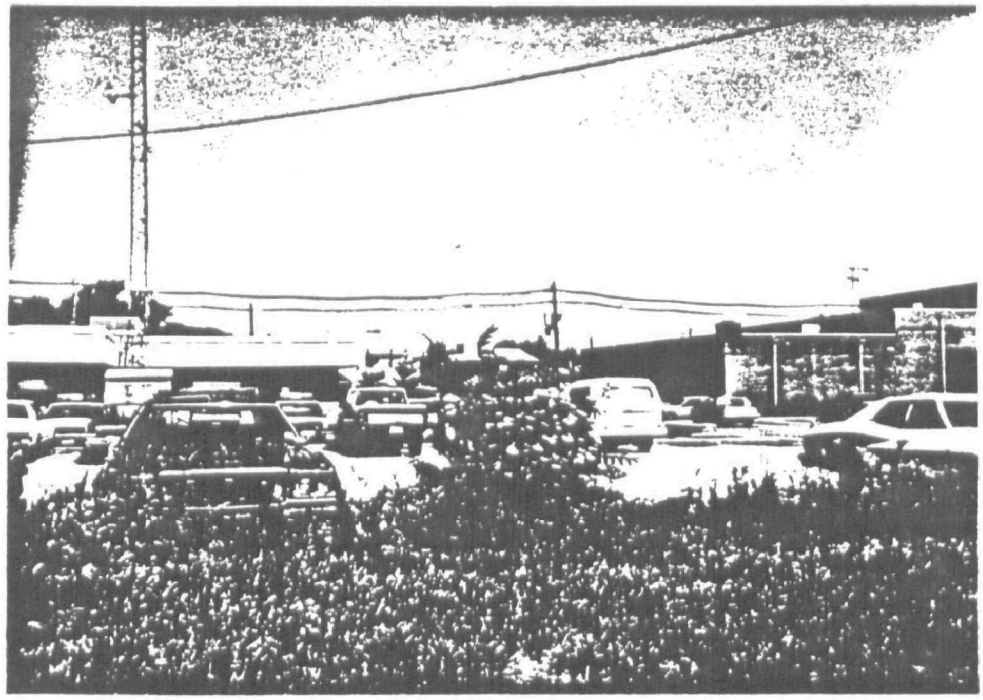
SCALE: 5 meters = 1 inch

roof composition: tar covered with gravel

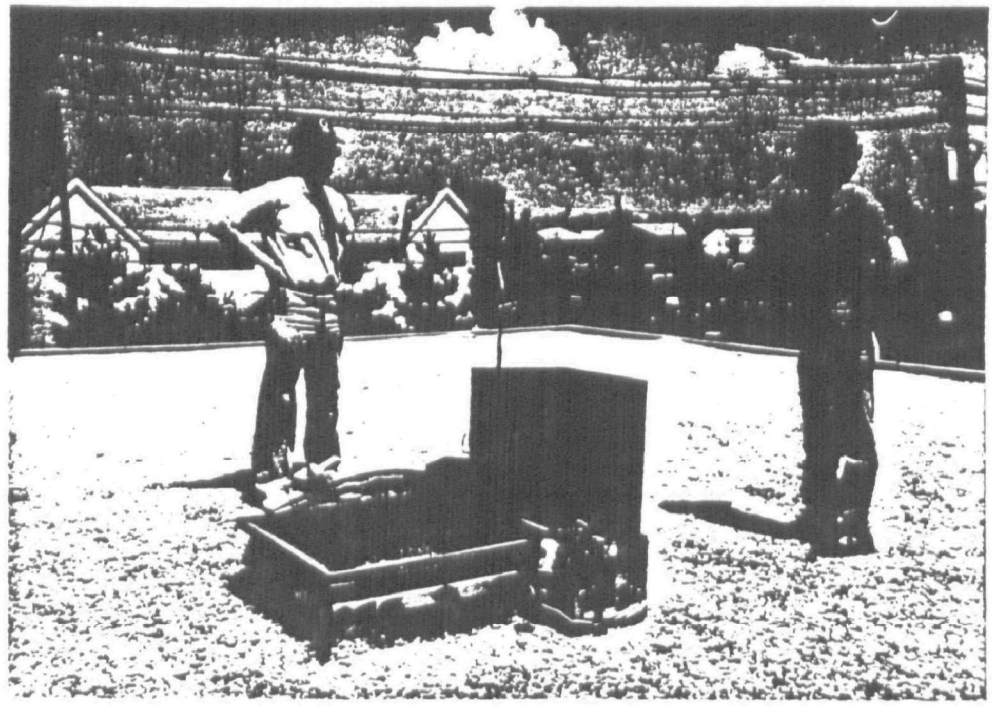
A.T.

NJDEP-NJIT

Carteret Police Station
230 Roosevelt Ave.
Carteret, NJ



North



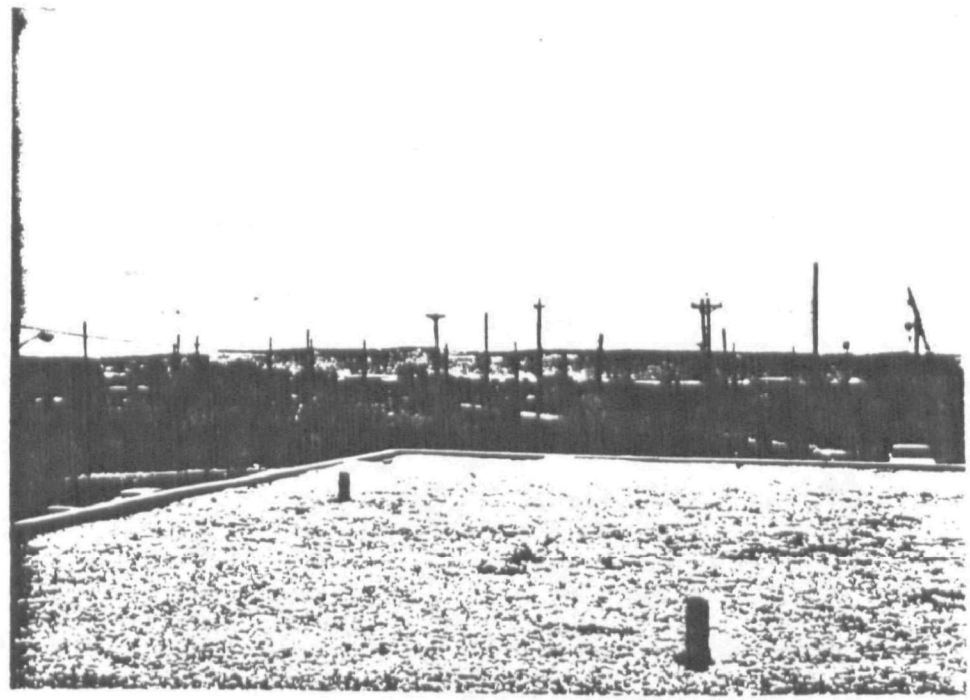
Close-up of NJIT monitoring apparatus with Bob Kelly and Marcus Kantz.

North

NJ DEP - NJIT

Carteret Police Station
230 Roosevelt Ave
Carteret, NJ

East

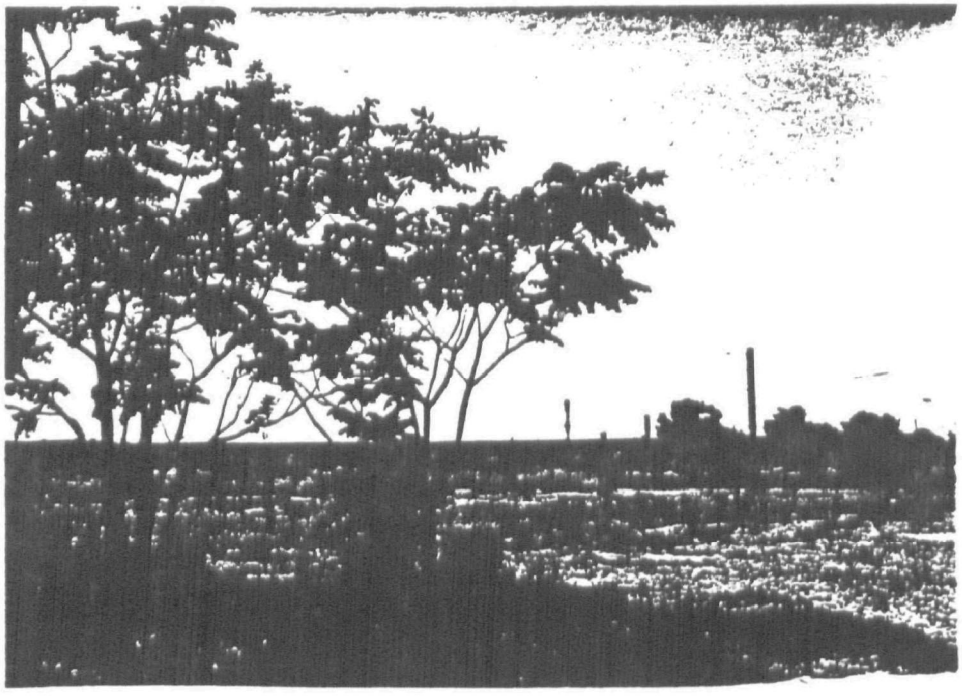


South East
Note; Fresh Kills Landfill in Background

NJDEP-NJIT

Carteret Police Station
230 Roosevelt Ave
Carteret NJ

South

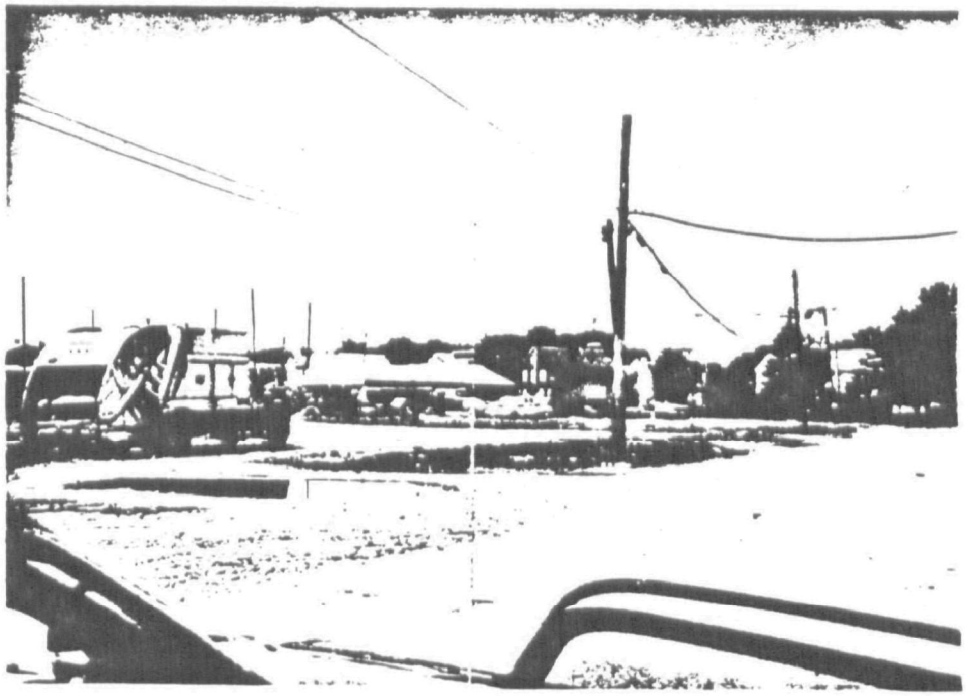


Southwest
Note: US Metals stacks

NJ DEP - NJIT

Carteret Police Station
235 Roosevelt Ave
Carteret, NJ

West



Northwest
Note: auto body shop to the right of truck

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   ✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Arthur Kill Fresh Kills Landfill			750 - 1000 feet 2500 - 3500 feet

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site
Auto Body Shop		SW	500 feet
Auto Body Shop		SW	1/4 mile

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOC's

Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	100' - 1/4 mile SW to N
Commercial	
Industrial	~1000' - 1/4 mile N to NE
Mobile NJ Turnpike	~ 1.5 mile NW
Other (describe) Fresh Kills Landfill	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban, industrial

NE Fresh Kills Landfill, industrial

E Fresh Kills Landfill, industrial

SE Fresh Kills Landfill, industrial

S industrial

SW suburban, commercial, industrial, NJ Turnpike

W

NW

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Names of Roadways (nearest to site first)

Type (check one)	Roosevelt Ave.	Liebig Lane	Irving St.						
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway	✓								
Local Street or Road		✓	✓						
Traffic Activity: (complete as applicable)									
1 *Distance of roadway from air intake(ft)	75	150	135						
2. Direction of roadway from air inlet (8 pts)	W	S	NW						
3. Composition of roadway	asph	asph	asph						
4. Number of traffic lanes	2	2	2						
5. Average daily traffic (estimate)									
6. Average vehicle speed (estimate, mph)	30	25	25						
7. Traffic is 1 or 2 way (1 or 2)	2	2	2						
8. Number of parking lanes	0	N/A	2						
9. Are parking lanes used for traffic part of day? (yes,no)	N/A	no	no						
10. Roadway paved (yes, no)	yes	yes	yes						
11. Is dust visibly re-entrained? (yes, no)	no	no	no						
12. Does roadway have curb? (yes, no)	yes	no*	yes						
13. Does dust collect near edges? (yes, no)		yes							

*Identify probe, if more than one.

* only has curb around police station

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service, NEWARK, NJ

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Enviro Chem	Portable GC
1. Location (top of building, ground level, other specify)	TOP	TOP	TOP	TOP		
2. If on building, give height (M)	4.3	4.3	4.3	4.3		
See map { width (M)						
See map { depth (M)						
3. Horizontal distance from supporting structure (M)	N/A	N/A	N/A	N/A		
4. Vertical distance above supporting structure (M)	N/A	N/A	N/A	N/A	N/A	
5. Height of probe above ground (M)	5.6	5.4	5.6	5.5		
6. Distance from trees (M)	>20m	>20m	>20m	>20m		
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	23m	23m	23m	23m		
8. Horizontal distance from nearest parking lot (M)	6m	6m	6m	6m		
9. Horizontal distance from walls, parapets, penthouses, etc. (M)	N/A	N/A	N/A	N/A		
10. Distance from obstacles, such as buildings	N/A	N/A	N/A	N/A		
11. Distance from furnace or incineration flues (M)	25*	25*	25*	26*		
12. Unrestricted air flow	yes	yes	yes	yes		
13. Located in paved area or vegetative ground cover	LOCATED ON		ROOF	SURFACE		
14. Roof Composition	TAR	COVERED	WITH	GRAVEL		

* 4 small chimneys, see roof map for details. [SW OF MONITORS, CLOSEST STACK measures 2½ FEET HIGH]

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	NJIT	NJIT		NJIT	GMW
Date Sampling Began	7/87	7/87		11/87	7/87
Sampling Frequency	1/6	1/6		1/6	1/6

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection New Jersey Institute of Technology
2. Individual's name Dr. Barbara Kebbekus
3. Phone Number (201) 596-3587
4. Agency analyzing samples New Jersey Institute of Technology
5. Individual's Name Dr. Barbara Kebbekus
6. Phone number (201) 596-3587
7. Reports of data are made to (Agency Name) New Jersey Department of Environmental Protection → UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
8. Individual's Name Charles Pietarinen (NJDEP), Rudy Kapichak (USEPA)
9. Phone number (609)-633-7648 (NJDEP), (212) 264-2517 (USEPA)

SITE EVALUATION

Site Identification number NEW JERSEY SITE B

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 11/23/87

Date of report 2/25/88

Signatures of Evaluators

Avraham Teitz

Comments The most outstanding feature of the site is that it is almost directly on the water by the Arthur Kill and across from the Fresh Kills Landfill. Traffic is only by the front of the police station as there are no through roads behind it.

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - New Jersey
2. City - Sewaren, NJ
3. County / Section - Middlesex County / Woodbridge
4. Site Code - NJ site C
5. Site Address - Mathew Jaye School - PS 28
   Sherman Avenue
   Sewaren, NJ
6. Names of Nearest Intersecting Streets - Glenecove Avenue and Cliff Place
7. Pollutants Monitored at this Site - VOCs
8. Date Inspected - 11/5/87
9. Outstanding Landmarks - Directly behind the Grover Cleveland rest stop on the NJ Turnpike between exits 11 + 12. It is on the roof of a large one story schoolbuilding which is in a residential neighborhood.

SITE CLASSIFICATION

1. Dominating Influence of site

Area VOCs

Mobile (from NJ Turnpike) VOCs

2. Land Use within 1/4 mile radius from the site:

SUBURBAN	DISTANCE AND DIRECTION FROM SITE
Residential	N to SW ~100' - ¼ mi
Commercial	
Industrial	N to SE ~¼ mi
Mobile NJ Turnpike	WSW to N ~700' - ¼ mi
Other (describe) Rest stop	SW to NW 500' ~ ¼ mi

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban Residential, Industrial, Turnpike

NE Industrial, Suburban Residential

E Industrial, Suburban Residential, Arthur Kill

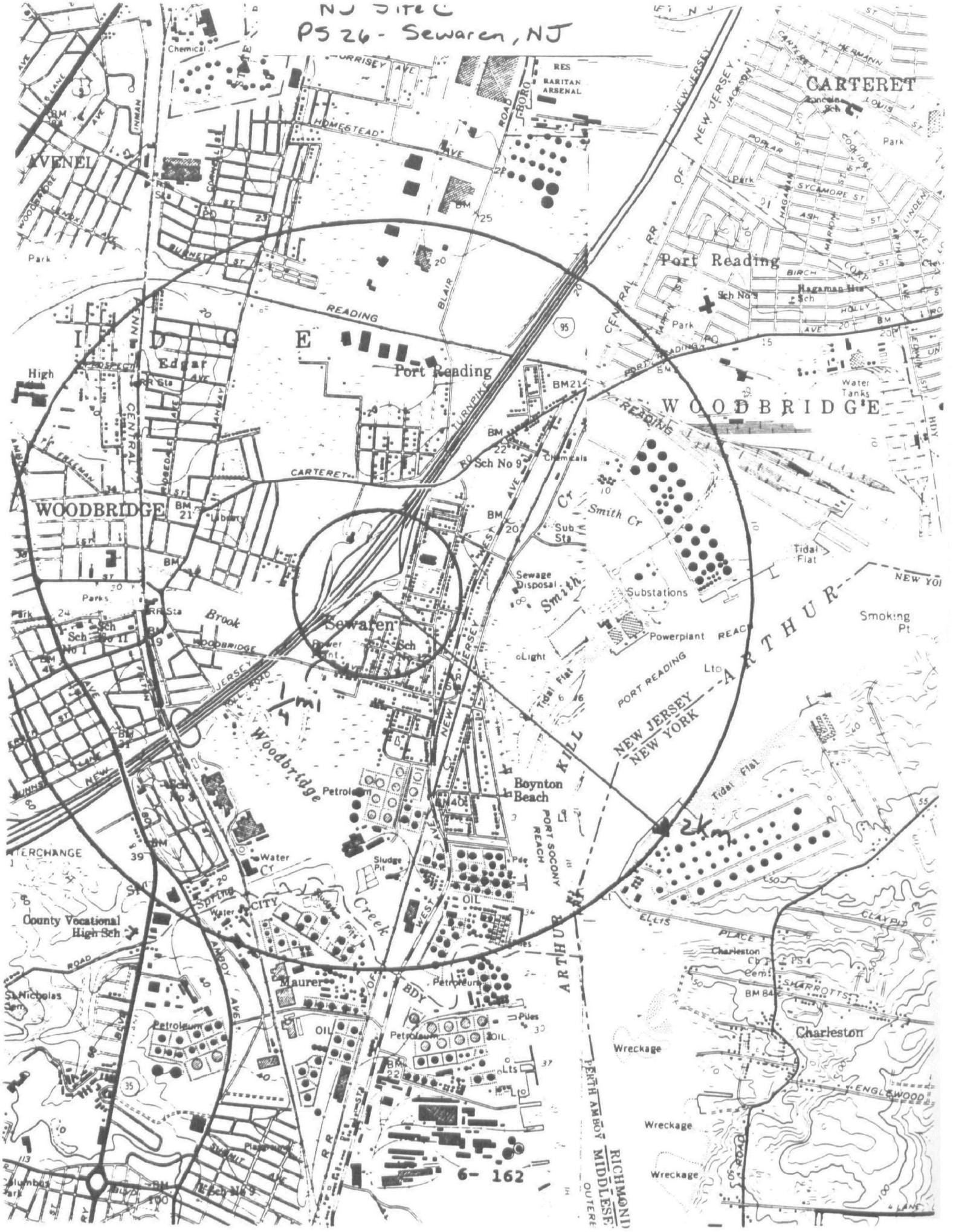
SE Industrial, Suburban Residential, Arthur Kill

S Suburban Residential, Industrial

SW Suburban Residential, Turnpike,

W Industrial, Turnpike,

NW Industrial, Turnpike,


NJ Site C
PS 26 - Sewaren, NJ
AVENEL
Chemical
RES
RARITAN ARSENAL
CARTERET
Port Reading
Edgar
WOODBRIDGE
Sewaren
Boynton Beach
Smith Cr
Woodbridge Creek
NEW JERSEY
NEW YORK
ARTHUR KILL
Tidal Flat
Substations
Powerplant
Sewage Disposal
Water Tanks
Smoking Pt
Charleston
Wreckage
Maurer
Petroleum
OIL
County Vocational High Sch
St Nicholas
Slumbers Park
Sludge Pit
Water Cr
Spring
Brook
Parks
Sch No 1
Sch No 11
Sch No 12
Sch No 9
Sch No 3
Sch No 5
PS 4
Charleston Cem
BM 84
BM 21
BM 22
BM 20
Lto
Lts
Piles
Pds
Light
Chemicals
Sub Sta
RR Sta
Liberty
Park
Hagaman Hts
Water Tanks
Tidal Flat
Smoking Pt
Wreckage
Wreckage
Wreckage
Charleston
ENGLEWOOD
CLAY PIT
ELLIS PLACE
SHARROTTS
PORT READING
PORT SOCONY REACH
NEW JERSEY TURNPIKE
CENTRAL RR OF NEW JERSEY
PENN CENTRAL
READING
CARTERET
HOMESTEAD AVE
BURNETT ST
WOODBRIDGE
FREEMAN
HIGH
EDGAR
BLAIR ROAD
AMBOY AVE
SMITH ST
WEST
NEW
JERSEY
ROUTE
INTERCHANGE
1 mi
2 km
6- 162

15 Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale where an immediate area information is needed. Include the following information on the drawing where applicable

NAMS at Center of Drawing
Roadways with names (paved and unpaved)
Parking Areas (paved and unpaved)
Stationary Sources (NEDS#)
Buildings (number of stories)
Undeveloped Land (ground cover)
Tree Lines or Clusters

N

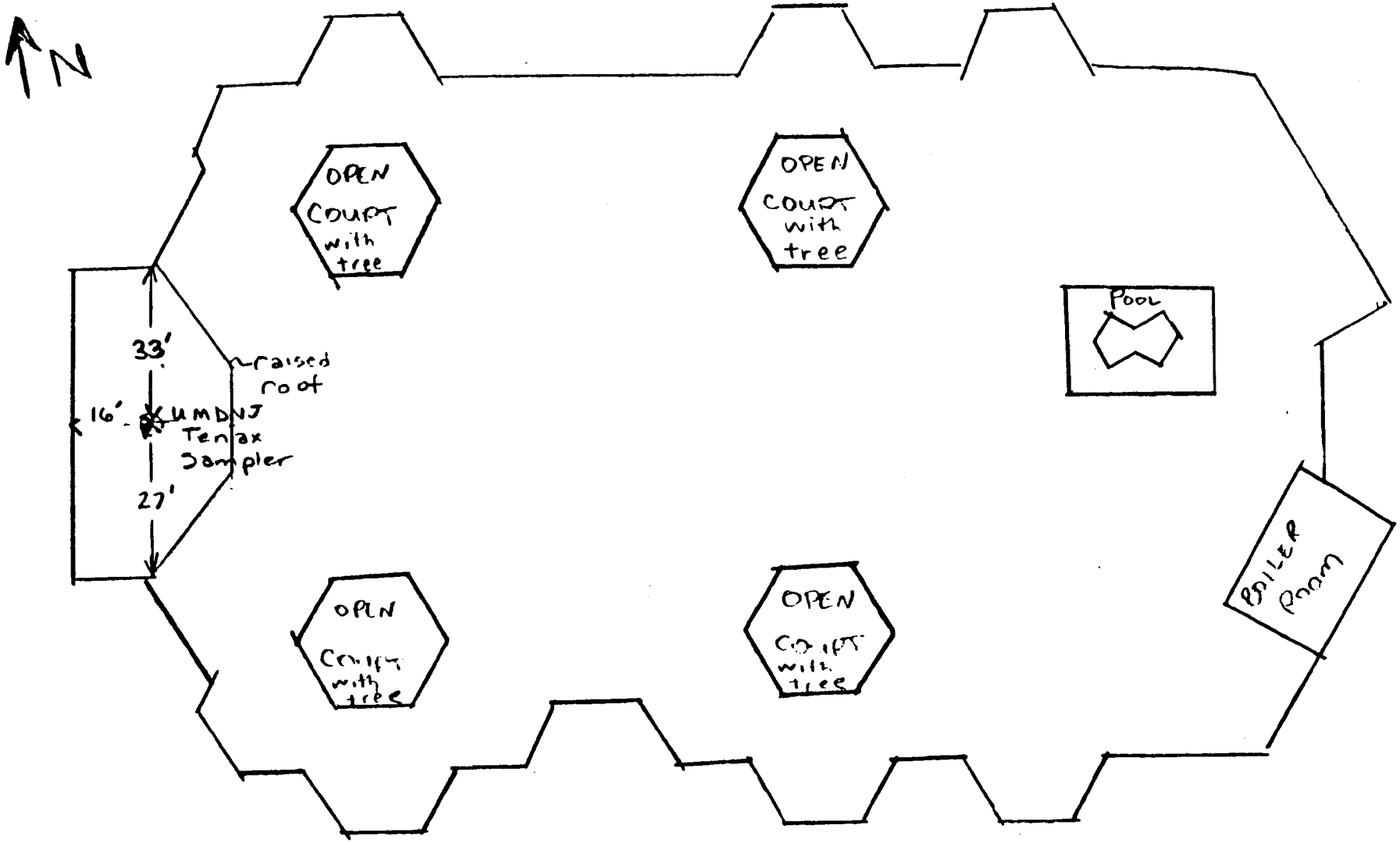
Residences
Trailer Parks
Recreation Parks
Recreation Fields
Railroad Yards
Bodies of Water
North Direction

16. Attach separate sheet of labeled photographs G

17. UTM Coordinates, Zone _____ East _____ North _____

or latitude and longitude _____ _____ _____ G

* . R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
– Blocks are reserved for site evaluation only



ROOF OF MATTHEW J. SAGO SR. ELEMENTARY SCHOOL

PS 28
Sewaren, NJ

PS-28
Sewaren, NJ

6-165

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Names of Roadways (nearest to site first)

Type (check one)	NJ Turnpike	Sherman ST	Glenwood Ave	Cliff Place					
Arterial Highway	✓								
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway									
Local Street or Road		✓	✓	✓					
Traffic Activity: (complete as applicable)									
1 *Distance of roadway from air intake (ft)	~700'	50'	~100'	~300'					
2. Direction of roadway from air inlet (8 pts)	NW	W	S	N					
3. Composition of roadway	asph	→	→	→					
4 Number of traffic lanes	12	2	2	2					
5. Average daily traffic (estimate)									
6. Average vehicle speed (estimate, mph)	60	25	25	25					
7. Traffic is 1 or 2 way (1 or 2)	2	2	2	2					
8. Number of parking lanes	0	2	2	2					
9. Are parking lanes used for traffic part of day? (yes, no)	N/A	No	→	→					
10. Roadway paved (yes, no)	yes	→	→	→					
11. Is dust visibly re-entrained? (yes, no)	no	→	→	→					
12. Does roadway have curb? (yes, no)	no	yes	→	→					
13 Does dust collect near edges? (yes, no)									

* Estimated distances

*Identify probe if more than one.

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   ✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site
Arthur Kill		East → SE	~ 1 mile

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site
NJ Turnpike	12 lanes	SW to N	>700'

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   ✓ National Weather Service Newark Airport

   ____ Airport Weather Service

   ____ Site Weather Station

   ____ Other (specify)

   ____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Enviro Chem	Portable GC
1. Location (top of building, ground level, other specify)	roof	roof				
2. If on building, give height (M)						
width (M)						
depth (M)						
3. Horizontal distance from supporting structure (M)	N/A	N/A				
4. Vertical distance above supporting structure (M)						
5. Height of probe above ground (M)	1.8m					
6. Distance from trees (M)	>20m	>20m				
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)						
8. Horizontal distance from nearest parking lot (M)	N/A	N/A				
9. Horizontal distance from walls, parapets, penthouses, etc. (M)						
10. Distance from obstacles, such as buildings	N/A	N/A				
11. Distance from furnace or incineration flues (M)	~100	~100				
12. Unrestricted air flow	Yes	Yes				
13. Located in paved area or vegetative ground cover	Yes	Yes				
14. Roof Composition (cracking) tar but roof is covered with canvas near monitor						

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	UMDNJ	Anderson			
Date Sampling Began	11/87	12/87			
Sampling Frequency	1/6	1/18			

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection UNIVERSITY OF MEDICINE AND DENTISTRY OF NEW JERSEY (UMDNJ)
2. Individual's name Dr. Linda Berrafato
3. Phone Number 201-463-4536
4. Agency analyzing samples UMDNJ (TENAX), PEI (CANISTER)

5. Individual's Name Dr. Linda Berrafato (UMDNJ), Bill Jess (PEI)
6. Phone number 201-463-4536 (UMDNJ), 513-782-4764 (PEI)

7. Reports of data are made to (Agency Name) NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NJ DEP), → UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA)

8. Individual's Name Charles Pietarinen (NJDEP), Rudy Kapichak (USEPA)
9. Phone number 609-633-7648 (NJDEP), 212-264-2517 (USEPA)

SITE EVALUATION

Site Identification number NJ Site C

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 11/5/87

Date of report 2/26/88

Signatures of Evaluators

Sue Jacquett

Comments This site is located directly behind the Grover Cleveland rest area on the NJ Turnpike. It may tend to get high readings due to automobile emissions. This site is representative of residences located in the Middlesex County Area bound by the NJ Turnpike and the Arthur Kill

STATEN ISLAND/ NORTHEASTERN NEW JERSEY
URBAN AIR TOXICS STUDY SITE REPORT

SITE INFORMATION

1. State - NEW JERSEY
2. City - Piscataway
3. County / Section - Middlesex County
4. Site Code - NEW JERSEY SITE D
5. Site Address - 26 Sturbridge Dr.
   Piscataway, NJ
6. Names of Nearest Intersecting Streets - Sturbridge Drive and Metlars Lane.
7. Pollutants Monitored at this Site - VOC's using Tenax and canister samplers.
8. Date Inspected - 11/4/87
9. Outstanding Landmarks - In backyard of a beige 2 story-1 family house located in a residential suburban community near Rutgers Piscataway Campus

15 Sketch a map to document the environment within a ¼ mile radius of the site except for CO microscale when only immediate area information is needed. Include the following information on the drawing where applicable

NAMS at Center of Drawing	Residences
Roadways with names (paved and unpaved)	Trailer Parks
Parking Areas (paved and unpaved)	Recreation Parks
Stationary Sources (NEDS#)	Recreation Fields
Buildings (number of stories)	Railroad Yards
Undeveloped Land (ground cover)	Bodies of Water
Tree Lines or Clusters	North Direction

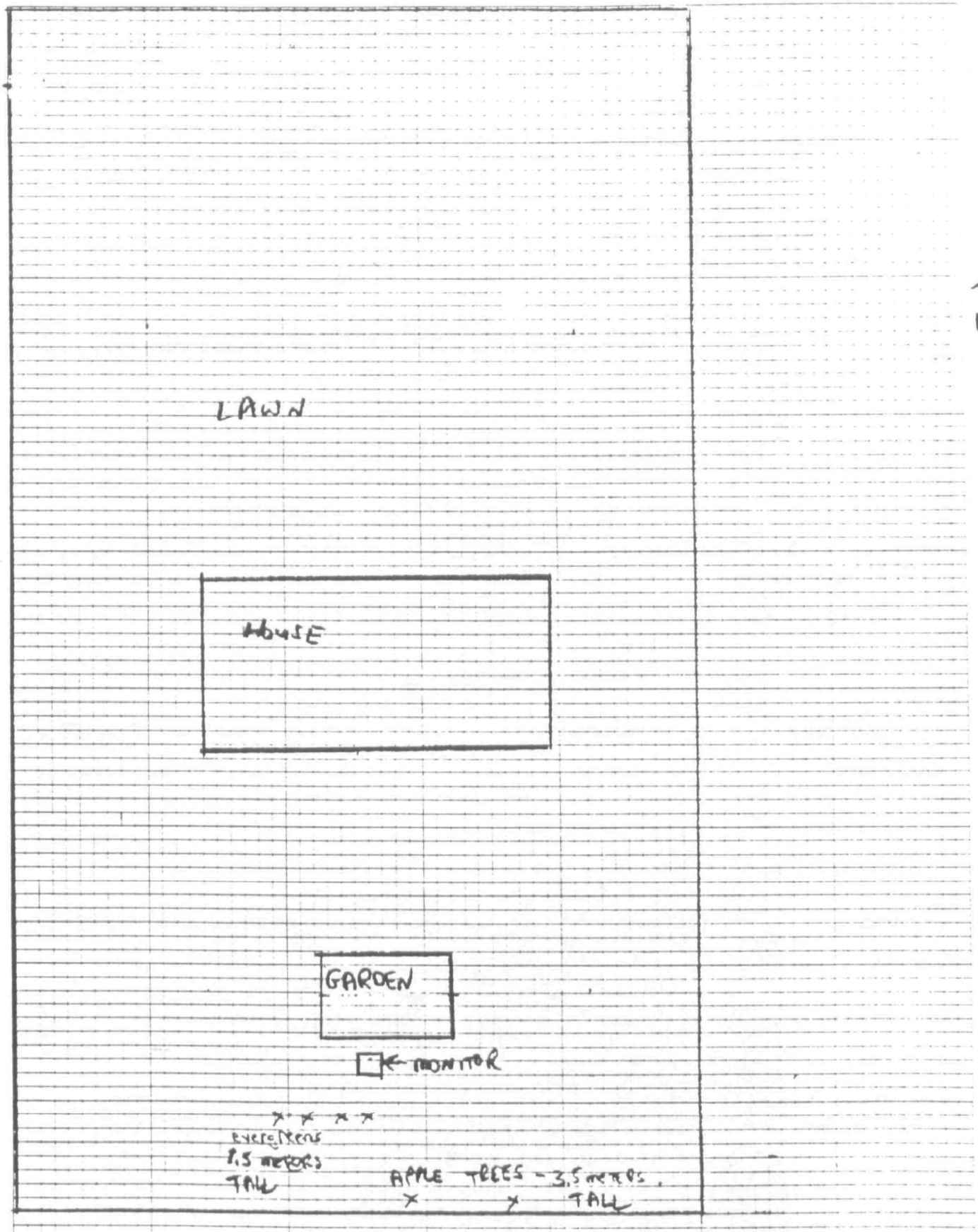
16 Attach separate sheet of labeled photographs G

17. UTM Coordinates, Zone _____ East _____ North _____

or latitude and longitude _____ _____ _____ G

* - R – Require (shall) be regulation
G – Guidance (should) by regulation, or guidance document
– Blocks are reserved for site evaluation only

STUDENT FORM - BACKGROUND SITE IN PISCATAWAY



1 inch = 8 METERS.

NJDEP-UMDNJ

Piscataway NJ
26 Sturbridge Dr

North

East

NJDEP-OUMDNJ

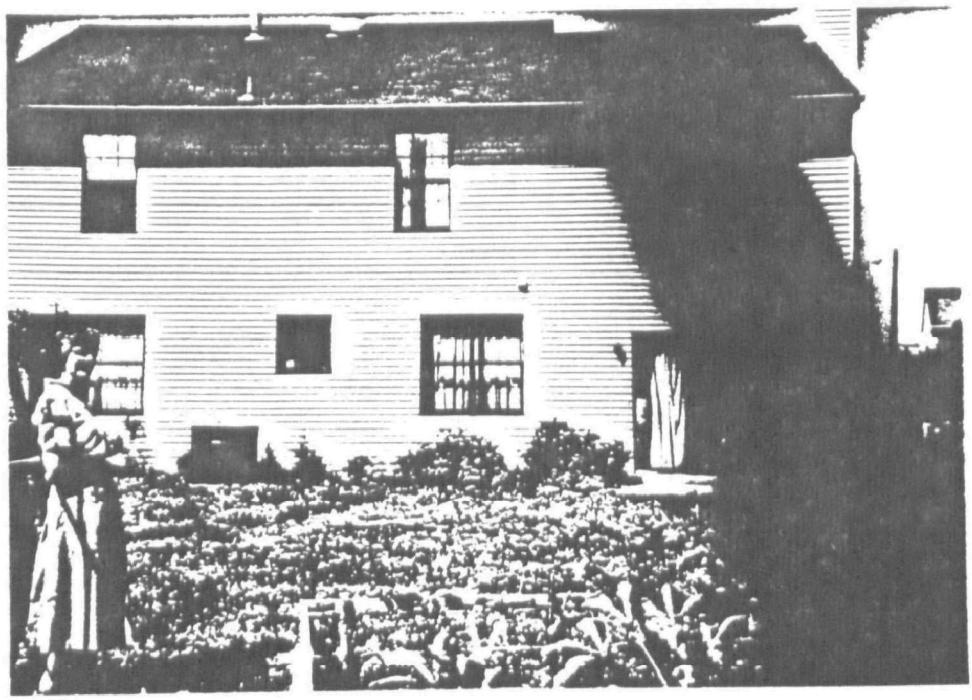
26 Sturbridge Dr
Piscataway NJ

South

SouthWest

NJDEP-umDNJ

24 Sturbridge Dr
Piscataway NJ



West

Northwest

NJ site D
Piscataway NJ
Background Site

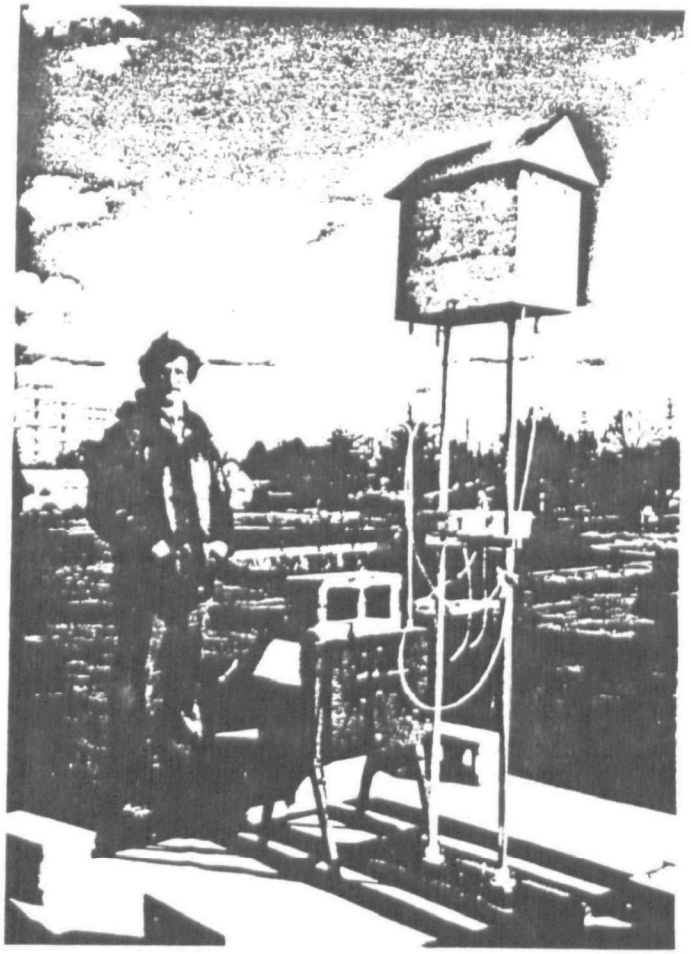
View of Tenar monitor from the street

Monitor location vs Ridge with trees

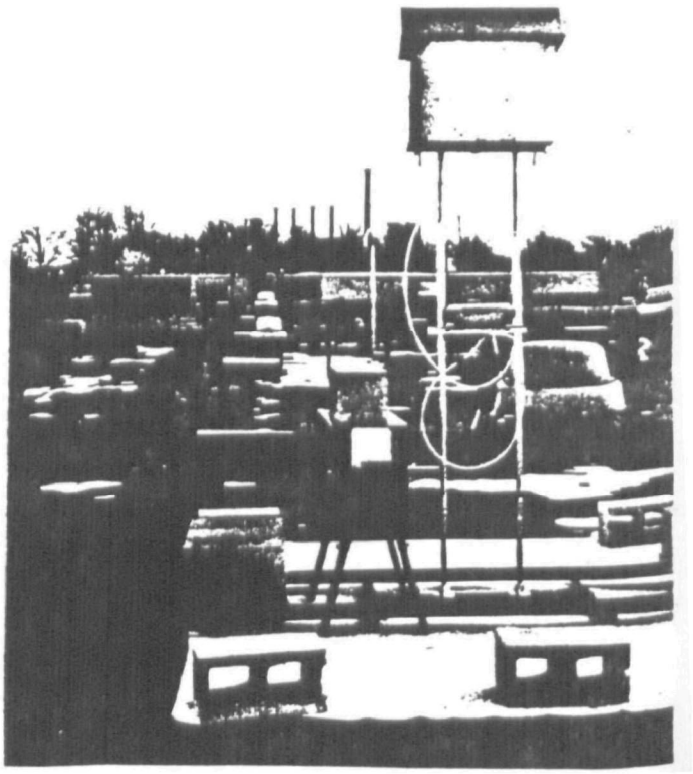
Addendum

NJ Site C
PS-26
Secaucus NJ

4/11



← Closeup of UMDNJ's Tenax sampler and Canister sampler on the roof of PS 26 facing E



UMDNJ's Tenax and Canister samplers on the roof of PS 26 in Secaucus facing SE.

Topography

1. The general characteristics of the terrain over a 2 mile radius from the site are (check one):

   ✓ Smooth, _____ Rolling, _____ Rough

2. Topographic features that influence the site:

   (Types – hills, valleys, depressions, bodies of water, ridges, cliffs)

(attach additional sheet if necessary)

Type	Size	Direction from Site	Distance from Site

Obstructions

List obstructions and complete information:

(Types – buildings, trees, ridges, cliffs)

Type	Size	Direction from Site	Distance from Site
Trees	4 feet tall	E	28 feet
Apple Trees	12 feet tall	SE	38 feet

Possible Interferences (Local VOC Sources)

Description	Size	Direction from Site	Distance from Site
Barbecue AGAINST HOUSE		W	35 feet
Apple Trees sprayed with pesticides		SE	38 feet
LAWN mower cutting grass		VARIABLE	VARIABLE

SITE CLASSIFICATION

1. Dominating Influence of site

   Area VOC's

   Mobile

2. Land Use within 1/4 mile radius from the site:

URBAN	DISTANCE AND DIRECTION FROM SITE
Residential	0-1/4 mile - All directions
Commercial	
Industrial	
Mobile	
Other (describe)	

3. Predominant Land Use by Direction (2 to 3 km from the site) (residential, commercial, industrial, suburban, and urban)

N Suburban residential, undeveloped land

NE Suburban residential

E Suburban residential

SE Rutgers University, suburban residential

S

SW

W Suburban residential

NW Park, cemetary, suburban residential

Mobile Source Worksheet

Mobile Sources that may Influence the Site

Type (check one)	Names of Roadways (nearest to site first): Meylars Lane	Styer Bridge Drive							
Arterial Highway									
Expressway									
Freeway									
Parkway									
Major Street or Highway									
Through Street or Highway	✓								
Local Street or Road		✓							
Traffic Activity: (complete as applicable)									
1 *Distance of roadway from air intake(ft)	¼ mile	55m							
2. Direction of roadway from air inlet (8 pts)	W	W							
3. Composition of roadway	asph	asph							
4. Number of traffic lanes	2	2							
5. Average daily traffic (estimate)									
6. Average vehicle speed (estimate, mph)	40	15							
7. Traffic is 1 or 2 way (1 or 2)	2	2							
8. Number of parking lanes	N/A	N/A							
9. Are parking lanes used for traffic part of day? (yes,no)	N/A	N/A							
10. Roadway paved (yes, no)	Yes	Yes							
11. Is dust visibly re-entrained? (yes, no)	no	no							
12. Does roadway have curb? (yes, no)	Yes	Yes							
13 Does dust collect near edges? (yes, no)	no	no							

*Identify probe, if more than one.

Meteorology and Climatology

1. Source of representative meteorological data (check one):

   _____ National Weather Service

   _____ Airport Weather Service

   _____ Site Weather Station

   _____ Other (specify)

   _____ Not available

2. Describe the annual and seasonal weather patterns that influence the site by summary wind roses or a table of frequency of occurrence for wind speeds and directions. Pollutant roses for the same periods desired if available. Provide attachments.

3. UTM Coordinates, Zone _____ East _____ North _____

   or Latitude and Longitude _____ _____

4. Location of representative meteorological station from monitoring site.

   Distance _____ Direction _____

Probe Siting

Information Topic	Tenax	Canister	DNPH	TSP	Environ Chem	Portable GC
1. Location (top of building, ground level, other specify)	ground	ground				
2. If on building, give height (M)	N/A	N/A				
width (M)	N/A	N/A				
depth (M)	N/A	N/A				
3. Horizontal distance from supporting structure (M)	N/A	N/A				
4. Vertical distance above supporting structure (M)	N/A	N/A			N/A	
5. Height of probe above ground (M)	2m	1m				
6. Distance from trees (M)	9m	9m				
7. Horizontal distance from edge of nearest traffic lane (See Appendix E, Fig. 1 and Tables 1, 2, 3 and 4) (M)	55m	55m				
8. Horizontal distance from nearest parking lot (M)	N/A	N/A				
9. Horizontal distance from walls, parapets, penthouses, etc. (M)	N/A	N/A	N/A	N/A	N/A	
10. Distance from obstacles, such as buildings height 8m	15m	15m	N/A			
11. Distance from furnace or incineration flues (M) ht 8m	15m	15m	N/A	N/A		
12. Unrestricted air flow	yes	yes				
13. Located in paved area or vegetative ground cover	yes	yes				
14. Roof Composition	N/A	N/A				

MONITOR INFORMATION

DOCUMENTATION OF MONITORING INFORMATION

Sampler Type	VOCs			Carbonyls	Metals
	Tenax	Canister	Portable GC	NDPH	Hi-vol
Instrument Manufacturer	UMDNJ	Anderson			
Date Sampling Began	8/87	11/87			
Sampling Frequency	1/6	1/18			

CUSTODY AND CONTROL OF DATA

1. Agency responsible for data collection University of Medicine and Dentistry of New Jersey (UMDNJ)
2. Individual's name Dr. Linda Berrafato
3. Phone Number (201) 463-4536
4. Agency analyzing samples UMDNJ (TENAX), PEI (CANISTER)
5. Individual's Name Dr. Linda Berrafato (UMDNJ), Bill JESS (PEI)
6. Phone number (201) 463-4536 (UMDNJ) (513) 782-4700 (PEI)
7. Reports of data are made to (Agency Name) New Jersey Department of Environmental Protection → UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
8. Individual's Name Charles Pietarinen (NJDEP), Rudy KAPICHAK (USEPA)
9. Phone number (609) 633-7648 (NJDEP), (201) 264-2517 (USEPA)

SITE EVALUATION

Site Identification number NJ SITE D

Individuals responsible for site evaluation and report preparation

Sue Jacquett and Avi Teitz (US Environmental Protection Agency)

Date of evaluation 11/4/87

Date of report 2/25/88

Signatures of Evaluators

Avraham Teitz

Comments This is a residential site and very suburban. The area is predominantly two story homes with fairly large size plots (~ 200 x 100 feet). The RUTGERS University campus nearby is also spread out over a large area. Possible interferences that must be kept in mind are the typical suburban activities such as gardening, cooking barbecues, etc. This is especially important as the monitor is in the breathing zone and therefore more affected by anthropogenic human activity than a roof top monitor

7. QUALITY ASSURANCE SUBCOMMITTEE REPORTS

Appendix A

Quality Assurance Assessments of Volatile Organic Compound Data As Reported by the Individual Organizations

Throughout the project, Quality Assurance responsibilities were carried out by the individual organizations and overseen by the Quality Assurance Subcommittee. A format for reporting this information, which included assessments of precision, accuracy, contamination, and data variability was devised by the Quality Assurance Subcommittee. This Appendix contains the QA Subcommittee guidance for the QA Report and the reports from the individual organizations. All of the reports has been reviewed and approved by the QA Subcommittee.

The Quality Assurance data in these reports was done on a quarterly basis. The purpose of this convention was that 1) This follows the format for data reported to the Data Management Subcommittee which was also done in quarterly increments, and 2) It allowed for the examination of trends that might otherwise be masked by the use of annual figures.

The need for the QA reports was especially acute in this project for the following reasons:

1. Several of the organizations involved in the project had no previous experience in ambient air VOC analysis.

2. The course of the project was long enough that changes in key personnel and analytical methodologies occurred at several organizations during the project.

3. The course of the project was long enough that equipment problems were eventually discovered in all laboratories.

Thus, the QA reports document the changes in the quality of the data as new personnel and equipment come on line, problems are discovered and then corrected, and incremental improvements increase the quality of the data submitted. Therefore the QA Subcommittee strongly feels that data should not be used without consulting the QA reports of the individual organizations. In fact these reported should be should be treated as part and parcel of the data itself.

MAR 16 1990.

Guidelines for the Preparation of Quality Assurance Reports for the Staten Island/New Jersey Urban Air Toxics Assessment Project

The Quality Assurance/Quality Control report for the project should be in the following format. There will be one final report for the project comprised of eight chapters, rather than discrete quarterly reports. However, quarterly data will be submitted as part of the individual chapters as outlined below. The eight chapters in the final report are:

1) Blanks
2) Duplicate samples
3) Distributed Volumes
4) Tenax vs. Canisters
5) Minimum Analytical Detection
6) Instrumental Accuracy
7) Chronological log of changes, alterations and improvements
8) Assessment of variability of the data

The logic behind the ordering of the chapters is to advance from the statistical assessments of data quality (chapters 1-6) to the narrative/descriptive assessments (chapter 7), to a an overall project assessment (Chapter 8) combining all phases of the project.

Chapters 1-4 are formatted in two parts; 1) An overall project assessment listing the methods used, results found, discussion of the data, and relevant conclusions and 2) Quarterly statistical reports (i.e. mean, standard deviation, 95% confidence limits), over the course of the project, with relevant notes and caveats. Formats for Chapters 1-4 are attached to this document.

Chapter 5 should specify the method used to determine the analytical detection limits, the result of these methods, and a discussion of the impact this has on the data in the study should be included. A table specifying analytical detection by compound, in ng (absolute detection) and ppb (typical sample limits), should be provided. A general guide to the discussion portion of this chapter should be the question "Are concentrations reported close to the detection limits less accurate or precise than those reported 3-4 times above this limit"?

Chapter 6 should relate the data obtained from outside sources (such as EPA/EMSL performance evaluation samples, PEI split samples, Research Triangle Institute audit cylinders, etc.) and the conclusions, explanations, or corrective actions resulting from this data.

Chapter 7 is a chronological, by quarter, list of changes and improvements in sampling and analysis that significantly affected data quality. This log should include addition of new equipment, changes in sampling procedure, changes in the way samples are shipped, new tracking procedures, significant maintenance (cleaning of the source, changing of columns etc.), findings of instrument drift or unusual unexplained results, etc. Significant problems detected (i.e. sample contamination) and resolution (new cleaning procedure) should also be clearly specified. The format

for this log should be a cataloging of items followed by brief annotations when necessary, allowing for an understanding of what happened when. This log is to be used to document the rigor of QA employed in this project, as well as an aid for data review and analysis.

Chapter 8 should present the researcher/institution's assessment of the variability of the data. The format for this chapter is appended to this document.

CHAPTER I

BLANKS

PROJECT SUMMARY

The project summary of the blank data should specify how the blank data were used, an examination of the data and a discussion of the results, and conclusions derived from this analysis. Questions to be considered should include :

1) Was any gross contamination present?
2) Were any compounds of specific concern with regard to contamination of samples?
3) Was there significant variation in the blanks during the course of the project?
4) If there is significant variation in the blank levels, what impact does this have on the quality of the data being reported?

QUARTERLY REPORT

The quarterly statistical format is attached. The following is an explanation of the data requested in these forms.

blanks run: how many blank samples were run during the quarter?

of contaminated samples: By compound, how many samples were determined to be unusable due to contamination.

Organization:_____ Sorbent:_____

QUARTER OF _____ TO _____ , 198_

BLANK SAMPLES

	# Blanks Run	# of Contaminated Samples
Toluene	#	#
Benzene	#	#
M/P Xylene	#	#
O Xylene	#	#
1,1,1 Trichloroethane	#	#
Tetrachloroethylene	#	#
Dichloromethane	#	#
Carbon Tetrachloride	#	#
Hexane	#	#

Notes Attached (Y/N):

QUARTER OF _____ TO _____ , 198_

BLANK SAMPLES

	# Blanks Run	# of Contaminated Samples
Toluene	#	#
Benzene	#	#
M/P Xylene	#	#
O Xylene	#	#
1,1,1 Trichloroethane	#	#
Tetrachloroethylene	#	#
Dichloromethane	#	#
Carbon Tetrachloride	#	#
Hexane	#	#

Notes Attached (Y/N):

CHAPTER II

DUPLICATE SAMPLES

PROJECT SUMMARY

The project summary of sample duplicates should be confined to true duplicate samples, as opposed to distributed volume pairs. The summary should include an examination of the data, a discussion of the results, and pertinent conclusions.

Questions to be considered should include :

1) Does the difference between duplicate samples differ by compound?
2) To what can these observed differences be ascribed to?
3) If the duplicate samples vary significantly, what impact does this have on the quality of the data being reported?

QUARTERLY REPORT

The quarterly statistical format is attached. The following is an explanation of the data requested in these forms.

pairs run: how many distributed volume pairs were run during the quarter?

Average Difference (ppb): This should be computed as (low flow - high flow) for each individual distributed volume sample pair in the quarter. These differences should then be summed and divided by the number of sample pairs.

Standard Deviation: This is computed by determining the standard deviation of the differences between the individual (low flow -high flow) sample pairs computed above and dividing by the square root of the number of samples. This is because this is the standard deviation of an average. The statistical reference for this is underlined in the enclosed handout.

95% Confidence Limits: The purpose of this statistic is to give the range of the differences between the low and high flow tubes with a 95% degree of confidence. Computation of this statistic is done using the T statistic and is outlined in an attachment to this document.

Organization:_____ Sorbent:_____

QUARTER OF _____ TO _____ , 198_

DUPLICATE SAMPLES

	# Pairs Run	Average Difference (ppb)	Std. Dev. Avg. Dif. (ppb)	95% CL Interval (ppb)
Toluene	#	x.x	x.x	x.x - x.x
Benzene	#	x.x	x.x	x.x - x.x
M/P Xylene	#	x.x	x.x	x.x - x.x
O Xylene	#	x.x	x.x	x.x - x.x
1,1,1 Trichloroethane	#	x.x	x.x	x.x - x.x
Tetrachloroethylene	#	x.x	x.x	x.x - x.x
Dichloromethane	#	x.x	x.x	x.x - x.x
Carbon Tetrachloride	#	x.x	x.x	x.x - x.x
Hexane	#	x.x	x.x	x.x - x.x

Notes Attached (Y/N):

QUARTER OF _____ TO _____ , 198_

DUPLICATE SAMPLES

	# Pairs Run	Average Difference (ppb)	Std. Dev. Avg. Dif. (ppb)	95% CL (ppb)
Toluene	#	x.x	x.x	x.x - x.x
Benzene	#	x.x	x.x	x.x - x.x
M/P Xylene	#	x.x	x.x	x.x - x.x
O Xylene	#	x.x	x.x	x.x - x.x
1,1,1 Trichloroethane	#	x.x	x.x	x.x - x.x
Tetrachloroethylene	#	x.x	x.x	x.x - x.x
Dichloromethane	#	x.x	x.x	x.x - x.x
Carbon Tetrachloride	#	x.x	x.x	x.x - x.x
Hexane	#	x.x	x.x	x.x - x.x

Notes Attached (Y/N):

CHAPTER III

DISTRIBUTED VOLUMES

PROJECT SUMMARY

The project summary of the distributed volume data should include an examination of the data, a discussion of the results, and pertinent conclusions.

Questions to be considered should include :

1) Does the difference between distributed volume pairs differ by compound?
2) Can the differences observed be ascribed to breakthrough?
3) If there is variation in distributed volume concentrations, what impact does this have on the reported concentrations?

QUARTERLY REPORT

The quarterly statistical format is attached. The following is an explanation of the data requested in these forms.

pairs run: how many distributed volume pairs were run during the quarter?

Average Difference (ppb): This should be computed as (low flow - high flow) for each individual distributed volume sample pair in the quarter. These differences should then be summed and divided by the number of sample pairs.

Standard Deviation: This is computed by determining the standard deviation of the average differences between the individual (low flow -high flow) sample pairs computed above and dividing by the square root of the number of samples. This is because this is the standard deviation of an average. The statistical reference for this is underlined in the enclosed handout.

95% Confidence Limits: The purpose of this statistic is to give the range of the differences between the low and high flow tubes with a 95% degree of confidence. Computation of this statistic is done using the T statistic and is outlined in an attachment to this document.

Paired t Test: A standard test and statistic to determine whether two means are from the same population or not. The purpose of using the T Test in this portion of the study is to determine whether the differences between the high and low flow concentrations, are statistically significant or not. The T test done using the following equation using the following values:

$$t = \frac{(D\ bar)}{s_{D\ bar}}$$

where

D bar = Quarterly mean of the difference between the individual low flow and high flow concentrations.

$s_{D\ bar}$ = The standard deviation of the quarterly mean of the difference between the individual low flow and high flow concentrations. The standard deviation of a mean is given above.

This value of T is then compared to the T Table for the 0.05 significance level. A value greater than the table value indicates that the populations are different from one another.

The powerful reasons for using this test are that:

1) It gives a yes/no answer on the significance of the differences between low flow and high flow concentrations.

2) It is a common and respected statistic.

3) It uses as input calculations that have already been made. This keeps extra computations down to a minimum, and readily facilitates the use of spreadsheets in the calculation of this statistic with a minimum of effort.

4) It is more reliable than a standard deviation since standard deviations are biased with respect to the mean that they are measuring, whereas the T statistic is independent of this bias.

5) It is robust, in that at the 5% significance level it functions well for both normal and non normally distributed populations.

Organization:_____ Sorbent:_____

QUARTER OF _____ TO _____ , 198_

DISTRIBUTED VOLUMES

	# Pairs Run	Average Difference (ppb)	Std. Dev. Avg. Dif. (ppb)	95% CL Interval (ppb)	T Test	T > 0.05 (Y/N)
Toluene	#	x.x	x.x	x.x - x.x	x.x	Y
Benzene	#	x.x	x.x	x.x - x.x	x.x	N
M/P Xylene	#	x.x	x.x	x.x - x.x	x.x	Y
O Xylene	#	x.x	x.x	x.x - x.x	x.x	N
1,1,1 Trichloroethane	#	x.x	x.x	x.x - x.x	x.x	Y
Tetrachloroethylene	#	x.x	x.x	x.x - x.x	x.x	N
Dichloromethane	#	x.x	x.x	x.x - x.x	x.x	N
Carbon Tetrachloride	#	x.x	x.x	x.x - x.x	x.x	N
Hexane	#	x.x	x.x	x.x - x.x	x.x	Y

Notes Attached (Y/N):

QUARTER OF _____ TO _____ , 198_

DISTRIBUTED VOLUMES

	# Pairs Run	Average Difference (ppb)	Std. Dev. Avg. Dif. (ppb)	95% CL (ppb)	T Test	T > 0.05 (Y/N)
Toluene	#	x.x	x.x	x.x - x.x	x.x	Y
Benzene	#	x.x	x.x	x.x - x.x	x.x	N
M/P Xylene	#	x.x	x.x	x.x - x.x	x.x	Y
O Xylene	#	x.x	x.x	x.x - x.x	x.x	N
1,1,1 Trichloroethane	#	x.x	x.x	x.x - x.x	x.x	Y
Tetrachloroethylene	#	x.x	x.x	x.x - x.x	x.x	N
Dichloromethane	#	x.x	x.x	x.x - x.x	x.x	N
Carbon Tetrachloride	#	x.x	x.x	x.x - x.x	x.x	N
Hexane	#	x.x	x.x	x.x - x.x	x.x	Y

Notes Attached (Y/N):

CHAPTER IV

TENAX vs. CANISTERS

PROJECT SUMMARY

The project summary of the tenax/canister comparison should include an examination of the data, discussion of the results, and pertinent conclusions.

Questions to be considered should include :

1) Does the difference between tenax and canisters differ by compound?
2) To what can the differences observed be ascribed to?
3) If there is variation between tenax and canisters, what impact does this have on the quality of the data being reported?

QUARTERLY REPORT

The quarterly statistical format is attached. The following is an explanation of the data requested in these forms.

\# pairs run: how many tenax/canister pairs were run during the quarter?

Average Difference (ppb): This should be computed as (tenax - canister) for each tenax/canister pair in the quarter. These differences should be summed and then divided by the number of sample pairs.

Standard Deviation: This is computed by determining the standard deviation of the average differences between the individual (low flow -high flow) sample pairs computed above and dividing by the square root of the number of samples. This is because this is the standard deviation of an average. The statistical reference for this is underlined in the enclosed handout.

95% Confidence Limits: Same logic and method used for distributed volumes.

T Test: Same logic and method used for distributed volumes.

Average % Difference: This should be computed as [(canister - tenax)/tenax] * 100 for each tenax/canister pair in the quarter. These differences should be summed and then divided by the number of sample pairs.

Organization:_____ Sorbent:_____

QUARTER OF _____ TO _____ , 198_

TENAX vs. CANISTER

	# Pairs Run	Average Difference (ppb)	Std. Dev. Avg. Dif. (ppb)	95% CL Interval (ppb)	T Test	T > 0.05 (Y/N)	Average % Difference
Toluene	#	x.x	x.x	x.x - x.x	x.x	Y	x.x
Benzene	#	x.x	x.x	x.x - x.x	x.x	N	x.x
M/P Xylene	#	x.x	x.x	x.x - x.x	x.x	Y	x.x
O Xylene	#	x.x	x.x	x.x - x.x	x.x	N	x.x
1,1,1 Trichloroethane	#	x.x	x.x	x.x - x.x	x.x	Y	x.x
Tetrachloroethylene	#	x.x	x.x	x.x - x.x	x.x	N	x.x
Dichloromethane	#	x.x	x.x	x.x - x.x	x.x	N	x.x
Carbon Tetrachloride	#	x.x	x.x	x.x - x.x	x.x	N	x.x
Hexane	#	x.x	x.x	x.x - x.x	x.x	Y	x.x

Notes Attached (Y/N):

QUARTER OF _____ TO _____ , 198_

TENAX vs. CANISTER

	# Pairs Run	Average Difference (ppb)	Std. Dev. Avg. Dif. (ppb)	95% CL Interval (ppb)	T Test	T > 0.05 (Y/N)	Average % Difference
Toluene	#	x.x	x.x	x.x - x.x	x.x	Y	x.x
Benzene	#	x.x	x.x	x.x - x.x	x.x	N	x.x
M/P Xylene	#	x.x	x.x	x.x - x.x	x.x	Y	x.x
O Xylene	#	x.x	x.x	x.x - x.x	x.x	N	x.x
1,1,1 Trichloroethane	#	x.x	x.x	x.x - x.x	x.x	Y	x.x
Tetrachloroethylene	#	x.x	x.x	x.x - x.x	x.x	N	x.x
Dichloromethane	#	x.x	x.x	x.x - x.x	x.x	N	x.x
Carbon Tetrachloride	#	x.x	x.x	x.x - x.x	x.x	N	x.x
Hexane	#	x.x	x.x	x.x - x.x	x.x	Y	x.x

Notes Attached (Y/N):

CHAPTER VIII

ASSESSMENT OF DATA VARIABILITY

PROJECT SUMMARY

The narrative portion of this chapter is the executive summary of the entire QA document. All of the most important points and caveats relevant to the quality of the data gathered for the project should be stated here, even if they appeared previously in the report. A general guide to this chapter should be the question "If a data user would read only one chapter of the QA report, what is it imperative for him to know about the quality of the data being provided?"

DATA REPORTED

The format is attached. Note that the data are reported in terms of the entire project, rather than quarter by quarter. If there was significant variability in the data at a given time, the data reported should be broken down by the dates that significant changes are being noted. For example, in the handout enclosed, the Tenax data is being reported for three separate time periods during the project and each would have its own mean and standard deviation. If the data was more homogenous, there would only be one entry for this method.

The purpose of the data is to show the overall variability of the relationship between the supposedly identical paired measurements.

The following is an explanation of the data requested in these forms.

 # samples run: How many samples were used in the computation to determine the variability of the data for this compound (a distributed volume pair would be considered as one sample)

Mean Sample Concentration (ppb):
The mean compound concentration of all the paired samples collected during the reported period. This number is important as a reference point when examining relative data variability and is needed here because this chapter will be treated as an executive summary by those who are not intimately familiar with the project data.

Mean difference between paired samples (ppb):
For the reported period, what was the mean concentration of the difference in concentration between the duplicates or distributed volume pairs used to determine the variability of the data? This is computed by summing the individual distributed volume or duplicate pair differences and dividing by

the number of samples run that was given above.

Standard Deviation: This is computed by determining the standard deviation of the differences between the individual (low flow -high flow) sample pairs computed above and dividing by the square root of the number of samples. This is because this is the standard deviation of an average. The statistical reference for this is underlined in the enclosed handout.

Organization:_____ Compound name:_____

DATA VARIABILITY FOR PROJECT

Method	# Samples Run	Mean Sample Concentration (ppb)	Mean Difference Between Paired Samples (ppb)	Standard Deviation of the Mean Differences Between Paired Samples (ppb)
Tenax (2/1/88-9/3/88)	#	x.x	x.x	x.x
Tenax (9/7/88-9/30/88)	#	x.x	x.x	x.x
Tenax (10/6/88-9/3/89)	#	x.x	x.x	x.x

Notes Attached (Y/N):

Compound name:_____

DATA VARIABILITY FOR PROJECT

Method	# Samples Run	Mean Sample Concentration (ppb)	Mean Difference Between Paired Samples (ppb)	Standard Deviation of the Mean Differences Between Paired Samples (ppb)
Tenax (2/1/88-9/3/88)	#	x.x	x.x	x.x
Tenax (9/7/88-9/30/88)	#	x.x	x.x	x.x
Tenax (10/6/88-9/3/89)	#	x.x	x.x	x.x

Appendix B

Inter-organization Comparisons

via

Canister Collocations

Table of Contents

Introduction..... 1
Descriptive Summary Statistics..... 4
Annotated Example of ANOVA and LSD.....11
Analysis of Variance and LSD.....16
Data Sets Used in Computations.....25

Table of Tables

Table 1. Year 1 Comparison Between Organizations and PEI... 8
Table 2. Year 2 Comparison Between Organizations and PEI... 9
Table 3. PEI Precision Analysis.....10
Table 4. Year 1 ANOVA for Toluene.....19
Table 5. Year 1 Anova for Benzene.....19
Table 6. Year 1 ANOVA for M/P Xylene.....19
Table 7. Year 1 ANOVA for Ortho Xylene.....19
Table 8. Year 1 ANOVA for 1,1,1 Trichloroethane.....20
Table 9. Year 1 ANOVA for Tetrachloroethene.....20
Table 10. Year 1 ANOVA for Hexane.....20
Table 11. Year 2 ANOVA for Toluene.....21
Table 12. Year 2 Anova for Benzene.....21
Table 13. Year 2 ANOVA for M/P Xylene.....21
Table 14. Year 2 ANOVA for Ortho Xylene.....21
Table 15. Year 2 ANOVA for 1,1,1 Trichloroethane.....22
Table 16. Year 2 ANOVA for Tetrachloroethene.....22
Table 17. Year 2 ANOVA for Hexane.....22
Table 18. Year 1 LSD for Toluene.....23
Table 19. Year 1 LSD for M/P Xylene.....23
Table 20. Year 1 LSD for Ortho Xylene.....23
Table 21. Year 2 LSD for Toluene.....23
Table 22. Year 2 LSD for Benzene.....23
Table 23. Year 2 LSD for 1,1,1 Trichloroethane.....23
Table 24. Table of LSD Rankings Where 'F' is Significant...24

Introduction

Sampling and analysis of volatile organics (VOCs) for the SI/NJ UATAP was conducted by three organizations; the New York State Department of Environmental Conservation (NYSDEC), the New Jersey Institute of Technology (NJIT) and the College of Staten Island (CSI). Each organization had sole jurisdiction over its sampling sites[1] and used unique sampling and analytical methodologies.[2] Since this resulted in the isolation of the sampling/analytical organizations from each other, it would not have been possible to assess the intercomparability of the results produced by the various organization. In order to mitigate the effects of this isolation and to provide a basis for statistical comparison, the QA Subcommittee developed and implemented two strategies.

The first approach was to have "shootouts", where all project participants gather collocated samples at one location for several days.[3] The resulting data could then be analyzed to determine the degree of comparability evident between organizations. However, shootouts are labor intensive, requiring extra sampling equipment, analytical capacity, and monitoring personnel not always available. As a result, shootouts could only be scheduled infrequently. Another consideration is that shootouts provide only a "snapshot" of an organization's capabilities over a short period of time, rather than a long term assessment.

The second approach involved more routine collocation of Summa canisters with the sorbent tubes normally used by each organization. By assessing the collocation results on an annual basis, comparisons between organizations could then be made. In practice, NYSDEC and CSI collected canister samples at the rate of one canister collocation for every three tube samples taken. Canisters were analyzed by PEI, a contractor to EPA/AREAL. NJIT was already collocating canister and sorbent tube samples, but in contrast to NYSDEC and CSI, was analyzing both the sorbent tube and the canister samples. To ensure consistent comparison of the NJIT data with that of NYSDEC and CSI, NJIT agreed to split canister samples with PEI on a monthly basis. Sample splitting was accomplished by having NJIT analyze an aliquot of gas from a sample canister and then sending the canister, still filled with sampled ambient air, to PEI for analysis.

This Appendix contains the results of the canister collocation data, and contains the data sets used to intercompare

---

[1] See Data Management Subcommittee report for a full listing of site jurisdictions.

[2] Details of sampling and analytical methodologies can be found in QA Appendix C, Management Systems Audits.

[3] Shootout results are reported in QA Appendix D.

organizations, the statistics and tables derived from these data, and a discussion of the results of the statistical analysis. The purpose of this analysis is to compare the NJIT, CSI, and NYSDEC results and to determine if any significant differences exist between them.

The first data year is defined as October 1987 - September 1988, and the second data year as October 1988 - September 1989. This convention is consistent with the annual averages reported by the Data Management Subcommittee and submitted to the Risk Assessment Subcommittee.

Caveats and Notes

1. All calculations were made on collocated data pairs for individual compounds.

2. Concentrations below the detection limit was deleted from the data set and resulted in the invalidation of the collocated data pair for the compound not detected.

3. Comparisons were made between all organizations for toluene, benzene, meta and para xylene, ortho xylene, tetrachloroethene, and 1,1,1 trichloroethane.

4. Dichloromethane data are presented for NYSDEC only. Computations on CSI's dichloromethane data were not included because they were computational artifacts resulting from the convention of reporting data below the detection limit as one half the detection limit. NJIT had analytical problems with dichloromethane that made its analysis subject to a variation of greater than an order of magnitude. As a result these data were withdrawn from consideration in the collocation comparisons.

5. Trichloroethene, chloroform, and carbon tetrachloride concentrations were almost always below the detection limit of PEI; therefore comparison with collocated sorbent tubes are omitted.

6. The PEI numbers for hexane in the first year of the project are suspect. Large concentrations (>50 ppb), were reported by PEI for these samples. CSI's collocated Tenax showed concentrations typically at 1 ppb or less, which was typical for all organizations throughout the project. Additionally, these high concentrations were only reported by PEI for a short period of time. Subsequent collocations revealed close agreement between PEI and CSI, as evidenced by the second year's data. However, there was no basis to disqualify PEI's results. Therefore the data has been included in the tables presented.

7. Hexane data were not reported by NYSDEC.

8. Ethyl benzene was not reported by NJIT.

9. There was insufficient NJIT tetrachloroethene data above the detection limit in the first year of the project to warrant inclusion.

10. PEI analysis is not a true "reference" or "standard" for any compound. However, it does represent a valid basis for comparison in this project. PEI analysis of collocated or split canister samples is the only available means for comparing continuing performance. PEI's consistently good precision results solidify this process. However, the resulting assessments should not be interpreted to represent true comparisons with a "reference" or "standard" but only for what they are, a comparison with a consistent, available basis.

Descriptive Summary Statistics

This section summarizes the statistics obtained from the evaluation of collocation or split analysis of canisters analyzed by PEI with samples analyzed by the participating organizations. The statistics are presented in Tables 1 and 2. Table 3 shows the standard deviation of collocated PEI canisters and is included here to show the precision of the PEI reference. The descriptions below outline how the components of these tables were computed.

% of Reference: This represents the degree of agreement between the PEI reference and the individual organizations. A value of 100% indicates total agreement. The NYSDEC and CSI results were derived by first computing annual means for the collocated canister and sorbent samples. Then, the annual means for the sorbent tube concentrations were divided by the PEI canister mean and multiplied by 100. NJIT's results were derived by first determining the annual means for NJIT and PEI that resulted from the NJIT/PEI split canister analyses. An annual mean was then computed for the NJIT Tenax samples that were collocated with the canisters used in the NJIT/PEI split analysis. The annual mean for NJIT canisters was then divided by the PEI annual mean and multiplied by 100. The same procedure was also applied to the annual means of the collocated Tenax samples.

When using the % of standard calculations to make inferences about the data, care must be used because the variability of the individual comparisons that make up the averages are not evident. This variability is dealt with in detail in the next section, in analysis of variance.

Average Concentration: This represents the annual mean concentration, in parts per billion, obtained by the individual sampling organization (NJIT, CSI, or NYSDEC) during collocation sampling.

Standard Deviation: This represents a measure of the variability between the sample and the collocated PEI reference. This statistic was generated by taking the differences between the samples and the collocated PEI references and determining the standard deviation of these differences.

Standard Error: This represents the standard error associated with the standard deviation reported above. It is obtained by taking the square root, of the quantity (standard deviation/sample size).

n: This is the number of collocated samples taken or the sample size. This number is a function of the way the study was constructed. NYSDEC had many sampling sites and therefore had the most collocated canister samples. NJIT was doing its own canister analysis and therefore sent a limited numbers of canisters to PEI for split analysis.

PEI Precision Analysis, Table 3: The standard deviation of duplicate PEI samples is included as a measure of PEI precision.

It was derived from two separate experiments that were pooled, after statistical testing indicated it was appropriate to do so.

Findings

Tables 1 and 2 show several clear and consistent patterns when comparing NJIT, CSI, and NYSDEC to the collocated PEI reference. In almost all cases, the results of the organizations were within ± 50 of the PEI reference, with the important exceptions noted below. The differences relative to the PEI reference were greater in the first year of the project than in the second year of the project. NYSDEC had the most consistent response from year to year and NJIT was the most variable. NJIT's variability may be due in part to its small collocation/split sample size. Specific findings for each organization are presented below.

NJIT Canisters: The benzene results were very close to the PEI reference for both years of the study. The NJIT canisters were 109% of the standard during the first year of the study and 116% during the second year. However, toluene, meta and para xylene, and ortho xylene results were 187%, 240%, and 144% of the PEI reference during the first year of the study. During the second year of the study, these same compounds were 91%, 75%, and 67% of PEI. The response of 1,1,1 trichloroethane also varied from the first year of the study to the second. During the first year, 1,1,1 trichloroethane was 78% of PEI, but this increased to 133% in the second year of the project.

NJIT Tenax: During the first year, response relative to the PEI reference was within 95% to 116% for all compounds examined. During the second year of the study toluene and benzene response changed substantially relative to PEI, while meta and para xylene and ortho xylene results remained constant. Specifically, toluene and benzene response relative to PEI for the first year was 116% and 97%, respectively. During the second year of the study, toluene and benzene were 143% and 136% of the PEI reference. Meta and para xylene and ortho xylene were within 6% of PEI during the first year of the project, and within 7% the second year. The response of 1,1,1 trichloroethane declined from 101% of the PEI concentration the first year of the study to 66% of the reference the second year.

NYSDEC Sorbent Tubes: For each year of the study, NYSDEC response was within 20% of the PEI reference for benzene, toluene, and meta and para xylene. Ortho xylene, dichloromethane, tetrachloroethene and 1,1,1 trichloroethane were 61% to 76% of the PEI reference the first year of the project and 57% to 79% of the PEI reference during the second year of the project. More remarkably, NYSDEC maintained an extremely consistent relationship to the PEI reference over the two years. A comparison with the first year percent of standard values with the second year values shows a difference of -16% for toluene, +12% for benzene, and less than ±9% for all other compounds reported.

CSI Tenax: Benzene response was close to the PEI reference for both years of the project. CSI was 89% of PEI the first year of the project and 107% the second. Meta and para xylene and 1,1,1 trichloroethane responses were also consistent for both years relative to the PEI reference. The meta and para xylene results were 130% of PEI for the first year of the project and 121% for the second year. 1,1,1 trichloroethane results were 58% of PEI the first year and 53% the second year. Toluene, ethyl benzene and tetrachloroethene showed declines in the relative % of reference data of at least 34% between the first year of the project and the second. Toluene and tetrachloroethene were 128% and 129% of PEI the first year of the project and declined to 94% and 95% of the reference during the second year of the project. Ethyl benzene was 169% of PEi the first year of the project, and declined to 120% the second year.

Table 1.

Comparison Between Organizations and PEI Canisters
Year Number of 1 Study

Organization	Toluene	Benzene	M/P Xylene	O-Xylene	Dichloro methane	Tetra chloro ethylene	1,1,1 Trichloro ethane	Hexane	Ethyl Benzene	Trichloro ethylene	Chloroform	Carbon Tetra chloride
NJIT Tenax (vs. PEI collocation)												
% of Reference	116	97	104	94	withdrawn	insuffi-	101	95	not done	insufficient data due to MDL		
Avg. Conc.	4.78	1.51	1.58	0.62	withdrawn	cient	0.71	1.71	not done	insufficient data due to MDL		
Std. Dev.	1.63	0.90	1.49	0.57	withdrawn	data due	0.68	----	not done	insufficient data due to MDL		
Std. Error	0.64	0.47	0.61	0.44	withdrawn	to PEI	0.63	----	not done	insufficient data due to MDL		
n	4	4	4	3	withdrawn	MDL	2	1	not done	insufficient data due to MDL		
NJIT Canister (vs. PEI collocation)												
% of Reference	187	109	240	144	withdrawn	insuffi-	78	111	not done	insufficient data due to MDL		
Avg. Conc.	7.73	1.07	3.67	0.96	withdrawn	cient	0.55	2.00	not done	insufficient data due to MDL		
Std. Dev.	4.26	0.75	2.49	0.66	withdrawn	data due	----	----	not done	insufficient data due to MDL		
Std. Error	1.03	0.43	0.79	0.41	withdrawn	to PEI	----	----	not done	insufficient data due to MDL		
n	4	4	4	4	withdrawn	MDL	1	1	not done	insufficient data due to MDL		
NYSDEC Tubes												
% of Reference	104	110	92	61	71	66	76	not done	NYR	insufficient data due to MDL		
Avg. Conc.	2.46	0.98	1.15	0.38	0.58	0.25	0.48	not done	NYR	insufficient data due to MDL		
Std. Dev.	0.97	0.60	0.55	0.32	0.41	0.36	0.32	not done	NYR	insufficient data due to MDL		
Std. Error	0.14	0.11	0.11	0.09	0.11	0.15	0.16	not done	NYR	insufficient data due to MDL		
n	48	47	42	40	33	17	12	not done	NYR	insufficient data due to MDL		
CSI Tubes												
% of Reference	128	89	130	60	artifact	129	58	4	169	insufficient data due to MDL		
Avg. Conc.	3.90	1.13	1.87	0.39	artifact	0.67	0.34	0.90	0.95	insufficient data due to MDL		
Std. Dev.	1.51	0.71	1.20	0.21	artifact	0.15	0.30	36.11	0.64	insufficient data due to MDL		
Std. Error	0.21	0.14	0.20	0.10	artifact	0.11	0.13	1.34	0.20	insufficient data due to MDL		
n	34	34	31	23	artifact	13	18	20	16	insufficient data due to MDL		

% of Reference = (Mean Organization Concentration/Mean PEI Concentration)*100
Avg. Conc. = Mean Annual Organization Concentration
Std. Dev. = Standard Deviation of the Difference Between the Collocated PEI and Organization Concentrations
Std. Err. = Standard Error; Square Root(Std. Dev./n)
n = Sample size
NYR = Data not yet received

Table 2.

Comparison Between Organizations and PEI Canisters
Year Number 2 of Study

Organization	Toluene	Benzene	M/P Xylene	O-Xylene	Dichloro methane	Tetra chloro ethylene	1,1,1 Trichloro ethane	Hexane	Ethyl Benzene	Trichloro ethylene	Chloroform	Carbon Tetra chloride
NJIT Tenax												
% of Reference	143	136	97	96	withdrawn	92	76	128	not done	Insufficient data due to MDL		
Avg. Conc.	5.50	2.44	1.35	0.55	withdrawn	0.18	0.59	1.84	not done	Insufficient data due to MDL		
Std. Dev.	4.17	1.61	1.75	0.62	withdrawn	0.05	0.46	1.42	not done	Insufficient data due to MDL		
Std. Error	0.83	0.52	0.54	0.32	withdrawn	0.11	0.28	0.53	not done	Insufficient data due to MDL		
n	6	6	6	6	withdrawn	4	6	5	not done	Insufficient data due to MDL		
NJIT Canister												
% of Reference	91	116	75	67	withdrawn	61	133	101	not done	Insufficient data due to MDL		
Avg. Conc.	3.51	2.08	1.05	0.38	withdrawn	0.12	1.04	1.46	not done	Insufficient data due to MDL		
Std. Dev.	0.71	0.27	0.44	0.14	withdrawn	0.06	0.23	0.60	not done	Insufficient data due to MDL		
Std. Error	0.34	0.21	0.27	0.15	withdrawn	0.12	0.20	0.35	not done	Insufficient data due to MDL		
	6	6	6	6	withdrawn	4	6	5	not done	Insufficient data due to MDL		
NYSDEC Tubes												
% of Reference	120	98	95	57	79	57	70	not done	NYR	Insufficient data due to MDL		
Avg. Conc.	3.76	1.14	1.47	0.48	0.76	0.52	0.48	not done	NYR	Insufficient data due to MDL		
Std. Dev.	1.31	0.36	1.00	0.98	0.68	1.08	0.34	not done	NYR	Insufficient data due to MDL		
Std. Error	0.10	0.05	0.09	0.09	0.08	0.15	0.06	not done	NYR	Insufficient data due to MDL		
n	130	127	123	109	114	51	108	not done	NYR	Insufficient data due to MDL		
CSI Tubes												
% of Reference	94	107	121	65	artifact	95	53	101	120	Insufficient data due to MDL		
Avg. Conc.	3.14	1.39	1.69	0.38	artifact	0.86	0.48	0.84	0.53	Insufficient data due to MDL		
Std. Dev.	2.01	0.45	0.63	0.15	artifact	0.30	0.50	0.32	0.23	Insufficient data due to MDL		
Std. Error	0.25	0.12	0.14	0.08	artifact	0.15	0.14	0.11	0.10	Insufficient data due to MDL		
n	31	30	30	25	artifact	13	25	25	25	Insufficient data due to MDL		

% of Reference = (Mean Organization Concentration/Mean PEI Concentration)*100
Avg. Conc. = Mean Annual Organization Concentration
Std. Dev. = Standard Deviation of the Difference Between the Collocated PEI and Organization Concentrations
Std. Err. = Standard Error; Square Root(Std. Dev./n)
n = Sample size
NYR = Data not yet received

Table 3.

PEI Precision Analysis

	Average Concentration	Standard Deviation
Toluene	3.01	0.34
Benzene	0.84	0.06
M/P Xylene	0.93	0.25
Dichloromethane	0.89	0.22
Hexane	0.79	0.26
O-Xylene	0.50	0.25
1,1,1 Trichloroethane	0.37	0.10
Ethyl Benzene	0.24	0.11
Tetrachloroethylene	0.16	0.03

Based on 2 studies.

Study 1 involved three collocated canisters over a p of four seperate days during shootout #2.

Study 2 was based on the pump/pumpless collocations conducted with three collocated canisters on two seperate days.

The data from the studies were pooled after analysis and homogeneity of variance tests indicated the acce such an approach.

Further statistics available upon request.

Annotated Example and References

of ANOVA and LSD

Approach to the Analysis of Variance

The analysis of variance is presented for seven compounds. These are toluene, benzene, meta and para xylene, ortho xylene, tetrachloroethene, 1,1,1 trichloroethane, and hexane. There were insufficient sample sizes for each of the other compounds. The reasons for this data insufficiency for these compounds are explained in the "Caveats and Notes" section of this Appendix. Calculations were done for each year of the project.

The sample set used for the analysis of variance was developed from the collocated samples as follows: For each collocation event, the concentration reported by the individual sampling organization was subtracted from the PEI canister result reported. This was done for all compounds examined, and for each organization. The transformation of data in this manner allows for the direct comparison of NJIT, CSI, and NYSDEC because the transformed data reflects only the variability between each organization, independent of the concentration evident at the time of sampling. This treatment of PEI as the "standard" although not technically true, still forms a legitimate reference for comparison. The approach of data transformation used here as well as the statistical methods applied have been developed in consultation with EPA/AREAL in Research Triangle Park, NC.

The results of the statistical analysis presented offer several important and different pieces of information. The analysis of variance (ANOVA) partitions the variance of the data set into the variance occurring between treatments and the variance occurring within treatments. In our case, the term treatment refers to the organizations and therefore, the ANOVA partitions the variance into the components attributable to the differences between CSI, NYSDEC and NJIT and the variance attributable to variability within the individual organizations themselves.

The F statistic is used to determine if these variance components determined in the ANOVA procedure indicate that the differences between treatments are statistically significant. If significance is indicated by the F test, further analysis may be done. The Least Significant Difference (LSD) can then be computed. The advantage of the LSD is that it allows a determination of which organizations are similar to one another and which are different. The F test, in contrast, only signifies that differences exist between all of the organizations analyzed. The LSDs presented here should only be used to compare the performance of the organizations. They should not be used to compare differences observed between individual sites operated by the different organizations. The limitations of the data set and the experimental design require the use of advances statistical models and computer programs as well as extensive statistical consultation to understand the inherent limitations, caveats, and assumptions inherent in an analysis of inter-site comparisons. Such comparisons may be performed during subsequent evaluations in the SI/NJ UATAP.

Annotated Example

2nd Year of Study

Toluene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES		
(1) Samples (n)	31	6	6	130		
(2) Sum (Xi)	6.50	2.10	-9.90	-81.34	(7) Y..	-82.64
(3) Sum (Xi^2)	117.71	2.83	88.42	269.61	(8)	478.56
(4) (Sum (Xi))^2/n	1.36	0.73	16.32	50.89	(9) C =	39.47
(5) Individual SS	116.35	2.09	72.10	218.71		
(6) Individual Mean	0.21	0.35	-1.65	-0.63		

(10) Total SS = 439.09 df = 172

(11) Treatment SS = 29.84 df = 3

(12) Error SS = 409.25 df = 169

Source of Variation	df	Sum of Squares	(15) Mean Square	(16) F
(13) Between treatments	3	29.84	9.95	4.11 **
(14) Within treatments	169	409.25	2.42	

(17) 2nd Year LSD Comparisons: Toluene

	NJIT Tenax	NJIT Caniste	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.76	1.27	1.36
NJIT Canisters	1.76	------	1.27	1.36
NYSDEC Tubes	1.27	1.27	------	0.61
CSI Tubes	1.36	1.36	0.61	------

ANOVA & LSD Explanations

(1) Samples. The number of data points. Data points are taken from collocated PEI/sampling organization samples by subtracting the results reported by the organization from the results reported by PEI.

(2) Sum (Xi) = Sum of all the data points for each organization.

(3) Sum (Xi^2) = Sum of each data point squared

(4) (Sum (Xi)^2)/n = (Sum of all data points)^2/number of samples

(5) Individual SS = Individual Sum of Squares (SS) , obtained by subtracting (4) from (3).

(6) Individual Mean = Sum of data points ((2)), divided by sample size (1).

(7) Y.. = Sum of all data points for all organizations, i.e. all the (2) 's summed up. This will be used to determine the Total Sum of Squares for the analysis. See page 140, Table 7.1 in the reference supplied for further information and an illustration of this.

(8) This number is the sum of all the (3) 's for each organization. This number is used in computing the Total SS.

(9) C = Correction factor for SS. It is obtained by taking (7) squared and dividing by the number of samples in the study. See equation 7.1 on page 140 for the general case, and equation 7.4 on page 146 for the case of unequal replication.

(10) Total SS = Computed by (8) minus (9). Also shown in equation 7.2, page 140.

Degrees of freedom for the Total SS = number of samples in study -1.

(11) Treatment SS = See equation 7.3, page 141 for the general case (and table 7.1 to see where they get the numbers from) and equation 7.9, page 146 for the specific case of unequal replication.

Degrees of freedom = Number of treatments - 1. Degrees of freedom in unequal replication can be found in table 7.5, page 147. No formula is given but it can be inferred from the calculation. Degrees of freedom for the standard case may be found in table 7.2, page 142.

(12) Error SS = Computed as (10) minus (11) . See equation 7.4, page 141. Equation 7.5, page 141 can be used as a check (This is dine by summing all the (5) 's.
Degrees of freedom = Total sum of squares degrees of freedom - Treatment sum of squares degrees of freedom.

(13) Between treatments = Variation due to sampling organization. It is the Treatment SS, (11) . See table 7.3, page 142 and the associated text for the further explanations and use of items (13) (14) (15) and (16) .

(14) Within Treatment = Intra-organization variation. It is the Error SS, (12) .

(15) Mean Square = Obtained by dividing the relevant sum of squares by its degrees of freedom.

(16) F = F Statistic. It is obtained by dividing Between Treatment Mean Square by the Error Mean Square. An Asterisk means significance at the 0.05 level, two asterisks indicate significance at the 0.01 level.

(17) Least significant difference (LSD).= It is obtained in the general case by equation 8.1 on page 173. This example uses the data from table 7.1, page 140 and Table 7.3, page 142. The case dealing with unequal replication is addressed on pages 191-192 in equation 8.20.

ANOVA and LSD Tables

Findings

This section includes the analysis of variance (ANOVA) and Least Significant Difference statistics for all sampling events that included collocation (or splits) with PEI canisters. Estimates of bias are between organizations relative to the PEI reference and not against an absolute standard.

First Year Data

The results of the analysis of variance and F tests are presented in Tables 4-10. Examination of this data shows that no significant differences existed between organizations for the analysis of benzene, 1,1,1 trichloroethane, tetrachloroethylene, and hexane. Significant differences, were found for toluene, meta and para xylene, and ortho xylene.

LSDs are presented for results shown to be significant by the F test in Tables 18-20. Analysis of the data using the LSDs is presented in Table 24. This table shows that for toluene and meta and para xylene, the NJIT canisters were biased high and showed significantly greater amounts of bias than all other organizations for these parameters. In the case of ortho xylene, the NJIT canisters were significantly different from the CSI and NYSDEC tubes. However, the magnitude of NJIT's bias for ortho xylene is almost equivalent to that of NYSDEC and CSI, the difference being that NYSDEC and CSI were biased low while the NJIT canisters were biased high. No significant difference was observed between the NJIT canisters and the NJIT Tenax for ortho xylene.

The NJIT tenax tubes were statistically indistinguishable from the CSI or NYSDEC tubes for all three cases shown to be different by the F test. The CSI tubes were statistically equivalent to the NYSDEC tubes in the case of ortho xylene, but were significantly different for toluene and meta and para xylene.

Second Year Data

The results of the analysis of variance and F tests are presented in Tables 11-17. Examination of this data shows no significant differences existed for meta and para xylene, ortho xylene, tetrachloroethylene, and hexane. Significant differences were found with toluene, benzene, and 1,1,1 trichloroethane.

LSDs are presented for results shown to be significant by the F test in Tables 21-23. Analysis of the data using the LSDs is presented in Table 24. Considering the benzene and toluene, this table shows that the NJIT tubes were biased high and were significantly different than either the CSI or NYSDEC tubes. The NJIT canisters were statistically indistinguishable from any other treatment for these two compounds. In the case of toluene, the NYSDEC tubes were significantly different from the CSI tubes, with the CSI tubes were biased high and the CSI tubes were biased low. For benzene, both CSI and NYSDEC were biased high and were

statistically equivalent. For the 1,1,1 trichloroethane data, the NJIT canisters were significantly biased high, whereas all other treatments were biased low. The NJIT canisters were significantly different from the CSI and NYSDEC tubes. The NJIT tubes were not significantly different from all the other treatments. The CSI and NYSDEC tubes were also significantly different from each , with the CSI tubes being biased low to a greater extent than the NYSDEC tubes.

Discussion

The findings elucidated by the above statistical analysis indicate that real biases did exist in the sampling/analysis of certain compounds. Furthermore, these biases were suggested by the descriptive statistics found in Tables 1 and 2. Other differences may exist, however they are obscured by the limitations of the data set and the inherent variability in the sampling/analysis methodology. The limitations of the data set are evident particularly when examining the data of NJIT. The limited sample size raises two problems. One, are these samples truly representative of the organization's ability? Two, the small sample size forces the estimation of the bounds of variability for this organization to be excessively wide obscuring all but the largest trends.

The results of table 1 and 2 show that almost no compounds deviated from the PEI reference by $\pm$ 50%. Deviations beyond this range were clearly shown to be significantly biased, as was the case with the NJIT canisters in the first year of the study. Additionally, the maximum amount of difference between any two organizations that was not found to be statistically significant was 53%. Thus, a reasonable rule of thumb for assessing the amount of bias that could go undetected for the seven compounds examined in this study would be a factor of 2.

Further Approaches

Approaches that may be tried to further evaluate the differences between organizations and sites include the following:

1. A) Examine the enclosed analyses of variance. B) In cases where significance was observed, adjust all data for that organization by the mean difference for each organization as stated in the ANOVA table. C) For each organization, construct 95% confidence bands around the data reported for each organization/site based on the QA information provided by the organizations.

2. Perform an analysis of variance, segregated by site, for each collocated pair. This will allow for the determination of the variability inherent within an organization that occurs at each site. (It is this "interaction" term of site and organization that complicated the analysis of variance so extensively to preclude its being presented here. The ANOVA is further made more difficult by the fact that each site was sampled by only one

organization with unequal replication of sites and collocations for each organization. Additionally the NJIT data is very sparse, and therefore the determination of site differences for NJIT is made more complex.)

Analysis of Variance Between Organizations

4th Quarter 1987 - 3rd Quarter 1988

Table 4. Toluene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	4	4	48	
Sum (Xi)	-27.50	-14.40	-2.60	-4.77	Y.. -49.27
Sum (Xi^2)	98.13	91.98	7.74	43.56	241.41
(Sum (Xi))^2/n	24.40	51.84	1.69	0.47	C = 27.90
Individual SS	73.73	40.14	6.05	43.08	
Individual Mean	-0.89	-3.60	-0.65	-0.10	

Total SS = 213.50 df = 86

Treatment SS = 50.50 df = 3

Error SS = 163.01 df = 83

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	50.50	16.83	8.57 **
Within treatments	83	163.01	1.96	

Table 5. Benzene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	4	4	47	
Sum (Xi)	5.10	-0.60	0.20	-4.15	Y.. 0.55
Sum (Xi^2)	15.98	1.34	1.96	16.65	35.93
(Sum (Xi))^2/n	0.84	0.09	0.01	0.37	C = 0.00
Individual SS	15.14	1.25	1.95	16.29	
Individual Mean	0.16	-0.15	0.05	-0.09	

Total SS = 35.93 df = 85

Treatment SS = 1.30 df = 3

Error SS = 34.63 df = 82

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	1.30	0.43	1.03
Within treatments	82	34.63	0.42	

Table 6. M/P Xylene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	4	4	42	
Sum (Xi)	-13.70	-8.60	-0.20	4.17	Y.. -18.33
Sum (Xi^2)	47.16	32.04	4.92	12.41	96.53
(Sum (Xi))^2/n	6.05	18.49	0.01	0.41	C = 4.15
Individual SS	41.11	13.55	4.91	11.99	
Individual Mean	-0.44	-2.15	-0.05	0.10	

Total SS = 92.38 df = 80

Treatment SS = 20.82 df = 3

Error SS = 71.56 df = 77

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	20.82	6.94	7.47 **
Within treatments	77	71.56	0.93	

Table 7. O-Xylene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	23	3	3	40	
Sum (Xi)	5.30	-0.90	0.10	10.20	Y.. 14.70
Sum (Xi^2)	2.15	0.83	0.51	6.52	10.01
(Sum (Xi))^2/n	1.22	0.27	0.00	2.60	C = 3.13
Individual SS	0.93	0.56	0.51	3.92	
Individual Mean	0.23	-0.30	0.03	0.26	

Total SS = 6.88 df = 68

Treatment SS = 0.96 df = 3

Error SS = 5.91 df = 65

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.96	0.32	3.53 *
Within treatments	65	5.91	0.09	

Analysis of Variance Between Organizations

4th Quarter 1987 - 3rd Quarter 1988

Table 8. 1st Year of Study

1,1,1 Trichloroethane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	18	1	2	12	
Sum (Xi)	4.00	0.80	-0.10	1.86	Y.. 6.56
Sum (Xi^2)	2.28	0.64	0.25	1.32	4.49
(Sum (Xi))^2/n	0.89	0.64	0.00	0.29	C = 1.30
Individual SS	1.39	0.00	0.25	1.03	
Individual Mean	0.22	0.80	-0.05	0.16	

Total SS = 3.18 df = 32

Treatment SS = 0.52 df = 3

Error SS = 2.66 df = 29

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.52	0.17	1.88
Within treatments	29	2.66	0.09	

Table 9. 1st Year of Study

Tetrachloroethylene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	13	0	0	17	
Sum (Xi)	-2.10			2.20	Y.. 0.10
Sum (Xi^2)	0.63			2.22	2.85
(Sum (Xi))^2/n	0.34			0.28	C = 0.0003
Individual SS	0.29			1.94	
Individual Mean	-0.16			0.13	

Total SS = 2.85 df = 29

Treatment SS = 0.62 df = 3

Error SS = 2.23 df = 26

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.62	0.21	2.43
Within treatments	26	2.23	0.09	

Table 10. 1st Year of Study

Hexane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	20	1	1		
Sum (Xi)	393.70	-0.20	0.10		Y.. 393.60
Sum (Xi^2)	31290.7	0.04	0.01		31290.76
(Sum (Xi))^2/n	7749.98	0.04	0.01		C = 7041.86
Individual SS	23540.7	0.00	0.00		
Individual Mean	19.69	-0.20	0.10		

Total SS = 24248.90 df = 21

Treatment SS = 708.17 df = 3

Error SS = 23540.73 df = 18

Source of Variation	Sum of Squares	Mean Square	F
Between treatments	708.17	236.06	0.18
Within treatments	23540.73	1307.82	

Analysis of Variance Between Organizations

4th Quarter 1987 - 3rd Quarter 1988

Table 11. Toluene — 2nd Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	6	6	130	
Sum (Xi)	6.50	2.10	-9.90	-81.34	Y.. -82.64
Sum (Xi^2)	117.71	2.83	88.42	269.61	478.56
(Sum (Xi))^2/n	1.36	0.73	16.32	50.89	C = 39.47
Individual SS	116.35	2.09	72.10	218.71	
Individual Mean	0.21	0.35	-1.65	-0.63	

Total SS = 439.09 df = 172

Treatment SS = 29.84 df = 3

Error SS = 409.25 df = 169

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	29.84	9.95	4.11 **
Within treatments	169	409.25	2.42	

Table 12. Benzene — 2nd Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	30	6	6	127	
Sum (Xi)	-2.90	-1.80	-4.00	3.10	Y.. -5.60
Sum (Xi^2)	5.75	0.80	13.58	16.51	36.64
(Sum (Xi))^2/n	0.28	0.54	2.67	0.08	C = 0.19
Individual SS	5.47	0.26	10.91	16.43	
Individual Mean	-0.10	-0.30	-0.67	0.02	

Total SS = 36.45 df = 168

Treatment SS = 3.38 df = 3

Error SS = 33.08 df = 165

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	3.38	1.13	5.62 **
Within treatments	165	33.08	0.20	

Table 13. M/P Xylene — 2nd Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	30	6	6	123	
Sum (Xi)	-9.00	2.10	0.21	9.90	Y.. 3.21
Sum (Xi^2)	14.00	1.63	12.91	121.93	150.47
(Sum (Xi))^2/n	2.70	0.74	0.01	0.80	C = 0.06
Individual SS	11.30	0.90	12.91	121.13	
Individual Mean	-0.30	0.35	0.03	0.08	

Total SS = 150.41 df = 164

Treatment SS = 4.18 df = 3

Error SS = 146.23 df = 161

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	4.18	1.39	1.53
Within treatments	161	146.23	0.91	

Table 14. O-Xylene — 2nd Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	25	6	6	109	
Sum (Xi)	5.30	1.10	0.20	38.50	Y.. 45.10
Sum (Xi^2)	1.69	0.31	1.60	115.77	119.37
(Sum (Xi))^2/n	1.12	0.20	0.01	13.60	C = 13.93
Individual SS	0.57	0.11	1.59	102.17	
Individual Mean	0.21	0.18	0.03	0.35	

Total SS = 105.44 df = 145

Treatment SS = 1.00 df = 3

Error SS = 104.44 df = 142

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	1.00	0.33	0.45
Within treatments	142	104.44	0.74	

Analysis of Variance Between Organizations

4th Quarter 1987 - 3rd Quarter 1988

Table 15. 2nd Year of Study

1,1,1 Trichloroethane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES		
Samples (n)	25	6	6	108		
Sum (Xi)	10.20	-1.70	1.10	21.82	Y..	31.42
Sum (Xi^2)	10.44	0.71	0.97	16.77		28.89
(Sum (Xi))^2/n	4.16	0.48	0.20	4.41	C =	6.81
Individual SS	6.28	0.23	0.77	12.36		
Individual Mean	0.41	-0.28	0.18	0.20		

Total SS = 22.08 df = 144

Treatment SS = 2.44 df = 3

Error SS = 19.63 df = 141

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	2.44	0.81	5.85 **
Within treatments	141	19.63	0.14	

Table 16. 2nd Year of Study

Tetrachloroethylene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES		
Samples (n)	13	4	4	51		
Sum (Xi)	0.50	0.20	0.00	20.05	Y..	20.75
Sum (Xi^2)	1.01	0.02	0.00	64.56		65.59
(Sum (Xi))^2/n	0.02	0.01	0.00	7.88	C =	5.98
Individual SS	0.99	0.01	0.00	56.68		
Individual Mean	0.04	0.05	0.00	0.39		

Total SS = 59.61 df = 71

Treatment SS = 1.93 df = 3

Error SS = 57.68 df = 68

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	1.93	0.64	0.76
Within treatments	68	57.68	0.85	

Table 17. 2nd Year of Study

Hexane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES		
Samples (n)	25	5	5			
Sum (Xi)	-0.30	0.00	-1.90		Y..	-2.20
Sum (Xi^2)	2.25	1.16	7.35			10.76
(Sum (Xi))^2/n	0.00	0.00	0.72		C =	0.14
Individual SS	2.25	1.16	6.63			
Individual Mean	-0.01	0.00	-0.38			

Total SS = 10.62 df = 34

Treatment SS = 0.59 df = 3

Error SS = 10.03 df = 31

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.59	0.20	0.60
Within treatments	31	10.03	0.32	

Least Significant Differences between Organizations

(All units are ppb)

First Year of Study

Table 18.

1st Year LSD Comparisons:Toluene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.97	1.45	1.48
NJIT Canisters	1.97	------	1.45	1.48
NYSDEC Tubes	1.45	1.45	------	0.64
CSI Tubes	1.48	1.48	0.64	------

Table 19.

1st Year LSD Comparisons:M/P Xylene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.36	1.00	1.02
NJIT Canisters	1.36	------	1.00	1.02
NYSDEC Tubes	1.00	1.00	------	0.45
CSI Tubes	1.02	1.02	0.45	------

Table 20.

1st Year LSD Comparisons:O-Xylene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	0.49	0.36	0.37
NJIT Canisters	0.49	------	0.36	0.37
NYSDEC Tubes	0.36	0.36	------	0.16
CSI Tubes	0.37	0.37	0.16	------

Second Year of Study

Table 21.

2nd Year LSD Comparisons:Toluene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.76	1.27	1.36
NJIT Canisters	1.76	------	1.27	1.36
NYSDEC Tubes	1.27	1.27	------	0.61
CSI Tubes	1.36	1.36	0.61	------

Table 22.

2nd Year LSD Comparisons:Benzene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	0.51	0.37	0.39
NJIT Canisters	0.51	------	0.37	0.39
NYSDEC Tubes	0.37	0.37	------	0.18
CSI Tubes	0.39	0.39	0.18	------

Table 23.

2nd Year LSD Comparisons:1,1,1 Trichloroethane

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	0.42	0.31	0.33
NJIT Canisters	0.42	------	0.31	0.33
NYSDEC Tubes	0.31	0.31	------	0.16
CSI Tubes	0.33	0.33	0.16	------

5.45

Table 24.

Table of LSD Rankings by Organization For Compounds Where 'F' is Significant

1st Year Data

TOLUENE

Organization	Average Difference From PEI (in ppb)
NYSDEC Tubes	-0.10 a
NJIT Tubes	-0.65 a,b
CSI Tubes	-0.89 b
NJIT Canisters	-3.60 c

M/P XYLENE

Organization	Average Difference From PEI (in ppb)
NJIT Tubes	-0.05 a,b
NYSDEC Tubes	0.10 a
CSI Tubes	-0.44 b
NJIT Canisters	-2.15 c

O-XYLENE

Organization	Average Difference From PEI (in ppb)
NJIT Tubes	0.03 a,b
CSI Tubes	0.23 a
NYSDEC Tubes	0.26 a
NJIT Canisters	-0.30 b

2nd Year Data

TOLUENE

Organization	Average Difference From PEI (in ppb)
CSI Tubes	0.21 a
NJIT Canisters	0.35 a,b,c
NYSDEC Tubes	-0.63 b
NJIT Tubes	-1.65 c

BENZENE

Organization	Average Difference From PEI (in ppb)
NYSDEC Tubes	0.02 a
CSI Tubes	-0.10 a
NJIT Canisters	-0.30 a,b
NJIT Tubes	-0.67 b

1,1,1 TRICHLOROETHANE

Organization	Average Difference From PEI (in ppb)
NJIT Tubes	0.18 a,b,c
NYSDEC Tubes	0.20 a
CSI Tubes	0.41 b
NJIT Canisters	-0.28 c

The letters following the "Average Difference From PEI" are used to indicate statistically significant differences.

Organizations that have the same letters are considered statistically indistinguishable from one another.

Data Sets Used in Computations

College of Staten Island

PEI Canisters vs. Tenax Data

4th Quarter 87 - 3rd Quarter 88

(All units are ppb)

Compound: 111-Trichloroethane

Canister	Tenax	Difference
1.3	0.3	1.0
0.6	0.5	0.1
0.4	0.1	0.3
0.3	0.3	0.0
0.8	0.2	0.6
0.3	0.2	0.1
0.4	0.2	0.2
0.4	0.1	0.3
0.4	0.2	0.2
0.7	0.2	0.5
0.6	0.2	0.4
0.9	1.1	-0.2
0.5	0.4	0.1
0.4	0.2	0.2
0.6	0.8	-0.2
0.6	0.5	0.1
0.6	0.3	0.3
0.5	0.5	0.0

Compound: Carbon Tetrachloride

Canister	Tenax	Difference
0.2	0.0	0.2
0.2	0.1	0.1
0.4	0.3	0.1

Compound: Tetrachloroethene

Canister	Tenax	Difference
0.3	0.2	0.1
0.2	0.3	-0.1
0.3	0.4	-0.1
0.4	0.5	-0.1
0.2	0.4	-0.2
0.3	0.7	-0.4
0.4	0.7	-0.3
0.8	1.1	-0.3
0.9	1.2	-0.3
0.6	0.9	-0.3
1.0	1.1	-0.1
0.4	0.5	-0.1
0.7	0.6	0.1

Compound: Ethylbenzene

Canister	Tenax	Difference
0.2	0.5	-0.3
0.7	1.0	-0.3
0.5	0.8	-0.3
0.3	0.8	-0.5
0.2	0.6	-0.4
0.4	1.1	-0.7
0.3	0.7	-0.4
0.5	0.7	-0.2
0.5	1.0	-0.5
0.7	0.9	-0.2
0.6	1.0	-0.4
0.5	0.7	-0.2
0.5	0.9	-0.4
0.6	1.3	-0.7
1.0	3.2	-2.2
1.3	0.2	1.1

Compound: Hexane

Canister	Tenax	Difference
0.9	0.4	0.5
0.6	1.7	-1.1
0.4	0.2	0.2
0.8	0.6	0.2
4.8	0.5	4.3
0.6	0.4	0.2
1.2	1.4	-0.2
0.5	0.8	-0.3
0.7	0.5	0.2
0.9	0.5	0.4
0.8	0.7	0.1
1.2	1.6	-0.4
68.2	1.4	66.8
132.0	1.2	130.8
74.8	3.5	71.3
59.0	0.4	58.6
27.2	0.4	26.8
17.9	0.5	17.4
10.2	0.8	9.4
9.0	0.5	8.5

Compound: Benzene

Canister	Tenax	Difference
1.7	0.9	0.8
0.9	3.0	-2.1
1.3	0.7	0.6
0.6	0.6	0.0
1.6	1.1	0.5
1.0	0.3	0.7
0.6	0.4	0.2
0.7	0.4	0.3
0.9	0.9	0.0
1.6	1.2	0.4
2.3	0.4	1.9
1.5	0.7	0.8
1.1	0.8	0.3
0.8	0.3	0.5
0.8	0.4	0.4
1.6	0.6	1.0
0.7	0.3	0.4
0.5	0.7	-0.2
1.4	1.3	0.1
1.2	1.6	-0.4
1.9	1.9	0.0
2.0	0.8	1.2
1.4	1.5	-0.1
1.9	1.7	0.2
2.4	3.1	-0.7
2.6	2.7	-0.1
1.2	1.8	-0.6
1.3	2.2	-0.9
0.6	0.7	-0.1
1.3	0.8	0.5
0.9	1.4	-0.5
0.6	0.9	-0.3
1.4	1.6	-0.2
0.7	0.9	-0.2

Compound: M/P Xylene

Canister	Tenax	Difference
0.7	0.6	0.1
0.5	1.0	-0.5
1.3	0.8	0.5
1.3	0.5	0.8
0.5	0.7	-0.2
0.7	0.6	0.1
1.0	1.6	-0.6
1.0	1.4	-0.4
2.5	2.9	-0.4
1.9	2.6	-0.7
0.6	1.0	-0.4
1.3	2.5	-1.2
1.3	1.9	-0.6
0.9	1.5	-0.6
1.0	2.6	-1.6
1.1	2.0	-0.9
0.8	2.4	-1.6
1.8	3.5	-1.7
2.0	3.3	-1.3
2.4	3.4	-1.0
1.6	2.6	-1.0
1.8	3.1	-1.3
2.7	4.3	-1.6
1.2	1.6	-0.4
1.4	2.3	-0.9
5.8	0.9	4.9
1.1	0.9	0.2
0.9	1.6	-0.7
0.7	1.1	-0.4
1.6	1.8	-0.2
0.9	1.0	-0.1

Compound: O-Xylene

Canister	Tenax	Difference
0.5	0.1	0.4
0.2	0.1	0.1
0.2	0.1	0.1
0.3	0.3	0.0
1.0	0.5	0.5
0.7	0.5	0.2
0.2	0.2	0.0
0.5	0.4	0.1
0.4	0.3	0.1
0.4	0.3	0.1
0.5	0.4	0.1
0.3	0.3	0.0
0.7	0.3	0.4
0.7	0.5	0.2
0.9	0.5	0.4
0.9	0.7	0.2
.7	0.5	0.2
0.8	0.6	0.2
0.9	0.8	0.1
1.4	1.0	0.4
0.6	0.3	0.3
1.0	0.1	0.9
0.6	0.3	0.3

Compound: Toluene

Canister	Tenax	Difference
1.6	1.7	-0.1
1.9	7.5	-5.6
1.5	1.8	-0.3
6.4	1.6	4.8
2.9	2.7	0.2
1.0	0.9	0.1
1.4	1.2	0.2
1.7	2.1	-0.4
1.9	2.7	-0.8
5.7	6.0	-0.3
3.9	4.6	-0.7
1.6	1.4	0.2
4.3	5.5	-1.2
2.3	2.9	-0.6
2.5	3.1	-0.6
3.8	5.4	-1.6
2.0	3.1	-1.1
1.5	2.9	-1.4
3.4	4.2	-0.8
4.3	6.3	-2.0
5.2	6.1	-0.9
5.0	5.7	-0.7
3.3	5.0	-1.7
3.7	5.0	-1.3
5.8	8.0	-2.2
7.0	7.8	-0.8
2.8	5.0	-2.2
3.5	5.8	-2.3
1.0	1.5	-0.5
2.3	2.4	-0.1
1.7	4.5	-2.8
1.5	1.9	-0.4
3.6	4.1	-0.5
1.9	2.5	-0.6

College of Staten Island

PEI Canisters vs. Tenax Data

4th Quarter 88 - 3rd Quarter 89

(All units are ppb)

Compound: 111-Trichloroethane

Canister	Tenax	Difference
1.2	0.8	0.4
0.6	0.4	0.2
0.9	0.9	0.0
0.4	0.2	0.2
0.7	0.5	0.2
0.8	0.6	0.2
0.4	0.4	0.0
2.3	1.4	0.9
0.9	0.6	0.3
2.0	1.3	0.7
1.3	0.6	0.7
1.0	0.8	0.2
0.6	0.5	0.1
0.9	0.5	0.4
0.3	0.3	0.0
0.4	0.4	0.0
0.4	0.3	0.1
0.4	0.3	0.1
0.8	0.3	0.5
1.1	0.2	0.9
0.4	0.1	0.3
0.5	0.1	0.4
2.7	0.2	2.5
0.5	0.2	0.3
0.8	0.2	0.6

Compound: Carbon Tetrachloride

Canister	Tenax	Difference
0.3	0.5	-0.2
0.2	0.6	-0.4

Compound: Trichloroethene

Canister	Tenax	Difference
0.3	0.4	-0.1
0.2	0.1	0.1
0.3	0.0	0.3

Compound: Tetrachloroethene

Canister	Tenax	Difference
0.6	0.4	0.2
0.3	0.3	0.0
3.3	3.9	-0.6
0.7	0.6	0.1
0.4	0.5	-0.1
0.4	0.4	0.0
0.2	0.3	-0.1
0.4	0.3	0.1
1.1	1.1	0.0
0.5	0.1	0.4
0.8	0.4	0.4
1.1	0.7	0.4
1.8	2.1	-0.3

Compound: Ethylbenzene

Canister	Tenax	Difference
0.3	0.3	0.0
0.4	1.0	-0.6
0.7	1.0	-0.3
0.4	0.5	-0.1
0.6	0.8	-0.2
0.6	0.8	-0.2
0.4	0.7	-0.3
0.8	1.5	-0.7
0.2	0.5	-0.3
0.3	0.4	-0.1
0.9	0.9	0.0
0.7	0.7	0.0
0.6	0.5	0.1
0.3	0.6	-0.3
0.2	0.3	-0.1
0.3	0.3	0.0
0.3	0.3	0.0
0.3	0.3	0.0
0.4	0.3	0.1
0.5	0.5	0.0
0.2	0.2	0.0
0.3	0.1	0.2
0.6	0.4	0.2
0.4	0.2	0.2
0.3	0.3	0.0

Compound: Hexane

Canister	Tenax	Difference
0.5	0.8	-0.3
1.1	1.8	-0.7
1.1	1.3	-0.2
0.6	0.7	-0.1
0.6	0.9	-0.3
0.8	0.7	0.1
0.8	0.9	-0.1
1.7	1.8	-0.1
0.7	0.7	0.0
0.7	0.6	0.1
0.4	0.4	0.0
1.5	1.5	0.0
1.3	0.7	0.6
0.9	1.0	-0.1
1.0	1.0	0.0
0.4	0.6	-0.2
0.5	0.3	0.2
1.2	1.8	-0.6
0.7	0.7	0.0
1.1	0.7	0.4
0.6	0.3	0.3
0.5	0.2	0.3
1.0	1.3	-0.3
0.5	0.2	0.3
0.5	0.1	0.4

Compound: Benzene

Canister	Tenax	Difference
0.5	0.5	0.0
0.9	0.9	0.0
0.3	0.3	0.0
2.1	3.0	-0.9
2.8	3.4	-0.6
0.6	0.9	-0.3
1.5	1.7	-0.2
1.8	1.9	-0.1
1.9	2.3	-0.4
0.8	1.1	-0.3
0.7	0.5	0.2
1.4	1.8	-0.4
2.9	4.3	-1.4
1.1	1.4	-0.3
1.0	1.0	0.0
0.9	0.8	0.1
2.3	2.6	-0.3
2.0	2.1	-0.1
1.7	2.2	-0.5
1.5	1.8	-0.3
1.4	1.6	-0.2
0.7	0.6	0.1
0.9	0.6	0.3
0.9	0.5	0.4
1.1	0.8	0.3
0.8	0.5	0.3
1.8	1.1	0.7
0.8	0.4	0.4
0.9	0.3	0.6
1.1	1.1	0.0

Compound: M/P Xylene

Canister	Tenax	Difference
0.5	0.6	-0.1
1.3	0.9	0.4
0.3	0.5	-0.2
2.4	3.5	-1.1
2.8	3.7	-0.9
0.4	0.9	-0.5
1.5	1.8	-0.3
2.1	2.7	-0.6
2.0	2.8	-0.8
0.8	1.4	-0.6
1.5	2.4	-0.9
2.5	5.1	-2.6
0.9	1.8	-0.9
1.3	1.4	-0.1
0.6	0.7	-0.1
2.9	2.9	0.0
2.2	2.4	-0.2
1.8	2.0	-0.2
1.4	2.2	-0.8
0.9	1.0	-0.1
1.1	1.2	-0.1
1.1	1.3	-0.2
1.1	1.2	-0.1
1.1	0.8	0.3
1.9	1.6	0.3
0.8	0.7	0.1
0.9	0.2	0.7
1.6	1.4	0.2
1.1	0.7	0.4
1.1	1.1	0.0

Compound: O-Xylene

Canister	Tenax	Difference
0.5	0.1	0.4
0.9	0.7	0.2
1.0	0.7	0.3
0.2	0.2	0.0
0.6	0.3	0.3
0.8	0.6	0.2
0.7	0.5	0.2
1.0	1.1	-0.1
0.3	0.4	-0.1
0.6	0.4	0.2
^ 2	0.2	0.0
1.1	0.8	0.3
0.9	0.5	0.4
0.8	0.5	0.3
0.6	0.5	0.1
0.3	0.2	0.1
0.3	0.2	0.1
0.4	0.3	0.1
0.6	0.2	0.4
0.7	0.4	0.3
0.3	0.1	0.2
0.3	0.0	0.3
0.7	0.3	0.4
0.5	0.1	0.4
0.5	0.2	0.3

Compound: Toluene

Canister	Tenax	Difference
0.9	1.1	-0.2
3.1	2.6	0.5
0.7	0.8	-0.1
5.1	5.7	-0.6
5.7	5.5	0.2
1.0	1.5	-0.5
3.2	2.9	0.3
4.0	4.3	-0.3
3.6	4.5	-0.9
1.9	2.8	-0.9
1.2	0.8	0.4
3.3	4.0	-0.7
5.2	8.4	-3.2
2.1	3.1	-1.0
3.1	2.6	0.5
1.5	1.4	0.1
7.6	7.0	0.6
5.9	5.0	0.9
3.2	3.8	-0.6
3.2	4.3	-1.1
1.5	1.9	-0.4
1.9	2.4	-0.5
2.6	2.3	0.3
2.4	2.5	-0.1
2.9	2.2	0.7
4.5	4.0	0.5
1.9	1.6	0.3
2.0	0.8	1.2
13.4	3.6	9.8
2.9	1.8	1.1
2.7	2.5	0.2

New York State Department of Environmental Conservation

PEI Canisters vs. Envirochem Sorbent Tubes

4th Quarter 1987 - 3rd Quarter 1988

(All units in ppb)

Compound:Toluene		
Canister	Tube	Difference
0.9	0.3	0.6
2.8	1.3	1.5
1.8	1.6	0.2
0.6	0.7	-0.1
1.7	1.8	-0.1
1.9	2.5	-0.6
1.7	1.0	0.7
3.5	3.1	0.4
1.8	2.4	-0.6
1.7	1.8	-0.1
2.9	4.4	-1.5
2.8	4.8	-2.0
1.7	1.1	0.6
2.7	2.5	0.2
1.4	4.4	-3.0
1.3	1.7	-0.4
5.5	4.5	1.0
3.7	2.3	1.4
4.2	3.6	0.6
2.0	1.4	0.6
5.8	4.4	1.4
2.7	1.4	1.3
6.7	4.4	2.3
1.8	2.1	-0.3
2.4	2.8	-0.4
2.9	3.5	-0.6
2.0	2.0	0.0
4.2	4.2	0.0
2.9	2.9	0.0
3.3	4.1	-0.8
2.7	2.5	0.2
1.1	1.5	-0.4
1.9	1.8	0.1
2.4	2.7	-0.3
1.7	1.5	0.2
3.3	3.3	0.0
2.5	2.0	0.5
0.8	1.0	-0.2
0.3	1.8	-1.5
1.2	1.4	-0.2
1.2	1.4	-0.2
1.4	2.4	-1.0
1.3	1.4	-0.1
2.2	2.4	-0.2
5.4	6.9	-1.5
0.7	1.4	-0.7
0.9	0.9	0.0
1.1	2.9	-1.8

Compound:Benzene		
Canister	Tube	Difference
0.8	1.0	-0.2
1.1	1.0	0.1
0.2	0.2	0.0
0.3	2.6	-2.3
0.5	1.1	-0.6
0.6	0.8	-0.2
0.8	0.1	0.8
0.6	0.3	0.3
0.6	1.0	-0.4
1.0	1.7	-0.7
1.2	2.1	-0.9
0.6	0.3	0.3
1.1	1.3	-0.2
0.5	1.8	-1.3
0.7	0.6	0.1
1.7	1.8	-0.1
1.9	0.7	1.2
1.0	1.5	-0.5
0.8	0.3	0.5
0.8	0.7	0.1
1.5	1.0	0.5
0.7	0.5	0.2
1.3	1.3	0.0
0.9	0.5	0.4
1.0	0.6	0.4
1.2	1.8	-0.6
0.9	0.6	0.3
1.8	0.9	0.9
1.5	0.9	0.6
1.2	1.4	-0.2
1.0	1.0	0.0
0.5	0.9	-0.4
0.7	0.5	0.2
1.1	0.8	0.3
0.6	0.9	-0.3
1.3	1.4	-0.1
0.7	0.4	0.3
0.8	1.2	-0.4
0.5	0.5	0.0
0.3	0.5	-0.2
0.5	1.5	-1.0
0.5	0.9	-0.4
0.9	0.7	0.2
2.1	3.0	-0.9
0.5	0.6	-0.1
0.5	0.3	0.2
0.5	0.5	0.0

Compound:M/P Xylenes		
Canister	Tube	Difference
0.5	0.3	0.2
1.2	0.9	0.3
0.8	1.0	-0.2
0.5	0.4	0.1
0.5	0.8	-0.3
0.7	1.1	-0.4
1.0	0.4	0.6
1.0	1.0	0.0
1.1	0.9	0.2
1.7	0.7	1.0
3.9	1.9	2.0
1.4	2.4	-1.0
0.7	0.5	0.2
1.3	1.3	0.0
1.2	2.0	-0.8
0.7	0.8	-0.1
2.1	1.8	0.3
2.0	1.1	0.9
1.5	1.2	0.3
1.4	0.7	0.7
1.0	0.5	0.5
1.9	1.4	0.5
1.0	1.0	0.0
1.2	1.3	-0.1
1.3	1.5	-0.2
1.0	1.1	-0.1
1.9	2.2	-0.3
1.6	1.1	0.5
1.5	2.0	-0.5
2.6	1.3	1.3
0.7	0.9	-0.2
0.9	0.9	0.0
1.0	1.2	-0.2
0.9	0.9	0.0
1.7	1.7	0.0
1.0	0.8	0.2
0.4	0.7	-0.3
0.2	0.5	-0.3
0.7	0.7	0.0
0.6	0.7	-0.1
1.0	1.0	0.0
3.0	3.5	-0.5

Compound:O-Xylene		
Canister	Tube	Difference
0.2	0.1	0.1
0.4	0.3	0.1
0.3	0.3	0.0
0.4	0.1	0.3
0.4	0.3	0.1
0.4	0.3	0.1
0.8	0.2	0.6
1.6	0.6	1.0
0.5	0.7	-0.2
0.5	0.2	0.3
0.5	0.4	0.1
0.6	0.6	0.0
0.3	0.3	0.0
1.1	0.6	0.5
1.5	0.4	1.1
1.2	0.5	0.7
1.1	0.3	0.8
0.7	0.2	0.5
1.1	0.4	0.7
1.2	0.6	0.6
0.4	0.3	0.1
0.5	0.4	0.1
0.5	0.4	0.1
0.4	0.3	0.1
0.5	0.7	-0.2
0.7	0.3	0.4
0.6	0.6	0.0
1.1	0.4	0.7
0.2	0.3	-0.1
0.6	0.3	0.3
0.4	0.4	0.0
0.6	0.3	0.3
0.6	0.6	0.0
0.6	0.3	0.3
0.2	0.2	0.0
0.3	0.3	0.0
0.3	0.2	0.1
0.4	0.3	0.1
1.1	1.0	0.1
0.5	0.1	0.4

New York State Department of Environmental Conservation

PEI Canisters vs. Envirochem Sorbent Tubes

4th Quarter 1987 - 3rd Quarter 1988

(All units in ppb)

Compound:1,1,1-Trichloroethane		
Canister	Tube	Difference
0.7	0.2	0.5
1.0	0.3	0.7
1.3	1.5	-0.2
0.3	0.5	-0.2
0.5	0.5	0.0
1.2	0.5	0.7
0.3	0.4	-0.1
0.4	0.3	0.1
0.6	0.5	0.1
0.5	0.4	0.1
0.4	0.3	0.1
0.4	0.3	0.1

Compound:Dichloromethane		
Canister	Tube	Difference
0.7	0.2	0.5
0.8	0.9	-0.1
0.6	0.3	0.3
0.8	0.6	0.2
0.6	0.9	-0.3
0.6	1.0	-0.4
1.0	0.2	0.8
0.7	1.3	-0.6
0.5	0.5	0.0
1.2	0.7	0.5
0.8	0.4	0.4
1.4	0.8	0.6
0.5	0.3	0.2
1.4	0.3	1.1
1.5	0.4	1.1
0.6	0.7	-0.1
1.6	2.0	-0.4
0.4	0.3	0.1
0.6	0.5	0.1
0.9	0.6	0.3
0.8	0.4	0.4
0.8	0.7	0.1
0.7	0.4	0.3
0.8	0.4	0.4
0.6	0.5	0.1
1.2	0.4	0.8
1.3	1.1	0.2
1.0	0.4	0.6
0.8	0.3	0.5
0.4	0.3	0.1
0.3	0.3	0.0
0.5	0.2	0.3
0.8	1.0	-0.2

Compound:Tetrachloroethane		
Canister	Tube	Difference
0.7	0.1	0.6
1.5	0.2	1.3
0.2	0.2	0.0
0.3	0.2	0.1
0.3	0.3	0.0
0.2	0.3	-0.1
0.2	0.4	-0.2
0.2	0.2	0.0
0.3	0.3	0.0
0.2	0.2	0.0
0.2	0.2	0.0
0.2	0.2	0.0
0.3	0.2	0.1
0.8	0.5	0.3
0.2	0.2	0.0
0.3	0.2	0.1
0.3	0.3	0.0

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: Toluene			Compound: Toluene (Continued)			Compound: Benzene			Compound: Benzene (Continued)		
Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference
2.4	2.6	-0.2	3.9	1.9	2.0	1.0	1.0	0.0	0.7	0.5	0.2
2.2	3.0	-0.8	0.6	0.4	0.2	0.9	1.1	-0.2	0.6	0.6	0.0
2.8	1.5	1.3	5.9	2.7	3.2	0.8	0.9	-0.1	0.3	0.2	0.1
4.3	4.6	-0.3	2.5	2.8	-0.3	1.9	1.4	0.5	0.4	0.1	0.3
2.9	3.6	-0.7	1.5	2.3	-0.8	1.2	0.9	0.3	0.4	0.3	0.1
4.2	5.2	-1.0	6.7	7.6	-0.9	1.8	1.5	0.3	0.6	0.6	0.0
3.3	7.2	-3.9	6.4	7.4	-1.0	1.2	0.9	0.3	1.3	1.2	0.1
1.1	1.9	-0.8	6.0	5.8	0.2	0.5	0.6	-0.1	0.8	0.6	0.2
3.3	5.1	-1.8	1.7	4.0	-2.3	1.4	1.2	0.2	1.3	1.2	0.1
2.4	3.4	-1.0	2.5	2.2	0.3	1.1	1.1	0.0	0.6	0.7	-0.1
1.7	1.9	-0.2	1.1	2.3	-1.2	0.6	0.6	0.0	1.1	1.3	-0.2
3.3	4.9	-1.6	0.5	0.7	-0.2	1.3	1.8	-0.5	1.9	2.2	-0.3
3.0	4.9	-1.9	0.7	1.3	-0.6	0.9	1.2	-0.3	0.6	0.4	0.2
1.7	2.2	-0.5	1.1	1.0	0.1	0.8	0.9	-0.1	1.6	0.8	0.8
1.2	0.9	0.3	1.1	1.1	0.0	0.5	0.4	0.1	0.6	0.7	-0.1
1.2	0.9	0.3	3.4	3.1	0.3	0.3	0.4	-0.1	1.0	1.2	-0.2
1.4	1.8	-0.4	2.0	1.9	0.1	0.5	0.8	-0.3	0.8	0.7	0.1
3.4	2.9	0.5	3.9	3.6	0.3	1.1	0.8	0.3	0.6	0.7	-0.1
5.4	6.0	-0.6	1.4	1.3	0.1	2.1	2.3	-0.2	0.7	0.8	-0.1
0.7	1.6	-0.9	3.8	4.7	-0.9	0.5	0.6	-0.1	1.3	2.2	-0.9
2.7	3.5	-0.8	9.9	11.0	-1.1	0.5	0.5	0.0	0.7	1.2	-0.5
3.9	5.6	-1.7	2.3	1.9	0.4	0.8	0.6	0.2	0.7	1.0	-0.3
2.4	3.6	-1.2	6.1	2.9	3.2	0.6	0.5	0.1	1.2	1.4	-0.2
2.8	4.2	-1.4	1.6	2.8	-1.2	2.1	2.3	-0.2	1.1	1.1	0.0
3.2	3.7	-0.5	2.2	3.8	-1.6	0.8	1.7	-0.9	1.4	1.1	0.3
4.6	6.2	-1.6	1.3	1.9	-0.6	1.6	1.0	0.6	0.7	0.8	-0.1
2.2	8.1	-5.9	1.6	2.8	-1.2	2.8	3.6	-0.8	0.5	0.7	-0.2
1.1	1.6	-0.5	1.5	2.3	-0.8	1.8	1.1	0.7	0.8	0.6	0.2
1.8	1.8	0.0	3.8	5.3	-1.5	1.0	0.8	0.2	1.3	1.2	0.1
1.0	1.0	0.0	1.9	2.7	-0.8	0.8	0.7	0.1	0.7	0.4	0.3
4.1	7.0	-2.9	2.2	4.4	-2.2	0.8	0.8	0.0	1.4	1.2	0.2
1.3	5.0	-3.7	3.0	3.9	-0.9	1.4	0.8	0.6	0.8	0.3	0.5
4.8	4.1	0.7	2.5	3.4	-0.9	0.8	0.6	0.2	0.8	0.4	0.4
4.1	10.1	-6.0	3.1	4.1	-1.0	0.7	0.7	0.0	1.1	0.9	0.2
3.2	4.2	-1.0	1.7	3.8	-2.1	0.9	1.4	-0.5	1.2	1.1	0.1
2.9	4.0	-1.1	1.6	2.1	-0.5	0.9	1.0	-0.1	0.7	0.6	0.1
1.3	1.9	-0.6	2.9	3.0	-0.1	2.2	3.0	-0.8	1.1	1.1	0.0
1.6	2.3	-0.7	3.5	4.7	-1.2	1.0	1.7	-0.7	0.8	0.7	0.1
3.8	2.6	1.2	2.3	1.5	0.8	2.4	2.2	0.2	1.0	0.7	0.3
1.1	1.5	-0.4	3.3	3.9	-0.6	2.1	2.5	-0.4	2.7	2.9	-0.2
2.8	3.5	-0.7	1.9	1.9	0.0	1.6	2.2	-0.6	0.6	0.9	-0.3
6.6	9.1	-2.5	3.7	1.9	1.8	1.5	1.3	0.2	1.5	1.5	0.0
3.4	5.0	-1.6	3.3	3.6	-0.3	1.9	2.2	-0.3	1.1	1.0	0.1
6.9	7.7	-0.8	2.9	2.7	0.2	0.9	0.4	0.5	2.7	2.2	0.5
8.1	9.3	-1.2	2.6	3.2	-0.6	4.2	3.8	0.4	3.4	3.2	0.2
8.1	7.3	0.8	2.8	2.8	0.0	0.6	0.5	0.1	0.7	0.7	0.0
6.1	6.9	-0.8	2.4	2.4	0.0	0.7	0.7	0.0	0.5	0.4	0.1
1.2	1.5	-0.3	2.5	2.7	-0.2	0.7	0.7	0.0	0.5	0.4	0.1
1.7	2.0	-0.3	8.2	9.8	-1.6	0.3	0.4	-0.1	0.7	0.8	-0.1
1.2	1.4	-0.2	1.1	5.0	-3.9	1.4	1.4	0.0	1.4	1.3	0.1
1.2	1.4	-0.2	3.9	4.0	-0.1	1.9	1.9	0.0	1.4	0.8	0.6
1.6	1.6	0.0	2.9	2.6	0.3	1.3	1.1	0.2	1.1	1.2	-0.1
1.8	2.2	-0.4	8.6	7.6	1.0	0.9	0.9	0.0	1.3	1.1	0.2
9.7	8.8	0.9	10.0	10.8	-0.8	2.5	2.8	-0.3	0.4	0.2	0.2
1.9	0.9	1.0	2.0	2.1	-0.1	1.5	0.1	1.4	0.5	0.4	0.1
10.9	10.2	0.7	1.2	1.3	-0.1	0.9	0.6	0.3	0.8	0.9	-0.1
1.0	0.6	0.4	1.2	1.4	-0.2	0.3	0.4	-0.1	0.6	0.5	0.1
3.3	3.1	0.2	4.5	4.9	-0.4	2.6	0.9	1.7	1.2	1.5	-0.3
2.0	2.9	-0.9	4.2	3.9	0.3	1.1	1.1	0.0	1.7	2.0	-0.3
4.2	7.3	-3.1	2.8	4.0	-1.2	0.7	0.7	0.0	1.2	1.4	-0.2
0.8	0.9	-0.1	4.1	5.2	-1.1	2.7	2.7	0.0	1.2	1.4	-0.2
4.5	7.3	-2.8	0.9	1.0	-0.1	3.0	3.5	-0.5	1.6	1.6	0.0
3.7	4.0	-0.3	1.9	2.3	-0.4	2.0	2.2	-0.2	1.8	2.2	-0.4
1.8	1.7	0.1	3.1	3.8	-0.7	0.7	0.6	0.1			
7.2	9.9	-2.7	1.8	2.6	-0.8						

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: M/P Xylene			Compound: M/P Xylene (Continued)			Compound: O-xylene			Compound: O-xylene (Continued)		
Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference
1.2	1.2	0.0	0.8	0.9	-0.1	0.3	0.3	0.0	0.7	0.5	0.2
1.1	1.7	-0.6	3.3	3.8	-0.5	0.6	0.7	-0.1	0.3	0.2	0.1
0.8	0.9	-0.1	3.4	4.1	-0.7	0.2	0.3	-0.1	0.6	0.6	0.0
1.9	1.7	0.2	2.8	2.5	0.3	0.6	0.7	-0.1	0.9	1.0	-0.1
1.3	1.3	0.0	0.9	0.9	0.0	0.4	0.4	0.0	0.3	0.2	0.1
1.9	2.4	-0.5	0.9	1.0	-0.1	0.6	0.3	0.3	0.9	0.3	0.6
1.5	2.1	-0.6	0.3	0.3	0.0	0.6	0.6	0.0	0.2	0.2	0.0
0.7	0.9	-0.2	0.3	0.4	-0.1	0.5	0.5	0.0	1.4	0.4	1.0
1.5	2.2	-0.7	0.6	0.5	0.1	0.3	0.3	0.0	0.2	0.2	0.0
1.0	1.2	-0.2	0.5	0.8	-0.3	0.2	0.2	0.0	0.2	0.3	-0.1
0.9	0.9	0.0	1.4	1.6	-0.2	0.7	0.2	0.5	0.2	0.2	0.0
1.7	2.0	-0.3	0.9	1.0	-0.1	0.3	0.4	-0.1	1.6	0.6	1.0
1.3	1.4	-0.1	1.7	1.8	-0.1	0.4	0.3	0.1	0.3	0.3	0.0
0.7	0.8	-0.1	0.6	0.6	0.0	1.1	0.9	0.2	1.7	0.4	1.3
0.6	0.6	0.0	1.2	1.5	-0.3	0.4	0.4	0.0	2.3	0.4	1.9
1.1	0.6	0.5	2.4	3.0	-0.6	0.7	0.8	-0.1	2.3	0.5	1.8
0.7	1.1	-0.4	0.7	0.5	0.2	0.5	0.4	0.1	0.2	0.2	0.0
1.2	1.1	0.1	2.3	0.9	1.4	0.5	0.5	0.0	0.2	0.2	0.0
3.0	2.9	0.1	0.6	0.7	-0.1	0.6	0.5	0.1	0.9	0.3	0.6
0.1	0.7	-0.6	1.9	1.5	0.4	0.8	0.8	0.0	1.2	0.5	0.7
1.1	1.2	-0.1	0.5	0.7	-0.2	0.4	0.3	0.1	0.2	0.3	-0.1
1.8	2.4	-0.6	0.6	0.8	-0.2	0.2	0.2	0.0	2.5	0.4	2.1
1.1	1.4	-0.3	0.5	0.6	-0.1	0.8	0.9	-0.1	0.4	0.3	0.1
1.1	1.5	-0.4	2.3	2.1	0.2	0.7	0.5	0.2	4.8	0.4	4.4
1.6	1.5	0.1	0.8	0.9	-0.1	0.7	1.3	-0.6	0.4	0.3	0.1
2.0	2.7	-0.7	0.7	1.0	-0.3	0.5	0.5	0.0	2.2	0.3	1.9
0.4	0.7	-0.3	2.1	1.3	0.8	0.6	0.4	0.2	0.5	0.4	0.1
0.9	0.9	0.0	2.9	1.1	1.8	0.2	0.2	0.0	0.4	0.3	0.1
0.5	0.6	-0.1	2.9	1.6	1.3	0.5	0.2	0.3	0.5	0.0	0.5
2.1	2.9	-0.8	0.5	0.8	-0.3	0.5	0.2	0.3	2.1	0.4	1.7
0.5	1.7	-1.2	0.6	0.7	-0.1	0.4	0.4	0.0	0.2	0.3	-0.1
1.8	1.5	0.3	1.5	1.3	0.2	1.2	1.2	0.0	0.6	0.4	0.2
1.9	4.4	-2.5	1.6	1.3	0.3	1.2	0.9	0.3	0.4	0.3	0.1
1.3	1.8	-0.5	0.6	0.6	0.0	1.5	1.3	0.2	8.6	0.8	7.8
1.3	1.2	0.1	1.3	1.4	-0.1	0.8	0.8	0.0	2.1	1.1	1.0
0.6	0.7	-0.1	0.9	1.0	-0.1	0.9	0.7	0.2	0.3	0.3	0.0
0.5	0.7	-0.2	1.1	0.3	0.8	1.1	1.0	0.1	0.2	0.2	0.0
1.6	0.8	0.8	2.6	1.0	1.6	0.4	0.2	0.2	0.2	0.1	0.1
0.9	0.8	0.1	2.9	1.1	1.8	1.4	1.1	0.3	0.8	0.6	0.2
0.4	0.5	-0.1	0.8	1.0	-0.2	0.2	0.2	0.0	1.9	0.5	1.4
1.0	1.2	-0.2	4.0	1.2	2.8	0.3	0.2	0.1	0.6	0.7	-0.1
2.6	3.6	-1.0	0.8	0.8	0.0	0.7	0.5	0.2	1.2	0.8	0.4
2.6	1.4	1.2	1.9	1.1	0.8	0.2	0.7	-0.5	0.2	0.2	0.0
1.3	1.4	-0.1	3.1	4.1	-1.0	0.7	0.6	0.1	0.3	0.3	0.0
3.4	3.0	0.4	0.4	1.1	-0.7	1.0	0.8	0.2	3.0	0.5	2.5
3.5	3.6	-0.1	1.5	1.6	-0.1	0.6	0.5	0.1	0.3	0.3	0.0
2.3	2.8	-0.5	1.0	1.1	-0.1	0.4	0.3	0.1			
2.4	2.3	0.1	9.0	2.9	6.1	1.2	1.3	-0.1			
2.6	3.0	-0.4	4.0	3.7	0.3	0.5	0.3	0.2			
0.9	0.6	0.3	0.6	0.7	-0.1	0.2	0.1	0.1			
3.3	3.5	-0.2	0.5	0.5	0.0	1.2	0.4	0.8			
0.5	0.6	-0.1	0.4	0.5	-0.1	0.5	0.4	0.1			
0.7	0.8	-0.1	1.7	1.9	-0.2	0.3	0.3	0.0			
0.5	1.6	-1.1	2.3	1.5	0.8	1.4	1.2	0.2			
0.4	0.2	0.2	1.4	2.0	-0.6	1.4	1.3	0.1			
1.7	2.0	-0.3	2.5	2.8	-0.3	1.5	0.8	0.7			
2.7	2.0	0.7	0.5	0.5	0.0	0.3	0.3	0.0			
1.5	1.6	-0.1	0.7	0.9	-0.2	0.3	0.3	0.0			
0.9	0.9	0.0	2.7	1.3	1.4	0.3	0.3	0.0			
3.0	4.3	-1.3	0.8	1.0	-0.2	0.3	0.2	0.1			
6.6	0.9	5.7				0.2	0.2	0.0			
0.4	0.2	0.2				0.5	0.5	0.0			
2.9	1.2	1.7				0.3	0.3	0.0			
1.1	1.3	-0.2									

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: 1,1,1-Trichloroethane			Compound: 1,1,1-Trichloroethane			Compound: Dichloromethane			Compound: Dichloromethane (Cntd)		
Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference
0.6	0.3	0.3	1.3	0.9	0.4	0.8	0.5	0.3	0.3	0.4	-0.1
0.6	0.3	0.3	0.5	0.3	0.2	0.8	0.8	0.0	1.0	0.8	0.2
0.3	0.4	-0.1	1.0	0.8	0.2	1.6	1.3	0.3	0.6	0.4	0.2
0.5	0.4	0.1	1.0	0.9	0.1	0.6	0.7	-0.1	2.4	1.3	1.1
1.7	1.0	0.7	0.3	0.2	0.1	0.8	0.7	0.1	0.4	0.2	0.2
1.1	0.6	0.5	1.5	0.3	1.2	0.7	0.3	0.4	1.0	0.8	0.2
0.6	0.3	0.3	0.5	0.4	0.1	1.1	2.2	-1.1	1.9	1.9	0.0
0.2	0.3	-0.1	0.4	0.2	0.2	0.6	1.0	-0.4	0.7	0.4	0.3
0.4	1.2	-0.8	0.3	0.3	0.0	1.2	0.3	0.9	2.0	0.6	1.4
0.7	0.3	0.4	0.3	0.3	0.0	1.3	0.9	0.4	0.3	0.2	0.1
0.2	0.0	0.2	0.5	0.4	0.1	0.5	0.2	0.3	0.6	0.6	0.0
0.7	0.4	0.3	0.8	0.9	-0.1	1.5	1.1	0.4	0.2	0.1	0.1
0.7	0.6	0.1	0.4	0.4	0.0	0.3	0.1	0.2	0.3	0.2	0.1
0.5	0.4	0.1	0.5	0.5	0.0	0.4	0.4	0.0	0.4	0.1	0.3
0.5	0.6	-0.1	0.6	0.5	0.1	0.6	0.4	0.2	1.3	1.1	0.2
0.6	0.3	0.3	0.7	0.5	0.2	0.8	0.9	-0.1	0.4	0.3	0.1
0.9	0.6	0.3	0.5	0.4	0.1	0.9	0.4	0.5	0.6	0.3	0.3
0.2	0.3	-0.1	0.5	0.4	0.1	1.1	1.2	-0.1	0.5	0.4	0.1
0.4	0.3	0.1	0.6	0.3	0.3	0.7	0.5	0.2	0.9	0.2	0.7
0.2	0.2	0.0	0.5	0.4	0.1	0.6	1.2	-0.6	0.5	0.3	0.2
0.7	0.4	0.3	0.7	0.4	0.3	0.7	0.3	0.4	0.4	0.3	0.1
1.0	0.5	0.5	0.5	0.2	0.3	1.2	1.4	-0.2	0.4	0.2	0.2
0.7	0.5	0.2	0.6	0.5	0.1	0.5	0.2	0.3	1.0	0.6	0.4
1.3	0.5	0.8	0.7	0.6	0.1	0.3	0.2	0.1	0.8	0.5	0.3
0.6	0.4	0.2	0.7	0.0	0.7	0.5	0.2	0.3	0.6	0.3	0.3
0.1	0.3	-0.2	0.6	0.3	0.3	0.6	0.5	0.1	0.7	0.7	0.0
0.4	0.5	-0.1	0.6	0.4	0.2	0.4	0.7	-0.3	0.5	0.6	-0.1
0.9	0.3	0.6	0.7	0.5	0.2	1.8	1.2	0.6	0.9	0.6	0.3
0.5	0.3	0.2	0.6	0.3	0.3	0.7	0.9	-0.2	0.9	0.4	0.5
0.3	0.4	-0.1	0.6	0.3	0.3	1.3	0.5	0.8	0.4	0.3	0.1
1.3	1.2	0.1	0.7	0.3	0.4	0.9	0.5	0.4	0.7	0.5	0.2
2.6	1.6	1.0	0.4	0.3	0.1	0.9	1.0	-0.1	0.6	0.3	0.3
1.7	1.1	0.6	0.6	0.3	0.3	0.5	0.2	0.3	0.4	0.1	0.3
1.1	0.7	0.4	0.7	0.4	0.3	0.7	0.5	0.2	0.2	0.2	0.0
1.8	1.4	0.4	1.5	0.8	0.7	2.4	3.9	-1.5	0.8	0.8	0.0
0.4	0.2	0.2	1.0	1.0	0.0	1.8	0.9	0.9	0.3	0.2	0.1
1.3	1.9	-0.6	0.7	0.4	0.3	2.6	2.9	-0.3	0.7	0.4	0.3
0.3	0.2	0.1	0.3	0.2	0.1	2.2	3.0	-0.8	0.7	0.5	0.2
0.5	0.3	0.2	0.4	0.3	0.1	1.5	0.8	0.7	2.1	1.0	1.1
0.9	0.7	0.2	0.6	0.4	0.2	2.6	2.3	0.3	2.3	2.1	0.2
0.3	0.1	0.2	0.7	0.3	0.4	0.7	0.3	0.4	0.5	0.3	0.2
1.2	0.9	0.3	0.9	0.4	0.5	6.4	3.2	3.2	0.5	0.3	0.2
1.6	0.9	0.7	0.6	0.4	0.2	0.2	0.2	0.0	0.4	0.4	0.0
1.0	0.6	0.4	0.8	0.4	0.4	0.4	0.1	0.3	1.0	0.8	0.2
0.3	0.1	0.2	0.7	0.3	0.4	2.2	0.7	1.5	0.5	0.2	0.3
0.3	2.3	-2.0				0.2	0.3	-0.1	0.5	0.2	0.3
0.5	0.3	0.2				0.7	1.9	-1.2	0.7	0.3	0.4
0.2	0.1	0.1				1.3	0.8	0.5	0.6	0.1	0.5
1.1	0.3	0.8				0.7	0.5	0.2	0.3	0.1	0.2
0.5	0.3	0.2				0.3	0.3	0.0	0.6	0.4	0.2
0.4	0.4	0.0				3.4	7.0	-3.6	0.6	0.2	0.4
0.7	0.5	0.2				0.6	0.1	0.5			
0.5	0.4	0.1				0.7	0.3	0.4			
0.8	0.4	0.4				1.0	1.0	0.0			
0.4	0.2	0.2				0.6	0.4	0.2			
0.5	0.2	0.3				0.9	0.8	0.1			
0.3	0.2	0.1				3.1	4.6	-1.5			
0.3	0.2	0.1				2.9	1.6	1.3			
0.2	0.2	0.0				0.4	0.1	0.3			
0.4	0.1	0.3				0.4	0.2	0.2			
0.5	0.3	0.2				0.2	0.2	0.0			
0.9	0.6	0.3				0.3	0.1	0.2			
0.8	0.7	0.1				3.2	0.3	2.9			

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: Tetrachloroethene

Canister	Tube	Difference
0.2	0.1	0.1
0.2	0.3	-0.1
0.3	0.2	0.1
0.3	0.3	0.0
0.8	0.6	0.2
0.2	0.3	-0.1
0.3	0.2	0.1
0.2	0.2	0.0
0.5	0.3	0.2
0.3	0.3	0.0
0.3	0.1	0.2
0.4	0.3	0.1
5.1	1.3	3.8
0.2	0.1	0.1
0.5	0.1	0.4
0.7	0.4	0.3
0.3	0.2	0.1
0.8	0.9	-0.1
0.9	0.4	0.5
0.9	0.6	0.3
0.8	0.6	0.2
1.8	1.1	0.7
0.8	0.7	0.1
0.4	0.3	0.1
6.7	0.3	6.4
0.6	0.5	0.1
1.1	0.7	0.4
1.4	1.3	0.1
0.2	0.1	0.1
5.4	3.0	2.4
0.3	0.2	0.1
0.4	0.2	0.2
0.2	0.2	0.0
0.7	0.5	0.2
0.9	0.6	0.3
0.4	0.2	0.2
0.7	0.6	0.1
0.3	0.2	0.1
0.3	0.1	0.2
0.2	0.1	0.1
3.7	4.4	-0.7
0.5	0.2	0.3
0.5	0.6	-0.1
1.2	0.5	0.7
0.6	0.3	0.3
0.6	0.3	0.3
0.3	0.2	0.1
0.3	0.2	0.1
0.8	0.3	0.5
0.5	0.4	0.1
0.5	0.4	0.1

CC188L

New Jersey Institute of Technology

PEI Canisters vs. NJIT Canisters and Tenax

4th Quarter 87 - 3rd Quarter 88

(All units are ppb)

Compound: Toluene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
3.1	11.9	3.2	-8.8	-0.1
3.0	3.3	4.2	-0.3	-1.2
5.1	7.3	4.1	-2.2	1.0
5.3	8.4	7.6	-3.1	-2.3

Compound: Benzene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
2.5	2.5	1.3	0.0	1.2
0.9	0.2	1.3	0.7	-0.4
1.0	1.7	1.0	-0.7	0.0
1.8	2.4	2.4	-0.6	-0.6

Compound: M/P Xylene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.6	3.8	0.9	-3.2	-0.3
1.8	6.4	1.3	-4.6	0.5
2.3	3.1	1.0	-0.8	1.3
1.4	1.4	3.1	0.0	-1.7

Compound: O-Xylene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.6	1.5	0.5	-0.9	0.1
0.9	1.0	0.4	-0.1	0.5
0.5	0.4	1.0	0.1	-0.5

Compound: Hexane

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
1.8	2.0	1.7	-0.2	0.1

Compound: 1,1,1-Trichloroethane

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.8		0.5	0.8	0.3
0.6	0.5	1.0		-0.4

Compound: Tetrachloroethene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
nd	0.1	0.2		
nd	0.0	0.3		
nd	0.1	0.2		
nd	0.1	0.2		

CC188L

New Jersey Institute of Technology

PEI Canisters vs. NJIT Canisters and Tenax

4th Quarter 88 - 3rd Quarter 89

(All units are ppb)

Compound: Toluene				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
3.4	3.4	4.8	0.0	-1.4
3.1	3.8	11.6	-0.7	-8.5
6.8	5.7	9.5	1.1	-2.7
1.9	1.5	1.0	0.4	0.9
2.3	1.9	2.9	0.4	-0.6
5.6	4.7	3.2	0.9	2.4

Compound: Benzene				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
2.0	2.5	2.3	-0.5	-0.3
1.7	2.2	4.4	-0.5	-2.7
3.1	3.3	5.4	-0.2	-2.3
0.9	0.9	0.6	0.0	0.3
1.0	1.1	0.9	-0.1	0.1
2.1	2.6	1.2	-0.5	0.9

Compound: M/P Xylene				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.8	0.6	1.6	0.2	-0.8
0.7	0.7	3.4	0.0	-2.7
3.2	2.2	1.2	1.0	2.0
0.7	0.8	0.2	-0.1	0.5
0.9	0.6	0.4	0.3	0.5
2.1	1.4	1.4	0.7	0.7

Compound: O-Xylene				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.3	0.2	0.6	0.1	-0.3
0.3	0.2	1.1	0.1	-0.8
1.2	0.8	0.3	0.4	0.9
0.3	0.3	0.1	0.0	0.2
0.4	0.2	0.3	0.2	0.1
0.9	0.6	0.8	0.3	0.1

Compound: Hexane				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
1.2	1.5	1.2	-0.3	0.0
1.3	1.8	3.4	-0.5	-2.1
1.5	1.5	2.8	0.0	-1.3
1.0	1.1	0.5	-0.1	0.5
2.2	1.3	1.2	0.9	1.0

Compound: 1,1,1-Trichloroethane				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.9	1.0	0.7	-0.1	0.2
0.8	1.0	1.2	-0.2	-0.4
0.7	1.3	0.7	-0.6	0.0
0.6	0.7	0.3	-0.1	0.3
0.5	0.7	0.3	-0.2	0.2
1.2	1.7	0.4	-0.5	0.8

Compound: Tetrachloroethene				
PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.2	0.2	0.2	0.0	0.0
0.2	0.2	0.2	0.0	0.0
0.2	0.1	0.2	0.1	0.0
0.2	0.1	0.2	0.1	0.0

Appendix C

Management Systems Audits

This Appendix contains the management systems audits of the New York State Department of Environmental Conservation (NYSDEC), the New Jersey Institute of Technology (NJIT) and the College of Staten Island (CSI). All audits were conducted by the QA Subcommittee.

STATEN ISLAND/NORTHERN NEW JERSEY

URBAN AIR TOXICS ASSESMENT PROJECT

QUALITY ASSURANCE SUBCOMMITTEE

AUDIT REPORT

OF THE

COLLEGE OF STATEN ISLAND

Auditors:

Avraham Teitz, USEPA - Region II
Monitoring Management Branch, USEPA - Region II

Joseph Soroka, Ph.D
Technical Support Branch, USEPA - Region II

Paul Brown
Monitoring Management Branch, USEPA - Region II

Sue Jacquett
Monitoring Management Branch, USEPA - Region II

Approved by:

Marcus Kantz, QA Subcommittee Chairman
Monitoring Management Branch, USEPA - Region II

Background

This audit report contains information on the performance of the College of Staten Island (CSI) in carrying out its duties and responsibilities for the Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP). Specific areas evaluated were the implementation of field and laboratory procedures used by CSI. The findings reported are the result of data submitted by CSI, conversations and meetings with CSI researchers and an on-site audit. Conclusions and recommendations are included at the end of this document. This report has been prepared by the United States Environmental Protection Agency - Region II for the Quality Assurance Subcommittee of the SI/NJ UATAP.

Agency audited: College of Staten Island
50 Bay Street
Staten Island, New York
(718) 390-7994

On site portion of audit: May 18, 1988

Personnel present at audit:

Joseph Soroka, Ph.D	- USEPA - Region II
Paul Brown	- USEPA - Region II
Sue Jacquett	- USEPA - Region II
Avraham Teitz	- USEPA - Region II
Clifford Weisel, Ph.D	- CSI

Organization responsibilities for the SI/NJ UATAP:

1. Prepare, sample, and analyze Tenax traps at three sites on Staten Island.

2. Operate canister sampler for EPA.

3. Design, construct and maintain Tenax and samplers.

Project Director:	Dr. John Oppenhiemer
Monitoring Network Manager:	Dr. Cliff Weisel
Quality Assurance Officer:	Dr. John Oppenhiemer
Field Operations Supervisor:	Dr. John Oppenhiemer
Laboratory Supervisor:	Dr. Cliff Weisel
Data Management Supervisor:	Dr. Cliff Weisel

FINDINGS

SAMPLING OPERATIONS

1. The College of Staten Island (CSI) operates three sites on Staten Island. Sampling equipment consists of a Tenax sampler at each site, and one canister sampler that rotates among the three sites. Tenax samples are collected each day at every site. Canister samples are collected every six days, with each site is sampled for one month of each quarter.

2. All three of the CSI's sites are complete and operational with regard to the requirements of the project. One operator is responsible for all sample handling at all the sites. Each site is visited daily to collect samples that have been run and to set-up new ones.

3. Standard Operating Procedures (SOPs) have been submitted to the QA Subcommittee for all field sampling. These SOPs are available to all field personnel although they are not physically present at the sampling sites. Training for sampling personnel is given on the job.

4. Flow rates used in sampling are calibrated before and after every sampling period using a rotameter that has been calibrated against a mass flow meter that has in turn been checked with a Gillian bubble flow apparatus. The field rotameter is recertified when it is dirty, the ball inside the rotameter is sticking or flow rates vary appreciably from the norm. No parameters exist to specify the tolerances in variation of rotameter flows before recalibration is necessary. In practice, recalibration of the rotameter occurs every three months. Flow rates are determined in the sampling line. Leak detection to determine sampling system integrity is carried out daily before sampling, to ensure the accuracy of air volume measurements.

5. Travel and handling blanks and are taken to every site each day. Duplicate samples are not taken currently, although they may be done in the future.

6. Sample information, including sample volumes, site number, dates, weather conditions, and comments are logged on data sheets on site at the time of sample collection. Data sheets are then stored in a binder in the laboratory for three months and are then archived. No logbooks are kept on site, and records are not kept on preventive maintenance taken, site operational problems, or corrective action taken.

7. Sampling occurs regardless of weather. The laboratory has no particular problems with either sampling or analysis of Tenax air samples due to moisture. Problems have occurred in the past with the canister sampler. The pump of the sampler burned out once and had to be replaced. This was followed by the inability of the sampler to pressurize sample canisters. This problem was alleviated by the replacement of the entire sampler by EPA.

LABORATORY OPERATIONS

Sample analysis:	Tenax tubes only; Canisters are analyzed by outside contractors.

The equipment being used in the laboratory is as follows:

Desorber:	Perkin Elmer ATD-50
Gas Chromatograph:	Hewlett Packard 5890A
Mass Spectrophotometer:	Hewlett Packard 5970 MSD with Chemstation data analysis package
GC/MS interface:	Capillary direct from GC
Chromatographic column:	J & W Scientific DB5, 0.25 mm i.d., 1.0 um thick film, 60 meter capillary
Tenax Cleaning System:	Heating oven with nitrogen purge

1. Standard operating procedures for all aspects of laboratory analytical work have been submitted by CSI to the QA subcommittee.

2. Tenax used for sampling is first cleaned using a Soxhlet extraction procedure using methanol and pentane. The exact procedure is listed in the appropriate SOP. Tenax is cleaned prior to each use by heating at 250C for 10 hours. The cleaning oven has a capacity of 26 tubes. One tube is analyzed as an oven blank after each cleaning run. After cleaning, tubes are stored in a closed paint can for approximately one week at ambient temperature until they are to be used for sampling. Samples are analyzed the same day that they are collected. The Tenax in a sample tube is replaced after 30 cycles of cleaning and sampling or if degradation of the Tenax is evident. Degradation is ascertained by the appearance of compounds in the blanks after cleaning.

3. The laboratory analyzes only Tenax samples. Canister samples are delivered to EPA Region II where they are shipped to PEI, one of the contract analysts for canisters in this study. All Tenax analysis is done by GC/MS. Compounds used as standards are obtained commercially and consist of 98% pure compounds dissolved in methanol, and a gas cylinder that contains 10 compounds of interest (all compounds originally agreed upon at the start of the study with the exception of toluene) at concentration of 20 ppm. No special tests are conducted to determine the purity and accuracy of the standards obtained. Standard stability is checked by comparing daily calibration runs.

4. Calibration curves are prepared using five calibration points. Calibration standards are prepared using a six port valve, loops of known volumes, inert carrier gas, a liquid spike and a Tenax tube as follows: The valve is rotated to connect the gas cylinder containing the compounds of interest and the loop of known volume. After the loop

is filled the valve is then rotated to connect the carrier gas and the Tenax tube via the loop. Thus carrier gas moves the spike from the loop and onto the Tenax tube. Additional compounds not in the gas are placed onto the Tenax with a syringe. Different calibration points are obtained by varying the volume of gas and liquids placed on the cartridge. This is done by spiking a tube several times, changing the amount of gas put onto the tube with each spike by using gas loops of different volumes, and/or changing the concentration of the liquid injection. The calibration range is 0.15 - 35 ng for benzene and the xylenes, 6 - 140 ng for toluene, and 0.1 - 15 ng for the remaining compounds of interest. All calibration and daily standards are prepared in a separate room on a different floor from the GC/MS instrument.

Minimum detection limits (MDL) are determined in two ways; For compounds which appear as background in oven blank samples (benzene, toluene, xylene, ethyl benzene), the detection limit is twice the level found in the travel blank. If compounds are not detectable at all in the oven samples, varying concentrations are made up until 5 samples of a given concentration give a peak ion count of 500-1000. At these levels, there are generally no secondary ions seen. This then becomes the MDL for this particular compound, and the value remains fixed.

5. Tuning is checked daily using the procedures specified in EPA Method 624 (GC/MS methods for volatile organics in water) utilizing bromofluorobenzene (BFB). Ion ratios are examined to see if the specifications described in the Method are met. If these specifications are not met, adjustments are made manually and another run is made.

6. Daily standards are used to ensure that the calibration curve is still in effect. Daily standards are prepared from liquid reference standards and injected by syringe onto a Tenax cartridge. The daily standards contain compounds in proportion to their prevalence in a typical ambient air sample, but at slightly elevated concentrations. The tolerance for the daily calibration run is $\pm$ 20% of the mean response for each compound. Approximately once a month, a multipoint calibration series is run. The results of this multipoint run is used in conjunction with the existing calibration curve to provide a rolling average calibration. In this way the instrument is fine tuned to account for subtle drift. This rolling average method is not used if the instrument was tuned during the interim. Should the slope of the multipoint calibration run vary from that of the original calibration curve by more than 5% or any one point exceed the mean response by more than 20%, the old calibration curve is invalidated and a new one must be run.

7. Desorption of organic compounds from the Tenax tube and subsequent cryofocussing are carried out using the Perkin Elmer ATD-50. Samples are transfered to the GC from the Perkin Elmer unit via a heated transfer line. Analysis by mass spectrometry is done using the total ion chromatogram. The particular ions used for quantitation are attached in Appendix A. Water in the sample has not been a problem.

The water peak has been observed to elute at 8-10 minutes and does not appreciably interfere with the analysis. The laboratory has an acknowledged problem with detection of methylene chloride at concentrations under 0.3-0.6 ppb. CSI believes that this is because background levels in its building are too high to allow them to analyze at lower levels.

No internal standards or surrogates are used to spike any samples. Attempts to spike samples with BFB prior to analysis were unsuccessful. However, external standards are used at the start of every run and after every 10 samples to insure the accuracy of instrument calibration. Results from the travel and handling blanks are subtracted from the results of samples. The criterion for acceptance of samples are that the a blank must contain less than 20% of what is detected in a sample, unless that level is a typical background concentration.

9. Laboratory equipment is maintained by Dr. Weisel. Additionally, service contracts are in place for all equipment with the appropriate manufacturer. Criteria for column replacement are that peak shapes and retention times differ substantially from the norms. To date, this has not occurred. The ion source in the mass spectrometer is cleaned if, after tuning, tuning parameters indicate a dirty source.

10. Samples are logged in and assigned a unique sample number as they are received in the laboratory. Logbooks are kept for all instruments in the laboratory. These logbooks are used to keep track of calibration data, but data pertaining to number of samples run or hours that the machine has been run are not recorded as maintenance is driven by machine performance.

11. Data from the GC/MS are automatically logged into a personal computer. A users manual has been prepared for the automated data acquisition and is kept in the analyst's or user's possession. Data is backed up nightly on tape, then archived after.

CONCLUSIONS

The CSI sampling and analytical programs are a model of efficiency. Samples are collected and analyzed daily, machines are calibrated, data is collected, tubes are cleaned, and performance is monitored with a minimum of down time. This is especially remarkable in that all laboratory work is done by one person. Data received from the CSI laboratory have been complete and timely. Analysis of these data, which includes shootout results, performance evaluation samples, and quarterly data reports, show that the performance of the CSI laboratory has been generally good to excellent. Data are analyzed thoroughly and problems are singled out for corrective action promptly. Additionally, all problems and progress have been communicated promptly. CSI personnel should also be singled out for the help they have offered other organizations in this project by sharing their expertise with them. This has even included personal visits to other organizations to help iron out difficulties and share techniques.

APPENDIX A

IONS USED FOR QUANTITATION

COMPOUND	RETENTION TIME	QUANTIFIER ION	QUALIFIER ION
METHYLENE CHLORIDE	7.5	49	84,86
1,1 - DICHLOROETHANE	9.0	63	65
n-HEXANE	9.8	56	56
CHLOROFORM	10.6	83	85,47
1,1,1 - TRICHLOROETHANE	11.8	97	61,99
1,2 - DICHLOROETHANE	11.9	62	49,64
BENZENE	12.5	78	51,77
CARBON TETRACHLORIDE	12.5	117	47,119,82
TRICHLOROETHENE	14.1	95	132,130
TOLUENE	17.2	91	92,65,51
1,1,2 - TRICHLOROETHANE	17.3	97	83,99
TETRACHLOROETHANE	19.1	94	166,168,129
CHLOROBENZENE	20.7	112	77,114
ETHYL BENZENE	21.3	91	105,106,77
M/P XYLENE	21.6	91	105,106,77
BROMOFORM	22.4	173	171,81
STYRENE	22.5	104	103,78
O - XYLENE	22.7	91	106,105,77
M - DICHLOROBENZENE	27.3	146	148,11,75
P - DICHLOROBENZENE	27.5	146	148,11,75
O - DICHLOROBENZENE	28.4	146	148,11,75

STATEN ISLAND/NORTHERN NEW JERSEY

URBAN AIR TOXICS ASSESSMENT PROJECT

QUALITY ASSURANCE SUBCOMMITTEE

AUDIT REPORT

OF THE

NEW JERSEY INSTITUTE OF TECHNOLOGY

Auditors:

Avraham Teitz
Monitoring Management Branch, USEPA - Region II

Joseph Soroka
Technical Support Branch, USEPA - Region II

Paul Brown
Monitoring Management Branch, USEPA - Region II

Approved by:

Marcus Kantz, QA Subcommittee Chairman
Monitoring Management Branch, USEPA - Region II

BACKGROUND

This Audit report contains information on the performance of the New Jersey Institute of Technology (NJIT) in carrying out its duties and responsibilities for the Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP). Specific areas evaluated were the implementation of field and laboratory procedures used by NJIT, with an emphasis on Tenax and canister methods. Formaldehyde sample preparation and analysis are not examined in great detail. However, the basic quality assurance measures taken with formaldehyde samples are outlined where they parallel similar methods used for the analysis of volatile organics. NJIT also performs analyses of high volume air samples for metals but this was beyond the scope of the audit. The findings reported are the result of the review of data submitted by NJIT, conversations and meetings with NJIT researchers, and an onsite audit. Conclusions and recommendations are included at the end of this document. This report has been prepared by the United States Environmental Protection Agency - Region II for the Quality Assurance Subcommittee of the SI/NJ UATAP.

Agency audited: New Jersey Institute of Technology
Air Pollution Research Laboratory
323 King Boulevard
Newark, New Jersey 07012
(201) 596-3587

On site portion of Audit: September 19, 1988

Personnel present at audit:

Joseph Soroka, Ph.D	- USEPA - Region II
Paul Brown	- USEPA - Region II
Avraham Teitz	- USEPA - Region II
Swroop Sahota	- USEPA - Region II
Steve Quan	- NJDEP
Barbara Kebbekus, Ph.D	- NJIT
Joseph Bozzelli, Ph.D	- NJIT

Organization responsibilities for the SI/NJ UATAP:

1. Prepare, sample, and analyze Tenax traps, canisters, formaldehyde cartridges, and high volume air samples at two sites in New Jersey.

2. Design, construct and maintain all samplers used in the study.

3. Periodically collocate canister trains and formaldehyde samplers and send duplicates to EPA or its contractors.

Project Director:	Dr. Barbara Kebbekus Dr. Joseph Bozzelli
Monitoring Network Manager:	Dr. Barbara Kebbekus Dr. Joseph Bozzelli
Quality Assurance Officer:	Dr. Barbara Kebbekus Dr. Joseph Bozzelli
Field Operations Supervisor:	Dr. Joseph Bozzelli
Laboratory Supervisor:	Edward Ritter
Data Management Supervisor:	Lillian Hung

FINDINGS

SAMPLING OPERATIONS

1. The New Jersey Institute of Technology (NJIT) operates two sites in New Jersey. Sampling equipment at each site consists of a two tube Tenax sampler, a canister sampler, a formaldehyde sampler, and a high volume particulate sampler. A second formaldehyde sampler is at one site using cartridges prepared and analyzed by EPA/RTP. A second Tenax sampler is rotated between sites to collect samples for mass spectrometric analyses.

2. Both sites are complete and operational with regard to the requirements of the project. Each site is visited twice every six days; once to set up fresh samples, and a second time 24 hours later to retrieve samples taken. The same team that placed each sample in the field is responsible for sample pickup at the conclusion of sampling.

3. Standard Operating Procedures (SOPs) have been submitted to the QA Subcommittee for all field sampling. These SOPs are available to all personnel both in the laboratory and in the field.

4. Flow rates used in Tenax and formaldehyde sampling are calibrated with rotameters in line behind the respective tubes before and after sampling. The rotameters are calibrated against wet test meters or bubble meters in the laboratory every 2-3 months. Leak testing is done at regular service intervals. With canister samples, flow rate is regulated by a critical orifice and is monitored in the field by measuring the pressure of the canister after sampling. This value is recorded and then compared to previous measurements to determine whether flow rates have been changing. Sampler inlet filters are also changed periodically.

5. Travel and handling blanks are taken each sampling day. Duplicates are taken as follows: Tenax samples are duplicated 10% of the time. However, these duplicate samples are analyzed by MS to identify the character of the compounds as opposed to the standard sample which is used for quantitation by GC. A duplicate formaldehyde sample is taken every sampling day at one of the two sites. One set of formaldehyde samples uses NJIT traps in series, and is analyzed by NJIT, and the other set uses EPA/RTP traps and is analyzed by EPA/RTP. Canister samples are not duplicated, although each sample analysis is. Additionally, once a month a canister sample that has been analyzed by NJIT is sent to PEI, an EPA contractor, for a duplicate analysis.

6. Sample information, including sample volumes, site number, dates weather conditions, and comments are logged on data sheets on site at the time of sample collection. Data sheets are stored in a binder in the laboratory. No logbooks are kept on site.

7. Weather is not usually a factor in the ability to collect and analyze samples. Generally, only weather that would preclude travel to the site is sufficient to cancel a sampling run. Occasionally, in heavy rain, some water does get into the samples, but better than 95% of all samples have been collected and analyzed.

8. Specific problems that have been faced with sampling and sampling apparatus has been the appearance of fine black particulate matter on the inside of the bellows of the canister sampler, and in the inside of some canisters. The pump was cleaned with some difficulty using methylene chloride, which contaminated subsequent samples, thus invalidating the methylene chloride analysis for a period of a few weeks.

LABORATORY OPERATIONS

Sample analysis: Tenax tubes, formaldehyde cartridges, and canister samples

The equipment used in the laboratory is as follows:

Tenax analysis:

Desorber: Tekmar 5000

Gas Chromatograph: Varian 3700 with Electron capture (ECD) and flame ionization (FID) detectors

Column: Hewlett Packard PONA Crosslinked methyl silicone, 50 meter capillary, 0.21 mm i.d., film thickness 0.5 um

Mass Spectrophotometer: Kratos MS25
GC/MS interface: Direct

Chromatography used with MS analysis is similar to that used with the GC/FID/ECD system, using the same columns, but a different model of GC.

Canister analysis:

GC/Canister interface: In-house designed cryogenic inlet system.

Gas Chromatograph: Same as for Tenax analysis

Column: Same as for Tenax analysis

Formaldehyde analysis:

High Prformance Liquid Chromatography:

LDC Milton-Roy with UV detection

1. Standard Operating Procedures (SOPs) have been received by the QA subcommittee for most of the laboratory's operation.

2. Tenax used for sampling is prepared by heating at 225C for three days and blank checked before use. It is felt by NJIT staff that the new Tenax currently being received is sufficiently clean to eliminate the need for long Soxhlet extractions with organic solvents. Used Tenax tubes are cleaned by heating for 24 hours at 225C. NJIT feels that cleaning times for Tenax must be substantial, as experience with shorter cleaning times have resulted in dirty blanks. The cleaning oven has a capacity of 12 tubes, of which 2 are used for oven blanks. Cleaned sample tubes are used within 2-3 days of cleaning and are stored in glass culture tubes with teflon lined caps. Caps must be boiled as toluene has been found in the glue used to attach the teflon to the cap. Samples are picked up immediately after sampling and are stored as they were before sampling. Analysis of Tenax tubes is within 1-2 days of sampling. Tenax is used until one of these conditions are satisfied: 30 cycles of sampling and cleaning, until background levels of contaminants in cleaned tubes start to rise, or the pressure drop across the tube increases sufficiently to indicate channelling.

Canisters used in sampling are obtained commercially. The NJIT apparatus allows four canisters to be cleaned simultaneously. Zero air for the cleaning procedure is obtained commercially. Canisters are prepared by pumping them to a vacuum at 35C. They are then filled with zero air and reevacuated. This process is repeated three times. One of the four canisters is left filled with air which is analyzed by GC to check for any residual contamination.

Formaldehyde samples are prepared according to the method of Tejada at EPA/RTP. As a result of communication with Tejada, NJIT changed its SOP slightly, and purifyied the clean nitrogen flow used in drying the formalfehyde traps. This resulted in a dramatic shift in the amount of formaldehyde reported by NJIT. This shift brought what was previously high levels of formaldehyde (15 ppb and subsequently invalidated) to more typically observed levels (3-4 ppb). Traps prepared by EPA/RTP that have been collocated with NJIT traps are sent to EPA/RTP for analysis in order to ascertain the quality of NJIT analysis. No data has been received to date.

3. A cylinder of standard gas is prepared from commercially available liquids and gaseous chloromethane by placing the compounds of interest in the cylinder at ppm levels, and then pressurizing with helium. The cylinder is then analyzed against NBS traceable standards in the NJIT laboratory and by a commercial laboratory. The compounds used as standards and their concentrations are listed in Appendix A. In general, the mixture in the standards is not similar to that found in ambient air, with chloroform, methylene chloride, and carbon tetrachloride being at concentrations greater than those of benzene, toluene or the xylenes. The same standards cylinder is used for all analyses of canister and Tenax samples.

Standards for formaldehyde analysis are synthesized by NJIT. NJIT has also received pure standards from EPA/RTP to use in preparation of cartridges and analysis to compare results obtained from the different standards. It was noted that the standard crystals of dinitrophenylhydrazone (DNPH) that NJIT synthesized were a different color than those supplied by EPA/RTP. Results of the use of different standards is not known due to the lack of results from EPA/RTP.

4. There are identical but separate GC/detector set-ups for tenax and canister samples. Calibrations for Tenax and canister samples are done by injecting standard gas into the GC with a gas sampling valve. The calibration spike for the Tenax GC is introduced into the system at the Tekmar furnace, whereas for the canister GC the spike is introduced at the sample line. Initially, four points are run three times for each compound to determine system linearity. After this is established, calibration is done at one point daily (about 10 ng for each compound) with a 2 ml injection of standard gas. Quantitation is obtained from the FID. The ECD is generally used for helping to identify peaks. The criterion for acceptance of the daily calibration check is ± 10% of the calibration average for each compound. Minimum detection limits are computed to 0.01 ppb by interpolating the results of the line formed by the daily calibration level and the origin. Such low levels are possible because of the sensitivity of the FID and ECD. Very little drift has been observed in any of the detectors, and they are kept running 24 hours a day.

5. As with the calibrations, daily analysis is primarily accomplished with the GC and the FID. Tenax samples are analyzed as follows: First, the tube is desorbed by heating, and the compounds purged from the Tenax are cryofocussed twice inside the Tekmar unit, once in the sample line and again at the column head. All transfer lines in contact with the sample are heated. A splitter is used such that 90% of the sample is run to the FID and 10% of the sample goes to the ECD.

Canister samples are run by first heating the canister to 35C. The canister valve is then opened and the sample travels down a heated sample line where the volatile organics are cryofocussed at -110C with a liquid propanol slush. The air in the sample passes through the focussing trap into a ballast that is of known volume and pressure. By measuring the difference in pressure the volume of air that is to be analyzed is determined. Hot water is then applied to the sample trap and the sample moves via carrier gas to the GC column where it is cryofocussed again with liquid nitrogen. The sample is then run on the GC using the same approach as with the Tenax samples. Canister samples are run two or three times to insure the accuracy of the analysis, and the data reported are the average of the runs.

Samples to be used for analysis by MS are prepared in a desorption system consisting of a nitrogen gas inlet, the sampled Tenax tube in an oven, and a 10 ml container. The Tenax tube is connected to the

10 ml container under reduced pressure, with the nitrogen gas inlet closed. The 10 ml container is kept at -60C in a methanol bath while the Tenax tube is heated to 210C. This is allowed to continue for a half hour. After this time the nitrogen gas inlet is turned on and the remainder of any volatiles from the Tenax tube is swept into the 10 ml container. Final pressure in the 10 ml sample vessel is 60 PSIA. Samples are injected into the MS by heating the 10 ml container and allowing sample to fill a 2 ml loop. Since no pressure measurements are made, the results are not quantitated. From the loop, the sample is transferred to a GC where it is cryofocussed at the head of the column. The output of the GC is connected directly to the MS.

6. There have been several problems in the past with the analysis for volatile organics in both the Tenax and the canister systems. With Tenax, it was discovered in February/March 1988 that the Tekmar furnace did not cool to the proper temperature at the base of the sample oven. As a result, compounds were desorbing from the Tenax traps from the moment they were placed in the Tekmar unit, while desorption was expected to start during the ballistic heating of the sample. This resulted in low recoveries of compounds from Tenax traps. This problem has been solved by not filling the bottom inch of the sampling tubes with Tenax. In this way, no sorbent is heated prior to when it is expected to be.

Canisters samples analyzed prior to March 1988 were of poor quality, as compound peaks were not well resolved. This was attributed to the use of liquid argon (-160C) in the cryofocussing step, causing CO2 from the sample to freeze and be focussed with the organics in the sample. When liquid argon was replaced with liquid propanol slush (-110C), peak resolution was improved.

The results of the steps taken above have been evidenced by a dramatic improvement in the analysis of the performance evaluation (PE) samples provided by EPA/RTP. Whereas previously there were biases as great as 90%, current samples have been within 40% or less for most compounds for both Tenax and canister samples. This performance is equivalent to other laboratories involved in this study. Additionally, results from the second shootout show that NJIT is within the bounds expected for data from this study for most compounds.

However, one problem that appears to be continuing is that data from canisters analyzed by NJIT appear to have high levels of carbon tetrachloride. The evidence for this is from shootout data, split analysis of NJIT sampled and analyzed canisters by an EPA contractor, PEI, and consistently higher levels reported by NJIT compared to other organizations. This problem is limited to canisters, as the results of Tenax analysis at the shootout did not show this trend. A major difference between the analysis of Tenax and canisters by NJIT is that with Tenax samples, carbon tetrachloride is quantitated using the ECD rather than the FID because interference is suspected. However with canisters the FID alone is used for the quantitation of

carbon tetrachloride. Currently NJIT is in the process of changing over to the ECD for carbon tetrachloride analysis of canisters.

8. Acceptance criteria of oven blanks, travel blanks and handling blanks used in the Tenax system are identical. Tubes are considered acceptable if benzene and toluene in the blanks are 10% or less than the amount found in exposed samples. All canister analysis is done in duplicate or triplicate. Acceptable results between duplicates is agreement within 25% or less. The results between the two tubes of Tenax used at every site are examined for obvious discrepancies.

9. Laboratory equipment is maintained by NJIT personnel. Major repairs are done by the manufacturer of the associated equipment, although no service contracts are currently in place. Funds for spare parts are not as plentiful as at other laboratories, and replacement parts are needed for some pieces of equipment that are currently in use.

10. The GC and MS are interfaced directly to a personal computer allowing all chromatographic runs to be saved electronically. All GC runs are recorded on chart paper with a chart recorder to allow chromatographic traces and peak identification to be done manually. After all peaks have been identified and the data have been found to be acceptable, the results of GC runs are manually entered into a Lotus spreadsheet file. As a result, all data is available for retrieval should the need arise.

CONCLUSIONS AND RECOMMENDATIONS

The New Jersey Institute of Technology has a very diverse program in place for this project. The laboratory performs four different types of analysis, whereas most other laboratories perform only one type of analysis. The complexity involved in this endeavor results in greater possibilities for problems to crop up, and in the past some have. However NJIT has had a long history of maintaining an analytical air pollution program and thus is able to draw upon its past experience in examining problems and correcting them. This has been especially evident in the analysis of volatile organic constituents where problems in the earlier part of 1988 has resulted in the invalidation of some data. However, the nature and extent of the problems were known to the leaders of the project, corrective measures were taken, and the problems were addressed. This was done internally by NJIT, and points to the fact that the quality assurance system in practice by the organization was performing its function.

The recent decision reached jointly by NJIT and NJDEP, its contract manager for this project, to invalidate blocks of data generated before the implementation of significant proces correction is very positive. It strongly supports a fundamental basis of this project that each organization will perform its own QA and will act to reject or qualify questionable data and to implement corrective action. Current data being generated by NJIT has been within the bounds of expectations for a project of this type. However, two important points exist:

1) Concentrations of carbon tetrachloride in canisters are too high. As a result, the data generated for this compound are suspect. There is also a trend toward relatively high levels of 1,1,1-trichloroethane and trichloroethylene being found in canisters. This was true when comparing NJIT canisters to PEI analysis of the same canister (split analysis), NJIT Tenax, or shootout results. This trend, although apparent, is not significant enough to warrant the invalidation of data for these compounds, but it should be examined to determine if there are any underlying causes to this observation.

2) Canisters should continue to be sent to PEI once a month for split analysis. This has not been done conscientiously in the past, although NJIT performance in this aspect has been much better lately.

Quality assurance methods with respect to formaldehyde samples have been in place. Exchanges of standards, duplicates sent to EPA/RTP, and ongoing analysis of data are being carried out. However, the accuracy of NJIT data is currently unknown due to the fact that no results from the tubes sent by NJIT to EPA/RTP have been reported. Discussions and feedback between EPA/RTP and NJIT have been ongoing, and as a result of these consultations, methods of preparation of tubes has changed from the original NJIT SOP. After instituting small changes, the results that have been obtained by NJIT for formaldehyde

have decreased from 15 ppb to 3 - 5 ppb, which is similar to results obtained for similar studies in urban air.

APPENDIX A

COMPOUNDS AND CONCENTRATIONS IN NJIT STANDARD GAS

COMPOUND	CONCENTRATION
Chloromethane	2.98 ppm
Methylene Chloride	11.86 ppm
Chloroform	12.66 ppm
1,1,1 - Trichloroethane	7.89 ppm
Carbon Tetrachloride	10.5 ppm
Trichloroethylene	9.15 ppm
Tetrachloroethylene	6.49 ppm
Benzene	9.50 ppm
Toluene	9.05 ppm
Hexane	7.54 ppm
O - Xylene	4.46 ppm
M/P - Xylene	3.51 ppm

STATEN ISLAND/NORTHERN NEW JERSEY

URBAN AIR TOXICS ASSESSMENT PROJECT

QUALITY ASSURANCE SUBCOMMITTEE

AUDIT REPORT

OF THE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Auditors:

Avraham Teitz
Monitoring Management Branch, USEPA - Region II

Joseph Soroka, Ph.D
Technical Support Branch, USEPA - Region II

Paul Brown
Monitoring Management Branch, USEPA - Region II

Approved by:

Marcus Kantz, QA Subcommittee Chairman
Monitoring Management Branch, USEPA -Region II

BACKGROUND

This Audit report contains information on the performance of the New York State Department of Environmental Conservation (NYSDEC), in carrying out their duties and responsibilities for the Staten Island/New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP). Specific areas evaluated were the implementation of field and laboratory procedures used by NYSDEC. The findings reported are the result of data submitted by NYSDEC, conversations and meetings with NYSDEC researchers and an onsite audit. Conclusions and recommendations are reported at the end of this document. This report has been prepared by the United States Environmental Protection Agency - Region II for the Quality Assurance Subcommittee of the SI/NJ UATAP.

Agency audited: New York State
Department of Environmental Conservation
Air Resources
50 Wolf Road
Albany, New York 12233-3527
(518) 457-7454

On site portion of Audit: September 15, 1988

Personnel present at audit:

Joseph Soroka, Ph.D	- USEPA - Region II
Paul Brown	- USEPA - Region II
Avraham Teitz	- USEPA - Region II
Garry Boynton	- NYSDEC
Brian Lay	- NYSDEC

Organization responsibilities for the SI/NJ UATAP:

1. Collect samples of Tenax, sorbent traps,canisters formaldehyde, and metals at appropriate sites.

2. Prepare and analyze sorbent traps from NYSDEC sites in Staten Island.

3. Maintain all samplers used in the study.

Project Director:	Don Gower
Monitoring Network Manager:	Will Smith
Quality Assurance Officer:	Ray McDermot
Field Operations Supervisor:	Mike Steineger
Laboratory Supervisor:	Garry A. Boynton
Data Management Supervisor:	Brian Lay

FINDINGS

SAMPLING OPERATIONS

1. The New York State Department of Environmental Conservation (NYSDEC) maintains six monitoring sites on Staten Island. The types of samples that are collected are: sorbent traps; i.e. Tenax tubes, Envirochem tubes, ATD-50 tubes, and Poropak tubes; canisters; formaldehyde cartridges; and high volume air filters for trace metals. The exact configuration at each site is attached in Appendix A. Most of the samples that are collected are not analyzed or prepared by NYSDEC. In addition, tubes that are analyzed by NYSDEC (Envirochem and ATD-50 tubes) originate from Albany, NY. Thus, almost all samples are transported to and from the analytical laboratories to the field office by mail. As a result, the field office devotes considerable time to tracking, distributing, packaging and mailing samples.

2. All six sites are completely operational with regard to the requirements of the project with the exception of the real time gas chromatographs which have not yet been implemented. One primary operator is responsible for all sites, but backups are currently being trained. Each site is visited at last every six days, except weekends, to retrieve samples that have been run and to replace them with new samples. In practice, site visits are more frequent due to the need to maintain equipment, distribute sampling material, and insure the smooth operation over such a large sampling network. Currently, samples are often left in the field for several days, either before or after sampling, prior to being picked up and sent for analysis. This is of particular concern with the sorbent tubes, in that samples must be protected from passive sampling and artifact formation. To deal with this, NYSDEC has developed a ball trap that seals the sample after vacuum has stopped flowing through the tube. Although some preliminary laboratory analysis on this technique has suggested that passive sampling has been stopped, a rigorous study of this method has not been conducted. This trap is being used with all sorbent media with the exception of the Poropak traps.

3. Standard operating procedures specific to this project have not been submitted to the QA Subcommittee for all field sampling. However, many of the same general techniques that apply to the NYSDEC air sampling system already in existence apply to this project. Sampling methods, Standard Operating Procedures (SOPs) and quality assurance procedures for methods that were in use prior to the SI/NJ UATAP are in EPA's possession. Modifications by NYSDEC to the existing documentation for methods in use for the SI/NJ UATAP are currently under way.

Training to field personnel is complete and thorough and involves a stagewise progression in a supervised program. The first stage of training involves site location, familiarization with personnel associated with the site, and the rudiments of equipment operation. Complexity is gradually added until in the later stages, the fine

points of each method are demonstrated. This includes special handling to avoid contamination and hands on experience. Training culminates with the trainee demonstrating proficiency with the use of the equipment while being monitored by the Field Operations Supervisor.

4. The samplers for all sorbent trap media, and the high volume metal samplers, function on the same principles, and are calibrated in the same fashion. The principle of operation is a vacuum drawing air through a critical orifice. After every sampling run, a manometer is used to measure the pressure drop across the orifice. This number is recorded, and using the calibration equation for the orifice and the time that the sampler was run, the volume of air sampled is computed. The critical orifice is audited quarterly by the Field Operations Supervisor using a mass flow controller whose calibration is traceable to a primary standard. Audits are conducted by NYSDEC Quality Assurance personnel to monitor field performance of the samplers. The criterion for acceptable performance of any sampler is $\pm$10% of the actual level.

The formaldehyde and canister samplers used by NYSDEC are housed together, but use different sampling lines. Flows for both are regulated by mass flow controllers. The flow rates were measured at the start of the study, but QA/QC measures have not yet been implemented for insuring the calibration of the mass flow controllers. This is more important with formaldehyde samples because canister performance can be judged by the final pressure after sampling. Also, measurements of flow rate are not needed to determine concentrations of pollutants in a canister sample, as the whole air sampled is contained in the canister; this is not the case with formaldehyde samples.

5. Travel blanks for Tenax, Envirochem, and ATD-50 samples are handled as follows. Samples are received by the field office in bulk, with generally 10-30 tubes per shipment. One sealed tube of each type is taken to a site where that particular tube will be sampled that day. After sampling, the sealed travel blank is sent to the appropriate laboratory together with all the sorbent tubes of the same type that were run that day. In the case that not enough sampling tubes are available, travel blanks can not be sent, although this has been the exception rather than the rule.

Travel blanks for the Poropak samples are handled differently. Upon receipt of a shipment of Poropak tubes, two tubes are selected as travel blanks. These blanks are taken to a site and left sealed on site for four to five days. After this time they are sent to the laboratory for analysis. Poropak tubes from regular sampling runs are not accompanied by a travel blank on the return trip from the field to the laboratory. Travel blanks are not used for canister and formaldehyde samples. Duplicate samples for sorbent media are taken at each sampling run as follows: Two tubes are run at different flow rates, as are all sorbent tubes throughout the study, and a third tube is run at the higher of the two flow rates. Formaldehyde and canister samples are not duplicated.

6. Sample information, including sample volumes, site number, sample number, dates, weather conditions, and comments are logged on data sheets on site at the time of sample collection. Data sheets are then stored by the operator in his office, and a copy is sent to Albany where it is archived in a notebook by the Data Management Supervisor. A logbook is kept at each site, and all data that is written on the data sheets is duplicated in the logbook. Additionally records are kept in the logbook on preventive maintenance taken, site operational problems, or corrective action taken.

7. Sampling occurs regardless of weather. The sampling portion of the NYSDEC system is separate from the analytical laboratories involved in this study with respect to personnel, geography and in many cases organization. As a result samples are sent to each lab with a report on weather conditions at sampling. The laboratory, upon examination of samples determines whether they can be run.

LABORATORY OPERATIONS

Sample analysis:	Envirochem and ATD-50 tubes only; All other analyses are conducted by outside contractors.

The equipment being used in the laboratory is as follows:

Desorber:	Perkin Elmer ATD-50 Envirochem
Gas Chromatograph:	Hewlett Packard 5890A
Mass Spectrophotometer:	Hewlett Packard 5970 MSD with Chemstation data analysis package
GC/MS interface:	Capillary direct from GC
Chromatographic column:	SGE BP-1, 0.23 mm i.d., 0.5 um thick film 50 meter capillary, bonded face

1. Standard Operating Procedures have not been received by the QA Subcommittee for any portion of the laboratory work being done. However, flow diagrams of analytical procedure have been promised by NYSDEC in the future.

2. The only laboratory analysis currently undertaken by NYSDEC is the analysis of the Envirochem and ATD-50 sorbent tubes. The sorbent being used, in both cases, is a combination of Ambersorb B, tenax and charcoal. The ATD-50 tube is a metal tube designed for use with the Perkin Elmer automatic thermal desorber (ATD), while the Envirochem trap is a more conventional glass tube. With both traps, the initial

sorbent cleaning and the packing of sorbent into the tubes is carried out by a contractor to the state. When new tubes are received by the NYSDEC, they twice undergo the standard cleaning procedure used to clean sampled tubes.

After tubes have been sampled and analyzed, they are cleaned by heating them for 10 minutes at 290C and are then purged for 10 minutes with an nitrogen. Six tubes are cleaned at one time and 10% of all cleaned tubes are treated as oven blanks. This cleaning has been found by NYSDEC to be sufficient, with background levels of cleaned blanks having < 60 ng of benzene and < 12-20 ng toluene. Tubes are replaced when background levels of organic compounds begin to rise in the oven blanks. This has not been observed to date, and this has been attributed to the fact that each tube has only been recycled 15-16 times.

3. Analysis of all sorbent tubes is by GC/MS. Compounds used as standards are obtained as NBS certified liquid permeation tubes and placed in permeation ovens. Calibration of the tubes is taken per the manufacturers specifications. Direct weighing of permeation tubes, to give direct gravimetric determinations of permeation efficiency was attempted, but fluctuations in the weight of the tube, due to heating effects, static electricity and humidity rendered this approach impractical.

4. The NYSDEC calibration system is set up as follows: Permeation tubes are first grouped according to the temperature that is specified in their calibration. Each group of tubes is then placed in an oven set at the appropriate temperature. Currently there are four Metronix ovens in 18 tubes in use. All the ovens outputs are ganged together by copper tubing that was cleaned with hexane and methanol and air then dried. A pump is in constant operation which sucks zero air through the permeation ovens. Zero air is obtained by cooling air to a dew point of -100C and then passing it through two canisters of carbon, one canister of molecular sieve, and one canister of Drierite. Air flow through the system is controlled with mass flow controllers. This zero air is checked daily through the calibration process. When a tube is to be calibrated, it is connected to a 1/4" Swagelok fitting and the output of the permeation ovens are diverted through the tube. The calibration system is set-up in such a manner that the output of any of the four permeation ovens in any combination may be diverted through the tube to be calibrated. Up to four sorbent tubes may be spiked at one time. Spike concentration is a function of the time that the oven outputs flow through the sorbent tube and the quantity of dilution air.

Minimum detection limits (MDL) are determined as follows. Injections of 25 ng of each compound are made into the GC/MS system. Then data are examined from previous runs where lower levels (0-20 ng) of compounds were observed. These two sets of data were compared for their relationship and consistency and determinations of MDL made. System linearity has also been checked and found to hold for levels up to 300 ng for the Envirochem tubes and at least 200 ng with the ATD-50 tubes.

5. The MS is tuned daily using the Hewlett Packard autotune procedure with perfluorotributylamine (PFTBA). After tuning, the GC/MS system in use with the ATD-50 tubes is calibrated for all compounds at three levels (0, 100, 200 ng). The Envirochem system is calibrated for all compounds at two points, 0 and 200 ng. It has been the experience of NYSDEC laboratory personnel that the daily recalibration is necessary as ion counts and areas were found to change after the execution of the autotune procedure.

6. There is no daily calibration check as the calibration curve is redone every day. No criteria currently exist, for the invalidation of any calibration run, except for the operators discretion. To test the stability of the GC/MS unit, Fluoro-2-iodobenzene (FIB) is spiked onto every tube as an internal standard. This standard is not used for quantitation, but rather, as a timing check, by monitoring the time of elution of this compound over the course of time. In practice, the elution time of FIB has varied less than 3%. Peak area counts of FIB with ATD-50 tubes has varied by less than 10-15% over a period of several months, whereas a variation of 30% was observed with the Envirochem tubes over the same time period. Stability of the permeation tubes is accomplished by monitoring the instrument response of the daily calibration tests and by inspecting the permeation tubes twice annually to insure that they are more than one quarter full.

7. Analysis of both types of tubes is carried out in identical GC/MS systems with each GC/MS dedicated to one type of sampling tube. Desorption procedures are different for the two types of sorbent traps used. With the ATD-50 tubes, each sample is desorbed and cryofocused (-20C), in the ATD-50 unit. The sample is then transferred via a heated transfer line to the head of the GC column. With the Envirochem tube/desorber system, the sample is desorbed and retrapped three separate times, with each desorption followed by a trap of a smaller volume, thus concentrating the sample. Purging from one trap to the other is done at 200C, and each trap is maintained at a temperature of about 40C. Cryofocussing is not used. Analysis by mass spectrometry is done using selected ion monitoring. The ions used for identifying each compound are listed in Appendix B. Water in the sample line is not usually a problem, although if there is standing water in a tube it will not be run. The laboratory has an acknowledged problem with the analysis of 1,1,1-trichloroethane (1,1,1-TCA) in the ATD-50 tubes, manifested by negatively biasing the quantitations of this compound by 80 - 90 %. Performance evaluation and shootout data confirm this bias. This problem has recently been traced to the MS in the ATD-50 system not seeing the 97 ion on 1,1,1-TCA. Currently, analysis of 1,1,1-TCA is being done with the ATD-50 MS using the secondary ions for quantitation. Tuning of the MS by Hewlett Packard personnel is planned. Misidentification of peaks is a problem that occurs infrequently, but is handled by examining results of all generated data.

8. Results of travel and handling blanks are used to determine a rolling average of the last five runs. These levels are then determined to be background and subtracted from the results of field

samples. Oven blanks are examined to insure that their levels do not exceed criteria that were established during a cleaning study at the beginning of the project. Contamination of tubes is determined at the discretion of the laboratory supervisor.

9. Laboratory equipment is maintained by Garry Boynton. Repairs of equipment is done by the appropriate manufacturer although no service contracts are in place. Criteria for column replacement are that peak shapes and retention times differ from the norm. Parameters for repair of the MS are evident from the results of the daily autotune procedure. To date, no columns have been replaced and neither source has yet had to be cleaned.

10. Documentation of samples received by the laboratory includes a unique sample number and the field data sheet. Logbooks are kept for most laboratory instruments. Data transfer from the GC/MS to a personal computer for data manipulation is done automatically. Raw data is stored on a Hewlett Packard minicomputer for a period of two years and is then archived on tape.

CONCLUSIONS AND RECOMMENDATIONS

The NYSDEC system in the SI/NJ UATAP is larger, more complex, and more diversified than any other organization in this study. The sampling and analytical portions of the NYSDEC network are completely segregated with respect to geography, personnel, and in many cases organizations. The quality assurance currently being exercised by the sampling portion of the NYSDEC is exemplary. The rigorous training of new personnel, the on site documentation and duplication of all data, and the maintenance and auditing of sampling equipment all give confidence in data reported with regard to sampling. Due to the responsibilities of the field office to obtain, distribute, sample and ship such a wide variety of samples to many different laboratories, if the proper measures were not instituted and carried out, chaos would quickly result. The training of the NYSDEC field personnel in managing networks previously is a great advantage to them in recognizing potential problems and instituting corrective action.

The analytical portion of the NYSDEC system is also performing well. This is based on the data from shootouts, performance evaluation samples from EPA/RTP, and data from the study. NYSDEC is also the only organization that has one duplicate sample for each sorbent tube pair that is sampled. As a result, the precision of NYSDEC data can be measured to a degree that is unobtainable by other organizations. The analysis of data by the laboratory has also been thorough, and as a result problems are quickly noted and corrective action implemented. This has been the case specifically with the lack of detection of 1,1,1-TCA. The laboratory however, has not yet submitted SOPs for procedures currently in use, although they are currently in the process of being generated.

The following recommendations are intended to improve a well functioning system.

1. All field and laboratory SOPs must be completed and submitted.

2. The potential positive sampling/artifact formation problem should be addressed through a more rigorous study, since sorbent tubes are left so long in the field both before and after sampling.

3. Procedures for checking the mass flow controllers on the formaldehyde sampling system should be developed and implemented.

ATTACHMENT #1

NYS Department of Environmental Conservation

Staten Island

Toxic Air Monitoring Status

Site	Poropak	2 Tube Tenax	Grad. Adsorbent	EPA CAN.	Auto GC's	Hi-Vol	Formaldehyde	Wind Spd Wind Dir	Met. Data Reporting	Sorbent Tube Data Reporting	Trace Metals Poropak Data Reporting
#1 S. Wagner H.S.	4/85	10/87 (~~ERT~~/UMDNJ)	7/87 (Envirochem)	4/27/88 (Every 6 days)	3-Oper 7/87-7/88 (HOLD)	Ongoing (Trace Metals)	7/88	Ongoing	Through 7/88	10/87 6/1/88-EPA Format 2nd Qtr. 1988	7/88 All Data
#2 P.S. #26 Travis	4/85	5/27/88 (UMDNJ)	7/87 (Envirochem)	8/88 (Every 18 days)	N.A.	Ongoing (Trace Metals)	N.A.	N.A.	N.A.	10/87 6/1/88-EPA Format 2nd Qtr. 1988	7/88 All Data
#4 Fire Station Great Kills	N.A.	N.A.	8/88 START 8/31 (ATD-50)	8/88 (Every 18 days)	N.A.	N.A.	N.A.	N.A.	N.A.	10/1/88 EPA Format 3rd Qtr. 1988	N.A.
#5 Post Office Port Richmond	N.A.	10/87 (~~ERT~~/ Texas A&M)	7/87 (Envirochem/ ATD-50)	6/88 (Every 6 days)	HOLD	TSP only	7/88	Optional	Optional	10/87 6/1/88 EPA Format	N.A.
#7 Pump Station S.I. Mall	N.A.	N.A.	9/88 START 9/30 ATD-50	9/88 (Every 18 days)	HOLD	N.A.	N.A.	9/30/88	9/30/88	10/1/88 EPA format 3rd Qtr. 1988	N.A.
#9 Fire Station Tottenville	N.A.	5/27/88 (~~ERT~~/ Texas A&M)	7/88 START (ATD-50)	6/88 (Every 18 days)	N.A.	N.A.	N.A.	4/27/88 (also R.H.)	Through 7/88	10/1/88 EPA Format 3rd Qtr. 1988	N.A.

8/23/88
88-3-141

7-88

APPENDIX A

APPENDIX B

IONS USED FOR QUANTITATION

COMPOUND	QUANTIFYING ION	QUALIFYING ION
DICHLOROMETHANE	49	84
CHLOROFORM	83-85	47
1,2 DICHLOROETHANE	62	49, 64
1,1,1-TRICHLROETHANE	97-99	61-63 *
BENZENE	78	77
CARBON TETRACHLORIDE	117-119	
TRICHLOROETHENE	130-134	95-97, 60-62
1,1,2-TRICHLOROETHANE	95-99	83-87
TOLUENE	91	92
TETRACHLOROETHENE	164-170	129-133
CHLOROBENZENE	112-114	77
ETHYL BENZENE	91	105-107
M/P - XYLENE	91	105-107
0 - XYLENE	91	105-107
1,3 - DICHLOROBENZENE	146-148	74-76,111
1,4 - DICHLOROBENZENE	146-148	74-76,111
1,2 - DICHLOROBENZENE	146-148	74-76,111

* The qualifying ions for this compound are used for quantitation in the ATD-50 system. This is discussed at greater length in the audit.

QUALITY ASSURANCE SUBCOMMITTEE REPORT

ON THE RESULTS OF

SHOOTOUT #2

CONDUCTED ON

JULY 25 - 28, 1988

Table of Contents

	Page
Introduction	1
Results	2
Discussion	6
Conclusion	12
Explanation of Abbreviations used in Figures and Tables	12a
Tables and Figures	13
Appendix A	43
Appendix B	46

Tables and Figures

		Page
Table	A - Mean Concentration for all Compounds for the Duration of the Shootout	12b
Table	1. - Benzene Concentrations	13
Figure	1. - Benzene Concentrations	14
Table	2. - Toluene Concentrations	15
Figure	2. - Toluene Concentrations	16
Table	3. - M/P - Xylene Concentrations	17
Figure	3. - M/P - Xylene Concentrations	18
Table	4. - O-Xylene Concentrations	19
Figure	4. - O-Xylene Concentrations	20
Table	5. - Dichloromethane Concentration	21
Figure	5. - Dichloromethane Concentrations	22
Table	6. - Carbon Tetrachloride Concentrations	23
Figure	6. - Carbon Tetrachloride Concentrations	24
Table	7. - 1,1,1 - Trichloroethane Concentrations	25
Figure	7. - 1,1,1 - Trichloroethane Concentrations	26
Table	8. - Tetrachloroethylene Concentrations	27
Figure	8. - Tetrachloroethylene Concentrations	28
Table	9. - Ethyl Benzene Concentrations	29
Figure	9. - Ethyl Benzene Concentrations	30
Table	10. - Trichloroethylene Concentrations	31
Figure	10. - Trichloroethylene Concentrations	32
Table	11. - Chloroform Concentrations	33
Figure	11. - Chloroform Concentrations	34
Table	12. - Benzene - % Difference from the mean	35
Table	13. - Toluene - % Difference from the mean	35
Table	14. - M/P - Xylene - % Difference from the mean	36
Table	15. - O-Xylene - % Difference from the mean	36
Table	16. - Dichloromethane - % Difference from the mean	37
Table	17. - Carbon Tetrachloride - % Difference from the mean	37
Table	18. - 1,1,1 - Trichloroethane - % Difference from the mean	38
Table	19. - Tetrachloroethylene - % Difference from the mean	38
Table	20. - Ethyl Benzene - % Difference from the mean	39
Table	21. - Average of All compounds - % Difference from the mean	40
Table	22. - Average of all compounds - Absolute % Difference from the mean	40
Table	23. - All compounds - % Difference between low and high flow tubes	41
Table	24. - All compounds - % Difference of data reported below MDL	42

INTRODUCTION

The Staten Island/Northern New Jersey Urban Air Toxics Assessment Project (SI/NJ UATAP) Quality Assurance Subcommittee has been charged with the task of assessing the validity and quality of data that is being generated in the SI/NJ UATAP project. Toward this end, a workplan and Quality Assurance Project Plan were submitted to the Steering Committee. One of the important facets of this plan called for the scheduling and implementation of collocation experiments, termed "shootouts," whereby all participants in the study would sample ambient air at the same location and at the same time. The need for collocation is required to estimate the variability between the organizations conducting sampling, allowing comparisons in measurements conducted by these organizations at different locations to be estimated.

The purpose of a shootout is to determine the ability, variability, and comparability within and between organizations to collect, analyze and report data. The first shootout was held October 21-23, 1987 at the beginning of the SI/NJ UATAP study. As the midpoint of the project approached, it was felt that a second shootout was necessary. This was to monitor the progress and abilities of the organizations involved in the project at a time when any startup problems evident at the beginning of the project should have been eliminated.

The participants present at the second shootout were the Environmental Monitoring Systems Laboratory (EMSL) of the Environmental Protection Agency at Research Triangle Park (EPA/RTP), New York State Department of Environmental Conservation (NYSDEC), College of Staten Island (CSI), University of Medicine and Dentistry of New Jersey (UMDNJ), and the New Jersey Institute of Technology (NJIT). The University of Texas A&M, although not present at the shootout, was responsible for analyzing some of NYSDEC's Tenax samples.

Every organization took sorbent and canister samples. NJIT, CSI, and UMDNJ analyzed the Tenax samples they had taken. NYSDEC analyzed the Envirochem and ATD-50 sorbent samples it had taken, but its Tenax samples were analyzed by Texas A&M. EPA/RTP Tenax and canister samples were analyzed by Battelle Inc. in Columbus, Ohio. NJIT analyzed its own canister samples. Canisters sampled by UMDNJ, CSI, and NYSDEC were analyzed by PEI Inc. in Cincinnati, Ohio.

Each organization within Region II involved in the project was requested to bring a duplicate sampling train for sorbent media. CSI and UMDNJ complied with this request fully. NYSDEC took two duplicate high flow sorbent samples with Envirochem tubes and a single duplicate high flow sample with ATD-50 and Tenax tubes. NJIT had only one sampling train for Tenax at the shootout. EPA/RTP had a four tube distributed volume train for Tenax samples and 2 canister sampling trains operating each day.

RESULTS

Weather data gathered at Newark airport shows that the weather over the course of the shootout was typical for this time of year. Daytime highs were in the 80's with humidities greater than 50%. As a result of weather, mechanical and human factors, the data set for the shootout was not complete for every organization. The following data are missing: NYSDEC ATD-50 samples for day 1 of the shootout, NJIT data for all samplers on day 2, duplicates of all CSI samples, CSI's benzene and carbon tetrachloride high flow tube samples, and EPA/RTP Tenax samples for day 3. EPA/RTP was only scheduled to sample for three days, and therefore no EPA/RTP data are presented for day 4 of the shootout.

The results of the shootout are presented in Tables 1 through 11, and Figures 1 through 11. Sorbent data were obtained by averaging the results of the high and low flow tubes that were reported. If one of the two sorbent tubes was reported as below the detection limit, the detection limit was averaged with the results of the second tube. If however, the difference between the two tubes was such that the minimum detection limit had been found with one tube, but, the second tube reported a concentration that was 20 times greater, it was assumed that an error had been made in sampling or analysis. In such a case, the data reported by all organizations for that compound and day were examined, and a judgement was made to see which data point fit best. The best fitting point was then reported and the second point discarded. This happened 4 times in the shootout, three times with UMDNJ and once with Texas A&M. Each time, the tube that was reported at the MDL was discarded. An asterisk was placed in Tables 1-11 whenever this procedure was done. It should be emphasized again that this procedure was only done when a laboratory's data were internally inconsistent. This approach described above was predicated on experience and knowledge obtained in the auditing of the laboratories in this study and is precisely the reason high and low flow tubes are used.

No judgement was made on the validity of data if both data points from each of the Tenax tubes were in agreement, regardless of the levels reported by other organizations. In the instance that the MDL was reported for both the high and low flow tubes, or an MDL was reported with any of the canister samples, a < symbol precedes the number in Tables 1-11. NYSDEC did not flag levels below the MDL. However, as NYSDEC reported the nanograms found for each tube as well as a ppb concentration, when the mass reported was recorded as "not found" the data were treated as below the MDL. Canister data were reported as received.

Given the limitations of time and resources, it was felt that the best method for comparison of data was through the use of percent difference. There is historical precedent for this statistic, as percent differences have traditionally been used as a measure to evaluate the accuracy of ambient air monitors. Although there is no standard against which to measure each organization's performance in the shootout, the relationship of an organization's

reported concentration to the mean of all reported concentrations could be assessed. The percent difference was computed for each day of the shootout for each compound according to the formula:

$$\frac{\text{(Organization's Reported Concentration - Mean Concentration)}}{\text{Mean Concentration}} * 100$$

The organization's reported concentration was derived by the method described above to obtain the values for Tables 1-11. Sorbent and canister samples were treated separately. The mean concentration was derived by averaging all of the reported concentrations for each compound and day. The data for the two EPA/RTP canisters and the three PEI canisters sampled by CSI, NYSDEC, and UMDNJ were each counted separately. However, as the result of the large sample size and the values of the data reported in the shootout, changing the computations for determining the percent difference by pooling the EPA/RTP canisters or the PEI canisters did not substantially change the mean.

Percent differences for each day and for the entire shootout are presented in Tables 12-20 for all of the compounds in the study, with the exception of chloroform and trichloroethylene. Chloroform and trichloroethylene percent differences are not reported because these compounds were reported at such low levels that differences of 0.15 ppb could result in >100% difference from the mean. Values that were reported below the MDL were ignored in determining the mean and in determining the percent difference. If an organization reported that a compound was below the detection limit, the letters MDL appear in place of a number in the appropriate column in Tables 12-20. The reason for this approach is that although an MDL indicates the maximum level for a compound, the actual level may be orders of magnitude less. Therefore comparisons between organizations based on data derived from the MDL would be hampered by the uncertainty of this number. Thus, the percent differences shown in this report are actually a comparison between organizations that reported a quantifiable data point for a particular compound.

Table 21 is the average of the percent differences from the mean for all compounds for each organization. It was computed for each organization by averaging the percent difference from the mean of each compound for every day of the shootout. Table 22 shows the average of the absolute value of the percent difference from the mean for all compounds for each organization. It was computed the same way as for Table 21, with the exception that the absolute value of the percent difference from the mean was used for each compound for every day of the shootout. Table 22 is useful because it reveals variability that may be masked or cancelled by the normal technique used in Table 21 can be thought of as a demonstration of accuracy error (or bias), while Table 22 can be thought of as a demonstration of precision accuracy (or scatter). For example, if the data for a reporting organization showed that compound A had a percent difference from the mean of 40% and compound B had a percent difference from the mean of -40% the

average that would be reported in Table 21 would be 0%. However the absolute value of the average difference from the mean that would be reported in Table 22 would be 40%.

The average percent differences between the low and high flow tubes for each organization and compound are presented in Table 23. The percent differences between low and high flow tubes are broken down for each day of the shootout and shown in Appendix A. There are several factors that may cause differences to occur between the low and high flow sorbent tubes, but, based on the pattern and consistency of the results obtained, the results may be interpreted as one of the following:

1) As a measure of laboratory precision; This is because both low and high flow tubes sample air at the same location and time, and therefore they are also crude duplicate samples. Thus differences between tubes may be indicative of a laboratory's precision in analyzing identical samples;

2) As breakthrough or tube saturation. This would be indicated if concentrations in the high flow tube are less than in the low flow tube. This would indicate that compounds were being desorbed from the high flow tube. The greater a compound's volatility and concentration, the greater the likelihood of breakthrough occurring. As presented in Table 23, this would be indicated by a negative percent difference;

3) As an estimate of analytical sensitivity. When low levels of a compound are present, it is possible that the high flow tube will be shown to contain a greater concentration of a compound than the low flow tube. This is because the low flow tube, having sampled less air, may not have trapped a sufficient amount of compound to be detected by the analytical instrumentation. The high flow tube on the other hand, having sampled a greater volume of air, may contain sufficient amounts of a compound to be detected. Thus, sensitivity limits would typically be expected at low concentrations (>0.2 ppb). As presented in Table 23, this would be indicated by a positive percent difference.

One last caveat in examining Table 23 is that at low compound concentration (0.1-0.2 ppb) high percentage differences are easily obtained. Therefore, high percentage differences with chloroform trichloroethylene, and carbon tetrachloride should not be assigned as much weight as similar results with toluene, benzene, xylene, tetrachloroethylene, and 1,1,1 trichloroethane. As with the means, if levels below the MDL were reported, the statistic could not be computed.

The amount of data that were reported below the MDL varied greatly for organization and compound. Table 24 summarizes these results for all tube samples taken, including duplicates when available.

DISCUSSION

From Tables 1-12, it can be seen that, although there were some technical difficulties, the data set for the shootout was complete for most of the participating organizations. However, complete sets of duplicate sorbent samples were unavailable for any organization through a combination of errors in planning, judgement or analysis. From previous shootout experience and after discussion with EPA/RTP EMSL personnel, it was expected that even with proper quality assurance, the data for any one organization could vary by ±50% from the mean. This is because of the heterogenous nature of the methods, sampler designs, personnel and laboratory facilities that were being used. If the data varied from the mean by more than ±50% or 0.2 ppb, whichever was greater, a bias was suspected and further investigation was warranted. Differences from the mean greater than ±25% are reported as trends, especially when these differences were uniform for an organization across all the compounds examined. Differences from the mean of less than ±25% were considered insignificant.

The significant points derived from the shootout were:

1) The point of greatest variation was seen between organizations and, at times, between the different days of the shootout for the same organization, rather than between sampling method. This is evidenced by the following:

As seen in Table 21, Texas A&M Tenax samples had an average percent difference from the mean of -44.58. However, percent differences from the mean of -57.45 and -90.35 were recorded for day 1 and day 2 of the shootout respectively. In contrast, percent differences from the mean for day 3 and 4 of the shootout were -25.21 and -4.84. Percent differences from the mean were particularly high with benzene and dichloromethane. Concentrations closer to the mean occurred with 1,1,1-trichloroethane,and tetrachloroethylene. However, even for the compounds for which the overall data were closer to the mean, the concentrations reported on the first two days of the shootout were very low relative to the mean.

Table 21 also shows that NJIT canisters were an average of 77.63% above the mean for all compounds. This difference was greatest on day 1 of the shootout, when the canisters were 116.5% greater than the mean, although a substantial degree of deviation from the mean is also evident on day 3. Examining each compound separately shows that results greater than the mean occurred consistently for all compounds with the exception of o-xylene. The results with carbon tetrachloride were >140% of the mean for all days, as can be seen in Tables 6 and 17. The results for 1,1,1-trichloroethane are also substantially greater than the mean, as can be seen in Tables 7 and 18.

NYSDEC Envirochem data were on average consistently lower than the mean during the first day of sampling. As shown in Table 21, the percent difference from the mean was -61.52% for the first day of

the shootout. On the other days, the percent difference from the mean was 41% or less. Examination of the individual compounds in Tables 1-20 corroborates that this finding was true for all compounds evaluated by NYSDEC.

2) Canisters and Tenax did not differ substantially from one another. Typically, for each compound, the pooled canister mean concentrations were 0.1 to 0.2 PPB greater than the pooled mean Tenax concentrations. The exception to this was with dichloromethane, for which canister concentrations were about 0.4 PPB greater than Tenax concentrations. This result can be explained by the greater potential for breakthrough with dichloromethane when Tenax is used, due to its high volatility and greater concentration relative to the other target compounds.

Another finding is that the results of the NYSDEC sorbent system (Tenax, Ambersorb, and charcoal) was equivalent to the results obtained from Tenax. The NYSDEC sorbent is used in both the ATD-50 and Envirochem tubes. As seen in Table 21, the ATD-50 tubes were an average of -16.52% from the mean, which was comparable to the NJIT Tenax results. When examining the performance of the ATD-50 tubes it was apparent that there was very little detection of 1,1,1- trichloroethane, but this problem has since been traced to the mass spectrometer. Although the Envirochem tubes averaged 35.04% from the mean, this may be due to the analytical system used to desorb the Envirochem tubes; This system does not feature a cryofocussing step and thus may lose some volatiles. As can be seen in Table 22, the absolute difference from the mean for the NYSDEC sorbent system was equivalent to that of many of the other organizations in the study. Evaluating the results of the NYSDEC sorbents compound by compound showed no uniform pattern of bias that was different from that expected of Tenax.

3) There were some significant differences from the mean that were compound specific. As seen in Table 15,the NYSDEC PEI canisters concentrations for o-xylene were greater than the mean by 100.4%. Table 17 shows that NJIT canister results for carbon tetrachloride were 247.9% greater than the mean. Table 18 shows that NYSDEC ATD-50 analysis of 1,1,1-trichloroethane was <90% of the mean, whereas NJIT canisters were 110.7% greater than the mean for the same compound.

4) The typical percent difference between low and high flow sorbent tubes was 20-40%. This much variation can be explained by analytical precision alone. As seen in Table 23, these results varied by organization and compound. With the NYSDEC Envirochem tubes, the difference between the high and low flow tubes was 200% for benzene. These results are not indicative of a lack of sensitivity in analysis because benzene is found at high levels. Breakthrough can not be suspected because it was the high flow tubes that contained larger amount of material in each case. An analytical error is suspected because the benzene results were skewed by the results of the

third day of sampling, when there was an 800% difference between the tubes. On other days, the results were more in line with expectations.

Table 23 also shows that Texas A&M had consistent differences between its high and low flow tubes that were greater than 100%. Examining the day by day results in Appendix A shows that for all compounds the differences between the tubes varied greatly from day to day. Analysis of Texas A&M raw data shows wide differences in duplicate high flow samples as well as between the low and high flow tubes during the course of the shootout. The magnitude of the problem and the consistency that is observed with all compounds seems to indicate that the differences observed between the low and high flow tubes are due to analytical technique.

The UMDNJ results presented in Table 23 shows that the differences between low and high flow tubes was greater for this organization than any other. These results are primarily due to the toluene, benzene, and dichloromethane results. This occurred because the high flow tubes had significant concentrations of target compounds whereas little or no target compound was observed in the low flow tubes. These results are most likely a result of analytical technique because of the magnitude of difference in the concentrations observed in the high and low flow tubes. It is important to note that only 14 valid tube pairs are included in this analysis. That is far fewer than for any other organization and represents 32% of the available pairs. The remaining 68% of the pairs were excluded because the results were reported below the MDL. The results include more than one data point for only 3 out of 11 compounds.

5) There was a substantial amount of difference in the fraction of data reported as being below the detection limit. Table 24 shows that 80.17% of all data reported by UMDNJ was reported as below the MDL. With PEI, 40.2% of the data was below the MDL. CSI had 9.9% of its data below the MDL. NYSDEC did not flag any data as being below the MDL. However, as it did report both the amount in nanograms and the ppb levels, if a compound was reported as "not found" the amount listed in the ppb column was assumed to be the detection limit. NYSDEC, had 8.52% of its Envirochem data and 10.10% of its ATD-50 data considered below the MDL. NJIT and EPA/RTP reported no data below the MDL. The reasons for the amount of data below the MDL that was reported varied by organization.

UMDNJ reported levels below the MDL for almost all compounds on all days for all tubes with the exception of the xylenes and ethyl benzene. This was the case even for compounds for which the average concentration during the shootout were close to or exceeded 1 ppb (benzene,toluene). UMDNJ has acknowledged that it has problems in its analytical process and admits that these trace amounts are false. In fact, UMDNJ has since resubmitted some

shootout data; they have not been included in the body of the report, but are included in Appendix B.

PEI had levels below the MDL that depended on the compound being analyzed. Generally levels below the MDL were recorded only when the mean was less than 0.4 ppb. PEI's stated detection limit is 0.2 ppb for most target compounds. It must be borne in mind that a canister system is inherently less sensitive than a sorbent system, particularly when a mass spectrometer is used for detection. This is because with canisters, ambient concentrations of air are analyzed whereas with Tenax, the compounds present in 10-20 liters of air are concentrated prior to analysis. Comparisons between NJIT and PEI canister analysis regarding the MDL are not valid as NJIT uses an FID/ECD detection system that is more sensitive then the MS detection system used by PEI. However, the Battelle GC/MS system used to run EPA/RTP samples was more sensitive than the system used by PEI.

The majority of the CSI data reported below the MDL were with dichloromethane. This is because CSI is unable to eliminate the interference caused by the use of dichloromethane in the building where they are housed; thus, only high levels of dichloromethane can be detected. The few other times that MDL's were cited by CSI were for trichloroethylene and chloroform. In these instances only one out of the pair of Tenax tubes used for a sample was reported as below the MDL.

NYSDEC Envirochem tubes had data below the MDL only with compounds that were found in the smallest amounts. This was with carbon tetrachloride, trichloroethylene, and chloroform. The ATD-50 tubes, on the other hand, had some data that were reported below the MDL with 1,1,1-trichloroethane. As explained earlier, the reason for this was traced to faulty detection in the MS. However, the ATD-50 tubes were more sensitive with trichloroethylene and chloroform compared to the Envirochem tubes.

6) The absolute percent difference from the mean, as shown in Table 22, is useful for comparing the overall precision of the organizations, rather than the overall accuracy, as shown in Table 21. All organizations were able to achieve absolute percent differences less than 45% except for UMDNJ, Texas A&M, and NJIT (canister only). NJIT canisters and Texas A&M also showed the highest percent difference in Table 21, indicating that most of the deviation was in one direction (high for NJIT canisters, low for Texas A&M). UMDNJ's low percent difference in Table 21 indicates a general lack of agreement with the mean in either direction (although it must be remembered that most of UMDNJ's data are not included), due to its failure to detect target compounds.

7) The results of the Performance Evaluation (PE) samples foreshadowed the results of the shootout in many instances. Texas A&M PE results showed a negative bias that varied from -40% to -80% below the spike level. Texas A&M's shootout

results also reflected a negative bias of this magnitude. NYSDEC's PE results with 1,1,1-trichloroethane using the ATD-50 tubes was negatively biased by >90%. NYSDEC shootout results for the same compound and tube type was -93% below the mean. The latest PE samples submitted by CSI showed a negative bias with carbon tetrachloride and benzene that was variable and was often 30-50%. Shootout results showed that CSI results for benzene and carbon tetrachloride had a variable negative bias that sometimes exceeded 50%. UMDNJ results could not be compared with their shootout performance because UMDNJ did not submit their PE samples. NJIT's Tenax PE results also reflected on its results at both shootouts. Prior to the first shootout, NJIT's PE results indicated a negative bias for all compounds > 50%. Results from the first shootout showed that NJIT was, on average, 43% below the mean for most compounds. A second set of PE samples that were analyzed prior to the second shootout showed that NJIT's performance with Tenax tubes had improved and that, on average, its results had a positive bias close to 39%. NJIT's performance in the shootout was 25.3% above the mean. The one case in which the PE samples did not correlate with the shootout was with the NJIT canisters. The PE results indicated that the average bias with the canisters was less than 25% and that carbon tetrachloride results in particular were biased only -4.3%. At the second shootout, the NJIT canisters were consistently high by 70-80%, and the carbon tetrachloride results in particular were 247.9% above the mean. Split analysis of NJIT field canister samples by PEI also corroborated NJIT's bias with regard to carbon tetrachloride.

8) Comparing the results of <u>this shootout with the previous shootout</u> shows that the variability of the data has not changed dramatically, although some differences should be noted. In the previous shootout <u>PEI</u> did not detect any compounds. As a result of an EPA/RTP audit and subsequent advice, they have been reporting data reliably for compounds with concentrations above 0.2-0.4 ppb. <u>NYSDEC and CSI</u> are little changed from the previous shootout, providing data that have been setting the standard for the study.

<u>NJIT</u> has improved substantially with respect to its Tenax analysis. As a result of its PE samples and its recent shootout performance, the Tenax data currently being generated by NJIT can be given a high degree of confidence, equivalent to that for NYSDEC and CSI. As can be seen in Table 22, NJIT Tenax had an absolute percent difference from the mean less than any other organization. This was not the case in the first shootout when NJIT's Tenax results were greater than 40% below the mean on a consistent basis. The absolute percent difference from the mean for NJIT canisters was little changed from the previous shootout and was about 80%. However, the variation from the mean for the NJIT canisters at the second shootout was always greater than the mean. In contrast, NJIT's

canister results from the first shootout were more evenly distributed above and below the mean.
UMDNJ performed slightly better at this shootout than at the previous one. At the previous shootout there were very few compounds reported due to problems with the samplers. At this shootout, approximately 80% of the total samples were reported as MDL, although useable data sets were available for two compounds. Analytical problems are very evident.

The EPA/RTP results are the reverse of the last shootout with regard to the performance of the Tenax and canister samples. Although the results at both shootouts were well within the acceptance criteria of the data, during the first shootout the Tenax samples had an absolute difference form the mean of 20% and the canisters were nearly 40%. In shootout 2 these numbers were reversed.

CONCLUSION

The results of this shootout bear out a number of points that are relevant to the SI/NJ UATAP. There are clear differences between the capabilities of the various organizations participating in the study. It also seems apparent that the variability in the reporting of pollutant concentrations is affected more by laboratory analytical ability than by the particular sampling method. There was also a high correlation between the results of the performance evaluation samples and the results of the shootout. The same magnitude and type of problems manifested in the performance evaluation samples were also seen in the shootout. Additionally, the results of Shootout I were close to that of Shootout II.

The most important facet of the shootout is that in conjunction with performance audit samples and laboratory audits, an assessment of the quality of data being generated for the project can be ascertained. Although not every problem may be caught, the methods outlined above have detected important problems that have been corrected or are currently being addressed. Had these methods not been carried out, the data collected would have been of entirely unknown quality.

As a result of all the extensive QA activities undertaken for the project, it is reasonable to expect up to an 80% difference between the data of any two organizations. This is derived from the fact that most organizations had data from the shootouts and PE samples that were within $\pm$40% of the mean. When comparing the data from different sites under the auspices of the same analytical laboratory, a difference of up to 45% between sites can be expected. This is derived from the fact that the variation from the mean for each organization tended to be in the same direction. This is revealed when examining the absolute value of the difference from the mean. The level of confidence in the data expressed above would be the case even if all performance evaluation samples, laboratory audits and shootout results were in order. Greater differences may exist for isolated individual points due to sampling, analytical or human error or if comparisons are made with laboratories where problems have been shown to exist.

Explanation of Abbreviations Used in Tables and Figures Tables:

NJIT - New Jersey Institute of Technology

NYDEC - New York State Department of Environmental Conservation

CSI - College of Staten Island

EPA/RTP - Environmental Protection Agency at Research Triangle Park

PEI - PEI Inc.

UMDNJ - University of Medicine and Dentistry of New Jersey

Figures:

NJ - New Jersey Institute of Technology

NYe - New York State Department of Environmental Conservation Envirochem Sorbent Tubes

NYa - New York Department of Environmental Conservation ATD-50 Sorbent Tubes

SI - College of Staten Island

MD - University of Medicine and Dentistry of New Jersey

AM - Texas A&M

RTP - Environmental Protection Agency at Research Triangle Park

Table A.

AVERAGE CONCENTRATION LEVELS OF TARGET COMPOUNDS IN PPB
DURING THE COURSE OF THE SHOOTOUT (JULY 25 - JULY 29, 1988)

COMPOUND	CONCENTRATION (PPB)
TOLUENE	3.55
M/P XYLENE	1.13
BENZENE	0.96
DICHLOROMETHANE	0.84
O-XYLENE	0.53
1,1,1-TRICHLOROETHANE	0.50
ETHYL BENZENE	0.31
TETRACHLOROETHYLENE	0.28
CARBON TETRACHLORIDE	0.26
TRICHLOROETHYLENE	0.17
CHLOROFORM	0.10

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 1.

SORBENT TUBES: BENZENE

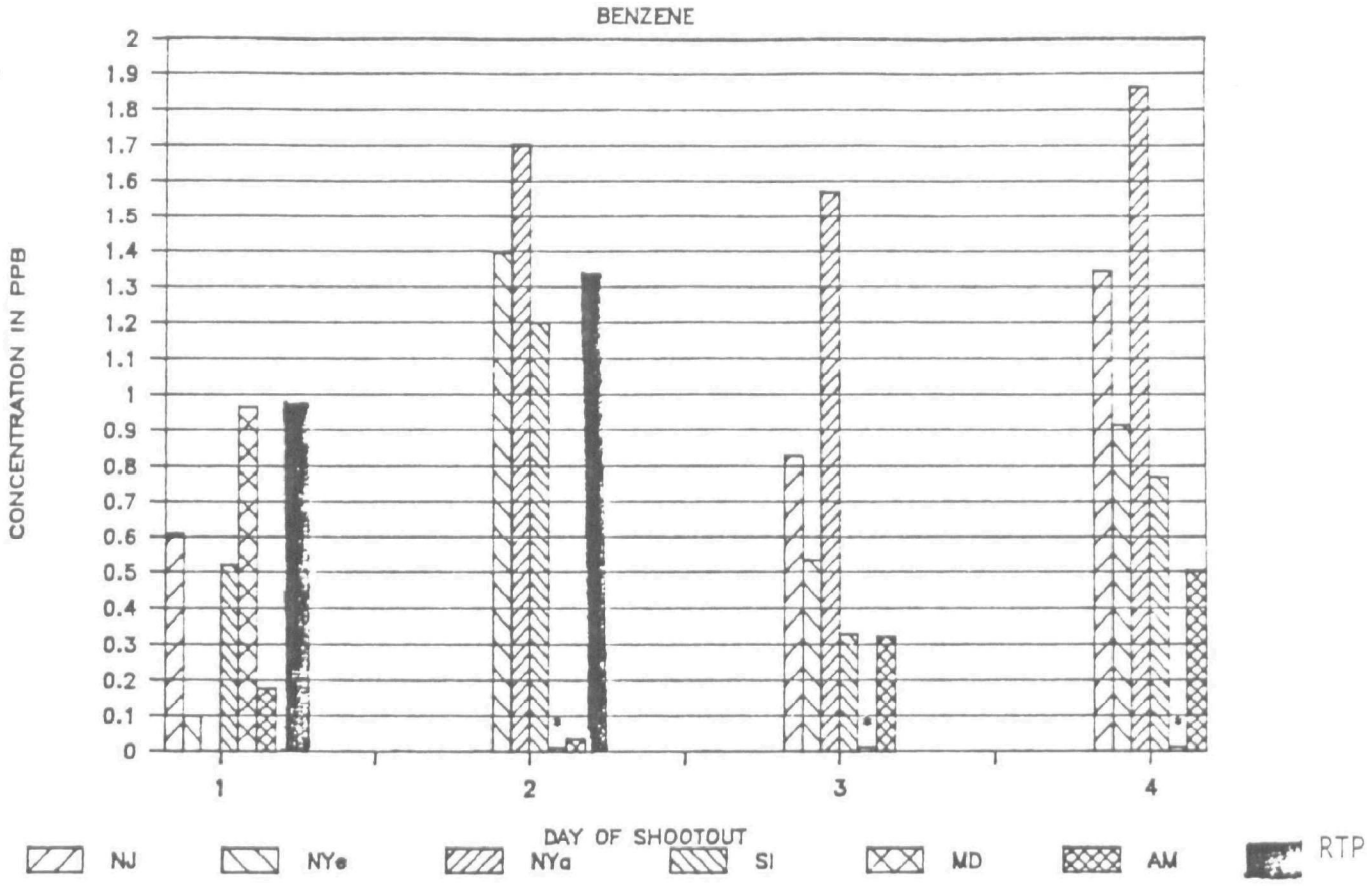
	NJIT TENAX AVERAGE 2-TUBES	NYSDEC ENVIROCHEM AVERAGE 2-TUBES	NYSDEC ATD-50 AVERAGE 2-TUBES	CSI LOW FLOW TUBE	UMDNJ TENAX AVERAGE 2-TUBES	TEXAS A&M TENAX 2 TUBE AVERAGE	EPA/RTP TENAX 4-TUBE AVERAGE
DAY # 1	0.61	0.10	N/S	0.52	0.97	0.18	0.99
DAY # 2	N/S	1.40	1.71	1.20	<0.01	0.03	1.34
DAY # 3	0.83	0.54	1.57	0.33	<0.01	0.32	N/S
DAY # 4	1.35	0.92	1.87	0.77	<0.01	0.50	N/S

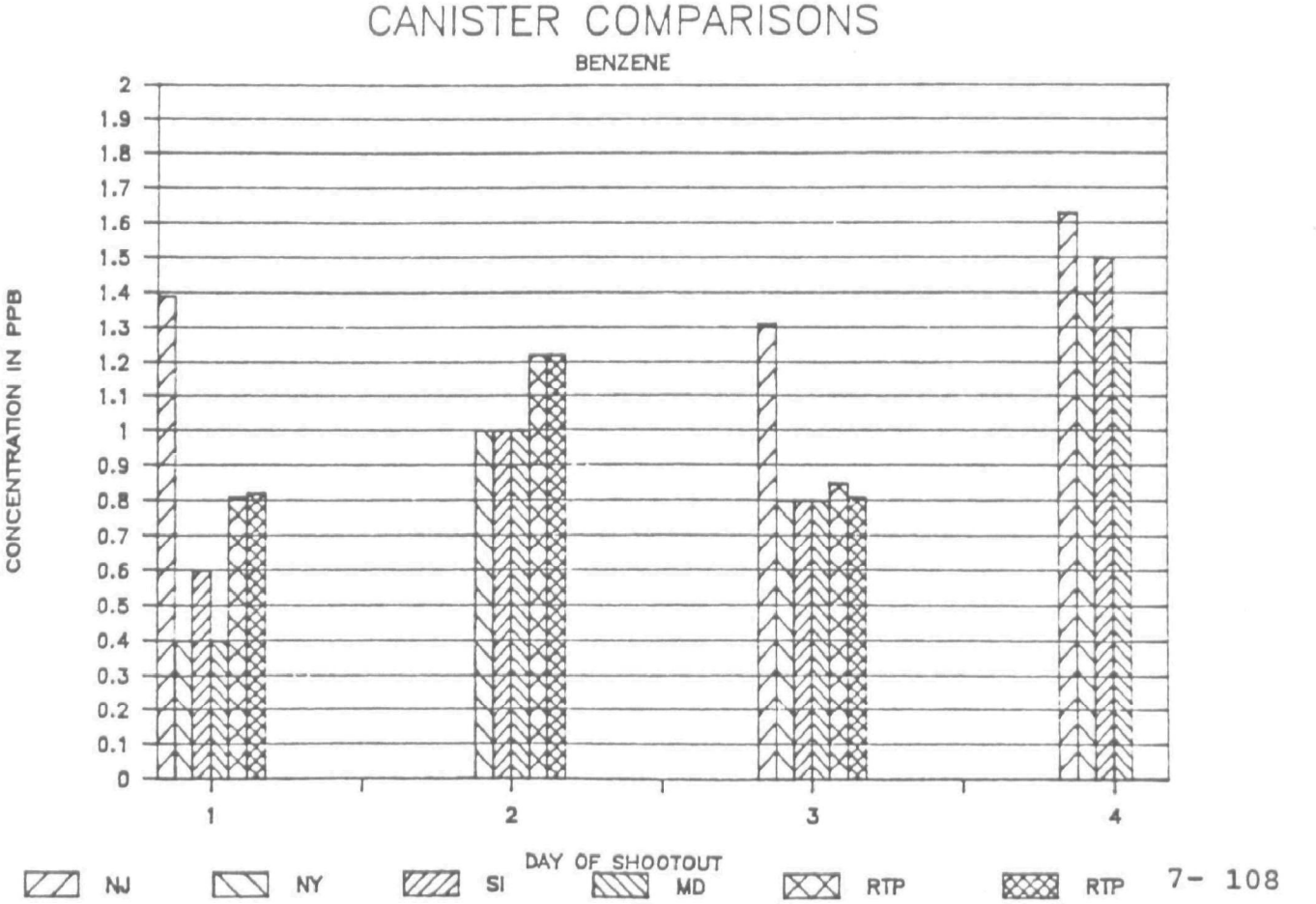
CANISTERS: BENZENE

	NJIT CANISTER	NYSDEC PEI CANISTER	CSI PEI CANISTER	UMDNJ PEI CANISTER	EPA/RTP CAN 1	EPA/RTP CAN 2	GRAND MEAN
DAY # 1	1.39	0.40	0.60	0.40	0.81	0.82	0.65
DAY # 2	N/S	1.00	1.00	1.00	1.22	1.22	1.11
DAY # 3	1.31	0.80	0.80	0.80	0.85	0.81	0.82
DAY # 4	1.63	1.40	1.50	1.30	N/S	N/S	1.24

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Figure 1.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 2.

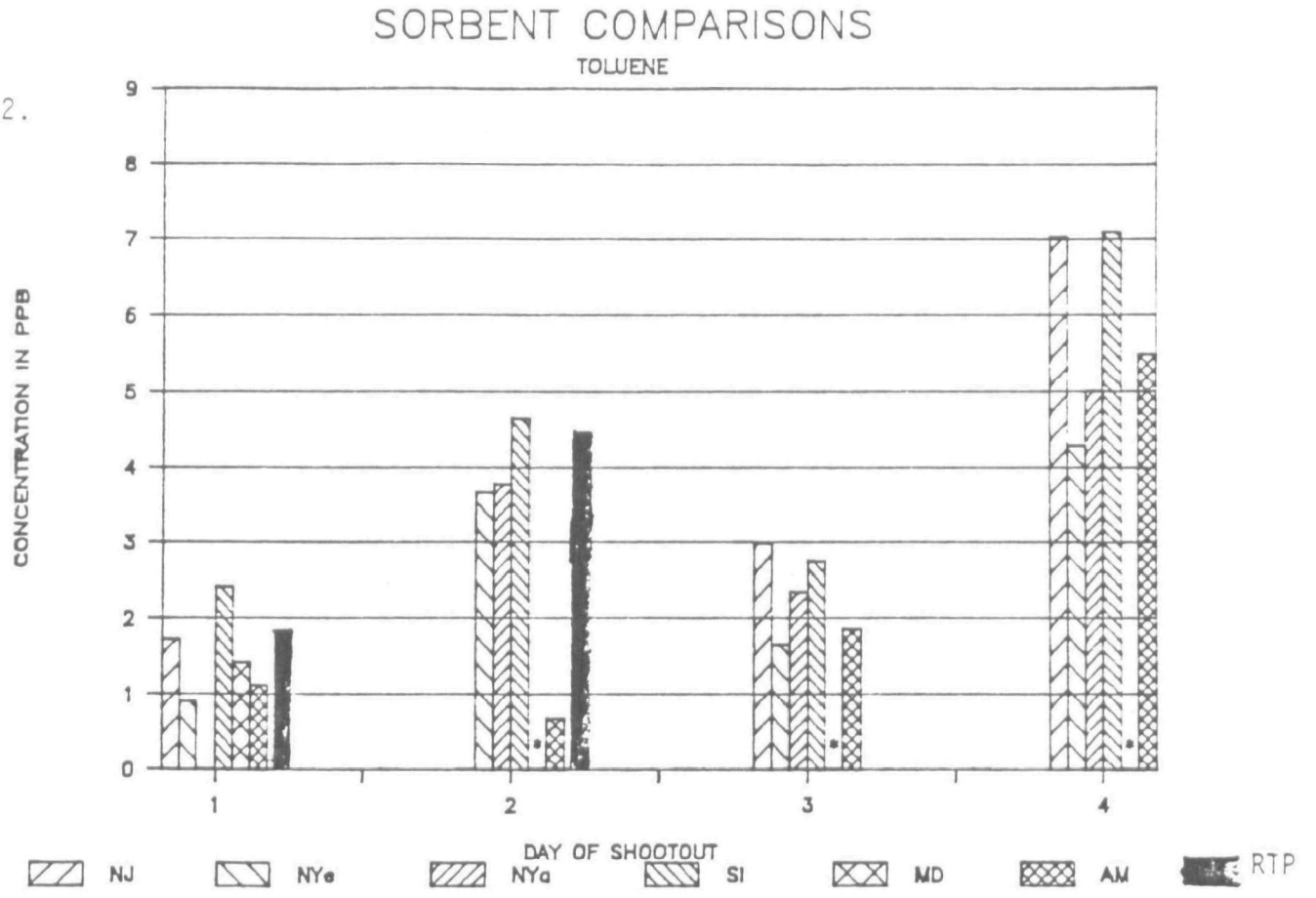
SORBENT TUBES: TOLUENE	NJIT TENAX AVERAGE 2-TUBES	NYSDEC ENVIROCHEM AVERAGE 2-TUBES	NYSDEC ATD-50 AVERAGE 2-TUBES	CSI TENAX AVERAGE 2-TUBES	UMDNJ TENAX AVERAGE 2-TUBES	TEXAS A&M TENAX 2 TUBE AVERAGE	EPA/RTP TENAX 4-TUBE AVERAGE
DAY # 1	1.74	0.91	N/S	2.43	1.43 *	1.12	1.83
DAY # 2	N/S	3.68	3.79	4.65	<0.01	0.68	4.42
DAY # 3	2.99	1.67	2.36	2.75	<0.01	1.87	N/S
DAY # 4	7.04	4.30	5.01	7.10	<0.01	5.49	N/S

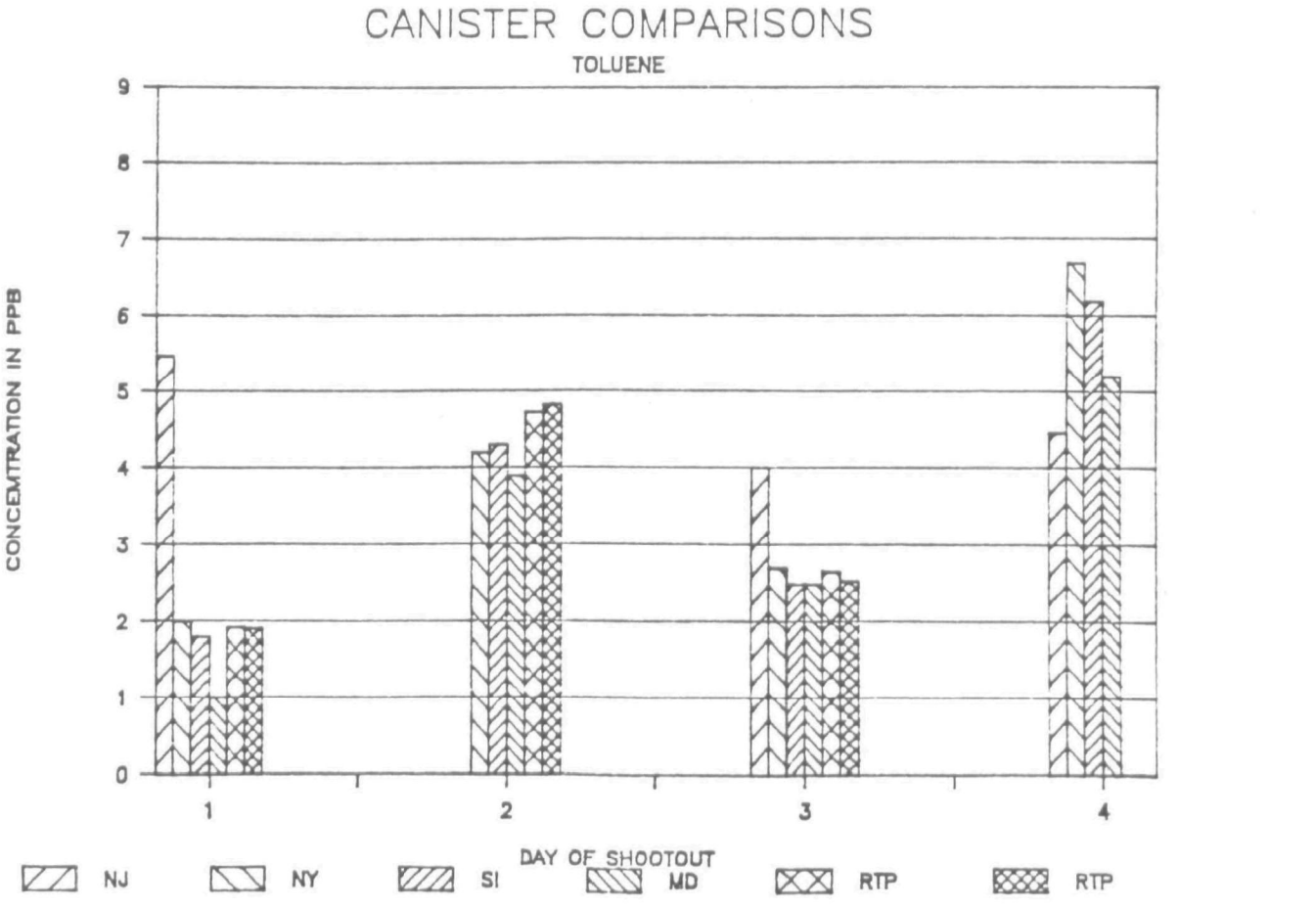
CANISTERS: TOLUENE	NJIT CANISTER	NYSDEC PEI CANISTER	CSI PEI CANISTER	UMDNJ PEI CANISTER	EPA/RTP CAN 1	EPA/RTP CAN 2	GRAND MEAN
DAY # 1	5.47	2.00	1.80	1.00	1.92	1.91	1.96
DAY # 2	N/S	4.20	4.30	3.90	4.73	4.83	3.92
DAY # 3	4.01	2.70	2.50	2.50	2.65	2.54	2.59
DAY # 4	4.46	6.70	6.20	5.20	N/S	N/S	5.72

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 2.

Figure 2.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 3.

SORBENT TUBES: M & P - XYLENE

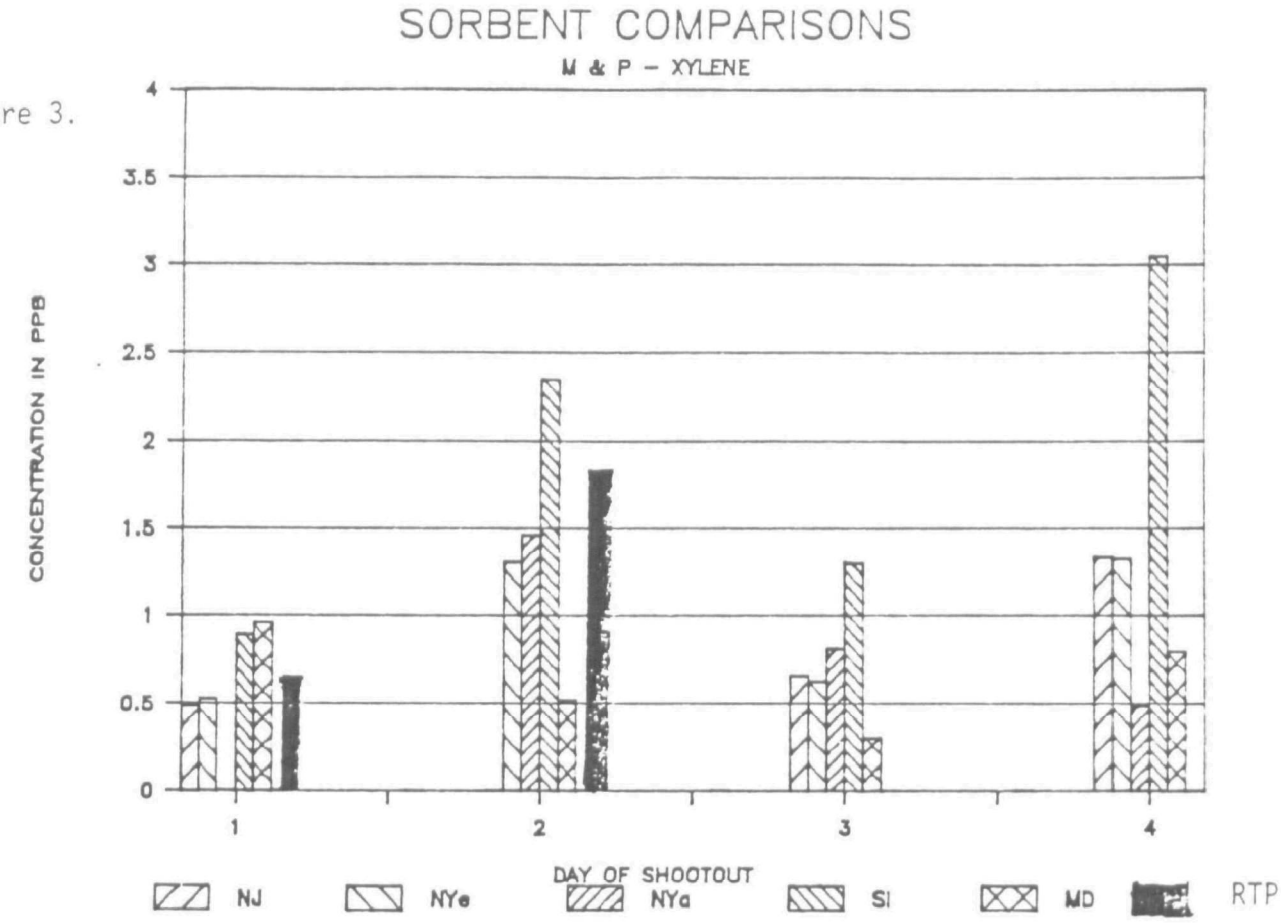
	NJIT TENAX AVERAGE 2-TUBES	NYSDEC ENVIROCHEM AVERAGE 2-TUBES	NYSDEC ATD-50 AVERAGE 2-TUBES	CSI TENAX AVERAGE 2-TUBES	UMDNJ TENAX AVERAGE 2-TUBES	TEXAS A&M TENAX 2 TUBE AVERAGE	EPA/RTP TENAX 4-TUBE AVERAGE
DAY # 1	0.49	0.53	N/S	0.90	0.96	N/R	0.61
DAY # 2	N/S	1.31	1.47	2.35	0.52	N/R	1.84
DAY # 3	0.66	0.63	0.82	1.30	0.30	N/R	N/S
DAY # 4	1.34	1.33	0.49	3.05	0.80	N/R	N/S

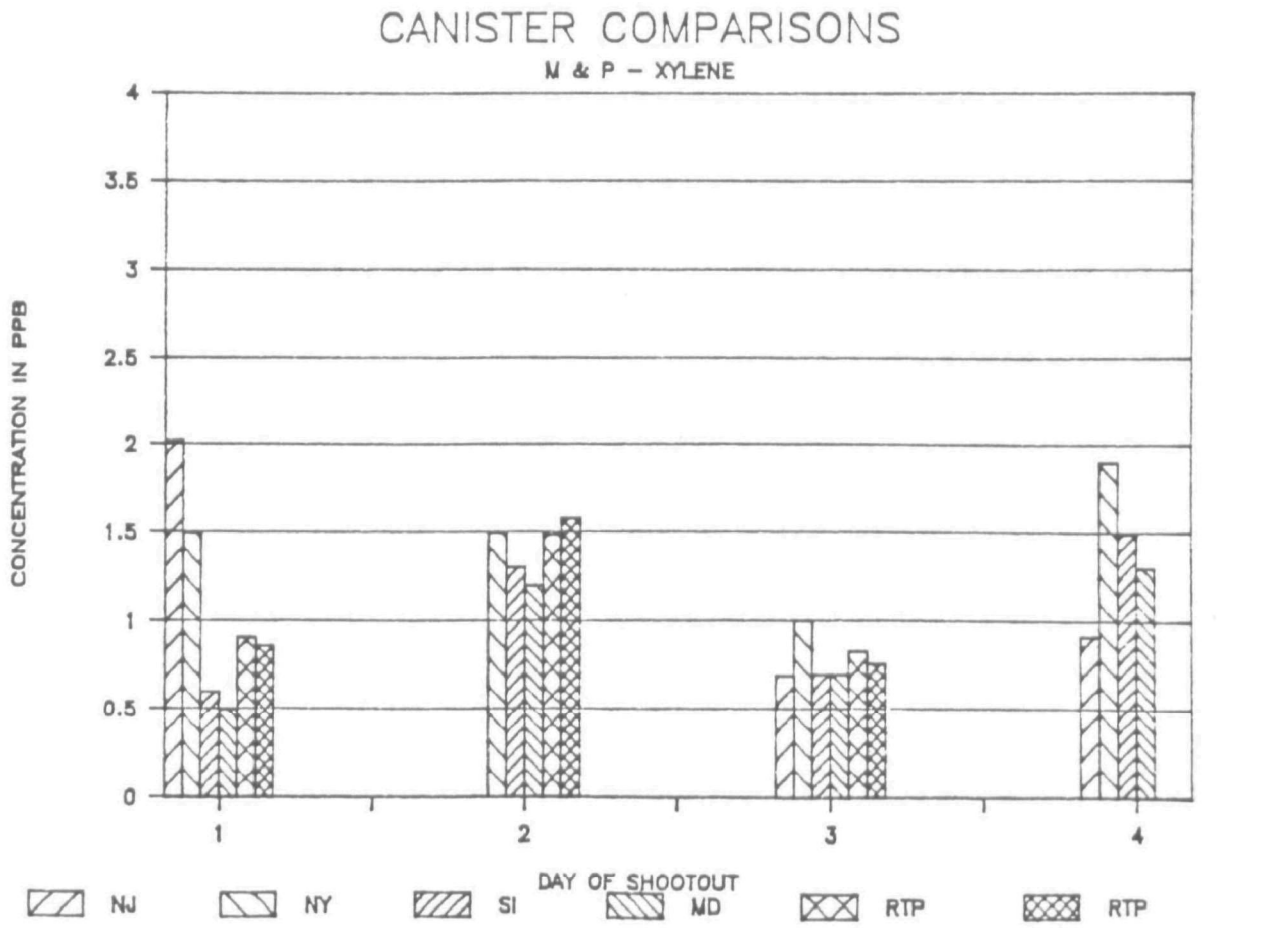
CANISTERS: M & P - XYLENE

	NJIT CANISTER	NYSDEC PEI CANISTER	CSI PEI CANISTER	UMDNJ PEI CANISTER	EPA/RTP CAN 1	EPA/RTP CAN 2	GRAND MEAN
DAY # 1	2.02	1.50	0.60	0.50	0.91	0.86	0.90
DAY # 2	N/S	1.50	1.30	1.20	1.49	1.58	1.46
DAY # 3	0.69	1.00	0.70	0.70	0.83	0.76	0.76
DAY # 4	0.92	1.90	1.50	1.30	N/S	N/S	1.40

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Figure 3.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 4.

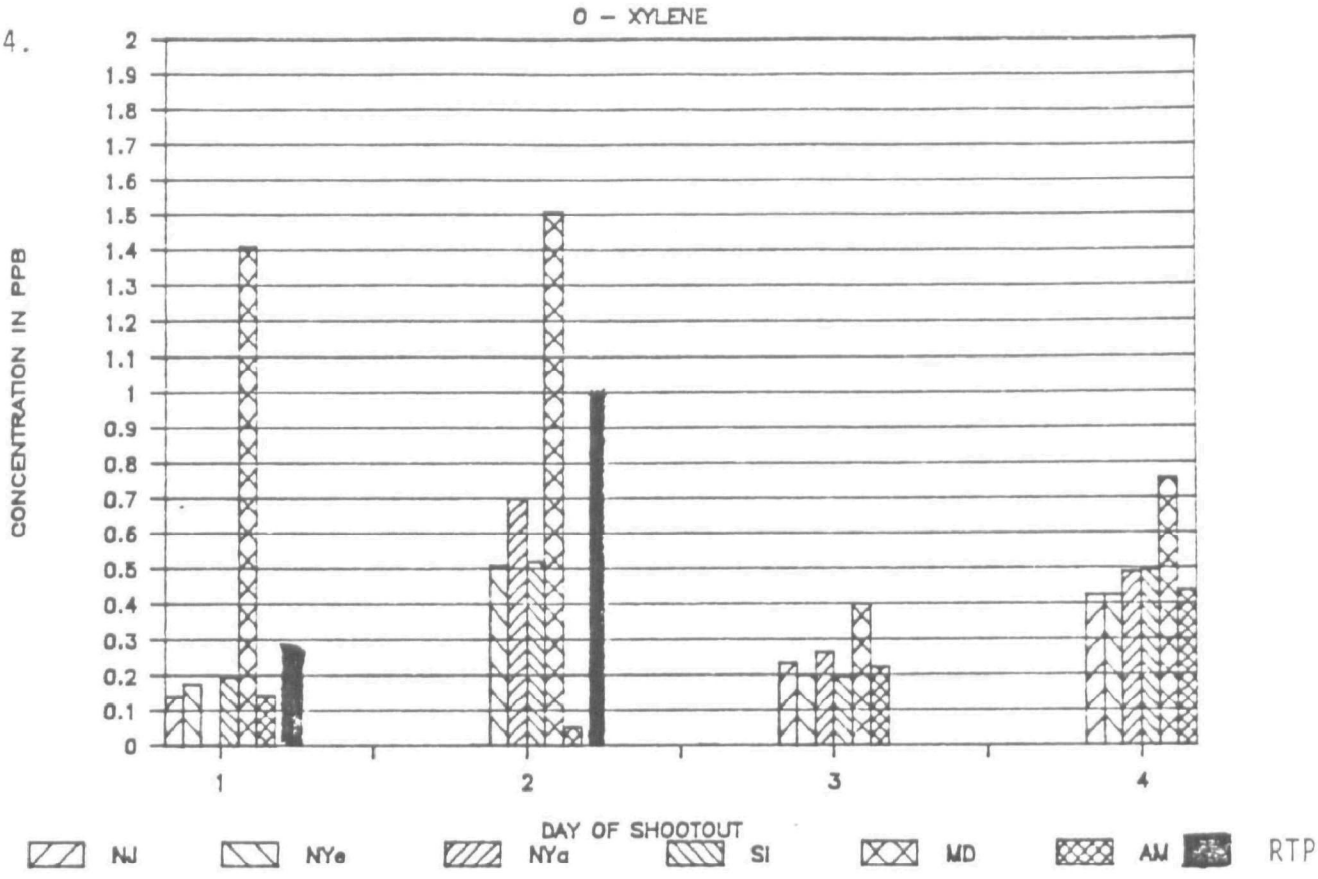
SORBENT TUBES:	O - XYLENE						
	NJIT TENAX AVERAGE 2-TUBES	NYSDEC ENVIROCHEM AVERAGE 2-TUBES	NYSDEC ATD-50 AVERAGE 2-TUBES	CSI TENAX AVERAGE 2-TUBES	UMDNJ TENAX AVERAGE 2-TUBES	TEXAS A&M TENAX 2 TUBE AVERAGE	EPA/RTP TENAX 4-TUBE AVERAGE
DAY # 1	0.14	0.18	N/S	0.20	1.41	0.14	0.28
DAY # 2	N/S	0.51	0.70	0.52	1.51	0.05	1.20
DAY # 3	0.24	0.20	0.27	0.20	0.40	0.22	N/S
DAY # 4	0.43	0.43	0.49	0.50	0.76	0.44	N/S

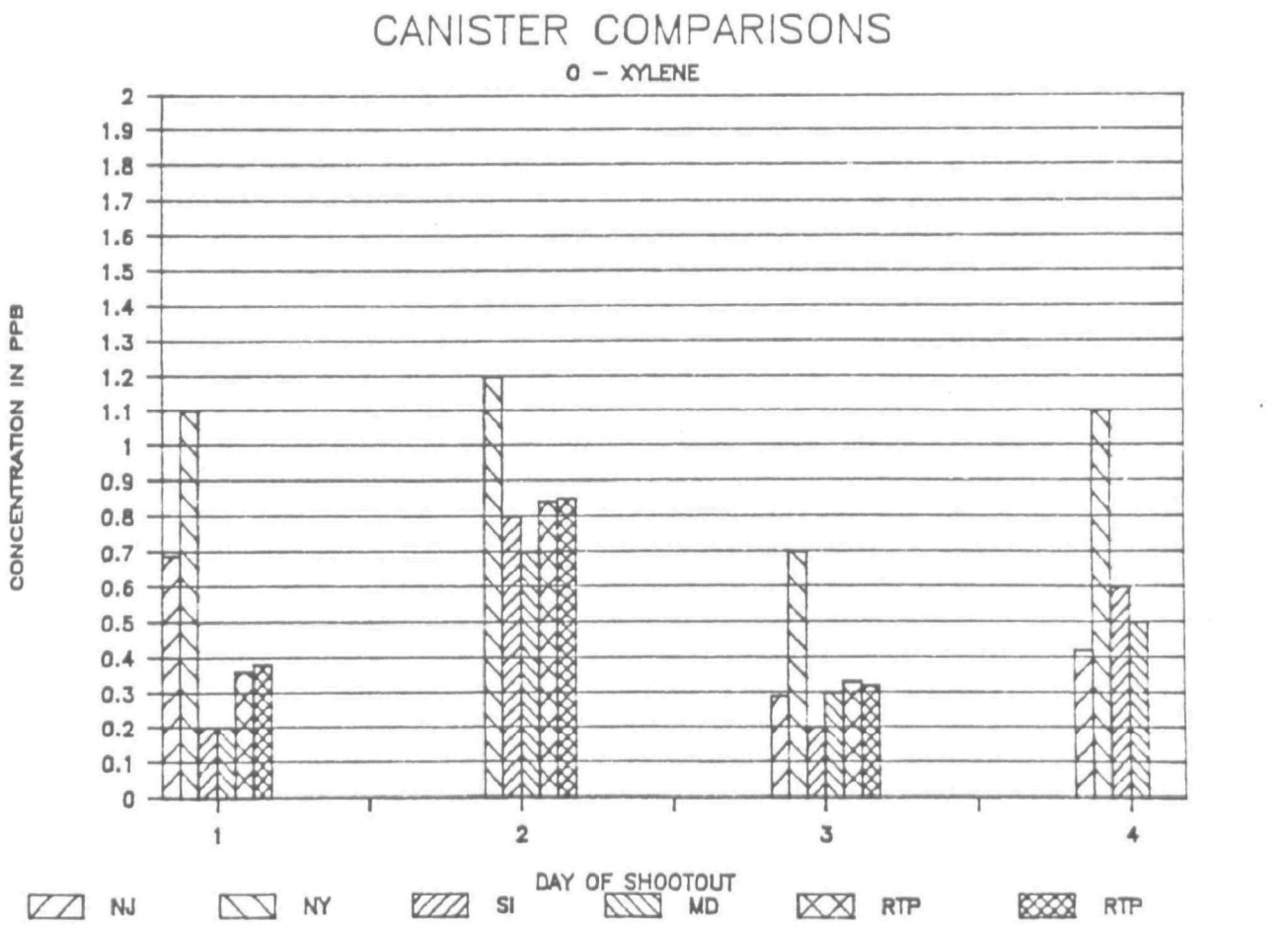
CANISTERS:	O - XYLENE						
	NJIT CANISTER	NYSDEC PEI CANISTER	CSI PEI CANISTER	UMDNJ PEI CANISTER	EPA/RTP CAN 1	EPA/RTP CAN 2	GRAND MEAN
DAY # 1	0.69	1.10	0.20	0.20	0.36	0.38	0.44
DAY # 2	N/S	1.20	0.80	0.70	0.84	0.85	0.81
DAY # 3	0.29	0.70	0.20	0.30	0.33	0.32	0.31
DAY # 4	0.42	1.10	0.60	0.50	N/S	N/S	0.57

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 4.

Figure 4.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 5.

SORBENT TUBES: DICHLOROMETHANE

	NJIT TENAX AVERAGE 2-TUBES	NYSDEC ENVIROCHEM AVERAGE 2-TUBES	NYSDEC ATD-50 AVERAGE 2-TUBES	CSI TENAX LOW FLOW TUBE	UMDNJ TENAX AVERAGE 2-TUBES	TEXAS A&M TENAX 2 TUBE AVERAGE	EPA/RTP TENAX 4-TUBE AVERAGE
DAY # 1	0.16	0.29	N/S	<0.45	>4.94	0.11	0.11
DAY # 2	N/S	0.83	0.46	0.43	0.11 *	0.02 *	0.10
DAY # 3	0.58	0.48	0.52	<0.60	<0.02	0.28	N/S
DAY # 4	1.62	0.44	0.68	0.43	<0.02	0.79	N/S

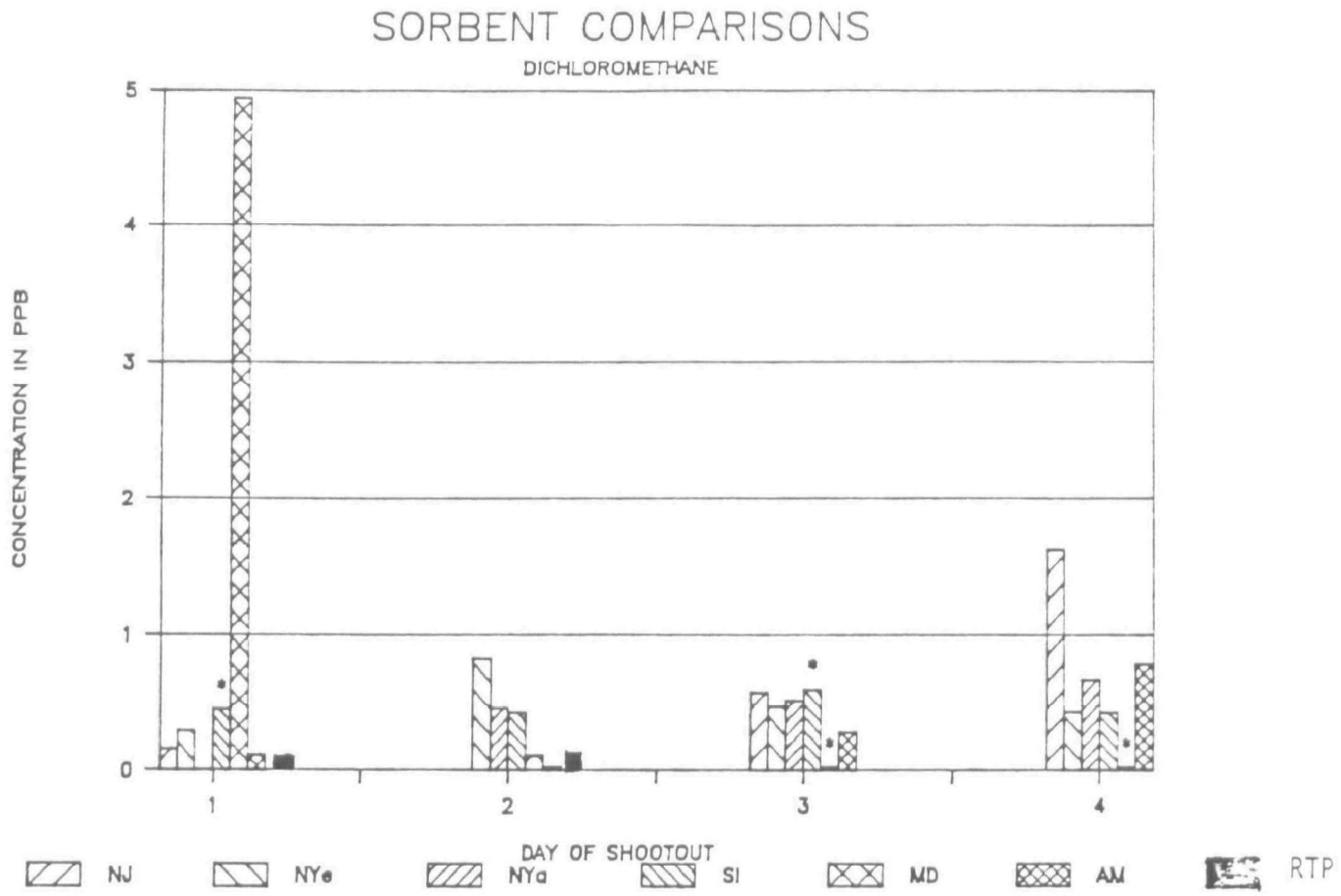
CANISTERS: DICHLOROMETHANE

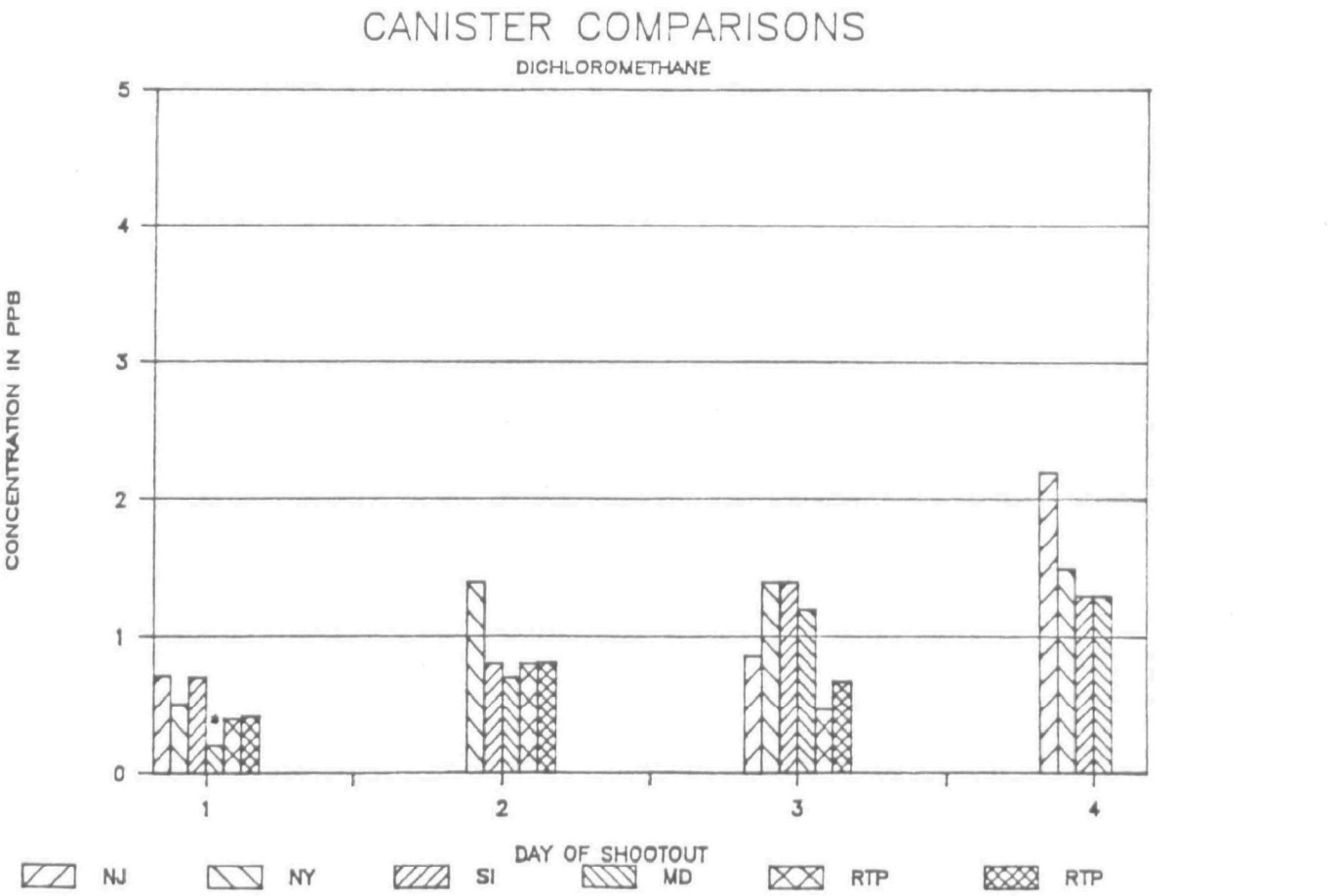
	NJIT CANISTER	NYSDEC PEI CANISTER	CSI PEI CANISTER	UMDNJ PEI CANISTER	EPA/RTP CAN 1	EPA/RTP CAN 2	GRAND MEAN
DAY # 1	0.71	0.50	0.70	<0.2	0.39	0.41	0.83
DAY # 2	N/S	1.40	0.80	0.70	0.80	0.81	0.59
DAY # 3	0.86	1.40	1.40	1.20	0.46	0.67	0.79
DAY # 4	2.20	1.50	1.30	1.30	N/S	N/S	1.14

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 5.

Figure 5.





* = Reported below MDL, therefore MDL is shown

Table 6.

SORBENT TUBES: CARBON TETRACHLORIDE

	NJIT	NYSDEC	NYSDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	ENVIROCHEM AVERAGE 2-TUBES	ATD-50 AVERAGE 2-TUBES	LOW FLOW TUBE	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY # 1	0.19	0.07	N/S	0.19	0.34 *	0.11	0.35
DAY # 2	N/S	0.12	0.11	0.08	<0.24	0.02	0.19
DAY # 3	0.13	0.05	<0.03	0.04	<0.26	0.11	N/S
DAY # 4	0.40	0.05	<0.03	0.05	<0.28	0.44	N/S

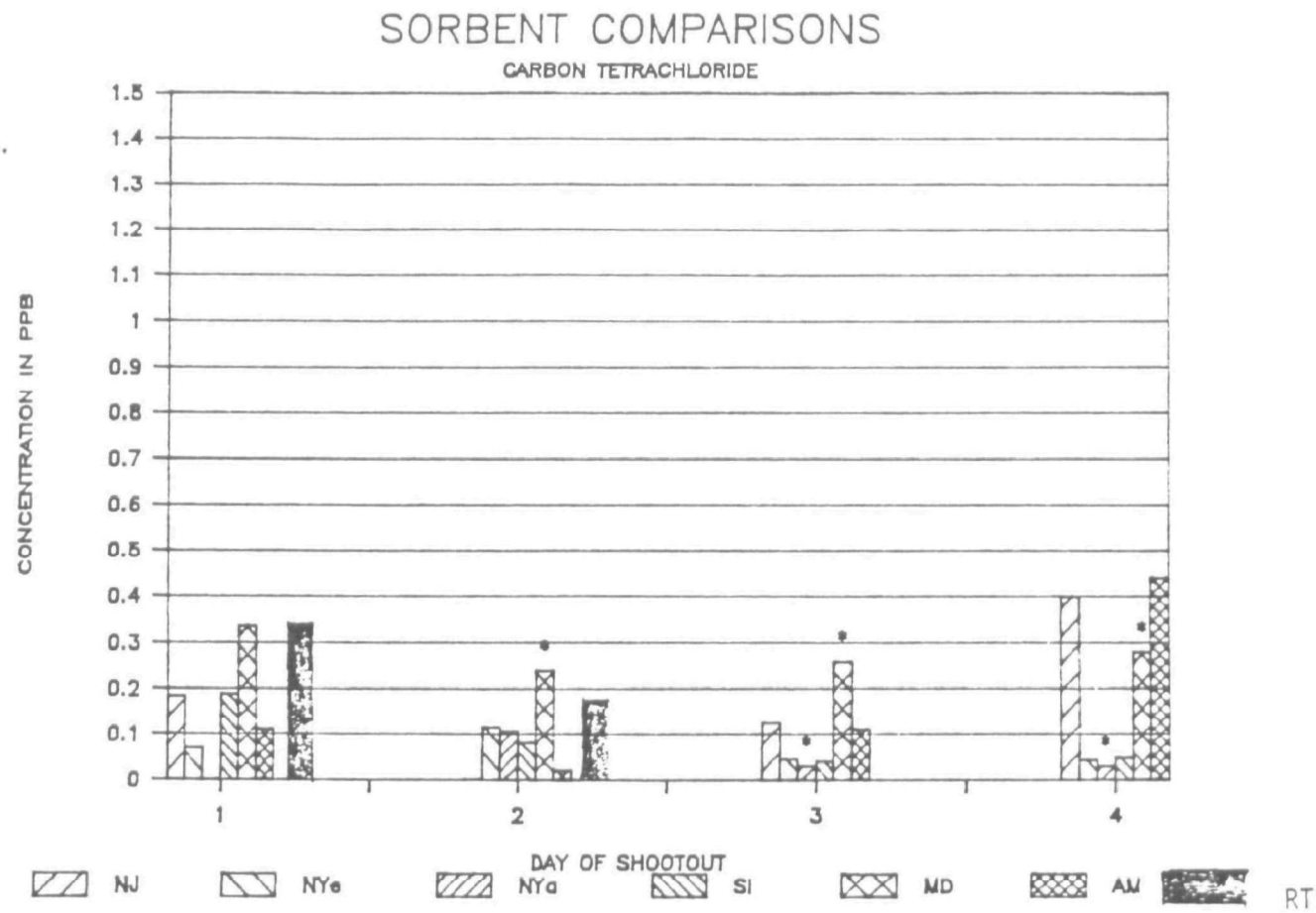
CANISTERS: CARBON TETRACHLORIDE

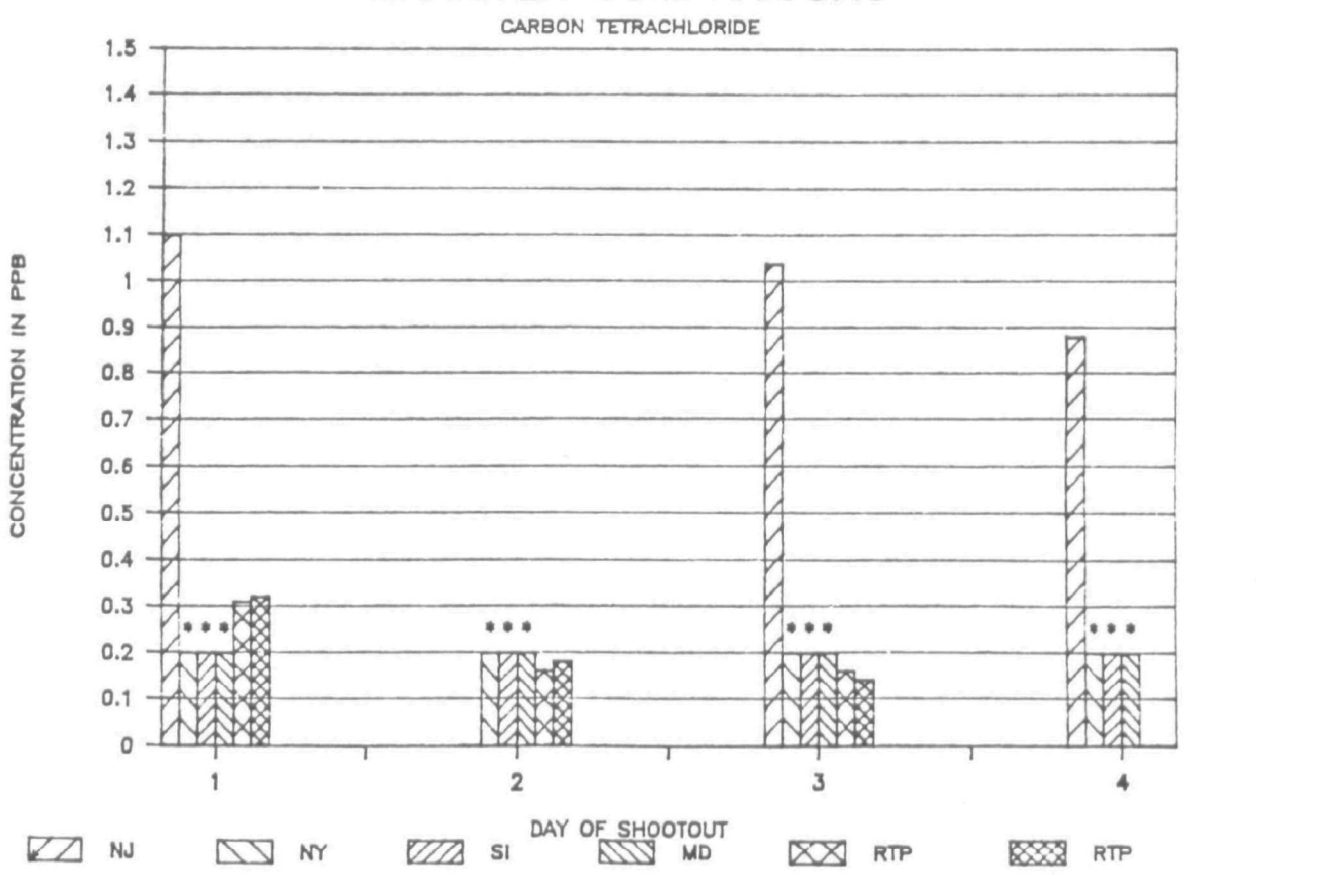
	NJIT	NYSDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	
	CANISTER	PEI CANISTER	PEI CANISTER	PEI CANISTER	CAN 1	CAN 2	GRAND MEAN
DAY # 1	1.10	<0.2	<0.2	<0.2	0.31	0.32	0.30
DAY # 2	N/S	<0.2	<0.2	<0.2	0.16	0.18	0.12
DAY # 3	1.04	<0.2	<0.2	<0.2	0.16	0.14	0.24
DAY # 4	0.88	<0.2	<0.2	<0.2	N/S	N/S	0.36

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 6.

Figure 6.





* = Reported below MDL, therefore MDL is shown

Table 7.

SORBENT TUBES: 1,1,1-TRICHLOROETHANE

	NJIT	NYSDEC	NYSDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	ENVIROCHEM AVERAGE 2-TUBES	ATD-50 AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY # 1	0.21	0.19	N/S	0.17	<0.26	0.36	0.38
DAY # 2	N/S	0.51	0.07	0.53	<0.24	0.07	1.71
DAY # 3	0.29	0.21	<0.03	0.22	<0.29	0.43	N/S
DAY # 4	0.57	0.48	0.02	0.41	<0.26	0.67	N/S

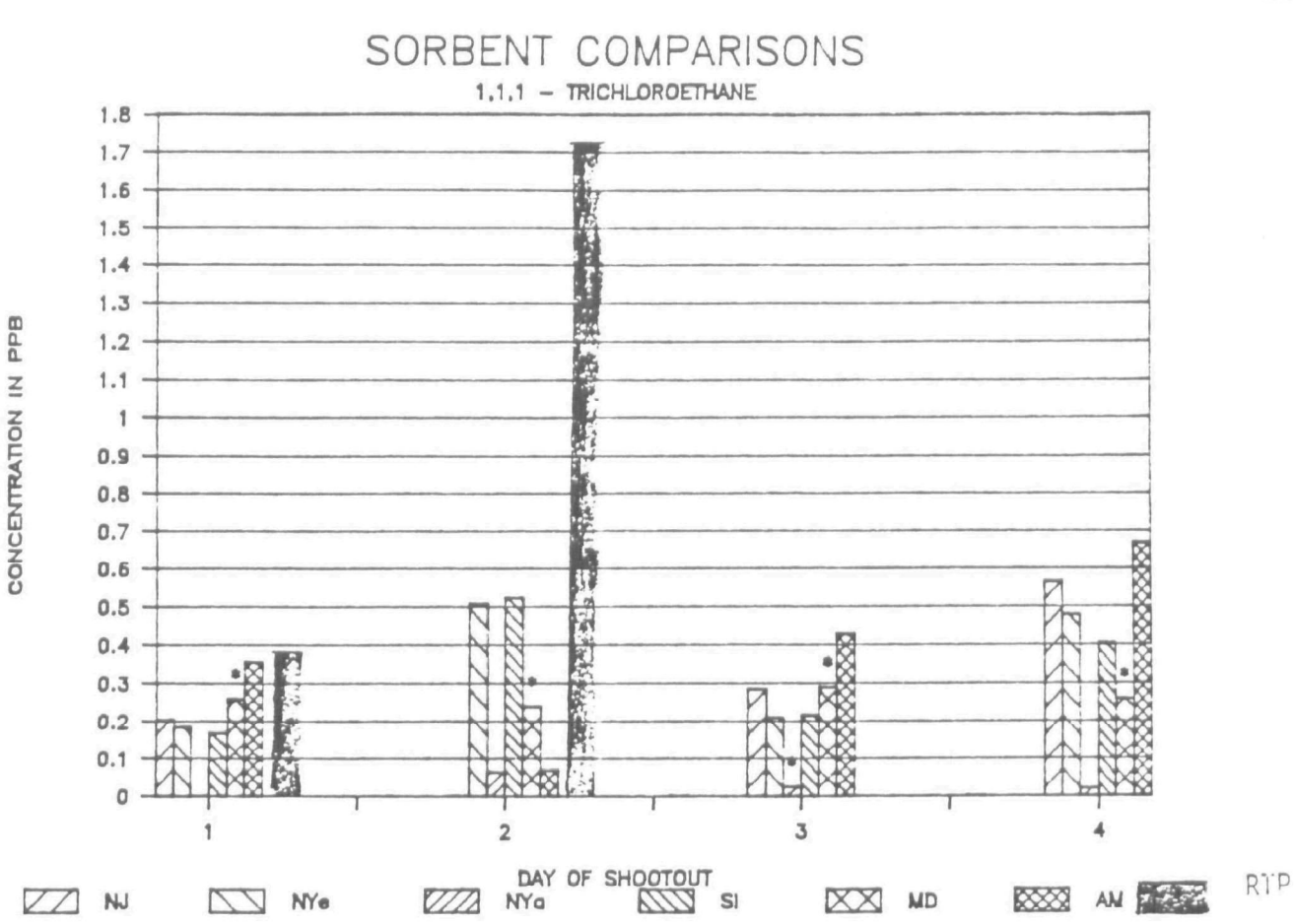
CANISTERS: 1,1,1-TRICHLOROETHANE

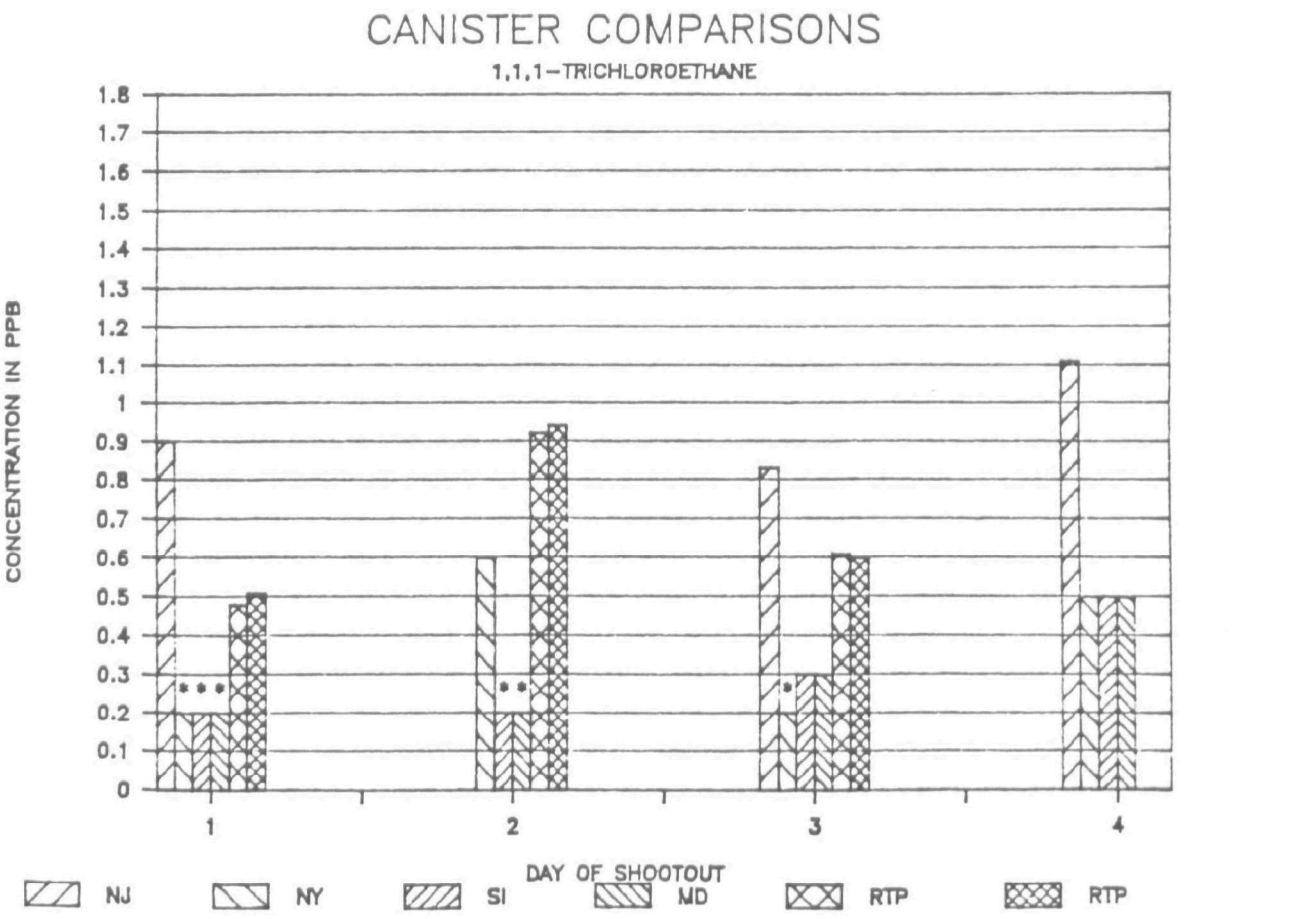
	NJIT	NYSDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	
	CANISTER	PEI CANISTER	PEI CANISTER	PEI CANISTER	CAN 1	CAN 2	GRAND MEAN
DAY # 1	0.90	<0.20	<0.20	<0.20	0.48	0.51	0.40
DAY # 2	N/S	0.60	<0.20	<0.20	0.92	0.94	0.66
DAY # 3	0.83	<0.20	0.30	0.30	0.61	0.60	0.42
DAY # 4	1.11	0.50	0.50	0.50	N/S	N/S	0.53

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 7.

Figure 7.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 8.

SORBENT TUBES: TETRACHLOROETHENE

	NJIT	NYSDEC	NYSDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	ENVIROCHEM AVERAGE 2-TUBES	ATD-50 AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY # 1	0.19	0.12	N/S	0.25	0.32	0.12	0.22
DAY # 2	N/S	0.31	0.36	0.56	<0.27	0.04	0.74
DAY # 3	0.18	0.13	0.12	0.17	<0.33	0.32	N/S
DAY # 4	0.33	0.22	0.22	0.47	<0.30	0.30	N/S

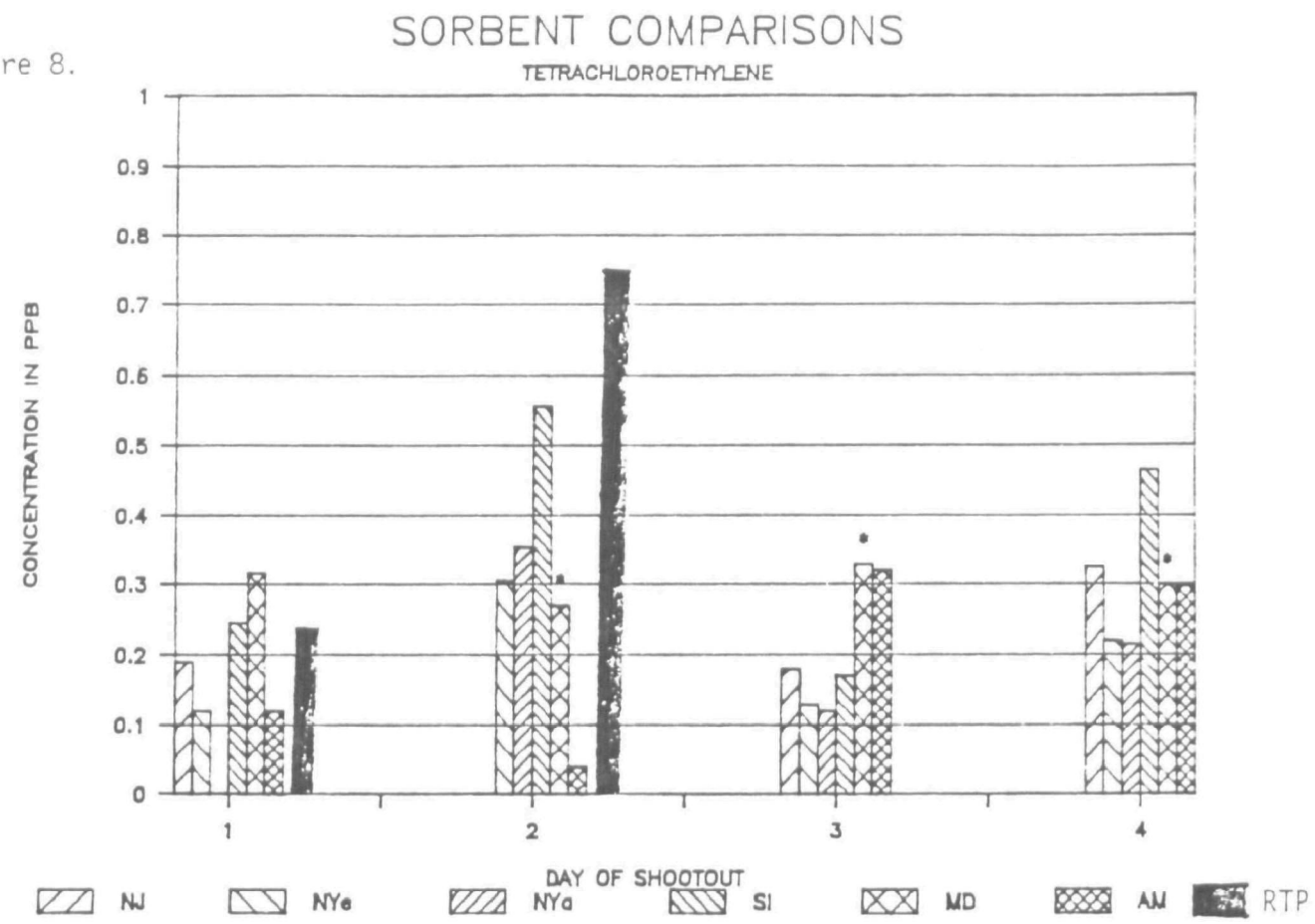
CANISTERS: TETRACHLOROETHENE

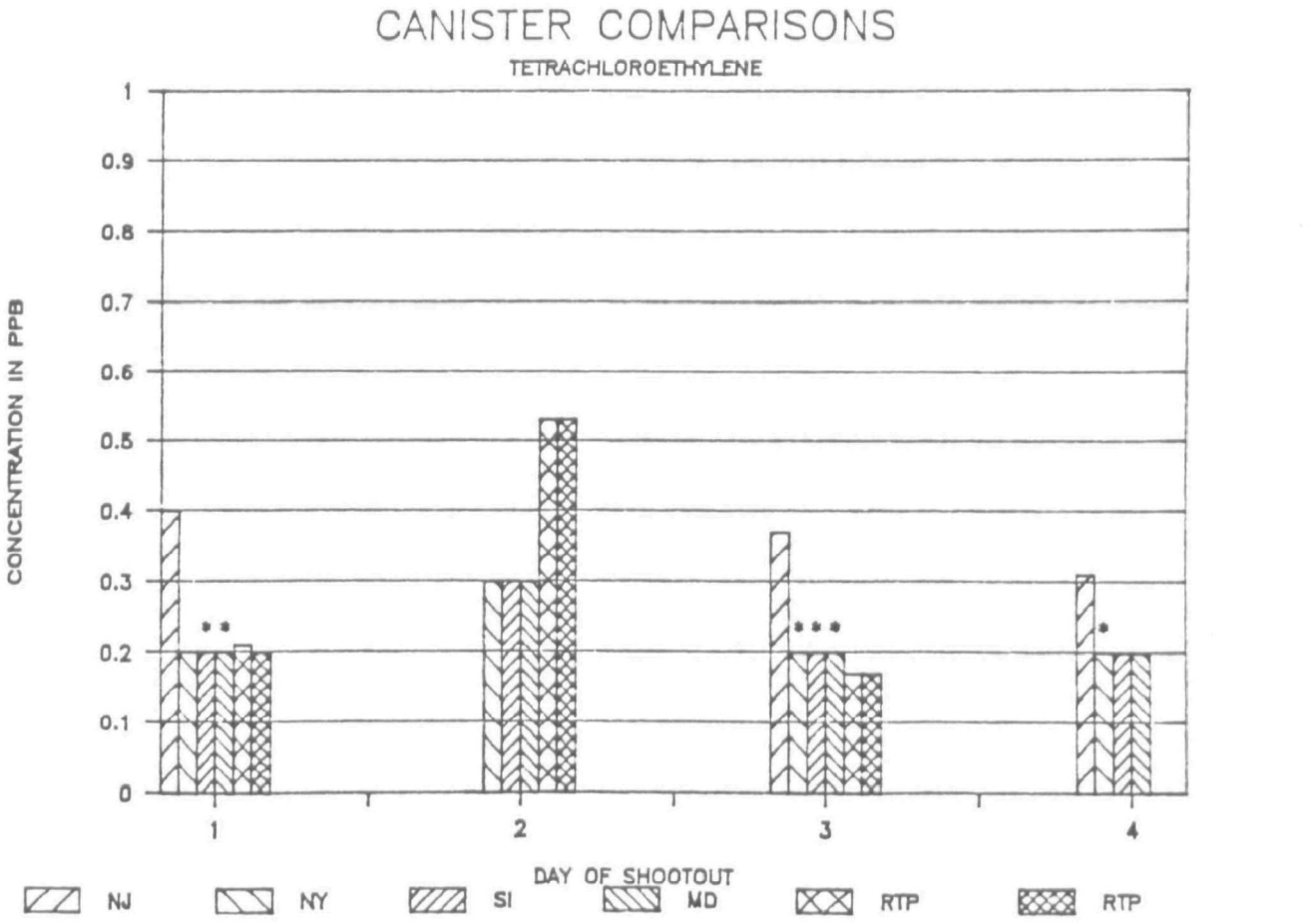
	NJIT	NYSDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	
	CANISTER	PEI CANISTER	PEI CANISTER	PEI CANISTER	CAN 1	CAN 2	GRAND MEAN
DAY # 1	0.40	0.20	<0.20	<0.20	0.21	0.20	0.22
DAY # 2	N/S	0.30	0.30	0.30	0.53	0.53	0.40
DAY # 3	0.37	<0.20	<0.20	<0.20	0.17	0.17	0.20
DAY # 4	0.31	<0.20	0.20	0.20	N/S	N/S	0.28

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED*
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 8.

Figure 8.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 9.

SORBENT TUBES: ETHYL BENZENE

	NJIT TENAX AVERAGE 2-TUBES	NYSDEC ENVIROCHEM AVERAGE 2-TUBES	NYSDEC ATD-50 AVERAGE 2-TUBES	CSI TENAX AVERAGE 2-TUBES	UMDNJ TENAX AVERAGE 2-TUBES	TEXAS A&M TENAX 2 TUBE AVERAGE	EPA/RTP TENAX 4-TUBE AVERAGE
DAY # 1	N/R	0.07	N/S	0.18	0.40	N/R	0.18
DAY # 2	N/R	0.21	0.36	0.72	0.24	N/R	0.51
DAY # 3	N/R	0.10	0.11	0.41	<0.22	N/R	N/S
DAY # 4	N/R	0.26	0.22	0.93	<0.21	N/R	N/S

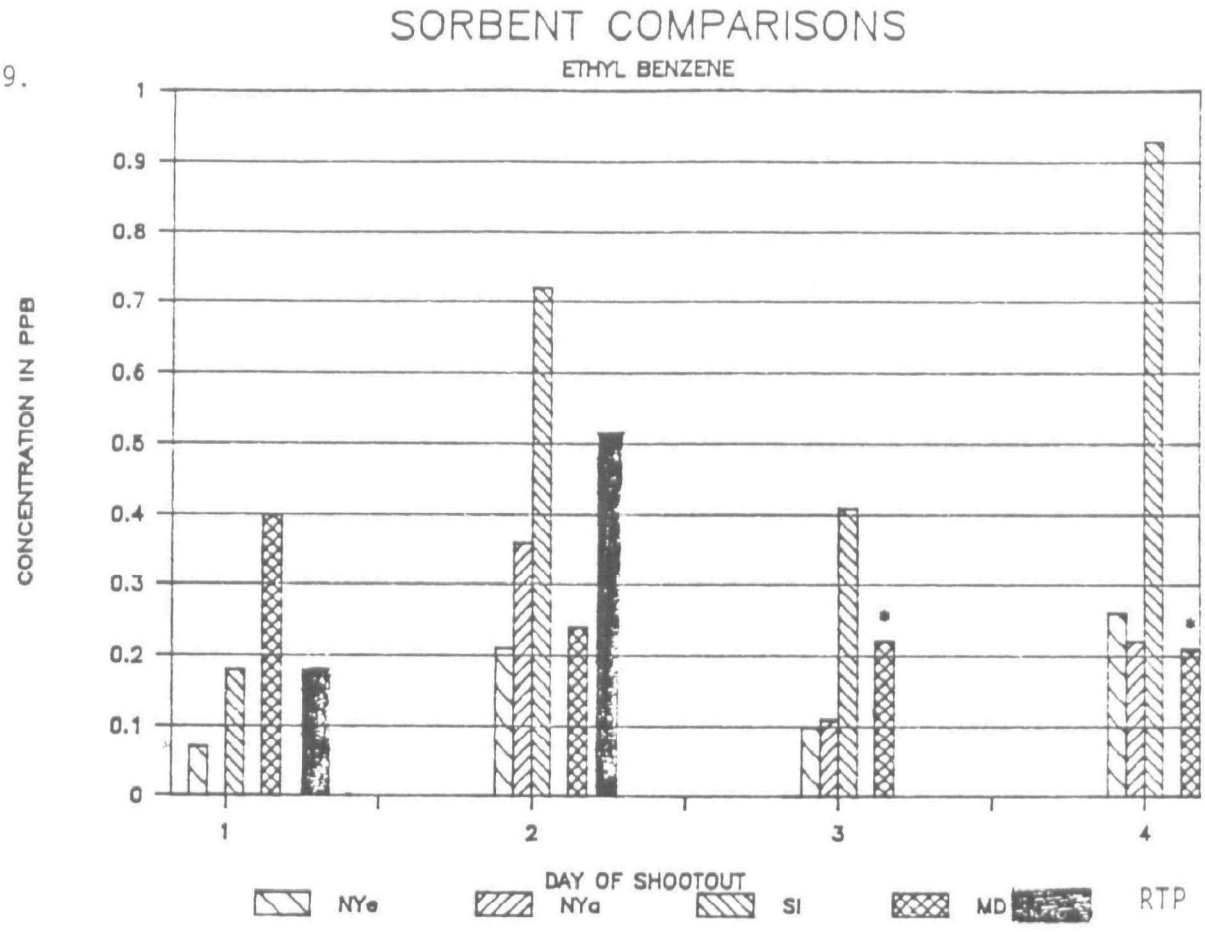
CANISTERS: ETHYL BENZENE

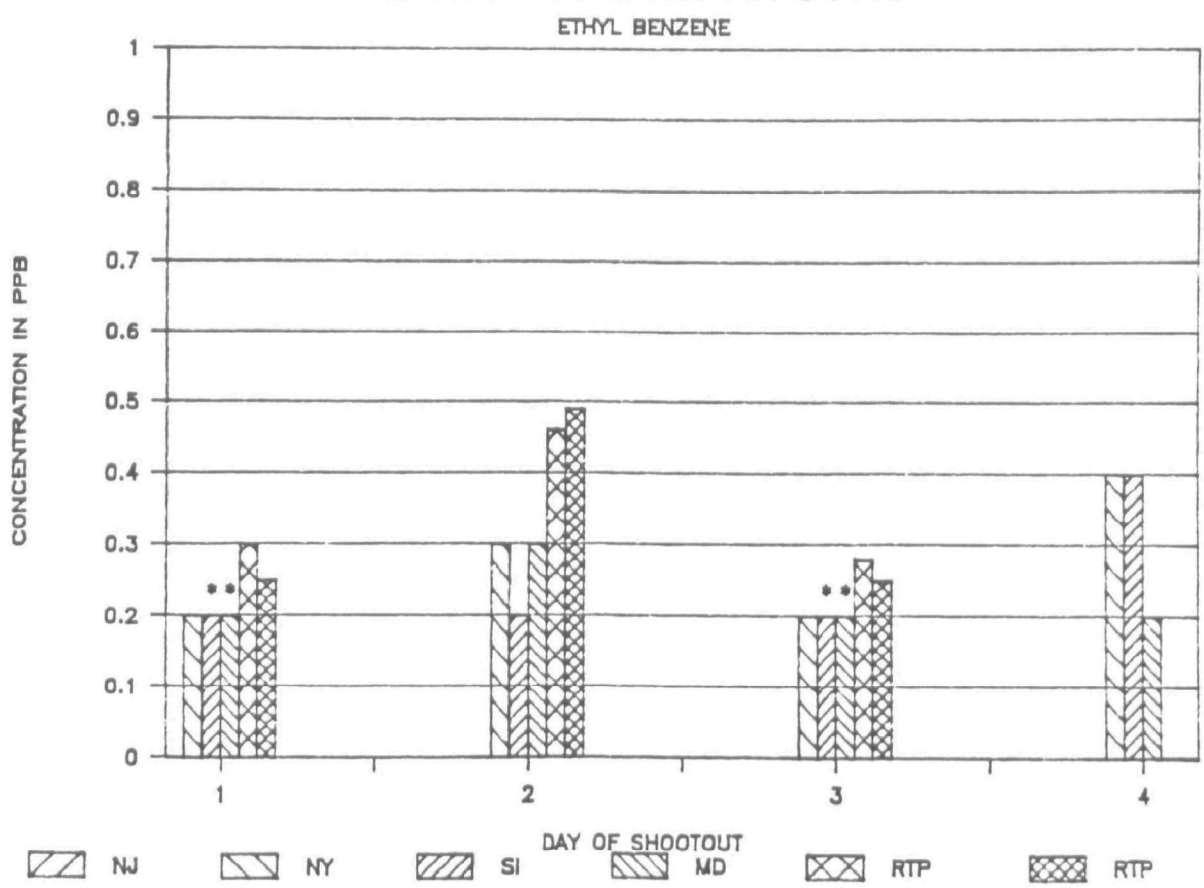
	NJIT CANISTER	NYSDEC PEI CANISTER	CSI PEI CANISTER	UMDNJ PEI CANISTER	EPA/RTP CAN 1	EPA/RTP CAN 2	GRAND MEAN
DAY # 1	N/R	0.20	<0.20	<0.20	0.30	0.25	0.23
DAY # 2	N/R	0.30	0.20	0.30	0.46	0.49	0.38
DAY # 3	N/R	0.20	<0.20	<0.20	0.28	0.25	0.23
DAY # 4	N/R	0.40	0.40	0.20	N/S	N/S	0.40

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = *ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED*

Table 9.

Figure 9.





* = Reported below MDL, therefore MDL is shown

Table 10.

SORBENT TUBES: TRICHLOROETHYLENE

	NJIT	NYSDEC	NYSDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	ENVIROCHEM AVERAGE 2-TUBES	ATD-50 AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY # 1	0.03	<0.01	N/S	0.02	<0.23	N/R	0.10
DAY # 2	N/S	0.03	0.07	0.08	<0.20	N/R	0.16
DAY # 3	0.04	<0.01	0.03	0.02	<0.24	N/R	N/S
DAY # 4	0.06	0.03	0.02	0.07	<0.23	N/R	N/S

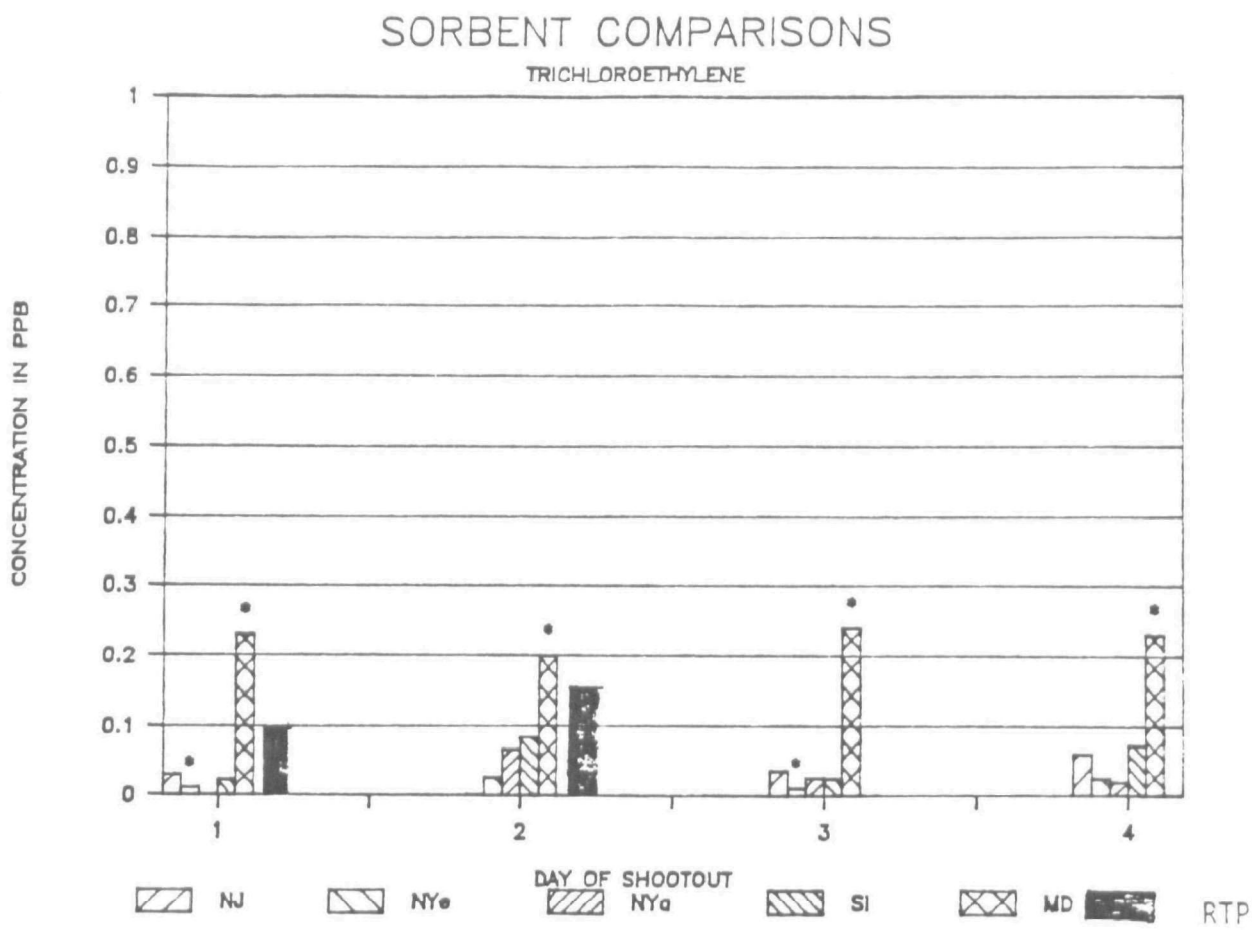
CANISTERS: TRICHLOROETHYLENE

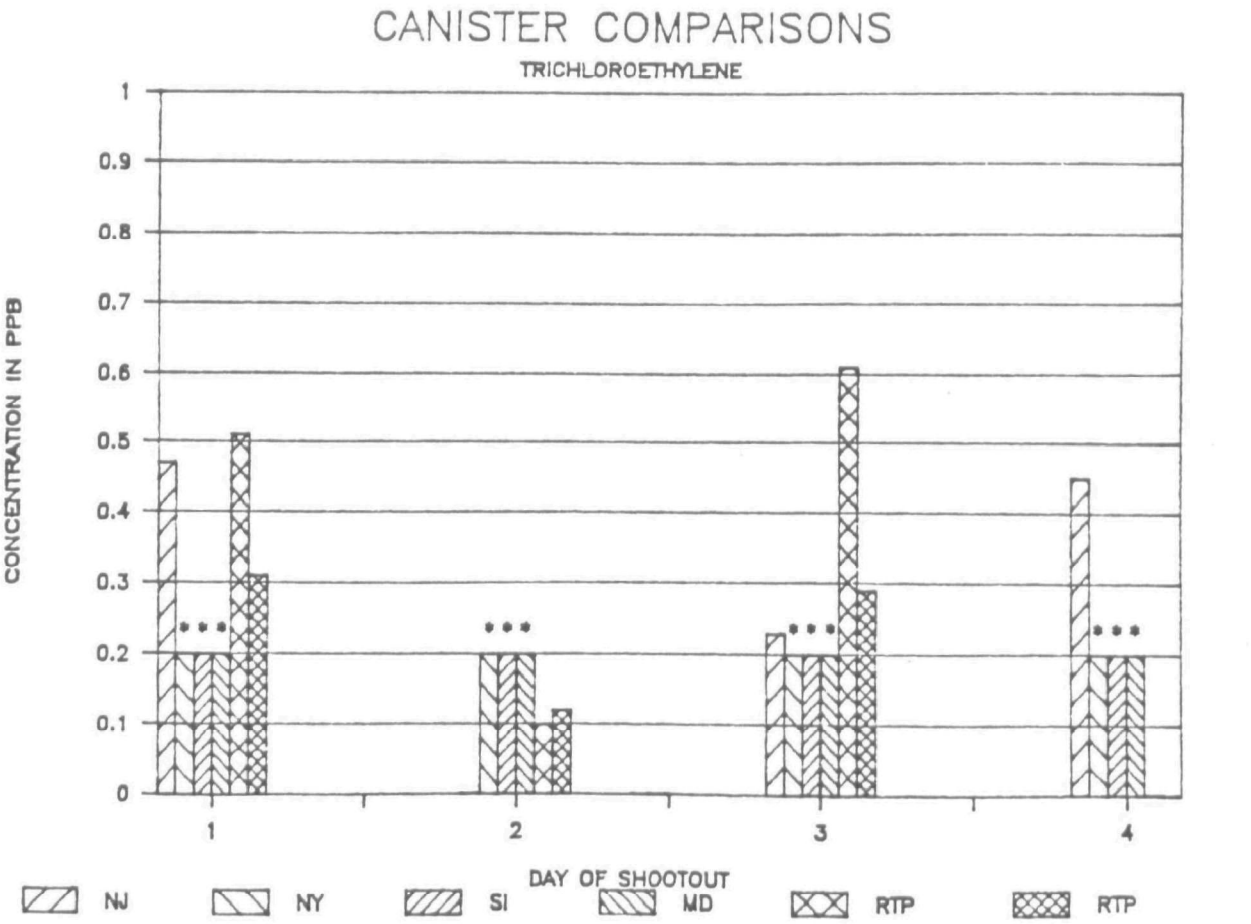
	NJIT	NYSDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	
	CANISTER	PEI CANISTER	PEI CANISTER	PEI CANISTER	CAN 1	CAN 2	GRAND MEAN
DAY # 1	0.47	<0.20	<0.20	<0.20	0.51	0.31	0.24
DAY # 2	N/S	<0.20	<0.20	<0.20	0.10	0.12	0.09
DAY # 3	0.23	<0.20	<0.20	<0.20	0.61	0.29	0.20
DAY # 4	0.45	<0.20	<0.20	<0.20	N/S	N/S	0.13

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Table 10.

Figure 10.





* = Reported below MDL, therefore MDL is shown

SHOOTOUT #2 ALL CONCENTRATIONS REPORTED IN PPB

Table 11.

SORBENT TUBES: CHLOROFORM

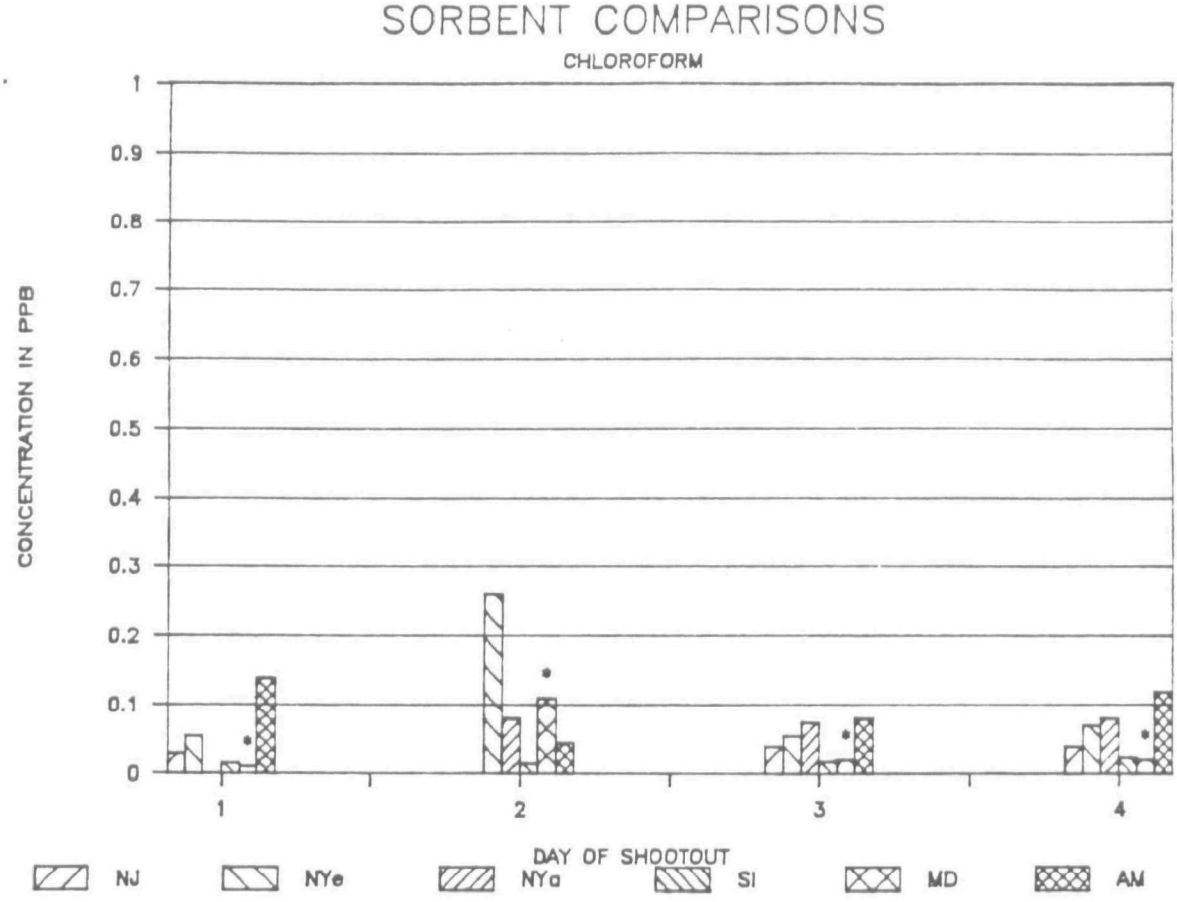
	NJIT	NYSDEC	NYSDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	ENVIROCHEM AVERAGE 2-TUBES	ATD-50 AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY # 1	0.03	0.06	N/S	0.02	<0.01	0.14	N/R
DAY # 2	N/S	0.26	0.08	0.01	<0.11	0.05	N/R
DAY # 3	0.04	0.06	0.08	0.02	<0.02	0.08	N/R
DAY # 4	0.04	0.07	0.08	0.02	<0.02	0.12	N/R

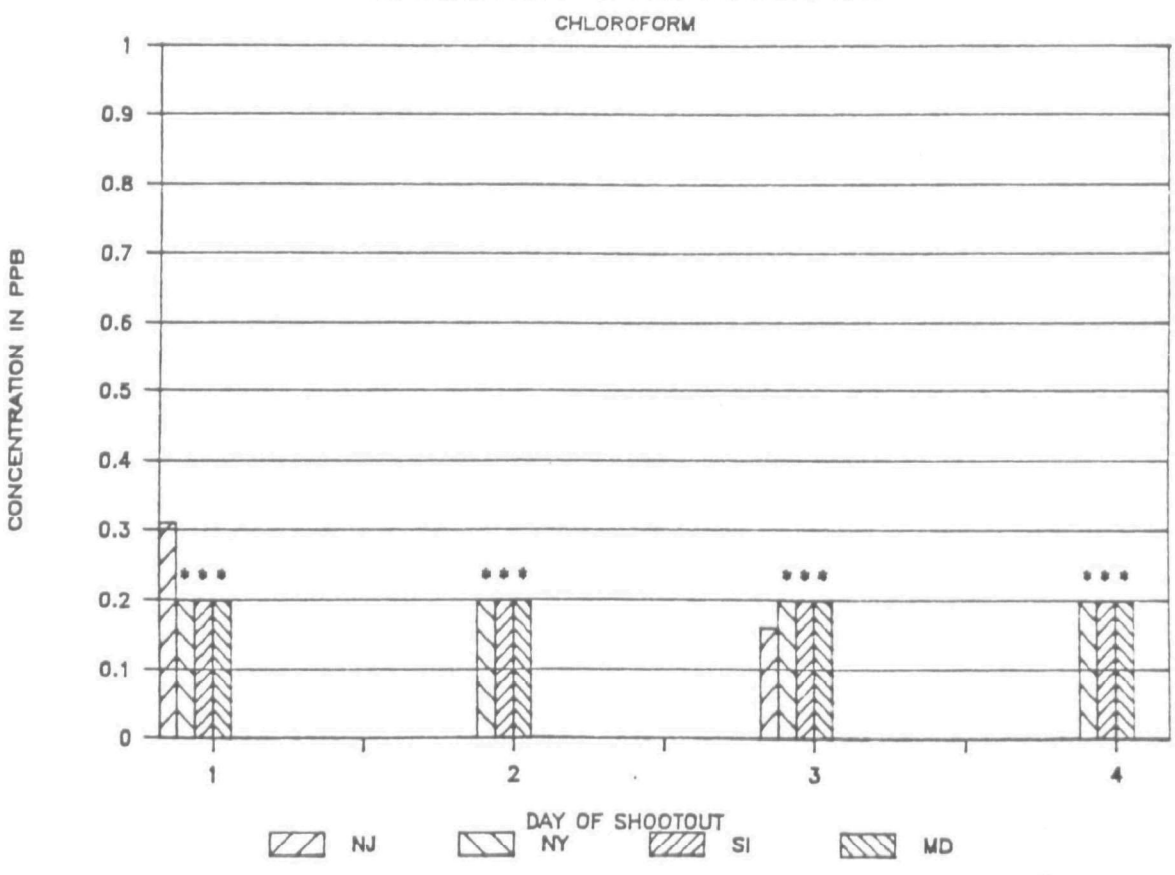
CANISTERS: CHLOROFORM

	NJIT	NYSDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	
	CANISTER	PEI CANISTER	PEI CANISTER	PEI CANISTER	CAN 1	CAN 2	GRAND MEAN
DAY # 1	0.31	<0.2	<0.2	<0.2	N/R	N/R	0.19
DAY # 2	N/S	<0.2	<0.2	<0.2	N/R	N/R	0.10
DAY # 3	0.16	<0.2	<0.2	<0.2	N/R	N/R	0.07
DAY # 4	0.00	<0.2	<0.2	<0.2	N/R	N/R	0.06

KEY: < = BELOW MDL, THEREFORE MDL REPORTED
N/S = NO SAMPLE TAKEN
N/R = SAMPLE TAKEN, COMPOUND NOT REPORTED
* = ONE OF THE TWO TUBES WAS BELOW THE MDL AND DISQUALIFIED

Figure 11.





7- 128

* = Reported below MDL, therefore MDL is shown

Table 12.

% DIFFERENCE FROM THE MEAN BENZENE

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	LOW FLOW	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	TUBE ONLY	2-TUBES	AVERAGE	AVERAGE
DAY 1	-6.15	-84.62	N/A	-20.00	48.46	-72.62	52.69
DAY 2	N/A	25.85	53.72	7.87	MDL	-96.94	20.46
DAY 3	1.22	-34.76	91.46	-59.76	MDL	-60.73	N/A
DAY 4	0.37	-26.21	50.40	-37.90	MDL	-59.40	N/A
AVERAGE	-1.52	-29.94	65.19	-27.45	48.46	-72.42	36.58

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	MEAN
		PEI	PEI	PEI			POLLUTANT
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	CONC. (PPB)
DAY 1	113.85	-38.46	-7.69	-38.46	24.62	26.15	0.65
DAY 2	N/S	-10.10	-10.10	-10.10	9.67	9.67	1.11
DAY 3	59.76	-2.44	-2.44	-2.44	3.66	-1.22	0.82
DAY 4	31.45	12.90	20.97	4.84	N/S	N/S	1.24
AVERAGE	68.35	-9.52	0.18	-11.54	12.65	11.53	0.96

Table 13.

% DIFFERENCE FROM THE MEAN TOLUENE

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	-11.22	-53.83	N/A	23.72	-26.94	-42.86	-6.63
DAY 2	N/A	-6.20	-3.39	18.68	MDL	-82.64	12.81
DAY 3	15.44	-35.52	-9.07	6.18	MDL	-27.80	N/A
DAY 4	22.99	-24.83	-12.41	24.13	MDL	-4.02	N/A
AVERAGE	9.07	-30.10	-8.29	18.17	-26.94	-39.30	3.09

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	MEAN
		PEI	PEI	PEI			POLLUTANT
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	CONC. (PPB)
DAY 1	179.08	2.04	-8.16	-48.98	-2.04	-2.55	1.96
DAY 2	N/S	7.20	9.75	-0.46	20.72	23.28	3.92
DAY 3	54.83	4.25	-3.47	-3.47	2.32	-1.93	2.59
DAY 4	-22.03	17.13	8.39	-9.09	N/S	N/S	5.72
AVERAGE	70.60	7.70	1.70	15.50	7.00	6.30	3.55

Table 14

% DIFFERENCE FROM THE MEAN M/P - XYLENE

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	-45.56	-41.11	N/A	-0.56	6.67	N/R	-32.78
DAY 2	N/A	-10.62	0.34	60.96	-64.16	N/R	26.20
DAY 3	-13.16	-17.11	7.24	71.05	-60.20	N/R	N/A
DAY 4	-4.64	-5.36	-65.00	117.86	-42.82	N/R	N/A
AVERAGE	-21.10	-18.60	-19.10	62.30	-40.10		-3.29

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	MEAN
							POLLUTANT
		PEI	PEI	PEI			CONC.
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	(PPB)
DAY 1	124.44	66.67	-33.33	-44.44	1.11	-4.44	0.90
DAY 2	N/S	2.74	-10.96	-17.81	2.05	8.22	1.46
DAY 3	-9.21	31.58	-7.89	-7.89	9.21	0.00	0.76
DAY 4	-34.29	35.71	7.14	-7.14	N/S	N/S	1.40
AVERAGE	27.00	34.17	-11.30	-19.30	4.10	1.30	1.13

Table 15.

% DIFFERENCE FROM THE MEAN O - XYLENE

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	-68.18	-60.23	N/A	-55.68	220.45	-67.50	-36.36
DAY 2	N/A	-37.04	-13.58	-35.80	86.17	-93.83	47.84
DAY 3	-24.19	-35.48	-14.52	-37.10	29.11	-27.74	N/A
DAY 4	-25.44	-25.44	-14.04	-13.16	32.81	-23.40	N/A
AVERAGE	-39.30	-39.50	-14.00	-35.40	92.10	-39.25	5.70

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	MEAN
							POLLUTANT
		PEI	PEI	PEI			CONC.
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	(PPB)
DAY 1	56.82	150.00	-54.55	-54.55	-18.18	-13.64	0.44
DAY 2	N/S	48.15	-1.23	-13.58	3.70	4.94	0.81
DAY 3	-6.45	125.81	-35.48	-3.23	6.45	3.23	0.31
DAY 4	-26.32	92.98	5.26	-12.28	N/S	N/S	0.57
AVERAGE	8.01	100.40	-21.50	-20.90	-2.70	-1.80	0.53

Table 16.

% DIFFERENCE FROM THE MEAN DICHLOROMETHANE

	NJIT	NYDEC ENVIROCHEM	NYDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY 1	-81.37	-65.14	N/A	MDL	493.75	-86.78	-87.08
DAY 2	N/A	41.40	-21.64	-27.60	-81.94	-96.59	-82.96
DAY 3	-26.11	-39.49	-33.76	MDL	MDL	-64.33	N/A
DAY 4	42.11	-61.84	-40.79	-62.28	MDL	-30.70	N/A
AVERAGE	21.80	-31.30	-32.10	-44.94	205.90	-69.60	-85.00

	NJIT	NYDEC PEI	CSI PEI	UMDNJ PEI	EPA/RTP	EPA/RTP	MEAN POLLUTANT CONC.
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	(PPB)
DAY 1	-14.66	-39.90	-15.87	MDL	-53.13	-50.72	0.83
DAY 2	N/S	138.50	36.29	19.25	36.29	37.99	0.59
DAY 3	9.55	78.34	78.34	52.87	-41.40	-14.65	0.79
DAY 4	92.98	31.58	14.04	14.04	N/S	N/S	1.14
AVERAGE	37.36	52.10	27.30	28.72	-19.40	-9.10	0.84

Table 17.

% DIFFERENCE FROM THE MEAN CARBON TETRACHLORIDE

	NJIT	NYDEC ENVIROCHEM	NYDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	LOW FLOW TUBE ONLY	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY 1	-36.70	-76.60	N/A	-36.60	13.30	-63.30	16.60
DAY 2	N/A	-4.17	-12.50	-30.83	MDL	-83.33	56.25
DAY 3	-45.83	-79.16	MDL	-83.33	MDL	-54.17	N/A
DAY 4	11.11	-86.11	MDL	-86.11	MDL	22.22	N/A
AVERAGE	-23.19	-61.51	-12.50	-59.22	13.30	-44.65	27.80

	NJIT	NYDEC PEI	CSI PEI	UMDNJ PEI	EPA/RTP	EPA/RTP	MEAN POLLUTANT CONC.
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	(PPB)
DAY 1	266.00	MDL	MDL	MDL	3.30	6.67	0.30
DAY 2	N/S	MDL	MDL	MDL	33.33	50.00	0.12
DAY 3	333.33	MDL	MDL	MDL	-33.33	-41.66	0.24
DAY 4	144.40	MDL	MDL	MDL	N/S	N/S	0.36
AVERAGE	247.91				1.10	5.00	0.26

Table 18.

% DIFFERENCE FROM THE MEAN 1,1,1 - TRICHLOROETHLENE

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	-48.75	-53.75	N/A	-57.50	MDL	-10.17	-5.00
DAY 2	N/A	-22.73	-90.15	-20.45	MDL	-89.39	158.71
DAY 3	-30.95	-0.50	MDL	-47.62	MDL	2.38	N/A
DAY 4	6.60	-9.43	-96.23	-23.58	MDL	26.42	N/A
AVERAGE	-24.37	-21.60	-93.19	-37.28		-17.69	76.80

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	MEAN
		PEI	PEI	PEI			POLLUTANT
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	CONC. (PPB)
DAY 1	125.00	MDL	MDL	MDL	20.00	27.50	0.40
DAY 2	N/S	-9.09	MDL	MDL	39.39	42.42	0.66
DAY 3	97.62	MDL	MDL	MDL	45.24	42.86	0.42
DAY 4	109.43	-5.66	-5.66	-5.66	N/S	N/S	0.53
AVERAGE	110.68	-7.40	-5.70	-5.70	34.88	37.59	0.50

Table 19.

% DIFFERENCE FROM THE MEAN TETRACHLOROETHYLENE

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	-13.64	-45.45	N/A	11.36	43.64	-45.45	-1.14
DAY 2	N/A	-23.75	-11.25	38.75	MDL	-90.00	84.38
DAY 3	-10.00	-35.00	-40.00	-15.00	MDL	60.00	N/A
DAY 4	16.07	-21.43	-23.21	66.07	MDL	6.44	N/A
AVERAGE	-2.50	-31.40	-28.20	25.30	43.60	-17.30	41.60

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP	MEAN
		PEI	PEI	PEI			POLLUTANT
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	CONC. (PPB)
DAY 1	81.82	-9.09	MDL	MDL	-4.55	-9.09	0.22
DAY 2	N/S	-25.00	-25.00	-25.00	32.50	32.50	0.40
DAY 3	85.00	MDL	MDL	MDL	-15.00	-15.00	0.20
DAY 4	10.71	MDL	-28.57	-28.57	N/S	N/S	0.28
AVERAGE	59.20	-17.00	-26.80	-26.80	4.30	2.80	0.28

Table 20.

% DIFFERENCE FROM THE MEAN ETHYL BENZENE

	NJIT	NYDEC ENVIROCHEM	NYDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	AVERAGE 2-TUBES	2 TUBE AVERAGE	4-TUBE AVERAGE
DAY 1	N/R	-69.57	N/A	-21.74	73.91	N/R	-21.74
DAY 2	N/A	-44.74	-5.26	89.47	-36.84	N/R	34.21
DAY 3	N/R	-56.52	-52.17	78.26	MDL	N/R	N/A
DAY 4	N/R	-35.00	-45.00	132.50	MDL	N/R	N/A
AVERAGE		-51.50	-34.10	69.60	18.50		6.20

	NJIT	NYDEC PEI	CSI PEI	UMDNJ PEI	EPA/RTP	EPA/RTP	MEAN POLLUTANT
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2	CONC. (PPB)
DAY 1	N/R	-13.04	MDL	MDL	30.43	8.70	0.23
DAY 2	N/S	-21.05	-47.37	-21.05	21.05	28.95	0.38
DAY 3	N/R	MDL	MDL	MDL	21.74	8.70	0.23
DAY 4	N/R	0.00	0.00	-50.00	N/S	N/S	0.40
AVERAGE		-11.40	23.70	35.50	24.40	15.50	0.31

Table 21.

% DIFFERENCE FROM THE MEAN FOR ALL COMPOUNDS/ALL ORGANIZATIONS

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	-38.95	-61.14	N/S	-19.62	118.52	-57.54	-13.49
DAY 2	N/S	-9.11	-11.52	11.23	-24.19	-90.35	39.77
DAY 3	-16.70	-37.06	-7.26	-10.91	-15.54	-25.21	N/S
DAY 4	8.65	-32.85	-30.78	13.06	-5.01	-4.84	N/S
AVERAGE	-15.67	-35.04	-16.52	-1.56	18.44	-44.48	13.14

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP
		PEI	PEI	PEI		
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2
DAY 1	116.54	16.89	-23.92	-52.48	-3.21	-2.24
DAY 2	N/S	16.42	-6.95	-9.82	23.12	24.19
DAY 3	78.05	24.05	5.81	7.17	-0.20	0.06
DAY 4	38.29	26.38	2.70	-11.73	N/S	N/S
AVERAGE	77.63	20.93	-5.59	-16.72	6.57	7.34

Table 22.

ABSOLUTE VALUE OF THE % DIFFERENCE FROM THE MEAN FOR ALL COMPOUNDS/ORGANIZATIONS

	NJIT	NYDEC	NYDEC	CSI	UMDNJ	TEXAS A&M	EPA/RTP
		ENVIROCHEM	ATD-50				
	AVERAGE	AVERAGE	AVERAGE	AVERAGE	AVERAGE	2 TUBE	4-TUBE
	2-TUBES	2-TUBES	2-TUBES	2-TUBES	2-TUBES	AVERAGE	AVERAGE
DAY 1	38.95	61.14	N/S	28.40	126.21	57.54	28.89
DAY 2	N/S	24.05	23.54	36.71	67.28	90.35	58.20
DAY 3	20.86	37.06	35.46	49.79	44.66	43.03	N/S
DAY 4	16.17	32.86	43.39	62.62	37.81	20.57	N/S
AVERAGE	25.33	38.78	34.13	44.38	68.99	50.76	43.55

	NJIT	NYDEC	CSI	UMDNJ	EPA/RTP	EPA/RTP
		PEI	PEI	PEI		
	CANISTER	CANISTER	CANISTER	CANISTER	CAN 1	CAN 2
DAY 1	120.21	45.60	45.60	52.48	14.10	15.64
DAY 2	N/S	32.73	20.10	15.32	23.12	24.19
DAY 3	81.97	29.27	48.48	25.53	19.74	16.61
DAY 4	58.95	26.38	28.00	11.25	N/S	N/S
AVERAGE	87.04	33.50	35.54	26.15	18.99	18.81

Table 23.

AVERAGE % DIFFERENCE BETWEEN LOW AND HIGH FLOW SORBENT TUBES FOR EACH TARGET COMPOUND

	NJIT	NYDEC ENVIROCHEM	NYDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP	SHOOTOUT AVERAGE CONCENTRATION IN PPB
TOLUENE	-12.44	-6.63	6.26	-16.10	9446.67	268.67	-22.60	3.55
M/P-XYLENE	-13.04	-7.08	2.14	-0.52	-41.20	N/R	37.43	1.13
BENZENE	-27.49	208.22	15.63	NO HI-FLOW	48150.00	251.87	-7.39	0.96
DICHLOROMETHANE	-64.90	-22.45	1.90	-53.37	15835.48	684.91	7.50	0.84
O - XYLENE	-18.10	-2.93	4.63	-17.68	-72.95	416.02	39.19	0.53
1,1,1-TRICHLOROETHYLENE	-35.54	-3.64	MDL	-54.91	MDL	101.83	-13.64	0.50
ETHYL BENZENE	N/R	24.38	-2.90	-7.71	-50.00	N/R	40.39	0.31
TETRACHLOROETHYLENE	-1.01	6.48	-14.80	-5.88	-51.29	317.86	26.22	0.28
CARBON TETRACHLORIDE	-19.20	-56.25	MDL	-68.75	-7.69	250.30	1.06	0.26
TRICHLOROETHYLENE	-8.33	MDL	-28.89	-31.02	MDL	N/R	-6.06	0.17
CHLOROFORM	-43.33	-22.09	66.19	-64.90	MDL	-55.76	N/R	0.10
AVERAGE	-24.34	11.80	5.57	-32.08	9151.13	279.46	10.21	
ABSOLUTE VALUE AVERAGE	22.12	44.31	23.37	32.08	9206.91	293.40	20.15	

COMPUTED AS: $\frac{\text{(HIGH FLOW TUBE - LOW FLOW TUBE)}*100}{\text{(LOW FLOW TUBE)}}$

MDL = BELOW MINIMUM DETECTION LIMIT
N/R = COMPOUND NOT REPORTED

Table 24. FREQUENCY COMPOUNDS WERE REPORTED BELOW THE MDL FOR EACH OF THE TARGET COMPOUNDS (PRESENTED AS # REPORTED BELOW MDL/TOTAL # OF SAMPLES ANALYZED)

COMPOUND	NJIT TENAX	NJIT CANISTER	DEC ENVIROCHEM	NYSDEC ATD-50	CSI TENAX	EPA/RTP TENAX	EPA CAN.	PEI CANISTER	UMDNJ TENAX	TEXAS A&M TENAX	AVERAGE CONCENTRATION DURING SHOOTOUT (PPB)
TOLUENE	0/8	0/4	0/16	0/9	0/5	0/8	0/6	0/12	9/11	0/12	3.55
M/P XYLENE	0/8	0/4	0/16	0/9	0/10	0/8	0/6	0/12	4/11	N/R	1.13
BENZENE	0/8	0/4	0/16	0/9	0/10	0/8	0/6	0/12	10/11	0/12	0.96
DICHLOROMETHANE	0/8	0/4	0/16	0/9	6/10	0/8	0/6	0/12	9/11	1/12	0.84
O-XYLENE	0/8	0/4	0/16	0/9	0/10	0/8	0/6	0/12	4/11	0/12	0.53
1,1,1-TRICHLOROETHANE	0/8	0/4	0/16	4/9	0/10	0/8	0/6	6/12	11/11	0/12	0.50
ETHYL BENZENE	0/8	0/4	0/16	0/9	0/10	0/8	0/6	4/12	8/11	0/12	0.31
TETRACHLOROETHYLENE	0/8	0/4	0/16	0/9	0/10	0/8	0/6	7/12	10/11	0/12	0.28
CARBON TETRACHLORIDE	0/8	0/4	3/16	6/9	0/6	0/8	0/6	12/12	10/11	0/12	0.26
TRICHLOROETHYLENE	0/8	0/4	10/16	0/9	1/10	0/8	0/6	12/12	11/11	N/R	0.17
CHLOROFORM	0/8	0/4	2/16	0/9	3/10	N/R	N/R	12/12	11/11	2/11	0.10
TOTAL	0/88	0/44	15/176	10/99	10/101	0/80	0/60	53/132	97/121	3/107	
% BELOW MDL	0	0	8.52	10.10	9.90	0	0	40.15	80.17	2.80	

N/R = COMPOUND NOT REPORTED

APPENDIX A.

% DIFFERENCE BETWEEN LOW FLOW AND HIGH FLOW TUBES

BENZENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-25.71	0.00	N/S	NO HI-FLOW	48150.00	948.39	-26.64
DAY #2	N/S	-65.87	-5.14	NO HI-FLOW	MDL	-64.00	11.86
DAY #3	-44.86	870.00	0.00	NO HI-FLOW	MDL	54.55	N/S
DAY #4	-11.89	28.75	52.03	NO HI-FLOW	MDL	68.53	N/S
AVERAGE	-27.49	208.22	15.63	NO HI-FLOW	48150.00	251.87	-7.39

TOLUENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-3.39	3.37	N/S	-13.46	9446.67	546.82	-18.36
DAY #2	N/S	-41.25	0.80	-14.00	MDL	550.27	-26.84
DAY #3	-31.55	14.10	6.58	-16.67	MDL	-21.81	N/S
DAY #4	-2.39	-2.75	11.39	-20.25	MDL	-0.62	N/S
AVERAGE	-12.44	-6.63	6.26	-16.10	9446.67	268.67	-22.60

M/P-XYLENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-4.00	0.00	N/S	67.16	24.62	N/R	57.45
DAY #2	N/S	-28.29	3.47	-12.00	N/R	N/R	17.40
DAY #3	-32.91	6.56	-1.22	-26.67	-99.83	N/R	N/S
DAY #4	-2.22	-6.57	4.17	-30.56	-89.59	N/R	N/S
AVERAGE	-13.04	-7.08	2.14	-0.52	-41.20	N/R	37.43

O - XYLENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-13.33	-5.56	N/S	-14.29	-83.62	1587.50	54.55
DAY #2	N/S	-3.85	5.88	-7.41	-82.42	53.85	23.83
DAY #3	-43.33	0.00	3.85	-22.73	-68.58	32.12	N/S
DAY #4	2.38	-2.33	4.17	-26.32	-57.17	-9.39	N/S
AVERAGE	-18.10	-2.93	4.63	-17.68	-72.95	416.02	39.19

DICHLOROMETHANE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-52.38	-18.75	N/S	MDL	15835.48	280.43	15.00
DAY #2	N/S	-54.39	24.39	-45.45	MDL	-67.35	0.00
DAY #3	-77.89	-10.00	-40.00	MDL	MDL	122.40	N/S
DAY #4	-64.44	-6.67	21.31	-61.29	MDL	2404.15	N/S
AVERAGE	-64.90	-22.45	1.90	-53.37	15835.48	684.91	7.50

N/R = COMPOUND NOT REPORTED

N/S= NO SAMPLE RUN

MDL = BELOW MINIMUM DETECTION LIMIT

APPENDIX A.

% DIFFERENCE BETWEEN LOW FLOW AND HIGH FLOW TUBES

CHLOROFORM	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-50.00	MDL	N/S	-53.33	MDL	0.00	N/R
DAY #2	N/S	-51.43	28.57	MDL	MDL	-80.00	N/R
DAY #3	-40.00	MDL	50.00	MDL	MDL	-98.67	N/S
DAY #4	-40.00	0.00	120.00	-76.50	MDL	-44.38	N/S
AVERAGE	-43.33	-22.09	66.19	-64.90	MDL	-55.76	N/S

CARBON TETRACHLORIDE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-23.81	MDL	N/S NO HI-FLOW		-7.69	890.00	-12.16
DAY #2	N/S	-56.25	MDL	-68.75	MDL	-70.00	14.29
DAY #3	-7.69	MDL	MDL NO HI-FLOW		MDL	-86.70	N/S
DAY #4	-26.09	MDL	MDL NO HI-FLOW		MDL	267.89	N/S
AVERAGE	-19.20	-56.25	MDL	-68.75	-7.69	250.30	1.06

1,1,1-TRICHLOROETHANE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	-36.00	5.56	N/S	-45.45	MDL	200.00	17.14
DAY #2	N/S	-45.45	MDL	-67.09	MDL	-39.02	-44.42
DAY #3	-50.00	33.33	MDL	-51.72	MDL	35.36	N/S
DAY #4	-20.63	-8.00	MDL	-55.36	MDL	210.98	N/S
AVERAGE	-35.54	-3.64	MDL	-54.91	MDL	101.83	-13.64

TETRACHLOROETHYLENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	0.00	0.00	N/S	-11.54	-51.29	1234.12	28.95
DAY #2	N/S	25.93	-2.78	-1.79	MDL	-16.36	23.48
DAY #3	0.00	0.00	-28.57	0.00	MDL	53.18	N/S
DAY #4	-3.03	0.00	-13.04	-10.20	MDL	0.53	N/S
AVERAGE	-1.01	6.48	-14.80	-5.88	-51.29	317.86	26.22

TRICHLOROETHYLENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	0.00	MDL	N/S	-13.04	MDL	N/R	0.00
DAY #2	N/S	MDL	-70.00	-27.08	MDL	N/R	-12.12
DAY #3	-25.00	MDL	50.00	-54.55	MDL	N/R	N/S
DAY #4	0.00	MDL	-66.67	-29.41	MDL	N/R	N/S
AVERAGE	-8.33	MDL	-28.89	-31.02	MDL	N/R	-6.06

N/R = COMPOUND NOT REPORTED

N/S= NO SAMPLE RUN

MDL = BELOW MINIMUM DETECTION LIMIT

APPENDIX A.

% DIFFERENCE BETWEEN LOW FLOW AND HIGH FLOW TUBES

ETHYL BENZENE	NJIT	NYSDEC ENVIROCHEM	NYSDEC ATD-50	CSI	UMDNJ	TEXAS A&M	EPA/RTP
DAY #1	N/R	60.00	N/S	40.74	-45.66	N/R	70.37
DAY #2	N/S	-29.17	-2.63	-8.00	-54.33	N/R	10.42
DAY #3	N/R	50.00	-8.70	-32.65	MDL	N/R	N/S
DAY #4	N/R	16.67	2.63	-30.91	MDL	N/R	N/S
AVERAGE	N/R	24.38	-2.90	-7.71	-50.00	0.00	40.39

N/R = COMPOUND NOT REPORTED

N/S= NO SAMPLE RUN

MDL = BELOW MINIMUM DETECTION LIMIT

Appendix B.
Supplemental UMDNJ shootout data reintegrated and reanalyzed.
UMDNJ Summer '88 Shootout
Volatile Organic Compounds, ppb
Results based on reintegrated raw data and calibration curves

July 26, 1988

Trap I.D.	G.T./51	G.T./87	G.T./78	G.T./63
Flow, ml/min	8.7	8.6	18.8	17.9
Time, min	1485	1485	1485	1485
volume, liters	12.92	12.77	27.92	26.58
Field I.D.	W726b2.1	W726b2.2	W726b.3	W726b2.4
Analysis I.D.	--------	825ba08a	825ba07a	825ba06a
Methyl.Chloride	No	20.8	10.1	30.3
Hexane	Analysis	0.35	0.02	2.12
Chloroform	Tenax	<0.04	<0.02	<0.02
1,1,1-TCE	spilled	0.46	<0.03	2.25
Benzene	out	0.78	0.10	3.35
Carbon Tetr.		<0.06	<0.03	0.12
Trichloroethylene		<0.07	<0.03	<0.03
Toluene		12.7	0.03	8.96
Tetrachlor.		0.85	<0.02	0.62
Ethylbenzene		1.75	0.17	0.57
m & p-Xylene		1.88	0.71	1.43
Styrene		0.13	<0.04	<0.04
o-Xylene		3.91	0.67	0.59

July 27, 1988

Trap I.D.	G.T./54	G.T./49	G.T./90	G.T./82
Flow, ml/min	8.3	8.3	15.9	15.9
Time, min	1341	1341	1341	1341
volume, liters	11.1	11.1	21.3	21.1
Field I.D.	W727b3.1	W727b3.2	W727b3.3	W727b3.4
Analysis I.D.	823ba09a	823ba04a	823ba06a	823ba08a
Methyl.Chloride	24.5	32.0	No peaks detected	
Hexane	2.14	0.28	Chromatogram shows	
Chloroform	<0.05	<0.05	possible high water	
1,1,1-TCE	1.79	0.72		
Benzene	3.11	1.18		
Carbon Tetr.	0.08	0.02		
Trichloroethylene	<0.08	<0.08		
Toluene	10.4	3.36		
Tetrachlor.	0.69	0.21		
Ethylbenzene	1.10	0.50		
m & p-Xylene	3.11	1.54		
Styrene	0.05	<0.09		
o-Xylene	1.42	0.65		

11/22/88

Annotated Example and References of ANOVA and LSD

Approach to the Analysis of Variance

The analysis of variance is presented for seven compounds. These are toluene, benzene, meta and para xylene, ortho xylene, tetrachloroethene, 1,1,1 trichloroethane, and hexane. There were insufficient sample sizes for each of the other compounds. The reasons for this data insufficiency for these compounds are explained in the "Caveats and Notes" section of this Appendix. Calculations were done for each year of the project.

The sample set used for the analysis of variance was developed from the collocated samples as follows: For each collocation event, the concentration reported by the individual sampling organization was subtracted from the PEI canister result reported. This was done for all compounds examined, and for each organization. The transformation of data in this manner allows for the direct comparison of NJIT, CSI, and NYSDEC because the transformed data reflects only the variability between each organization, independent of the concentration evident at the time of sampling. This treatment of PEI as the "standard" although not technically true, still forms a legitimate reference for comparison. The approach of data transformation used here as well as the statistical methods applied have been developed in consultation with EPA/AREAL in Research Triangle Park, NC.

The results of the statistical analysis presented offer several important and different pieces of information. The analysis of variance (ANOVA) partitions the variance of the data set into the variance occurring between treatments and the variance occurring within treatments. In our case, the term treatment refers to the organizations and therefore, the ANOVA partitions the variance into the components attributable to the differences between CSI, NYSDEC and NJIT and the variance attributable to variability within the individual organizations themselves.

The F statistic is used to determine if these variance components determined in the ANOVA procedure indicate that the differences between treatments are statistically significant. If significance is indicated by the F test, further analysis may be done. The Least Significant Difference (LSD) can then be computed. The advantage of the LSD is that it allows a determination of which organizations are similar to one another and which are different. The F test, in contrast, only signifies that differences exist between all of the organizations analyzed. The LSDs presented here should only be used to compare the performance of the organizations. They should not be used to compare differences observed between individual sites operated by the different organizations. The limitations of the data set and the experimental design require the use of advances statistical models and computer programs as well as extensive statistical consultation to understand the inherent limitations, caveats, and assumptions inherent in an analysis of inter-site comparisons. Such comparisons may be performed during subsequent evaluations in the SI/NJ UATAP.

Annotated Example

2nd Year of Study

Toluene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES		
(1) Samples (n)	31	6	6	130		
(2) Sum (Xi)	6.50	2.10	-9.90	-81.34	Y..	-82.64 (7)
(3) Sum (Xi^2)	117.71	2.83	88.42	269.61		478.56 (8)
(4) (Sum (Xi))^2/n	1.36	0.73	16.32	50.89	C =	39.47 (9)
(5) Individual SS	116.35	2.09	72.10	218.71		
(6) Individual Mean	0.21	0.35	-1.65	-0.63		

(10) Total SS = 439.09 df = 172

(11) Treatment SS = 29.84 df = 3

(12) Error SS = 409.25 df = 169

Source of Variation	df	Sum of Squares	Mean (15) Square	F (16)	
(13) Between treatments	3	29.84	9.95	4.11	**
(14) Within treatments	169	409.25	2.42		

(17) 2nd Year LSD Comparisons: Toluene

	NJIT Tenax	NJIT Caniste	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.76	1.27	1.36
NJIT Canisters	1.76	------	1.27	1.36
NYSDEC Tubes	1.27	1.27	------	0.61
CSI Tubes	1.36	1.36	0.61	------

ANOVA & LSD Explanations

(1) Samples. The number of data points. Data points are taken from collocated PEI/sampling organization samples by subtracting the results reported by the organization from the results reported by PEI.

(2) Sum (Xi) = Sum of all the data points for each organization.

(3) Sum (Xi^2) = Sum of each data point squared

(4) (Sum (Xi)^2)/n = (Sum of all data points)^2/number of samples

(5) Individual SS = Individual Sum of Squares (SS) , obtained by subtracting (4) from (3).

(6) Individual Mean = Sum of data points ((2)), divided by sample size (1).

(7) Y.. = Sum of all data points for all organizations, i.e. all the (2) 's summed up. This will be used to determine the Total Sum of Squares for the analysis. See page 140, Table 7.1 in the reference supplied for further information and an illustration of this.

(8) This number is the sum of all the (3) 's for each organization. This number is used in computing the Total SS.

(9) C = Correction factor for SS. It is obtained by taking (7) squared and dividing by the number of samples in the study. See equation 7.1 on page 140 for the general case, and equation 7.4 on page 146 for the case of unequal replication.

(10) Total SS = Computed by (8) minus (9). Also shown in equation 7.2, page 140.

Degrees of freedom for the Total SS = number of samples in study -1.

(11) Treatment SS = See equation 7.3, page 141 for the general case (and table 7.1 to see where they get the numbers from) and equation 7.9, page 146 for the specific case of unequal replication.

Degrees of freedom = Number of treatments - 1. Degrees of freedom in unequal replication can be found in table 7.5, page 147. No formula is given but it can be inferred from the calculation. Degrees of freedom for the standard case may be found in table 7.2, page 142.

(12) Error SS = Computed as (10) minus (11) . See equation 7.4, page 141. Equation 7.5, page 141 can be used as a check (This is dine by summing all the (5) 's.
Degrees of freedom = Total sum of squares degrees of freedom - Treatment sum of squares degrees of freedom.

(13) Between treatments = Variation due to sampling organization. It is the Treatment SS, (11) . See table 7.3, page 142 and the associated text for the further explanations and use of items (13) (14) (15) and (16) .

(14) Within Treatment = Intra-organization variation. It is the Error SS, (12) .

(15) Mean Square = Obtained by dividing the relevant sum of squares by its degrees of freedom.

(16) F = F Statistic. It is obtained by dividing Between Treatment Mean Square by the Error Mean Square. An Asterisk means significance at the 0.05 level, two asterisks indicate significance at the 0.01 level.

(17) Least significant difference (LSD).= It is obtained in the general case by equation 8.1 on page 173. This example uses the data from table 7.1, page 140 and Table 7.3, page 142. The case dealing with unequal replication is addressed on pages 191-192 in equation 8.20.

ANOVA and LSD Tables

Findings

This section includes the analysis of variance (ANOVA) and Least Significant Difference statistics for all sampling events that included collocation (or splits) with PEI canisters. Estimates of bias are between organizations relative to the PEI reference and not against an absolute standard.

First Year Data

The results of the analysis of variance and F tests are presented in Tables 4-10. Examination of this data shows that no significant differences existed between organizations for the analysis of benzene, 1,1,1 trichloroethane, tetrachloroethylene, and hexane. Significant differences, were found for toluene, meta and para xylene, and ortho xylene.

LSDs are presented for results shown to be significant by the F test in Tables 18-20. Analysis of the data using the LSDs is presented in Table 23. The toluene and meta and para xylene data showed the same trends. All organizations had greater concentrations than the collocated PEI canisters, with the exception of NYSDEC's results with meta and para xylene. The NJIT canisters, showing the most extreme case of this "bias", were significantly different from all other organizations and sampling methods. The NYSDEC tubes most closely resembled the collocated PEI canisters, and were significantly different from the CSI tubes. The NJIT tubes were indistinguishable from either the CSI or NYSDEC sorbent tubes.

With ortho xylene, CSI and NYSDEC had lower concentrations than the PEI canisters, whereas the NJIT canisters had greater concentrations than PEI. NJIT's tubes were almost equal to the PEI canisters. The NYSDEC and CSI tubes were statistically indistinguishable from one another, although both were significantly different from the NJIT canisters. The NJIT tubes were equivalent to all samples and methods used.

Second Year Data

The results of the analysis of variance and F tests are presented in Tables 11-17. Examination of this data shows no significant differences existed for benzene, meta and para xylene, ortho xylene, tetrachloroethylene, and hexane. Significant differences were found with toluene and 1,1,1 trichloroethane.

LSDs are presented for results shown to be significant by the F test in Tables 21-22. Analysis of the data using the LSDs is presented in Table 23. With toluene, the NJIT canisters and CSI tubes had lower concentrations than the PEI canisters, whereas the NYSDEC and NJIT tubes had greater concentrations relative to the PEI canisters. The NJIT canisters and Tenax were not significantly different from any other organizations, or each other. The CSI and NYSDEC tubes however, were significantly different from each other.

With 1,1,1 trichloroethane, CSI, NYSDEC and NJIT tubes had lower concentrations relative to the PEI canisters, while the NJIT canisters had greater concentrations. The CSI tubes had lowest concentrations, relative to PEI, and was significantly different from all other organizations. The NJIT canisters exhibited the same trend, but of opposite magnitude, averaging concentrations greater than all other organizations relative to PEI. The NJIT canisters were also statistically different from al other organizations. The NJIT and NYSDEC tubes had identical responses.

Discussion

The findings elucidated by the above statistical analysis indicate that real biases did exist in the sampling/analysis of certain compounds. Furthermore, these biases were suggested by the descriptive statistics found in Tables 1 and 2. Other differences may exist, however they are obscured by the inherent variability in the sampling/analysis methodology.

The Tenax methods showed a remarkable degree of agreement across organizations relative to PEI. The range of difference between all organizations, relative to PEI was never greater than 63%, and was typically 30-40% or less, validating the coarse "factor of two" rule of thumb used to estimate the range of variation between organizations that was developed as a result of the shootouts. The results of the NJIT canister comparisons can not be done in greater detail, due to the limited amount of data available. Therefore, trends observed with these canisters should be examined closely to insure that they are truly representative, and not skewed by any one result.

Further Approaches

Approaches that may be tried to further evaluate the differences between organizations and sites include the following:

1. A) Examine the enclosed analyses of variance. B) In cases where significance was observed, adjust all data for that organization by the mean difference for each organization as stated in the ANOVA table. C) For each organization, construct 95% confidence bands around the data reported for each organization/site based on the QA information provided by the organizations.

2. Perform an analysis of variance, segregated by site, for each collocated pair. This will allow for the determination of the variability inherent within an organization that occurs at each site. (It is this "interaction" term of site and organization that complicated the analysis of variance so extensively to preclude its being presented here. The ANOVA is further made more difficult by the fact that each site was sampled by only one organization with unequal replication of sites and collocations for each organization. Additionally the NJIT data is very sparse, and therefore the determination of site differences for NJIT is made more complex.)

Analysis of Variance Between Organizations

4th Quarter 1987 - 3rd Quarter 1988

Table 4. Toluene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	4	4	48	
Sum (Xi)	-27.50	-14.40	-2.60	-4.77	Y.. -49.27
Sum (Xi^2)	98.13	91.98	7.74	43.56	241.41
(Sum (Xi))^2/n	24.40	51.84	1.69	0.47	C = 27.90
Individual SS	73.73	40.14	6.05	43.08	
Individual Mean	-0.89	-3.60	-0.65	-0.10	

Total SS = 213.50 df = 86

Treatment SS = 50.50 df = 3

Error SS = 163.01 df = 83

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	50.50	16.83	8.57 **
Within treatments	83	163.01	1.96	

Table 5. Benzene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	4	4	47	
Sum (Xi)	5.10	-0.60	0.20	-4.15	Y.. 0.55
Sum (Xi^2)	15.98	1.34	1.96	16.65	35.93
(Sum (Xi))^2/n	0.84	0.09	0.01	0.37	C = 0.00
Individual SS	15.14	1.25	1.95	16.29	
Individual Mean	0.16	-0.15	0.05	-0.09	

Total SS = 35.93 df = 85

Treatment SS = 1.30 df = 3

Error SS = 34.63 df = 82

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	1.30	0.43	1.03
Within treatments	82	34.63	0.42	

Table 6. M/P Xylene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	4	4	42	
Sum (Xi)	-13.70	-8.60	-0.20	4.17	Y.. -18.33
Sum (Xi^2)	47.16	32.04	4.92	12.41	96.53
(Sum (Xi))^2/n	6.05	18.49	0.01	0.41	C = 4.15
Individual SS	41.11	13.55	4.91	11.99	
Individual Mean	-0.44	-2.15	-0.05	0.10	

Total SS = 92.38 df = 80

Treatment SS = 20.82 df = 3

Error SS = 71.56 df = 77

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	20.82	6.94	7.47 **
Within treatments	77	71.56	0.93	

Table 7. O-Xylene 1st Year of Study

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	23	3	3	40	
Sum (Xi)	5.30	-0.90	0.10	10.20	Y.. 14.70
Sum (Xi^2)	2.15	0.83	0.51	6.52	10.01
(Sum (Xi))^2/n	1.22	0.27	0.00	2.60	C = 3.13
Individual SS	0.93	0.56	0.51	3.92	
Individual Mean	0.23	-0.30	0.03	0.26	

Total SS = 6.88 df = 68

Treatment SS = 0.96 df = 3

Error SS = 5.91 df = 65

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.96	0.32	3.53 *
Within treatments	65	5.91	0.09	

Analysis of Variance Between Organizations

4th Quarter 1987 - 3rd Quarter 1988

Table 8. 1st Year of Study

1,1,1 Trichloroethane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	18	1	2	12	
Sum (Xi)	4.00	0.80	-0.10	1.86	Y.. 6.56
Sum (Xi^2)	2.28	0.64	0.25	1.32	4.49
(Sum (Xi))^2/n	0.89	0.64	0.00	0.29	C = 1.30
Individual SS	1.39	0.00	0.25	1.03	
Individual Mean	0.22	0.80	-0.05	0.16	

Total SS = 3.18 df = 32

Treatment SS = 0.52 df = 3

Error SS = 2.66 df = 29

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.52	0.17	1.88
Within treatments	29	2.66	0.09	

Table 9. 1st Year of Study

Tetrachloroethylene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	13	0	0	17	
Sum (Xi)	-2.10			2.20	Y.. 0.10
Sum (Xi^2)	0.63			2.22	2.85
(Sum (Xi))^2/n	0.34			0.28	C = 0.0003
Individual SS	0.29			1.94	
Individual Mean	-0.16			0.13	

Total SS = 2.85 df = 29

Treatment SS = 0.62 df = 3

Error SS = 2.23 df = 26

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.62	0.21	2.43
Within treatments	26	2.23	0.09	

Table 10. 1st Year of Study

Hexane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	20	1	1		
Sum (Xi)	393.70	-0.20	0.10		Y.. 393.60
Sum (Xi^2)	31290.7	0.04	0.01		31290.76
(Sum (Xi))^2/n	7749.98	0.04	0.01		C = 7041.86
Individual SS	23540.7	0.00	0.00		
Individual Mean	19.69	-0.20	0.10		

Total SS = 24248.90 df = 21

Treatment SS = 708.17 df = 3

Error SS = 23540.73 df = 18

Source of Variation	Sum of Squares	Mean Square	F
Between treatments	708.17	236.06	0.18
Within treatments	23540.73	1307.82	

Analysis of Variance Betwen Organizations

4th Quarter 1988 - 3rd Quarter 1989

Table 11. 2nd Year of Study

Toluene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	31	6	32	130	
Sum (Xi)	6.50	2.10	-11.00	-81.34	Y.. -83.74
Sum (Xi^2)	117.71	2.83	148.19	269.61	538.33
(Sum (Xi))^2/n	1.36	0.73	3.78	50.89	C = 35.23
Individual SS	116.35	2.09	144.41	218.71	
Individual Mean	0.21	0.35	-0.34	-0.63	

Total SS = 503.10 df = 198

Treatment SS = 21.54 df = 3

Error SS = 481.56 df = 195

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	21.54	7.18	2.91 *
Within treatments	195	481.56	2.47	

Table 12. 2nd Year of Study

Benzene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	30	6	33	127	
Sum (Xi)	-2.90	-1.80	-4.60	3.10	Y.. -6.20
Sum (Xi^2)	5.75	0.80	18.98	16.51	42.04
(Sum (Xi))^2/n	0.28	0.54	0.64	0.08	C = 0.20
Individual SS	5.47	0.26	18.34	16.43	
Individual Mean	-0.10	-0.30	-0.14	0.02	

Total SS = 41.84 df = 195

Treatment SS = 1.34 df = 3

Error SS = 40.50 df = 192

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	1.34	0.45	2.12
Within treatments	192	40.50	0.21	

Table 13. 2nd Year of Study

M/P Xylene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	30	6	32	123	
Sum (Xi)	-9.00	2.10	8.81	9.90	Y.. 11.81
Sum (Xi^2)	14.00	1.63	17.71	121.93	155.27
(Sum (Xi))^2/n	2.70	0.74	2.42	0.80	C = 0.73
Individual SS	11.30	0.90	15.29	121.13	
Individual Mean	-0.30	0.35	0.28	0.08	

Total SS = 154.54 df = 190

Treatment SS = 5.92 df = 3

Error SS = 148.62 df = 187

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	5.92	1.97	2.49
Within treatments	187	148.62	0.79	

Table 14. 2nd Year of Study

O-Xylene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	25	6	30	109	
Sum (Xi)	5.30	1.10	3.00	38.50	Y.. 47.90
Sum (Xi^2)	1.69	0.31	2.40	115.77	120.17
(Sum (Xi))^2/n	1.12	0.20	0.30	13.60	C = 13.50
Individual SS	0.57	0.11	2.10	102.17	
Individual Mean	0.21	0.18	0.10	0.35	

Total SS = 106.67 df = 169

Treatment SS = 1.73 df = 3

Error SS = 104.95 df = 166

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	1.73	0.58	0.91
Within treatments	166	104.95	0.63	

Analysis of Variance Between Organizations

4th Quarter 1988 - 3rd Quarter 1989

Table 15. 2nd Year of Study

1,1,1 Trichloroethane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	25	6	32	108	
Sum (Xi)	10.20	-1.70	6.30	21.82	Y.. 36.62
Sum (Xi^2)	10.44	0.71	4.03	16.77	31.95
(Sum (Xi))^2/n	4.16	0.48	1.24	4.41	C = 7.84
Individual SS	6.28	0.23	2.79	12.36	
Individual Mean	0.41	-0.28	0.20	0.20	

Total SS = 24.10 df = 170

Treatment SS = 2.45 df = 3

Error SS = 21.65 df = 167

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	2.45	0.82	6.30 **
Within treatments	167	21.65	0.13	

Table 16. 2nd Year of Study

Tetrachloroethylene

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	13	4	11	51	
Sum (Xi)	0.50	0.20	0.50	20.05	Y.. 21.25
Sum (Xi^2)	1.01	0.02	0.17	64.56	65.76
(Sum (Xi))^2/n	0.02	0.01	0.02	7.88	C = 5.72
Individual SS	0.99	0.01	0.15	56.68	
Individual Mean	0.04	0.05	0.05	0.39	

Total SS = 60.04 df = 78

Treatment SS = 2.22 df = 3

Error SS = 57.83 df = 75

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	2.22	0.74	0.96
Within treatments	75	57.83	0.77	

Table 17. 2nd Year of Study

Hexane

	CSI TUBES	NJIT CANS	NJIT TUBES	NYSDEC TUBES	
Samples (n)	25	5	25		
Sum (Xi)	-0.300	0.000	0.000		Y.. -0.30
Sum (Xi^2)	2.250	1.160	9.240		12.65
(Sum (Xi))^2/n	0.004	0.000	0.000		C = 0.00
Individual SS	2.246	1.160	9.240		
Individual Mean	-0.012	0.000	0.000		

Total SS = 12.650 df = 54

Treatment SS = 0.002 df = 3

Error SS = 12.646 df = 51

Source of Variation	df	Sum of Squares	Mean Square	F
Between treatments	3	0.002	0.002	0.003
Within treatments	51	12.646	0.248	

Least Significant Differences between Organizations

(All units are ppb)

First Year of Study

able 18.

1st Year LSD Comparisons:Toluene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.97	1.45	1.48
NJIT Canisters	1.97	------	1.45	1.48
NYSDEC Tubes	1.45	1.45	------	0.64
CSI Tubes	1.48	1.48	0.64	------

able 19.

1st Year LSD Comparisons:M/P Xylene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.36	1.00	1.02
NJIT Canisters	1.36	------	1.00	1.02
NYSDEC Tubes	1.00	1.00	------	0.45
CSI Tubes	1.02	1.02	0.45	------

able 20.

1st Year LSD Comparisons:O-Xylene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	0.49	0.36	0.37
NJIT Canisters	0.49	------	0.36	0.37
NYSDEC Tubes	0.36	0.36	------	0.16
CSI Tubes	0.37	0.37	0.16	------

Second Year of Study

Table 21.

2nd Year LSD Comparisons:Toluene

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	1.37	0.61	0.78
NJIT Canisters	1.37	------	1.29	1.37
NYSDEC Tubes	0.61	1.29	------	0.62
CSI Tubes	0.78	1.37	0.62	------

Table 22.

2nd Year LSD Comparisons:1,1,1 Trichloroethane

	NJIT Tenax	NJIT Canisters	NYSDEC Tubes	CSI Tubes
NJIT Tenax	------	0.31	0.14	0.19
NJIT Canisters	0.31	------	0.30	0.32
NYSDEC Tubes	0.14	0.30	------	0.16
CSI Tubes	0.19	0.32	0.16	------

Table 23.

Table of LSD Rankings by Organization for Compounds Where 'F' is Significant

1st Year Data		2nd Year Data	
TOLUENE		**TOLUENE**	
Organization	Average Difference From PEI (in ppb)	Organization	Average Difference From PEI (in ppb)
NYSDEC Tubes	-0.10 a	NJIT Canisters	0.35 a,b
NJIT Tubes	-0.65 a,b	CSI Tubes	0.21 a
CSI Tubes	-0.89 b	NJIT Tubes	-0.34 a,b
NJIT Canisters	-3.60 c	NYSDEC Tubes	-0.63 b
M/P XYLENE		**1,1,1 TRICHLOROETHANE**	
NYSDEC Tubes	0.10 a	CSI Tubes	0.41 a
NJIT Tubes	-0.05 a,b	NJIT Tubes	0.20 b
CSI Tubes	-0.44 b	NYSDEC Tubes	0.20 b
NJIT Canisters	-2.15 c	NJIT Canisters	-0.28 c
O-XYLENE			
NYSDEC Tubes	0.26 a		
CSI Tubes	0.23 a		
NJIT Tubes	0.03 a,b		
NJIT Canisters	-0.30 b		

The letters following the "Average Difference From PEI" are used to indicate statistically significant differences.

Organizations that have the same letters are considered statistically indistinguishable from one another.

Data Sets Used in Computations

College of Staten Island

PEI Canisters vs. Tenax Data

4th Quarter 87 - 3rd Quarter 88

(All units are ppb)

Compound: 111-Trichloroethane

Canister	Tenax	Difference
1.3	0.3	1.0
0.6	0.5	0.1
0.4	0.1	0.3
0.3	0.3	0.0
0.8	0.2	0.6
0.3	0.2	0.1
0.4	0.2	0.2
0.4	0.1	0.3
0.4	0.2	0.2
0.7	0.2	0.5
0.6	0.2	0.4
0.9	1.1	-0.2
0.5	0.4	0.1
0.4	0.2	0.2
0.6	0.8	-0.2
0.6	0.5	0.1
0.6	0.3	0.3
0.5	0.5	0.0

Compound: Carbon Tetrachloride

Canister	Tenax	Difference
0.2	0.0	0.2
0.2	0.1	0.1
0.4	0.3	0.1

Compound: Tetrachloroethene

Canister	Tenax	Difference
0.3	0.2	0.1
0.2	0.3	-0.1
0.3	0.4	-0.1
0.4	0.5	-0.1
0.2	0.4	-0.2
0.3	0.7	-0.4
0.4	0.7	-0.3
0.8	1.1	-0.3
0.9	1.2	-0.3
0.6	0.9	-0.3
1.0	1.1	-0.1
0.4	0.5	-0.1
0.7	0.6	0.1

Compound: Ethylbenzene

Canister	Tenax	Difference
0.2	0.5	-0.3
0.7	1.0	-0.3
0.5	0.8	-0.3
0.3	0.8	-0.5
0.2	0.6	-0.4
0.4	1.1	-0.7
0.3	0.7	-0.4
0.5	0.7	-0.2
0.5	1.0	-0.5
0.7	0.9	-0.2
0.6	1.0	-0.4
0.5	0.7	-0.2
0.5	0.9	-0.4
0.6	1.3	-0.7
1.0	3.2	-2.2
1.3	0.2	1.1

Compound: Hexane

Canister	Tenax	Difference
0.9	0.4	0.5
0.6	1.7	-1.1
0.4	0.2	0.2
0.8	0.6	0.2
4.8	0.5	4.3
0.6	0.4	0.2
1.2	1.4	-0.2
0.5	0.8	-0.3
0.7	0.5	0.2
0.9	0.5	0.4
0.8	0.7	0.1
1.2	1.6	-0.4
68.2	1.4	66.8
132.0	1.2	130.8
74.8	3.5	71.3
59.0	0.4	58.6
27.2	0.4	26.8
17.9	0.5	17.4
10.2	0.8	9.4
9.0	0.5	8.5

Compound: Benzene

Canister	Tenax	Difference
1.7	0.9	0.8
0.9	3.0	-2.1
1.3	0.7	0.6
0.6	0.6	0.0
1.6	1.1	0.5
1.0	0.3	0.7
0.6	0.4	0.2
0.7	0.4	0.3
0.9	0.9	0.0
1.6	1.2	0.4
2.3	0.4	1.9
1.5	0.7	0.8
1.1	0.8	0.3
0.8	0.3	0.5
0.8	0.4	0.4
1.6	0.6	1.0
0.7	0.3	0.4
0.5	0.7	-0.2
1.4	1.3	0.1
1.2	1.6	-0.4
1.9	1.9	0.0
2.0	0.8	1.2
1.4	1.5	-0.1
1.9	1.7	0.2
2.4	3.1	-0.7
2.6	2.7	-0.1
1.2	1.8	-0.6
1.3	2.2	-0.9
0.6	0.7	-0.1
1.3	0.8	0.5
0.9	1.4	-0.5
0.6	0.9	-0.3
1.4	1.6	-0.2
0.7	0.9	-0.2

Compound: M/P Xylene

Canister	Tenax	Difference
0.7	0.6	0.1
0.5	1.0	-0.5
1.3	0.8	0.5
1.3	0.5	0.8
0.5	0.7	-0.2
0.7	0.6	0.1
1.0	1.6	-0.6
1.0	1.4	-0.4
2.5	2.9	-0.4
1.9	2.6	-0.7
0.6	1.0	-0.4
1.3	2.5	-1.2
1.3	1.9	-0.6
0.9	1.5	-0.6
1.0	2.6	-1.6
1.1	2.0	-0.9
0.8	2.4	-1.6
1.8	3.5	-1.7
2.0	3.3	-1.3
2.4	3.4	-1.0
1.6	2.6	-1.0
1.8	3.1	-1.3
2.7	4.3	-1.6
1.2	1.6	-0.4
1.4	2.3	-0.9
5.8	0.9	4.9
1.1	0.9	0.2
0.9	1.6	-0.7
0.7	1.1	-0.4
1.6	1.8	-0.2
0.9	1.0	-0.1

Compound: O-Xylene

Canister	Tenax	Difference
0.5	0.1	0.4
0.2	0.1	0.1
0.2	0.1	0.1
0.3	0.3	0.0
1.0	0.5	0.5
0.7	0.5	0.2
0.2	0.2	0.0
0.5	0.4	0.1
0.4	0.3	0.1
0.4	0.3	0.1
0.5	0.4	0.1
0.3	0.3	0.0
0.7	0.3	0.4
0.7	0.5	0.2
0.9	0.5	0.4
0.9	0.7	0.2
0.7	0.5	0.2
0.8	0.6	0.2
0.9	0.8	0.1
1.4	1.0	0.4
0.6	0.3	0.3
1.0	0.1	0.9
0.6	0.3	0.3

Compound: Toluene

Canister	Tenax	Difference
1.6	1.7	-0.1
1.9	7.5	-5.6
1.5	1.8	-0.3
6.4	1.6	4.8
2.9	2.7	0.2
1.0	0.9	0.1
1.4	1.2	0.2
1.7	2.1	-0.4
1.9	2.7	-0.8
5.7	6.0	-0.3
3.9	4.6	-0.7
1.6	1.4	0.2
4.3	5.5	-1.2
2.3	2.9	-0.6
2.5	3.1	-0.6
3.8	5.4	-1.6
2.0	3.1	-1.1
1.5	2.9	-1.4
3.4	4.2	-0.8
4.3	6.3	-2.0
5.2	6.1	-0.9
5.0	5.7	-0.7
3.3	5.0	-1.7
3.7	5.0	-1.3
5.8	8.0	-2.2
7.0	7.8	-0.8
2.8	5.0	-2.2
3.5	5.8	-2.3
1.0	1.5	-0.5
2.3	2.4	-0.1
1.7	4.5	-2.8
1.5	1.9	-0.4
3.6	4.1	-0.5
1.9	2.5	-0.6

College of Staten Island

PEI Canisters vs. Tenax Data

4th Quarter 88 - 3rd Quarter 89

(All units are ppb)

Compound: 111-Trichloroethane		
Canister	Tenax	Difference
1.2	0.8	0.4
0.6	0.4	0.2
0.9	0.9	0.0
0.4	0.2	0.2
0.7	0.5	0.2
0.8	0.6	0.2
0.4	0.4	0.0
2.3	1.4	0.9
0.9	0.6	0.3
2.0	1.3	0.7
1.3	0.6	0.7
1.0	0.8	0.2
0.6	0.5	0.1
0.9	0.5	0.4
0.3	0.3	0.0
0.4	0.4	0.0
0.4	0.3	0.1
0.4	0.3	0.1
0.8	0.3	0.5
1.1	0.2	0.9
0.4	0.1	0.3
0.5	0.1	0.4
2.7	0.2	2.5
0.5	0.2	0.3
0.8	0.2	0.6

Compound: Carbon Tetrachloride		
Canister	Tenax	Difference
0.3	0.5	-0.2
0.2	0.6	-0.4

Compound: Trichloroethene		
Canister	Tenax	Difference
0.3	0.4	-0.1
0.2	0.1	0.1
0.3	0.0	0.3

Compound: Tetrachloroethene		
Canister	Tenax	Difference
0.6	0.4	0.2
0.3	0.3	0.0
3.3	3.9	-0.6
0.7	0.6	0.1
0.4	0.5	-0.1
0.4	0.4	0.0
0.2	0.3	-0.1
0.4	0.3	0.1
1.1	1.1	0.0
0.5	0.1	0.4
0.8	0.4	0.4
1.1	0.7	0.4
1.8	2.1	-0.3

Compound: Ethylbenzene		
Canister	Tenax	Difference
0.3	0.3	0.0
0.4	1.0	-0.6
0.7	1.0	-0.3
0.4	0.5	-0.1
0.6	0.8	-0.2
0.6	0.8	-0.2
0.4	0.7	-0.3
0.8	1.5	-0.7
0.2	0.5	-0.3
0.3	0.4	-0.1
0.9	0.9	0.0
0.7	0.7	0.0
0.6	0.5	0.1
0.3	0.6	-0.3
0.2	0.3	-0.1
0.3	0.3	0.0
0.3	0.3	0.0
0.3	0.3	0.0
0.4	0.3	0.1
0.5	0.5	0.0
0.2	0.2	0.0
0.3	0.1	0.2
0.6	0.4	0.2
0.4	0.2	0.2
0.3	0.3	0.0

Compound: Hexane		
Canister	Tenax	Difference
0.5	0.8	-0.3
1.1	1.8	-0.7
1.1	1.3	-0.2
0.6	0.7	-0.1
0.6	0.9	-0.3
0.8	0.7	0.1
0.8	0.9	-0.1
1.7	1.8	-0.1
0.7	0.7	0.0
0.7	0.6	0.1
0.4	0.4	0.0
1.5	1.5	0.0
1.3	0.7	0.6
0.9	1.0	-0.1
1.0	1.0	0.0
0.4	0.6	-0.2
0.5	0.3	0.2
1.2	1.8	-0.6
0.7	0.7	0.0
1.1	0.7	0.4
0.6	0.3	0.3
0.5	0.2	0.3
1.0	1.3	-0.3
0.5	0.2	0.3
0.5	0.1	0.4

Compound: Benzene		
Canister	Tenax	Difference
0.5	0.5	0.0
0.9	0.9	0.0
0.3	0.3	0.0
2.1	3.0	-0.9
2.8	3.4	-0.6
0.6	0.9	-0.3
1.5	1.7	-0.2
1.8	1.9	-0.1
1.9	2.3	-0.4
0.8	1.1	-0.3
0.7	0.5	0.2
1.4	1.8	-0.4
2.9	4.3	-1.4
1.1	1.4	-0.3
1.0	1.0	0.0
0.9	0.8	0.1
2.3	2.6	-0.3
2.0	2.1	-0.1
1.7	2.2	-0.5
1.5	1.8	-0.3
1.4	1.6	-0.2
0.7	0.6	0.1
0.9	0.6	0.3
0.9	0.5	0.4
1.1	0.8	0.3
0.8	0.5	0.3
1.8	1.1	0.7
0.8	0.4	0.4
0.9	0.3	0.6
1.1	1.1	0.0

Compound: M/P Xylene		
Canister	Tenax	Difference
0.5	0.6	-0.1
1.3	0.9	0.4
0.3	0.5	-0.2
2.4	3.5	-1.1
2.8	3.7	-0.9
0.4	0.9	-0.5
1.5	1.8	-0.3
2.1	2.7	-0.6
2.0	2.8	-0.8
0.8	1.4	-0.6
1.5	2.4	-0.9
2.5	5.1	-2.6
0.9	1.8	-0.9
1.3	1.4	-0.1
0.6	0.7	-0.1
2.9	2.9	0.0
2.2	2.4	-0.2
1.8	2.0	-0.2
1.4	2.2	-0.8
0.9	1.0	-0.1
1.1	1.2	-0.1
1.1	1.3	-0.2
1.1	1.2	-0.1
1.1	0.8	0.3
1.9	1.6	0.3
0.8	0.7	0.1
0.9	0.2	0.7
1.6	1.4	0.2
1.1	0.7	0.4
1.1	1.1	0.0

Compound: O-Xylene		
Canister	Tenax	Difference
0.5	0.1	0.4
0.9	0.7	0.2
1.0	0.7	0.3
0.2	0.2	0.0
0.6	0.3	0.3
0.8	0.6	0.2
0.7	0.5	0.2
1.0	1.1	-0.1
0.3	0.4	-0.1
0.6	0.4	0.2
0.2	0.2	0.0
1.1	0.8	0.3
0.9	0.5	0.4
0.8	0.5	0.3
0.6	0.5	0.1
0.3	0.2	0.1
0.3	0.2	0.1
0.4	0.3	0.1
0.6	0.2	0.4
0.7	0.4	0.3
0.3	0.1	0.2
0.3	0.0	0.3
0.7	0.3	0.4
0.5	0.1	0.4
0.5	0.2	0.3

Compound: Toluene		
Canister	Tenax	Difference
0.9	1.1	-0.2
3.1	2.6	0.5
0.7	0.8	-0.1
5.1	5.7	-0.6
5.7	5.5	0.2
1.0	1.5	-0.5
3.2	2.9	0.3
4.0	4.3	-0.3
3.6	4.5	-0.9
1.9	2.8	-0.9
1.2	0.8	0.4
3.3	4.0	-0.7
5.2	8.4	-3.2
2.1	3.1	-1.0
3.1	2.6	0.5
1.5	1.4	0.1
7.6	7.0	0.6
5.9	5.0	0.9
3.2	3.8	-0.6
3.2	4.3	-1.1
1.5	1.9	-0.4
1.9	2.4	-0.5
2.6	2.3	0.3
2.4	2.5	-0.1
2.9	2.2	0.7
4.5	4.0	0.5
1.9	1.6	0.3
2.0	0.8	1.2
13.4	3.6	9.8
2.9	1.8	1.1
2.7	2.5	0.2

New York State Department of Environmental Conservation

PEI Canisters vs. Envirochem Sorbent Tubes

4th Quarter 1987 - 3rd Quarter 1988

(All units in ppb)

Compound:Toluene		
Canister	Tube	Difference
0.9	0.3	0.6
2.8	1.3	1.5
1.8	1.6	0.2
0.6	0.7	-0.1
1.7	1.8	-0.1
1.9	2.5	-0.6
1.7	1.0	0.7
3.5	3.1	0.4
1.8	2.4	-0.6
1.7	1.8	-0.1
2.9	4.4	-1.5
2.8	4.8	-2.0
1.7	1.1	0.6
2.7	2.5	0.2
1.4	4.4	-3.0
1.3	1.7	-0.4
5.5	4.5	1.0
3.7	2.3	1.4
4.2	3.6	0.6
2.0	1.4	0.6
5.8	4.4	1.4
2.7	1.4	1.3
6.7	4.4	2.3
1.8	2.1	-0.3
2.4	2.8	-0.4
2.9	3.5	-0.6
2.0	2.0	0.0
4.2	4.2	0.0
2.9	2.9	0.0
3.3	4.1	-0.8
2.7	2.5	0.2
1.1	1.5	-0.4
1.9	1.8	0.1
2.4	2.7	-0.3
1.7	1.5	0.2
3.3	3.3	0.0
2.5	2.0	0.5
0.8	1.0	-0.2
0.3	1.8	-1.5
1.2	1.4	-0.2
1.2	1.4	-0.2
1.4	2.4	-1.0
1.3	1.4	-0.1
2.2	2.4	-0.2
5.4	6.9	-1.5
0.7	1.4	-0.7
0.9	0.9	0.0
1.1	2.9	-1.8

Compound:Benzene		
Canister	Tube	Difference
0.8	1.0	-0.2
1.1	1.0	0.1
0.2	0.2	0.0
0.3	2.6	-2.3
0.5	1.1	-0.6
0.6	0.8	-0.2
0.8	0.1	0.8
0.6	0.3	0.3
0.6	1.0	-0.4
1.0	1.7	-0.7
1.2	2.1	-0.9
0.6	0.3	0.3
1.1	1.3	-0.2
0.5	1.8	-1.3
0.7	0.6	0.1
1.7	1.8	-0.1
1.9	0.7	1.2
1.0	1.5	-0.5
0.8	0.3	0.5
0.8	0.7	0.1
1.5	1.0	0.5
0.7	0.5	0.2
1.3	1.3	0.0
0.9	0.5	0.4
1.0	0.6	0.4
1.2	1.8	-0.6
0.9	0.6	0.3
1.8	0.9	0.9
1.5	0.9	0.6
1.2	1.4	-0.2
1.0	1.0	0.0
0.5	0.9	-0.4
0.7	0.5	0.2
1.1	0.8	0.3
0.6	0.9	-0.3
1.3	1.4	-0.1
0.7	0.4	0.3
0.8	1.2	-0.4
0.5	0.5	0.0
0.3	0.5	-0.2
0.5	1.5	-1.0
0.5	0.9	-0.4
0.9	0.7	0.2
2.1	3.0	-0.9
0.5	0.6	-0.1
0.5	0.3	0.2
0.5	0.5	0.0

Compound:M/P Xylenes		
Canister	Tube	Difference
0.5	0.3	0.2
1.2	0.9	0.3
0.8	1.0	-0.2
0.5	0.4	0.1
0.5	0.8	-0.3
0.7	1.1	-0.4
1.0	0.4	0.6
1.0	1.0	0.0
1.1	0.9	0.2
1.7	0.7	1.0
3.9	1.9	2.0
1.4	2.4	-1.0
0.7	0.5	0.2
1.3	1.3	0.0
1.2	2.0	-0.8
0.7	0.8	-0.1
2.1	1.8	0.3
2.0	1.1	0.9
1.5	1.2	0.3
1.4	0.7	0.7
1.0	0.5	0.5
1.9	1.4	0.5
1.0	1.0	0.0
1.2	1.3	-0.1
1.3	1.5	-0.2
1.0	1.1	-0.1
1.9	2.2	-0.3
1.6	1.1	0.5
1.5	2.0	-0.5
2.6	1.3	1.3
0.7	0.9	-0.2
0.9	0.9	0.0
1.0	1.2	-0.2
0.9	0.9	0.0
1.7	1.7	0.0
1.0	0.8	0.2
0.4	0.7	-0.3
0.2	0.5	-0.3
0.7	0.7	0.0
0.6	0.7	-0.1
1.0	1.0	0.0
3.0	3.5	-0.5

Compound:O-Xylene		
Canister	Tube	Difference
0.2	0.1	0.1
0.4	0.3	0.1
0.3	0.3	0.0
0.4	0.1	0.3
0.4	0.3	0.1
0.4	0.3	0.1
0.8	0.2	0.6
1.6	0.6	1.0
0.5	0.7	-0.2
0.5	0.2	0.3
0.5	0.4	0.1
0.6	0.6	0.0
0.3	0.3	0.0
1.1	0.6	0.5
1.5	0.4	1.1
1.2	0.5	0.7
1.1	0.3	0.8
0.7	0.2	0.5
1.1	0.4	0.7
1.2	0.6	0.6
0.4	0.3	0.1
0.5	0.4	0.1
0.5	0.4	0.1
0.4	0.3	0.1
0.5	0.7	-0.2
0.7	0.3	0.4
0.6	0.6	0.0
1.1	0.4	0.7
0.2	0.3	-0.1
0.6	0.3	0.3
0.4	0.4	0.0
0.6	0.3	0.3
0.6	0.6	0.0
0.6	0.3	0.3
0.2	0.2	0.0
0.3	0.3	0.0
0.3	0.2	0.1
0.4	0.3	0.1
1.1	1.0	0.1
0.5	0.1	0.4

New York State Department of Environmental Conservation

PEI Canisters vs. Envirochem Sorbent Tubes

4th Quarter 1987 - 3rd Quarter 1988

(All units in ppb)

Compound:1,1,1-Trichloroethane		
Canister	Tube	Difference
0.7	0.2	0.5
1.0	0.3	0.7
1.3	1.5	-0.2
0.3	0.5	-0.2
0.5	0.5	0.0
1.2	0.5	0.7
0.3	0.4	-0.1
0.4	0.3	0.1
0.6	0.5	0.1
0.5	0.4	0.1
0.4	0.3	0.1
0.4	0.3	0.1

Compound:Dichloromethane		
Canister	Tube	Difference
0.7	0.2	0.5
0.8	0.9	-0.1
0.6	0.3	0.3
0.8	0.6	0.2
0.6	0.9	-0.3
0.6	1.0	-0.4
1.0	0.2	0.8
0.7	1.3	-0.6
0.5	0.5	0.0
1.2	0.7	0.5
0.8	0.4	0.4
1.4	0.8	0.6
0.5	0.3	0.2
1.4	0.3	1.1
1.5	0.4	1.1
0.6	0.7	-0.1
1.6	2.0	-0.4
0.4	0.3	0.1
0.6	0.5	0.1
0.9	0.6	0.3
0.8	0.4	0.4
0.8	0.7	0.1
0.7	0.4	0.3
0.8	0.4	0.4
0.6	0.5	0.1
1.2	0.4	0.8
1.3	1.1	0.2
1.0	0.4	0.6
0.8	0.3	0.5
0.4	0.3	0.1
0.3	0.3	0.0
0.5	0.2	0.3
0.8	1.0	-0.2

Compound:Tetrachloroethane		
Canister	Tube	Difference
0.7	0.1	0.6
1.5	0.2	1.3
0.2	0.2	0.0
0.3	0.2	0.1
0.3	0.3	0.0
0.2	0.3	-0.1
0.2	0.4	-0.2
0.2	0.2	0.0
0.3	0.3	0.0
0.2	0.2	0.0
0.2	0.2	0.0
0.2	0.2	0.0
0.3	0.2	0.1
0.8	0.5	0.3
0.2	0.2	0.0
0.3	0.2	0.1
0.3	0.3	0.0

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: Toluene			Compound: Toluene (Continued)			Compound: Benzene			Compound: Benzene (Continued)		
Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference
2.4	2.6	-0.2	3.9	1.9	2.0	1.0	1.0	0.0	0.7	0.5	0.2
2.2	3.0	-0.8	0.6	0.4	0.2	0.9	1.1	-0.2	0.6	0.6	0.0
2.8	1.5	1.3	5.9	2.7	3.2	0.8	0.9	-0.1	0.3	0.2	0.1
4.3	4.6	-0.3	2.5	2.8	-0.3	1.9	1.4	0.5	0.4	0.1	0.3
2.9	3.6	-0.7	1.5	2.3	-0.8	1.2	0.9	0.3	0.4	0.3	0.1
4.2	5.2	-1.0	6.7	7.6	-0.9	1.8	1.5	0.3	0.6	0.6	0.0
3.3	7.2	-3.9	6.4	7.4	-1.0	1.2	0.9	0.3	1.3	1.2	0.1
1.1	1.9	-0.8	6.0	5.8	0.2	0.5	0.6	-0.1	0.8	0.6	0.2
3.3	5.1	-1.8	1.7	4.0	-2.3	1.4	1.2	0.2	1.3	1.2	0.1
2.4	3.4	-1.0	2.5	2.2	0.3	1.1	1.1	0.0	0.6	0.7	-0.1
1.7	1.9	-0.2	1.1	2.3	-1.2	0.6	0.6	0.0	1.1	1.3	-0.2
3.3	4.9	-1.6	0.5	0.7	-0.2	1.3	1.8	-0.5	1.9	2.2	-0.3
3.0	4.9	-1.9	0.7	1.3	-0.6	0.9	1.2	-0.3	0.6	0.4	0.2
1.7	2.2	-0.5	1.1	1.0	0.1	0.8	0.9	-0.1	1.6	0.8	0.8
1.2	0.9	0.3	1.1	1.1	0.0	0.5	0.4	0.1	0.6	0.7	-0.1
1.2	0.9	0.3	3.4	3.1	0.3	0.3	0.4	-0.1	1.0	1.2	-0.2
1.4	1.8	-0.4	2.0	1.9	0.1	0.5	0.8	-0.3	0.8	0.7	0.1
3.4	2.9	0.5	3.9	3.6	0.3	1.1	0.8	0.3	0.6	0.7	-0.1
5.4	6.0	-0.6	1.4	1.3	0.1	2.1	2.3	-0.2	0.7	0.8	-0.1
0.7	1.6	-0.9	3.8	4.7	-0.9	0.5	0.6	-0.1	1.3	2.2	-0.9
2.7	3.5	-0.8	9.9	11.0	-1.1	0.5	0.5	0.0	0.7	1.2	-0.5
3.9	5.6	-1.7	2.3	1.9	0.4	0.8	0.6	0.2	0.7	1.0	-0.3
2.4	3.6	-1.2	6.1	2.9	3.2	0.6	0.5	0.1	1.2	1.4	-0.2
2.8	4.2	-1.4	1.6	2.8	-1.2	2.1	2.3	-0.2	1.1	1.1	0.0
3.2	3.7	-0.5	2.2	3.8	-1.6	0.8	1.7	-0.9	1.4	1.1	0.3
4.6	6.2	-1.6	1.3	1.9	-0.6	1.6	1.0	0.6	0.7	0.8	-0.1
2.2	8.1	-5.9	1.6	2.8	-1.2	2.8	3.6	-0.8	0.5	0.7	-0.2
1.1	1.6	-0.5	1.5	2.3	-0.8	1.8	1.1	0.7	0.8	0.6	0.2
1.8	1.8	0.0	3.8	5.3	-1.5	1.0	0.8	0.2	1.3	1.2	0.1
1.0	1.0	0.0	1.9	2.7	-0.8	0.8	0.7	0.1	0.7	0.4	0.3
4.1	7.0	-2.9	2.2	4.4	-2.2	0.8	0.8	0.0	1.4	1.2	0.2
1.3	5.0	-3.7	3.0	3.9	-0.9	1.4	0.8	0.6	0.8	0.3	0.5
4.8	4.1	0.7	2.5	3.4	-0.9	0.8	0.6	0.2	0.8	0.4	0.4
4.1	10.1	-6.0	3.1	4.1	-1.0	0.7	0.7	0.0	1.1	0.9	0.2
3.2	4.2	-1.0	1.7	3.8	-2.1	0.9	1.4	-0.5	1.2	1.1	0.1
2.9	4.0	-1.1	1.6	2.1	-0.5	0.9	1.0	-0.1	0.7	0.6	0.1
1.3	1.9	-0.6	2.9	3.0	-0.1	2.2	3.0	-0.8	1.1	1.1	0.0
1.6	2.3	-0.7	3.5	4.7	-1.2	1.0	1.7	-0.7	0.8	0.7	0.1
3.8	2.6	1.2	2.3	1.5	0.8	2.4	2.2	0.2	1.0	0.7	0.3
1.1	1.5	-0.4	3.3	3.9	-0.6	2.1	2.5	-0.4	2.7	2.9	-0.2
2.8	3.5	-0.7	1.9	1.9	0.0	1.6	2.2	-0.6	0.6	0.9	-0.3
6.6	9.1	-2.5	3.7	1.9	1.8	1.5	1.3	0.2	1.5	1.5	0.0
3.4	5.0	-1.6	3.3	3.6	-0.3	1.9	2.2	-0.3	1.1	1.0	0.1
6.9	7.7	-0.8	2.9	2.7	0.2	0.9	0.4	0.5	2.7	2.2	0.5
8.1	9.3	-1.2	2.6	3.2	-0.6	4.2	3.8	0.4	3.4	3.2	0.2
8.1	7.3	0.8	2.8	2.8	0.0	0.6	0.5	0.1	0.7	0.7	0.0
6.1	6.9	-0.8	2.4	2.4	0.0	0.7	0.7	0.0	0.5	0.4	0.1
1.2	1.5	-0.3	2.5	2.7	-0.2	0.7	0.7	0.0	0.5	0.4	0.1
1.7	2.0	-0.3	8.2	9.8	-1.6	0.3	0.4	-0.1	0.7	0.8	-0.1
1.2	1.4	-0.2	1.1	5.0	-3.9	1.4	1.4	0.0	1.4	1.3	0.1
1.2	1.4	-0.2	3.9	4.0	-0.1	1.9	1.9	0.0	1.4	0.8	0.6
1.6	1.6	0.0	2.9	2.6	0.3	1.3	1.1	0.2	1.1	1.2	-0.1
1.8	2.2	-0.4	8.6	7.6	1.0	0.9	0.9	0.0	1.3	1.1	0.2
9.7	8.8	0.9	10.0	10.8	-0.8	2.5	2.8	-0.3	0.4	0.2	0.2
1.9	0.9	1.0	2.0	2.1	-0.1	1.5	0.1	1.4	0.5	0.4	0.1
10.9	10.2	0.7	1.2	1.3	-0.1	0.9	0.6	0.3	0.8	0.9	-0.1
1.0	0.6	0.4	1.2	1.4	-0.2	0.3	0.4	-0.1	0.6	0.5	0.1
3.3	3.1	0.2	4.5	4.9	-0.4	2.6	0.9	1.7	1.2	1.5	-0.3
2.0	2.9	-0.9	4.2	3.9	0.3	1.1	1.1	0.0	1.7	2.0	-0.3
4.2	7.3	-3.1	2.8	4.0	-1.2	0.7	0.7	0.0	1.2	1.4	-0.2
0.8	0.9	-0.1	4.1	5.2	-1.1	2.7	2.7	0.0	1.2	1.4	-0.2
4.5	7.3	-2.8	0.9	1.0	-0.1	3.0	3.5	-0.5	1.6	1.6	0.0
3.7	4.0	-0.3	1.9	2.3	-0.4	2.0	2.2	-0.2	1.8	2.2	-0.4
1.8	1.7	0.1	3.1	3.8	-0.7	0.7	0.6	0.1			
7.2	9.9	-2.7	1.8	2.6	-0.8						

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: M/P Xylene			Compound: M/P Xylene (Continued)			Compound: O-xylene			Compound: O-xylene (Continued)		
Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference
1.2	1.2	0.0	0.8	0.9	-0.1	0.3	0.3	0.0	0.7	0.5	0.2
1.1	1.7	-0.6	3.3	3.8	-0.5	0.6	0.7	-0.1	0.3	0.2	0.1
0.8	0.9	-0.1	3.4	4.1	-0.7	0.2	0.3	-0.1	0.6	0.6	0.0
1.9	1.7	0.2	2.8	2.5	0.3	0.6	0.7	-0.1	0.9	1.0	-0.1
1.3	1.3	0.0	0.9	0.9	0.0	0.4	0.4	0.0	0.3	0.2	0.1
1.9	2.4	-0.5	0.9	1.0	-0.1	0.6	0.3	0.3	0.9	0.3	0.6
1.5	2.1	-0.6	0.3	0.3	0.0	0.6	0.6	0.0	0.2	0.2	0.0
0.7	0.9	-0.2	0.3	0.4	-0.1	0.5	0.5	0.0	1.4	0.4	1.0
1.5	2.2	-0.7	0.6	0.5	0.1	0.3	0.3	0.0	0.2	0.2	0.0
1.0	1.2	-0.2	0.5	0.8	-0.3	0.2	0.2	0.0	0.2	0.3	-0.1
0.9	0.9	0.0	1.4	1.6	-0.2	0.7	0.2	0.5	0.2	0.2	0.0
1.7	2.0	-0.3	0.9	1.0	-0.1	0.3	0.4	-0.1	1.6	0.6	1.0
1.3	1.4	-0.1	1.7	1.8	-0.1	0.4	0.3	0.1	0.3	0.3	0.0
0.7	0.8	-0.1	0.6	0.6	0.0	1.1	0.9	0.2	1.7	0.4	1.3
0.6	0.6	0.0	1.2	1.5	-0.3	0.4	0.4	0.0	2.3	0.4	1.9
1.1	0.6	0.5	2.4	3.0	-0.6	0.7	0.8	-0.1	2.3	0.5	1.8
0.7	1.1	-0.4	0.7	0.5	0.2	0.5	0.4	0.1	0.2	0.2	0.0
1.2	1.1	0.1	2.3	0.9	1.4	0.5	0.5	0.0	0.2	0.2	0.0
3.0	2.9	0.1	0.6	0.7	-0.1	0.6	0.5	0.1	0.9	0.3	0.6
0.1	0.7	-0.6	1.9	1.5	0.4	0.8	0.8	0.0	1.2	0.5	0.7
1.1	1.2	-0.1	0.5	0.7	-0.2	0.4	0.3	0.1	0.2	0.3	-0.1
1.8	2.4	-0.6	0.6	0.8	-0.2	0.2	0.2	0.0	2.5	0.4	2.1
1.1	1.4	-0.3	0.5	0.6	-0.1	0.8	0.9	-0.1	0.4	0.3	0.1
1.1	1.5	-0.4	2.3	2.1	0.2	0.7	0.5	0.2	4.8	0.4	4.4
1.6	1.5	0.1	0.8	0.9	-0.1	0.7	1.3	-0.6	0.4	0.3	0.1
2.0	2.7	-0.7	0.7	1.0	-0.3	0.5	0.5	0.0	2.2	0.3	1.9
0.4	0.7	-0.3	2.1	1.3	0.8	0.6	0.4	0.2	0.5	0.4	0.1
0.9	0.9	0.0	2.9	1.1	1.8	0.2	0.2	0.0	0.4	0.3	0.1
0.5	0.6	-0.1	2.9	1.6	1.3	0.5	0.2	0.3	0.5	0.0	0.5
2.1	2.9	-0.8	0.5	0.8	-0.3	0.5	0.2	0.3	2.1	0.4	1.7
0.5	1.7	-1.2	0.6	0.7	-0.1	0.4	0.4	0.0	0.2	0.3	-0.1
1.8	1.5	0.3	1.5	1.3	0.2	1.2	1.2	0.0	0.6	0.4	0.2
1.9	4.4	-2.5	1.6	1.3	0.3	1.2	0.9	0.3	0.4	0.3	0.1
1.3	1.8	-0.5	0.6	0.6	0.0	1.5	1.3	0.2	8.6	0.8	7.8
1.3	1.2	0.1	1.3	1.4	-0.1	0.8	0.8	0.0	2.1	1.1	1.0
0.6	0.7	-0.1	0.9	1.0	-0.1	0.9	0.7	0.2	0.3	0.3	0.0
0.5	0.7	-0.2	1.1	0.3	0.8	1.1	1.0	0.1	0.2	0.2	0.0
1.6	0.8	0.8	2.6	1.0	1.6	0.4	0.2	0.2	0.2	0.1	0.1
0.9	0.8	0.1	2.9	1.1	1.8	1.4	1.1	0.3	0.8	0.6	0.2
0.4	0.5	-0.1	0.8	1.0	-0.2	0.2	0.2	0.0	1.9	0.5	1.4
1.0	1.2	-0.2	4.0	1.2	2.8	0.3	0.2	0.1	0.6	0.7	-0.1
2.6	3.6	-1.0	0.8	0.8	0.0	0.7	0.5	0.2	1.2	0.8	0.4
2.6	1.4	1.2	1.9	1.1	0.8	0.2	0.7	-0.5	0.2	0.2	0.0
1.3	1.4	-0.1	3.1	4.1	-1.0	0.7	0.6	0.1	0.3	0.3	0.0
3.4	3.0	0.4	0.4	1.1	-0.7	1.0	0.8	0.2	3.0	0.5	2.5
3.5	3.6	-0.1	1.5	1.6	-0.1	0.6	0.5	0.1	0.3	0.3	0.0
2.3	2.8	-0.5	1.0	1.1	-0.1	0.4	0.3	0.1			
2.4	2.3	0.1	9.0	2.9	6.1	1.2	1.3	-0.1			
2.6	3.0	-0.4	4.0	3.7	0.3	0.5	0.3	0.2			
0.9	0.6	0.3	0.6	0.7	-0.1	0.2	0.1	0.1			
3.3	3.5	-0.2	0.5	0.5	0.0	1.2	0.4	0.8			
0.5	0.6	-0.1	0.4	0.5	-0.1	0.5	0.4	0.1			
0.7	0.8	-0.1	1.7	1.9	-0.2	0.3	0.3	0.0			
0.5	1.6	-1.1	2.3	1.5	0.8	1.4	1.2	0.2			
0.4	0.2	0.2	1.4	2.0	-0.6	1.4	1.3	0.1			
1.7	2.0	-0.3	2.5	2.8	-0.3	1.5	0.8	0.7			
2.7	2.0	0.7	0.5	0.5	0.0	0.3	0.3	0.0			
1.5	1.6	-0.1	0.7	0.9	-0.2	0.3	0.3	0.0			
0.9	0.9	0.0	2.7	1.3	1.4	0.3	0.3	0.0			
3.0	4.3	-1.3	0.8	1.0	-0.2	0.3	0.2	0.1			
6.6	0.9	5.7				0.2	0.2	0.0			
0.4	0.2	0.2				0.5	0.5	0.0			
2.9	1.2	1.7				0.3	0.3	0.0			
1.1	1.3	-0.2									

New York State Department of Environmental Conservation
PEI Canisters vs. AT050 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: 1,1,1-Trichloroethane			Compound: 1,1,1-Trichloroethane			Compound: Dichloromethane			Compound: Dichloromethane (Cntd)		
Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference	Canister	Tube	Difference
0.6	0.3	0.3	1.3	0.9	0.4	0.8	0.5	0.3	0.3	0.4	-0.1
0.6	0.3	0.3	0.5	0.3	0.2	0.8	0.8	0.0	1.0	0.8	0.2
0.3	0.4	-0.1	1.0	0.8	0.2	1.6	1.3	0.3	0.6	0.4	0.2
0.5	0.4	0.1	1.0	0.9	0.1	0.6	0.7	-0.1	2.4	1.3	1.1
1.7	1.0	0.7	0.3	0.2	0.1	0.8	0.7	0.1	0.4	0.2	0.2
1.1	0.6	0.5	1.5	0.3	1.2	0.7	0.3	0.4	1.0	0.8	0.2
0.6	0.3	0.3	0.5	0.4	0.1	1.1	2.2	-1.1	1.9	1.9	0.0
0.2	0.3	-0.1	0.4	0.2	0.2	0.6	1.0	-0.4	0.7	0.4	0.3
0.4	1.2	-0.8	0.3	0.3	0.0	1.2	0.3	0.9	2.0	0.6	1.4
0.7	0.3	0.4	0.3	0.3	0.0	1.3	0.9	0.4	0.3	0.2	0.1
0.2	0.0	0.2	0.5	0.4	0.1	0.5	0.2	0.3	0.6	0.6	0.0
0.7	0.4	0.3	0.8	0.9	-0.1	1.5	1.1	0.4	0.2	0.1	0.1
0.7	0.6	0.1	0.4	0.4	0.0	0.3	0.1	0.2	0.3	0.2	0.1
0.5	0.4	0.1	0.5	0.5	0.0	0.4	0.4	0.0	0.4	0.1	0.3
0.5	0.6	-0.1	0.6	0.5	0.1	0.6	0.4	0.2	1.3	1.1	0.2
0.6	0.3	0.3	0.7	0.5	0.2	0.8	0.9	-0.1	0.4	0.3	0.1
0.9	0.6	0.3	0.5	0.4	0.1	0.9	0.4	0.5	0.6	0.3	0.3
0.2	0.3	-0.1	0.5	0.4	0.1	1.1	1.2	-0.1	0.5	0.4	0.1
0.4	0.3	0.1	0.6	0.3	0.3	0.7	0.5	0.2	0.9	0.2	0.7
0.2	0.2	0.0	0.5	0.4	0.1	0.6	1.2	-0.6	0.5	0.3	0.2
0.7	0.4	0.3	0.7	0.4	0.3	0.7	0.3	0.4	0.4	0.3	0.1
1.0	0.5	0.5	0.5	0.2	0.3	1.2	1.4	-0.2	0.4	0.2	0.2
0.7	0.5	0.2	0.6	0.5	0.1	0.5	0.2	0.3	1.0	0.6	0.4
1.3	0.5	0.8	0.7	0.6	0.1	0.3	0.2	0.1	0.8	0.5	0.3
0.6	0.4	0.2	0.7	0.0	0.7	0.5	0.2	0.3	0.6	0.3	0.3
0.1	0.3	-0.2	0.6	0.3	0.3	0.6	0.5	0.1	0.7	0.7	0.0
0.4	0.5	-0.1	0.6	0.4	0.2	0.4	0.7	-0.3	0.5	0.6	-0.1
0.9	0.3	0.6	0.7	0.5	0.2	1.8	1.2	0.6	0.9	0.6	0.3
0.5	0.3	0.2	0.6	0.3	0.3	0.7	0.9	-0.2	0.9	0.4	0.5
0.3	0.4	-0.1	0.6	0.3	0.3	1.3	0.5	0.8	0.4	0.3	0.1
1.5	1.2	0.1	0.7	0.3	0.4	0.9	0.5	0.4	0.7	0.5	0.2
2.6	1.6	1.0	0.4	0.3	0.1	0.9	1.0	-0.1	0.6	0.3	0.3
1.7	1.1	0.6	0.6	0.3	0.3	0.5	0.2	0.3	0.4	0.1	0.3
1.1	0.7	0.4	0.7	0.4	0.3	0.7	0.5	0.2	0.2	0.2	0.0
1.8	1.4	0.4	1.5	0.8	0.7	2.4	3.9	-1.5	0.8	0.8	0.0
0.4	0.2	0.2	1.0	1.0	0.0	1.8	0.9	0.9	0.3	0.2	0.1
1.3	1.9	-0.6	0.7	0.4	0.3	2.6	2.9	-0.3	0.7	0.4	0.3
0.3	0.2	0.1	0.3	0.2	0.1	2.2	3.0	-0.8	0.7	0.5	0.2
0.5	0.3	0.2	0.4	0.3	0.1	1.5	0.8	0.7	2.1	1.0	1.1
0.9	0.7	0.2	0.6	0.4	0.2	2.6	2.3	0.3	2.3	2.1	0.2
0.3	0.1	0.2	0.7	0.3	0.4	0.7	0.3	0.4	0.5	0.3	0.2
1.2	0.9	0.3	0.9	0.4	0.5	6.4	3.2	3.2	0.5	0.3	0.2
1.6	0.9	0.7	0.6	0.4	0.2	0.2	0.2	0.0	0.4	0.4	0.0
1.0	0.6	0.4	0.8	0.4	0.4	0.4	0.1	0.3	1.0	0.8	0.2
0.3	0.1	0.2	0.7	0.3	0.4	2.2	0.7	1.5	0.5	0.2	0.3
0.3	2.3	-2.0				0.2	0.3	-0.1	0.5	0.2	0.3
0.5	0.3	0.2				0.7	1.9	-1.2	0.7	0.3	0.4
0.2	0.1	0.1				1.3	0.8	0.5	0.6	0.1	0.5
1.1	0.3	0.8				0.7	0.5	0.2	0.3	0.1	0.2
0.5	0.3	0.2				0.3	0.3	0.0	0.6	0.4	0.2
0.4	0.4	0.0				3.4	7.0	-3.6	0.6	0.2	0.4
0.7	0.5	0.2				0.6	0.1	0.5			
0.5	0.4	0.1				0.7	0.3	0.4			
0.8	0.4	0.4				1.0	1.0	0.0			
0.4	0.2	0.2				0.6	0.4	0.2			
0.5	0.2	0.3				0.9	0.8	0.1			
0.3	0.2	0.1				3.1	4.6	-1.5			
0.3	0.2	0.1				2.9	1.6	1.3			
0.2	0.2	0.0				0.4	0.1	0.3			
0.4	0.1	0.3				0.4	0.2	0.2			
0.5	0.3	0.2				0.2	0.2	0.0			
0.9	0.6	0.3				0.3	0.1	0.2			
0.8	0.7	0.1				3.2	0.3	2.9			

New York State Department of Environmental Conservation
PEI Canisters vs. ATD50 Tubes
4th Quarter 1988 - 3rd Quarter 1989

(All units are ppb)

Compound: Tetrachloroethane

Canister	Tube	Difference
0.2	0.1	0.1
0.2	0.3	-0.1
0.3	0.2	0.1
0.3	0.3	0.0
0.8	0.6	0.2
0.2	0.3	-0.1
0.3	0.2	0.1
0.2	0.2	0.0
0.5	0.3	0.2
0.3	0.3	0.0
0.3	0.1	0.2
0.4	0.3	0.1
5.1	1.3	3.8
0.2	0.1	0.1
0.5	0.1	0.4
0.7	0.4	0.3
0.3	0.2	0.1
0.8	0.9	-0.1
0.9	0.4	0.5
0.9	0.6	0.3
0.8	0.6	0.2
1.8	1.1	0.7
0.8	0.7	0.1
0.4	0.3	0.1
6.7	0.3	6.4
0.6	0.5	0.1
1.1	0.7	0.4
1.4	1.3	0.1
0.2	0.1	0.1
5.4	3.0	2.4
0.3	0.2	0.1
0.4	0.2	0.2
0.2	0.2	0.0
0.7	0.5	0.2
0.9	0.6	0.3
0.4	0.2	0.2
0.7	0.6	0.1
0.3	0.2	0.1
0.3	0.1	0.2
0.2	0.1	0.1
3.7	4.4	-0.7
0.5	0.2	0.3
0.5	0.6	-0.1
1.2	0.5	0.7
0.6	0.3	0.3
0.6	0.3	0.3
0.3	0.2	0.1
0.3	0.2	0.1
0.8	0.3	0.5
0.5	0.4	0.1
0.5	0.4	0.1

CC188L

New Jersey Institute of Technology

PEI Canisters vs. NJIT Canisters and Tenax

4th Quarter 87 - 3rd Quarter 88

(All units are ppb)

Compound: Toluene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
3.1	11.9	3.2	-8.8	-0.1
3.0	3.3	4.2	-0.3	-1.2
5.1	7.3	4.1	-2.2	1.0
5.3	8.4	7.6	-3.1	-2.3

Compound: Benzene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
2.5	2.5	1.3	0.0	1.2
0.9	0.2	1.3	0.7	-0.4
1.0	1.7	1.0	-0.7	0.0
1.8	2.4	2.4	-0.6	-0.6

Compound: M/P Xylene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.6	3.8	0.9	-3.2	-0.3
1.8	6.4	1.3	-4.6	0.5
2.3	3.1	1.0	-0.8	1.3
1.4	1.4	3.1	0.0	-1.7

Compound: O-Xylene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.6	1.5	0.5	-0.9	0.1
0.9	1.0	0.4	-0.1	0.5
0.5	0.4	1.0	0.1	-0.5

Compound: Hexane

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
1.8	2.0	1.7	-0.2	0.1

Compound: 1,1,1-Trichloroethane

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.8		0.5	0.8	0.3
0.6	0.5	1.0		-0.4

Compound: Tetrachloroethene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
nd	0.1	0.2		
nd	0.0	0.3		
nd	0.1	0.2		
nd	0.1	0.2		

CC188L

New Jersey Institute of Technology

PEI Canisters vs. NJIT Canisters and Tenax

4th Quarter 88 - 3rd Quarter 89

(All units are ppb)

Compound: Toluene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
3.4	3.4	4.8	0.0	-1.4
3.1	3.8	11.6	-0.7	-8.5
6.8	5.7	9.5	1.1	-2.7
1.9	1.5	1.0	0.4	0.9
2.3	1.9	2.9	0.4	-0.6
5.6	4.7	3.2	0.9	2.4

Compound: Hexane

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
1.2	1.5	1.2	-0.3	0.0
1.3	1.8	3.4	-0.5	-2.1
1.5	1.5	2.8	0.0	-1.3
1.0	1.1	0.5	-0.1	0.5
2.2	1.3	1.2	0.9	1.0

Compound: Benzene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
2.0	2.5	2.3	-0.5	-0.3
1.7	2.2	4.4	-0.5	-2.7
3.1	3.3	5.4	-0.2	-2.3
0.9	0.9	0.6	0.0	0.3
1.0	1.1	0.9	-0.1	0.1
2.1	2.6	1.2	-0.5	0.9

Compound: 1,1,1-Trichloroethane

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.9	1.0	0.7	-0.1	0.2
0.8	1.0	1.2	-0.2	-0.4
0.7	1.3	0.7	-0.6	0.0
0.6	0.7	0.3	-0.1	0.3
0.5	0.7	0.3	-0.2	0.2
1.2	1.7	0.4	-0.5	0.8

Compound: M/P Xylene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.8	0.6	1.6	0.2	-0.8
0.7	0.7	3.4	0.0	-2.7
3.2	2.2	1.2	1.0	2.0
0.7	0.8	0.2	-0.1	0.5
0.9	0.6	0.4	0.3	0.5
2.1	1.4	1.4	0.7	0.7

Compound: Tetrachloroethene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.2	0.2	0.2	0.0	0.0
0.2	0.2	0.2	0.0	0.0
0.2	0.1	0.2	0.1	0.0
0.2	0.1	0.2	0.1	0.0

Compound: O-Xylene

PEI Canister	NJIT Canister	NJIT Tenax	Difference Canister	Difference Tenax
0.3	0.2	0.6	0.1	-0.3
0.3	0.2	1.1	0.1	-0.8
1.2	0.8	0.3	0.4	0.9
0.3	0.3	0.1	0.0	0.2
0.4	0.2	0.3	0.2	0.1
0.9	0.6	0.8	0.3	0.1

New Jersey Institiute of Technology

Supplemental Collocation Data from Sewaren and Piscataway
From
January 1988 - October 1989

1,1 Trichloroethane			Benzene			Tetrachloroethene			Ortho-Xylene			Toluene		
EI			PEI			PEI			PEI			PEI		
an.	Tenax	Difference	Can.	Tenax	Difference	Can.	Tenax	Difference	Can.	Tenax	Difference	Can.	Tenax	Difference
1.6	1.6	0	2.4	3.1	-0.7	0.6	0.3	0.3	1	1.1	-0.1	6.9	9.2	-2.3
0.3	0.2	0.1	0.4	0.6	-0.2	0.2	0.1	0.1	0.4	0.2	0.2	0.9	1.1	-0.2
0.4	0.1	0.3	1	0.9	0.1	0.3	0.2	0.1	0.4	0.1	0.3	2	2.3	-0.3
0.6	0.4	0.2	0.5	0.6	-0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.7	0.7	0
0.2	0.2	0	0.5	1	-0.5	0.3	0.5	-0.2	0.2	0.4	-0.2	0.7	0.7	0
0.2	0.5	-0.3	0.8	0.9	-0.1	3.8	0.1	3.7	0.3	0.2	0.1	2	1.7	0.3
0.7	0.4	0.3	0.8	0.7	0.1	0.3	0.2	0.1	0.3	0.2	0.1	2	7.3	-5.3
0.5	0.3	0.2	0.7	0.9	-0.2	0.3	0.3	0	0.2	0.1	0.1	1.8	2.2	-0.4
0.4	0.3	0.1	0.8	1.3	-0.5				0.4	0.2	0.2	2.1	3	-0.9
0.9	1.2	-0.3	1.6	1.2	0.4	Meta and Para Xylene			0.9	0.6	0.3	5.7	5.1	0.6
0.8	0.5	0.3	0.8	0.5	0.3	PEI			0.4	0.2	0.2	1.9	1	0.9
0.4	0.2	0.2	1.4	0.8	0.6	Can.	Tenax	Difference	0.8	0.5	0.3	4.3	2.2	2.1
0.6	0.2	0.4	0.6	0.4	0.2				0.3	0.2	0.1	1.3	0.8	0.5
0.6	0.2	0.4	1.5	2.6	-1.1	2.6	2.7	-0.1	0.7	0.5	0.2	4.1	4.5	-0.4
0.8	0.4	0.4	1.9	2.8	-0.9	1	0.6	0.4	0.7	0.6	0.1	5	6.7	-1.7
1.5	1.7	-0.2	0.7	0.4	0.3	0.9	0.4	0.5	0.3	0.2	0.1	1.4	0.8	0.6
0.5	0.3	0.2	0.4	0.4	0	0.5	0.2	0.3	0.2	0.1	0.1	2.1	1.5	0.6
0.6	0.3	0.3	0.5	0.3	0.2	0.3	0.2	0.1	0.2	0.2	0	1.8	0.9	0.9
1.7	0.8	0.9	0.7	0.4	0.3	0.9	0.5	0.4	0.3	0.2	0.1	2.1	1	1.1
0.3	0.2	0.1	0.3	0.4	-0.1	0.8	0.3	0.5	0.3	0.4	-0.1	0.8	0.6	0.2
0.3	0.2	0.1	0.4	0.4	0	0.5	0.3	0.2	0.3	0.2	0.1	0.7	0.5	0.2
1.1	0.5	0.6	0.7	1	-0.3	0.9	0.7	0.2	0.2	0.3	-0.1	2	2.5	-0.5
0.8	0.5	0.3	0.6	0.7	-0.1	2.3	1.5	0.8	0.3	0.1	0.2	1.9	2.1	-0.2
0.4	0.7	-0.3	1.3	0.5	0.8	0.8	0.5	0.3	0.7	0.3	0.4	1.8	3.2	-1.4
0.6	0.3	0.3	0.7	0.9	-0.2	1.8	0.9	0.9				4.7	1.7	3
1	0.4	0.6	0.7	0.2	0.5	0.6	0.3	0.3				3.3	1.8	1.5
			1.1	0.5	0.6	1.8	1.5	0.3						
						1.9	1.8	0.1						
ane						0.7	0.1	0.6						
EI						0.4	0.2	0.2						
an.	Tenax	Difference				0.5	0.3	0.2						
						0.8	0.2	0.6						
1.4	2	-0.6				0.3	0.1	0.2						
0.4	0.5	-0.1				0.3	0.1	0.2						
0.9	0.7	0.2				0.9	0.8	0.1						
1	0.7	0.3				0.7	0.5	0.2						
0.4	0.3	0.1				0.6	0.8	-0.2						
0.7	0.7	0				0.5	0.2	0.3						
0.4	0.8	-0.4				1.6	0.6	1						
1.8	1.2	0.6												