Workplan.HW336025.10-22-2007.IndoorAirMonitoringPlan

INDOOR AIR MONITORING PLAN

FOR THE

SECOND ROUND OF INDOOR AIR QUALITY TESTING

Prepared for the

"Wallkill Wellfield" Property

located at

20 Industrial Place
City of Middletown
Orange County, New York

October 22, 2007

ESI File: LM97145.41

Prepared By:

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Ecosystems Strategies, Inc.
Environmental Services and Solutions

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The undersigned has reviewed this Report and certifies to Laurwal Holding Corporation that the information provided in this document is accurate as of the date of issuance by this office.

Any and all questions or comments, including requests for additional information, should be submitted to the undersigned.

Paul H. Ciminello
President

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1.0 INTRODUCTION

1.1 Purpose

This Indoor Air Monitoring Plan (IAMP) has been prepared to provide guidance on the manner in which investigative services will be provided to address potential indoor air quality concerns for off-site properties adjacent to the property known as "Wallkill Wellfield Site" and formerly referred to as "General Switch", located at the intersection of Highland Avenue and Industrial Place in the City of Middletown, Orange County, New York.

This IAMP is considered by Ecosystems Strategies, Inc. (ESI) to be a "Draft" document for submission to the United States Environmental Protection Agency (USEPA) for their review and acceptance. This document will be considered "Final" when specific comments made by the USEPA are considered and incorporated into this IAMP, and when the USEPA issues a letter indicating final approval of the IAMP.

The IAMP is modeled on the USEPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils - Subsurface Vapor Intrusion Guidance (hereafter "Indoor Air Evaluation Guidance" or "IAEG").

The USEPA has developed the Data Quality Objectives (DQO) process as a means of securing accurate and usable data on a specific site as well as ensuring consistency of data over different sites. This IAMP has been prepared and will be implemented in general conformance with the DQO process.

1.2 Limitations

This IAMP has been prepared as a response to potential indoor air quality concerns for properties near the Wallkill Wellfield property, located at 20 Industrial Place in the City of Middletown, Orange County, New York. The "Site" for the purposes of the IAMP is considered to be comprised of the Wallkill Wellfield building and the residential structures located on properties 1 to 22, depicted on Figure 2 (hereafter the "Site"). The proposed fieldwork is based on information gathered to date from multiple on-Site investigations. This IAMP cannot address conditions that have not been documented to date, or that have occurred after the dates of fieldwork. Other areas of concern and media of concern that have been identified on and/or near the Wallkill Wellfield property are the focus of separate investigations and remedial workplans.

1.3 Site Location and Description

The Wallkill Wellfield (Wallkill) property is an approximately 5-acre parcel located on the southern side of Industrial Place, City of Middletown, Orange County, New York. One building exists on the property, near its northwestern corner. The Wallkill building is an approximately 40,000-square-foot, one-story structure, currently used for furniture manufacture and warehousing.

1.4 Previous Investigations

This IAMP has been developed to assess indoor air quality in the residential structures adjacent to the Wallkill property. To that end, the property history, investigations conducted to date, and current conditions are described in this section to provide context for the proposed activities.

According to a review of previous reports, manufacturing activities at Wallkill included the production of electrical switches, circuit breakers, and panel boards. The manufacturing process included the use of tetrachloroethylene (PCE).

Investigations of the Wallkill property began in 1983 when PCE, trichloroethylene (TCE), and other chlorinated solvents were identified in groundwater samples collected from adjoining and surrounding properties. Jacobs Environmental, Inc. (Jacobs), and Shakti Consultants, Inc. (Shakti) conducted on-Site soil and groundwater investigations documented in their Draft Partial Site Characterization Report (Characterization Report) dated March 29, 1993. ESI was not involved on this project at this time and does not know the status of this Characterization Report.

In 1997, ESI began providing environmental services to the property owner. ESI has conducted additional soil and groundwater investigations, and also developed and implemented remedial workplans for soil and groundwater, some of which are ongoing through present. In addition, ESI conducted groundwater testing as a means of documenting changes in water quality and determining the need for active groundwater remediation. Each medium (soil and groundwater) is discussed separately below.

Soil

Between 1998 and 2006, soil investigation and/or removal activities were conducted on-Site to both investigate and remediate "hot spots" north and south of the building where Jacobs and Shakti identified PCE, TCE, and trichloroethane in soils and groundwater. In total, over 500 cubic yards of solvent contaminated soils have been removed. Eight final soil samples were collected at the northern "hot spot"; laboratory data documented PCE levels in remaining soils at levels ranging from 0.079 ppm to 0.89 ppm. At the southern "hot spot", eleven final end point samples documented PCE levels of 37 ppm and 50 ppm at ten feet below surface grade at the northern edge of the excavation (additional excavation was not possible due to concerns about undermining the structure). In addition, soil present under an electrical cable (and therefore inaccessible) at the southwestern edge of the excavation contained 70 ppm of PCE. In November of 2006 and March of 2007 subslab soil testing revealed additional contamination under the building. A separate proposal has been submitted to the USEPA for remediation of this area.

Groundwater

The Wallkill property currently contains 26 wells (16 overburden wells and ten bedrock wells) which have been sampled in 1992, 2000, 2003, and 2005 (not all wells were sampled on all rounds due to Site conditions). Data confirmed dissolved PCE [and several metabolites: TCE, dichloroethylene (1,1-DCE; cis-1,2,-DCE; trans-1,2-DCE), and vinyl chloride (VC)] contamination in both the shallow and bedrock aquifers. Groundwater is moving to the south, supporting the conclusion that any dissolved PCE in shallow groundwater near the northern "hot spot" would migrate under the building. Shallow groundwater contamination is present in the highest concentrations at wells to the south of the southern "hot spot", with no detected concentrations of PCE in wells to the north of the building (however, no well is located within the boundary of the northern "hot spot"). Similarly, PCE concentrations in the bedrock wells are highest to the south of the building.

Data from an annual groundwater monitoring event (May 2005) document that wells located to the north and northwest of the Wallkill building tend to have low to non detectable concentrations of PCE. PCE concentrations in wells on this portion of the Site ranged from non-detect (6 wells) to 670 µg/l (in MW-202, a deep bedrock well closest to the building). The next highest detected concentration of PCE on this portion of the Site was 25 µg/l, followed by 4 µg/l. Wells to the south and southeast of the building tend to have higher concentrations of PCE. Detected concentrations on this portion of the Site ranged from 69 µg/l to 26,000 µg/l, with the highest concentrations (1,600 µg/l, 2,100 µg/l, 2,700 µg/l, 4,200 µg/l, 7,300 µg/l, and 26,000 µg/l) located closest to the southern corner of the building. Annual groundwater monitoring conducted at the Site since 1998 has shown a trend toward the reduction of PCE levels throughout the Site.

Depth to water at the Wallkill property has been established during all seasons. Groundwater elevations fluctuate several feet in the shallow wells, with less elevation change noted in the bedrock wells. Depth to water at the two wells in the vicinity of the Wallkill building (MW-1 and MW-8) has been in the 5' to 8' range. Depth to water at the two wells near residences along Highland Avenue (MW-12 and MW-13) has been in the 15' to 22' range. A map showing groundwater elevations is provided as Appendix D.

1.5 Data Quality Objectives

The Data Quality Objective (DQO) Process provides a systematic approach for defining the criteria that a data collection design should satisfy. In this case, implementation of the DQO process, as detailed herein, will determine the objectives and methodologies for execution of this IAMP. The DQO Process will also provide criteria for recommending follow-up actions based on the information generated through the performance of this IAMP. The DQO Process described herein is taken from the USEPA's publication "Data Quality Objectives Process for Hazardous Waste Site Investigation" (dated final, January 2000).

DQOs, outputs of the DQO Process, are qualitative and quantitative statements developed in the first six steps of the DQO Process; namely: 1) State the Problem; 2) Identify the Decision; 3) Identify Inputs into the Decision; 4) Define the Study Boundaries; 5) Develop a Decision Rule; and 6) Specify Limits on Decision Errors.

1.5.1 Problem Statement

Previous investigations, detailed above in Section 1.4, have identified elevated levels of PCE, and its metabolites, in soils and groundwater on the Wallkill Property. It is possible that these compounds are generating vapors that may intrude into the adjacent residential buildings, affecting indoor air quality.

1.5.2 Decision Statement

Two decisions are to be made from this investigation:

a) Does indoor air quality meet acceptable risk-based criteria for building occupants (i.e., residents) exposed to contamination that is related to historical Site activities? and

b) If a slab is present, do vapors exist under the buildings that represent a potential source of future indoor air quality concerns?

1.5.3 Inputs Into the Decision

The following information inputs are required to resolve the decision statements in Section 1.5.2:

- Indoor air concentrations of target analytes (see list in Section 2.2.4) or, if a slab is present, subslab gas concentrations of target analytes.
- Outdoor (i.e., meteorological) conditions and indoor conditions during sampling.
- Laboratory analysis of ambient air collected from locations between any off-Site sources of "fugitive vapors" and the residences (see Section 2.2.2, Task 1b).
- USEPA risk-based screening criteria [guidance levels] (see Section 2.2.5).
- Data Validation Reports from an independent data validator.

1.5.4 Study Boundaries

The geographic study boundaries are within each residential building and from the 1 to 2 foot below slab interval, for the residences with slabs. The proposed specific location of each sample is shown on the map titled "Figure 2 – Proposed Sampling Points" (Appendix A) and described in Sections 2.2.2 and 2.2.3.

The temporal study boundaries of this IAMP are dependent upon timing of the first sampling round and the laboratory results generated from the survey described herein. Gradients between indoor and outdoor atmospheric conditions affect vapor intrusion, and cold months (i.e., temperatures warmer inside than outside) generally exacerbate vapor intrusion unless the cold is extreme.

1.5.5 The Decision Rule

Laboratory results will be analyzed with consideration given to study timing, data validation reports, and other mitigating factors described elsewhere herein (e.g., fugitive vapors). Possible recommendations are detailed in Section 2.2.5, and include remedial actions, occupant notification, and retesting.

Indoor air quality that is below guideline values will result in a recommendation for no further action. Study timing will affect recommendations for possible retesting if results are close to, but below, guideline values.

Laboratory results at or near guideline levels, with no exceedances, may indicate the need for an additional round of sampling if data was generated during warm weather (see comments above, Section 1.5.4 regarding temporal study boundaries).

*1.5.6 Limits on Decision Error (*both the Wallkill building and all relevant residential structures)

The *a priori* assumptions at the Site by ESI are that that soil gas sampling will document the presence of PCE and its metabolites under the building slabs, if contamination exists; and in the absence of a slab, air testing will document the presence of PCE and its metabolites inside of the residences. Any data at variance to the hypotheses will be considered justification for further study and/or response actions. The selection of response actions will be based upon the chemical-specific matrices found in Appendix E. The need for and type of response actions required for each property will be determined in consultation with the USEPA.

2.0 Sampling Plan

2.1 Specified Objective

The objective of this IAMP is to assess indoor air quality (IAQ) associated with volatile organic compounds (VOCs), specifically PCE, at residential properties adjacent to the Wallkill property.

If warranted, mitigation actions may be taken at a later date. It is not an objective of this IAMP to propose specific mitigation actions, as necessary actions cannot be determined until IAMP activities are complete.

2.2 Air Sampling

2.2.1 Site Preparation

- *Scheduling of Sampling Event*

  Sampling will be timed, in coordination with individual property owners, to occur during a 24-hour period so that fluctuations and changes in air quality throughout the day are appropriately captured.

- *Resident Notifications*

  Residents will be notified of possible IAQ concerns and plans for indoor air monitoring.

- *Agency Notification/Oversight Mandate*

  The USEPA will be notified in writing at least two weeks prior to the initiation of the air sampling event.

2.2.2 Sample Collection: Indoor Air Quality

Task 1a: Physical Inspection for On-Site Vapor Sources

Prior to sample collection, the on-Site buildings (i.e., all relevant residential structures) will be inspected to identify any "point sources", where chemicals are used or stored, that would significantly impact testing results. The inspection and any findings will be recorded on a standard Survey Form (attached as Appendix B). The residents will also be interviewed, if possible, as an information reference for all portions of the Survey Form. Any potentially confounding indoor sources shall be removed from the residences a minimum of 48 hours prior to sampling, whenever possible. Additionally, the residences will be screened in multiple locations using a photo-ionization detector (PID) calibrated to 100 parts per million-calibration gas equivalents (ppm-cge) isobutylene in air. The purpose of this screening will be to determine if there are any "hot spots" that would legitimize the relocation of a proposed sampling point.

Task 1b: Survey of Potential Off-Site Vapor Sources

Concurrent with Task 1a, likely or observed activities on nearby properties (within 500 feet) will be documented with particular detail given to any suspect or known chemical usage activities. Potential off-Site sources of "fugitive vapors" will be evaluated and additional ambient air samples will be taken from locations between potential off-Site sources and the on-Site buildings.

Task 2: Sample Collection Method

Summa canisters fitted with calibrated flow controllers and pressure gauges will be used to collect the air samples. The canisters will be six liter in size with stainless steel fittings. The canisters will be individually certified clean by the laboratory. The Summa canisters will be set to collect air over a twenty four (24) hour period.

Samples from indoor air in houses without slabs, and one sample from outdoor air will be collected. Proposed sampling points are shown on Figure 2 in Appendix A. The outdoor sample location will be determined at the time of the survey, based on wind direction. One (1) duplicate sample will be included. Houses with slabs will have subslab gas sampling, instead of indoor air sampling, as described in Section 2.2.3.

Field logs will be maintained that record ambient outdoor and indoor temperature, outdoor and indoor humidity, outdoor and indoor barometric pressure prior to and after sampling is completed. For each sampling canister, the pre- and post-sample canister pressure, start and stop times, and the exact location of each sampling point will be recorded. Any obvious mitigating factors will also be recorded.

Sampling and laboratory quality assurance/quality control (QA/QC) is detailed fully in the "Standard Operating Procedure (SOP) – Determination of VOCs in Air Matrices using Whole Air Sampling" (Appendix C).

2.2.3 Sample Collection: Subslab Gas

Sample Timing and Locations

Subslab gas sampling will be conducted in the residences with slabs to determine if subsurface contamination is a potential source of VOCs. Subslab air samples will be collected from one sampling point in the building, away from the edges of the building foundation (see Figure 2 - Proposed Sampling Points, Appendix A).

Sample Collection Method

Subslab gas sampling will be conducted directly beneath the slab, in the aggregate (if present). Tubing will be extended a maximum depth of two (2) inches into the subslab material. Actual depth will be dependent on-Site conditions. The cause of any significant deviation from this depth will be documented.

The end of the sample tubing (0.188 inch inner diameter Teflon) will be attached to an "air stone" filter and inserted through the slab breach. The surface and any space between the borehole and probe rod will be sealed off with a non-VOC containing material to prevent surface air from entering the system. Before purging, a properly calibrated PID will be used to measure volatile organics by connecting the PID to the inserted Teflon tubing. Field measurement of temperature and weather conditions will also be recorded at the time of sampling.

The space around the sampling point will be properly encapsulated and insulated to allow the introduction of a tracer gas (helium) into the area surrounding the probe point. Tracer gas will be introduced into the space around the probe point as an indicator of any leaks or intrusions of building air into the sub-slab gas sample space. The tracer gas will be introduced and maintained throughout the duration of the sample collection.

A vacuum pump will then be utilized to purge the standing air from the tubing and open soil interval prior to sample collection. The exact purge volume will be dependent on the boring depth and subsequent length of tubing. Three borehole and tubing volumes will be purged prior to collection. The purge rate will not exceed 0.2 liters per minute. All purge gas will be collected in Tedlar bags, in order to prevent it from being discharged into the indoor air. The Tedlar bags will be discharged outside of the building, and then re-used for subsequent purging.

The formula for calculating purge volume (under these conditions) is detailed below:

internal volume of 0.188 inch inner diameter tubing = 5.43 milliliters/foot [ml.ft]
slab breach typically utilizes 4 feet of tubing = 21.72 ml per 4 feet of tubing
volume of a one (1) foot void = 240 ml (approx.)
purge volume of one borehole and tubing = 262 ml (approx.)
x 3 = 786 ml (approx.) total purge

Following purging of ambient air from the collection device, the subslab soil gas sample will be collected over a one (1) hour period (at a rate not exceeding 0.2 liters per minute) via Summa canister, consistent with the SOP attached in Appendix C.

Post-survey Sample Point Abandonment

After the collection of soil-gas samples, and removal of sampling equipment, the boreholes will be patched with concrete and the floor will be returned to its pre-survey condition.

2.2.4 Laboratory Analyses

After sample collection, samples will be transported within 24 hours via courier to York Analytical Laboratories, Inc., a New York State Department of Health Environmental Laboratory Approval Program (ELAP) certified laboratory (ELAP # 10854) for VOC analyses. Appropriate chain of custody procedures will be followed.

All samples will be analyzed for the compounds of concern: PCE; TCE; 1,1-DCE; cis-1,2,-DCE; trans-1,2-DCE; 1,2-dichloroethane, and VC. These seven (7) compounds are collectively referred to as the "target analytes" for the remainder of this IAMP. Samples will be analyzed for the target analytes using USEPA Method TO-15. The SOP for Method TO-15 is included as Appendix C. The laboratory will use Selective Ion Monitoring (SIM) mode for the GC/MS analyses, with a method detection limit of 0.05 ppbv (dilution, if necessary, will increase MDL). All method analytes will be provided in the complete laboratory data and will be discussed in the Final Report.

In addition, each sub-slab sample will be analyzed for the presence of helium (tracer gas) using a variation of USEPA Method 3C. The laboratory will utilize hydrogen as a carrier gas. The detection limit is 1%.

2.2.5 Laboratory Data Review

Air Quality Guidance Values

For the purpose of this assessment, data from indoor air and subslab vapor samples will be compared to risk-based screening criteria developed by the USEPA and NYSDOH (see Appendix E). Final decisions regarding action levels and follow up remediation will be developed and implemented with the consensus of USEPA.

Data Quality Review

Subslab samples will also be analyzed for detectable levels of tracer gas (helium) using the appropriate USEPA Methodology (Method 3C).

Complete data validation will be conducted by an independent third party.

Results and Recommendations

Follow-up actions will be recommended on the basis of analytical results. Specific recommended actions may include one or more of the following: follow-up testing, installation of a remediation and/or indoor air purifying system, and occupant notification. Any follow-up testing conducted will be done in accordance with the protocols detailed in this IAMP, although the number and location of indoor air samples may be modified as appropriate, based on results of previous sampling events. Specific follow-up actions cannot be recommended until after the completion of indoor air monitoring and the receipt of analytical results.

3.0 Timing and Deliverables

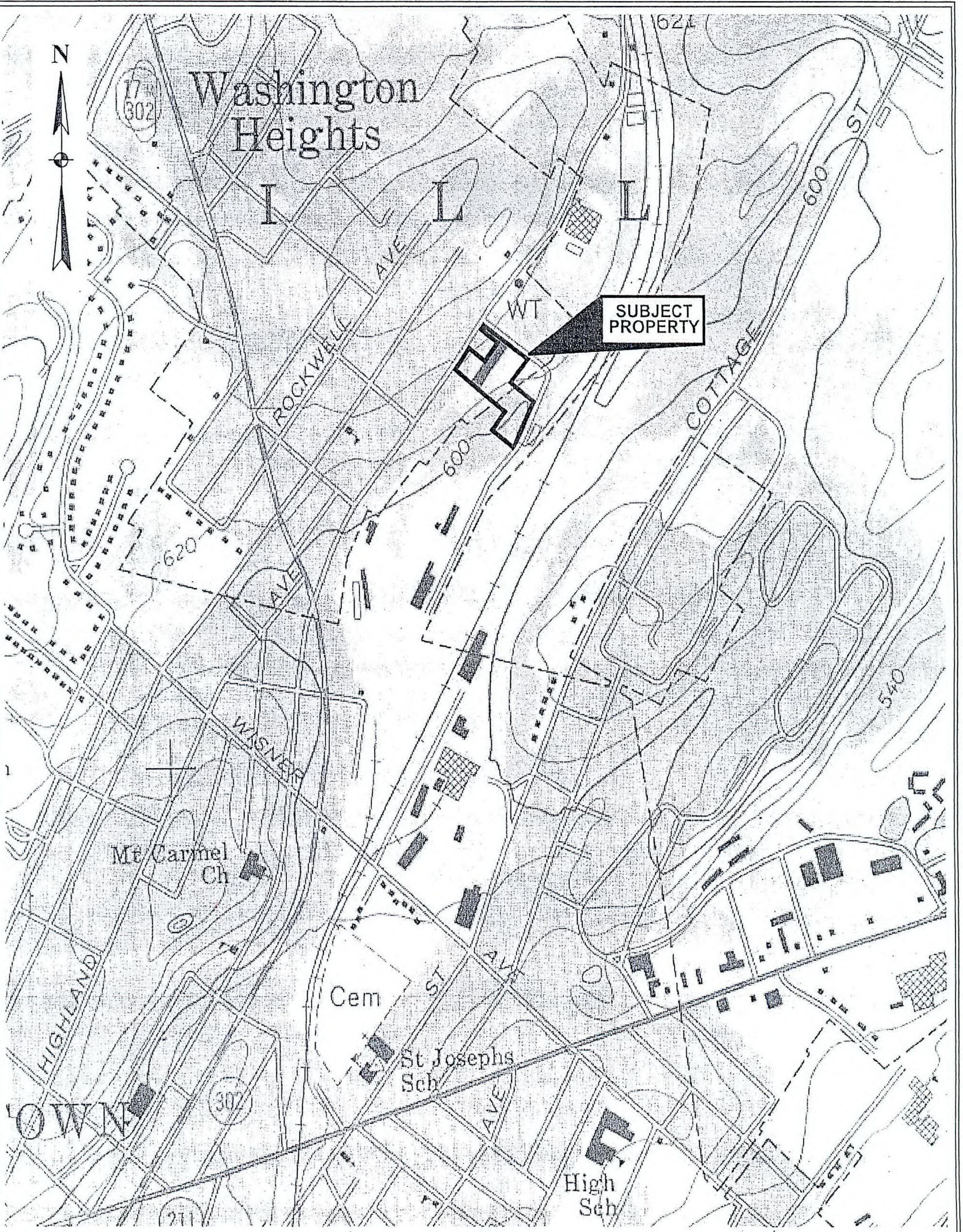
This sampling event will be conducted during the first week in December 2007, after receiving written authorization from the USEPA, and is subject to securing access to on-Site residential properties for the purpose of sample collection. A second sampling round may be warranted depending on the data from this round.

Upon receipt of laboratory results, an Indoor Air Quality Report (IAQ Report) will be prepared that summarizes all fieldwork conducted (including field recordings and mitigating factors), laboratory findings, and conclusions and recommendations. This IAQ Report will include (as appendices) figures detailing sampling points, field logs, laboratory analyses, and the report from the independent data validator.

Within three weeks of receipt of all laboratory reports and QA/QC reports, three copies of the IAQ Report will be delivered to the USEPA.

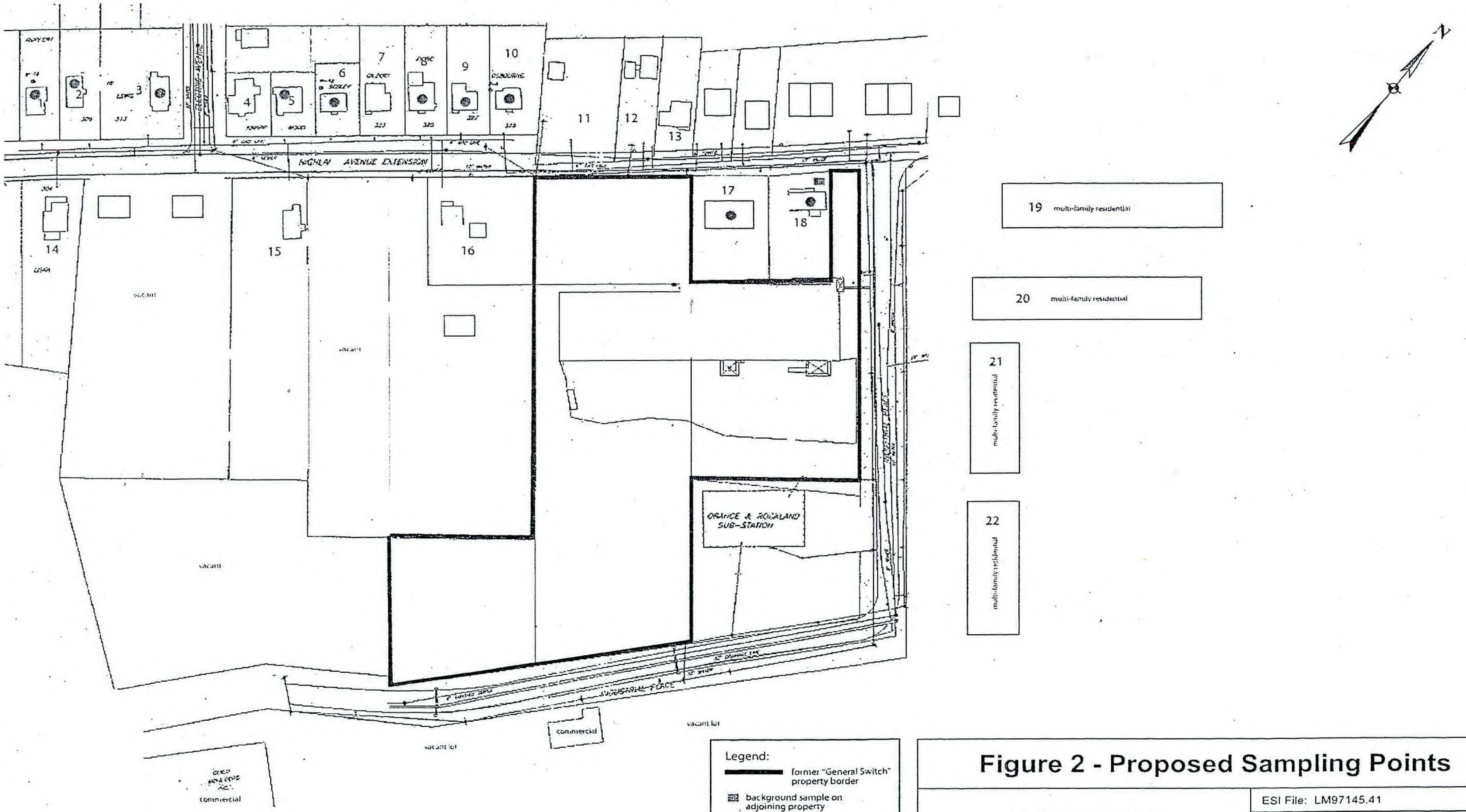
APPENDIX A

Maps



Source: U.S. Department of the Interior Geological Survey Topographic Map of the Middletown, NY Quadrangle, dated 1969 (photorevised 1976).

Figure 1 - Site Location on U.S.G.S. Topographic Map Wallkill Wellfield Site 20 Industrial Place, City of Middletown Orange County, New York	Legend: ▬ former "General Switch" property border	ESI File: LM97145.41 October 2007 Scale 1 : 24,000 Appendix A - Figure 1



Legend:

▬	former "General Switch" property border
▨	background sample on adjoining property
●	proposed sampling point on adjoining property
☐	new construction on adjoining property

Figure 2 - Proposed Sampling Points

Wallkill Wellfield Site
20 Industrial Place, City of Middletown
Orange County, New York

ESI File: LM97145.41
Not to scale
October 2007
Appendix A - Figure 2
Ec⊕systems Strategies, Inc.

APPENDIX B

Survey Form

INDOOR AIR BUILDING SURVEY
& SAMPLING FORM

(Taken from *New Jersey Department of Environmental Protection*)

Survey Completed by: ______________________________ Date: __________

Site Name: ______________________________ Case #: __________

Part I - Occupants

Building Address: ____

Property Contact: ____________________ Owner / Renter / other: ______________

Contact's Phone: home (   )__________ work (   )__________ cell (   )__________

Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults _____

Part II – Building Characteristics

Building type: single-family residential / multi-family residential / office / strip mall / commercial / industrial

Describe building: ____

Number of floors - below grade: _____ (full basement / crawl space / slab) at or above grade: _______

Basement size: ______ ft^2 Basement floor: concrete / dirt / floating / other (specify): __________

Foundation type: poured concrete / cinder blocks / stone / other (specify) ______________

Type of ground cover around outside of building: grass / concrete / asphalt / other (specify) __________

Basement sump present? *Yes / No* Sump pump? *Yes / No*

Type of heating system (circle all that apply):

- hot air circulation
- hot air radiation
- wood
- steam radiation
- hot water radiation
- kerosene heater
- electric baseboard
- heat pump
- other (specify): ______________

Type of ventilation system (circle all that apply):

- central air conditioning
- mechanical fans
- bathroom ventilation fans
- individual air conditioning units
- kitchen range hood fan
- other (specify): __________

Type of fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood / coal / solar / kerosene / outside (fresh) air intake

Septic system? *Yes / Yes (but not used) / No* Irrigation/private well? *Yes / Yes (but not used) / No*

Existing subsurface depressurization (radon) system in place? *Yes / No* and running? *Yes / No*

Part III - Outside Contaminant Sources

NYSDEC State Hazardous Waste Site (1,000-ft. radius): ______________________

Other stationary sources nearby (gas stations, emission stacks, etc.): ______________________

Heavy vehicular traffic nearby (or other mobile sources): ______________________

Building address: ______________________

Part IV – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor & room), and whether the item was removed from the building 48 hours prior to indoor air sampling event.

Potential Sources	Location(s)	Removed Prior to Sampling? (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Recent painting in building?		NA
Hobbies - glues, paints, etc.		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes / No* How often? ______________

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*

When were dry-cleaned clothes last brought into the building? ______________

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): ______________

Any known spills of a chemical immediately outside or inside the building? *Yes / No*

Describe (with location): ______________

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes* / No

If so, when and which chemicals? ______________

Building address: ______________________

Part VI – Sampling Information

Sample Technician: ______________________ Phone number: (   ) ______ - ________

Sampler Type: Tedlar / Sorbent / Canister Analytical Method: TO-15 / TO-17 / other: ________

Laboratory: ______________________ NJ Certified Lab? Yes / No

Sample #	**Floor**	**Room**	**Canister / Tube #**	**Pump ID #** (if applicable)	**Sample Start** Date / Time	**Sample End** Date / Time

Sample location(s):

Provide Drawing of Sample Location(s) in Building

Sample # _____ - ______________________

Sample # _____ - ______________________

Sample # _____ - ______________________

Sample # _____ - ______________________

Sample # _____ - ______________________

Sample # _____ - ______________________

Sample # _____ - ______________________

Did the occupants **not** follow any of the "Instructions for Residents" directions? *Yes / No*

If so, describe modifications: ______________________

____

Part VII - Weather Conditions

Outside temperature at time of sampling: _____ °F

Expected high temperature: _______ °F Expected low temperature: _______ °F

Was there significant precipitation within 12 hours of (or during) the sampling event? *Yes / No*

Describe the general weather conditions: ______________________

Building address: ______________________

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; NYDOH 1997; VDOH 1993; MA DEP 2002)

Building address: ______________________

AMBIENT INDOOR WEATHER CONDITIONS

BEGINNING

Time Temperature Humidity Barometric Pressure Wind Direction/Speed

_______AM/PM _______________ _______________ _________________ _________________

END

Time Temperature Humidity Barometric Pressure Wind Direction/Speed

_______AM/PM _______________ _______________ _________________ _________________

AMBIENT INDOOR WEATHER CONDITIONS

BEGINNING

Time Temperature Humidity Barometric Pressure

_______AM/PM _______________ _______________ _________________

END

Time Temperature Humidity Barometric Pressure

_______AM/PM _______________ _______________ _________________

Sample ID	Location	Canister / Tube #	Pump ID # (if applicable)	Start Time	End Time	Pre-Sample Canister Pressure	Post-Sample Canister Pressure	

APPENDIX C

Standard Operating Procedure for Method TO-15

YORK
ANALYTICAL LABORATORIES, INC.

GCMSAIR111692
Date of Issue: 11/16/1992
Revision No.: 4.0
Date of Revision: 01/25/2005

STANDARD OPERATING PROCEDURE

Determination of Volatile Organic Compounds In Air Matrices using Whole Air Sampling With Analysis by GC/MS by EPA Compendium Methods TO-14A and TO-15

SOP Reviewed and Approved by:____________ Date: 01/16/1992
Robert Q. Bradley
Managing Director

STANDARD OPERATING PROCEDURE FOR METHOD TO14A AND TO15

DETERMINATION OF VOLATILE ORGANIC COMPOUNDS (VOCS) IN AMBIENT AIR and SOIL GAS USING SUMMA PASSIVATED CANISTER SAMPLING AND GAS CHROMATOGRAPHY MASS SPECTROMETRY ANALYSIS

SCOPE, APPLICATION AND SUMMARY OF METHOD

This document describes the procedure for the analysis of volatile organic compounds (VOCs) in various air matrices. The method is based on collection of whole air samples in Summa passivated stainless steel (or Silcosteel ™) canisters or tedlar bags. The VOCs are subsequently cryo-trapped and released into a gas chromatograph for compound separation then speciated and measured by a mass spectrometer.

This method is based upon EPA Methods TO-14A and TO-15 and is applicable to specific VOC's that have been tested and determined to be stable when stored in pressurized and subatmospheric pressure canisters. Numerous compounds have been successfully tested for storage stability in pressurized canisters.

The organic compounds that have been successfully collected in pressurized canisters by this method are listed in the TO-14A and TO-15 methods. These compounds have been successfully measured at the low parts per billion by volume (ppbv) level.

A sample of ambient air is drawn through a sampling train comprised of components that regulate the rate and duration of sampling (critical orifice) into a pre-cleaned, pre-evacuated (27 in. Hg) Summa passivated canister. Grab sampling is performed with no orifice in line. Tedlar bags are typically used for high level work where the concentration of VOCs is in excess of 50 ppbv.

After the air sample is collected, the pressure/vacuum in the canister is recorded, the canister valve is closed, an identification tag is attached to the canister, and the canister is transported to our laboratory for analysis.

Upon receipt at the laboratory, the sample is logged into the LIMS. At the time of analysis the canister tag data is recorded and the canister is attached to the analytical system. During pre-concentration, water vapor and CO_2 are reduced in the gas stream and the VOCs are then concentrated by collection in a cryogenically-cooled trap. The cryogen is then removed and the temperature of the trap is raised. The VOCs originally collected in the trap are revolatilized, seperated on a GC capillary column, then speciared and detected by mass spectrometry.

Interior surfaces of the canisters are treated by the Summa™ passivation process, in which a pure chrome-nickel oxide is formed on the surface. This type of vessel has been used in the past for sample collection and has demonstrated sample storage stability of many specific organic compounds. The presence of water vapor (humidity) is highly desirable as it enhances the stability of VOCs in the canister, especially polar species like ketones, alcohols and the like.

This method can be applied to sampling and analysis of not only VOCs, but also some selected semi-volatile organic compounds (SVOCs). The term "semi-volatile organic compounds" is used to broadly describe organic compounds that are too volatile to be collected by filtration air sampling but not volatile enough for thermal desorption from solid sorbents. SVOCs can generally be classified as those with saturation vapor pressures at 250°F between 10^{-1} and 10^{-7} mm Hg. VOCs are generally classified as those organics having saturated vapor pressure at 250°F less than 10^{-1} mm Hg.

1.0 CONVENTIONS

For organizational purposes all activities for Volatile Organic Analysis (VOA) have strict conventions of coding standards, data files, header information, custom Programs, and instrumentation nomenclature.

1.1 STANDARDS: All Standards for TO-14A/TO-15 target list compounds are traceable to EPA and/or NIST where available or certified grade and are purchased through Spectra Gases, Inc., Alpha, NJ or equivalent. All standards, upon receipt are logged in the appropriate log book with the date of receipt, source and lot number(s). Any certification information received is filed appropriately.

VOCs not specified on the TO-14A/TO-15 lists are prepared in-house by injection of a known amount of neat material into a heated injection port of a GC. The helium carrier gas which then carries the vapor into an evacuated Summa Canister containing 50 ul of water. See Section 3.3 for details.

2.0 EQUIPMENT REQUIRMENTS

The TO-14A/TO-15 methodology requires a cryo-focusing system(sample concentrator system) interfaced to a Gas Chromatography/Mass Spectrometry/Data System. The specific instrument requirements are detailed as follows.

2.1 CALIBRATION

A. Gas Dilution System: Capable of preparing and delivering ppbv level Standards to Summa Canisters for static calibration. An Environics Series 2000 Computerized Multi-Component Gas Mixer is used to dynamically produce ppbv range standards from commercially or in-house prepared stock standards.

B. Stock TO-14A Gas Standard: 1000 ppbv, 39 compound Traceable Standard. Others, including Internal standards are purchased at 100 ppbv from Spectra Gases, Inc., Alpha, NJ.

C. Stock TO-15 Gas Standard: 1000 ppbv, 25 additional compound mixture purchased from Spectra Gases

D. Audit Sample/Lab Control Sample (LCS): 100 ppbv nominal purchased from separate source, Scott Specialty Gases, Plumsteadville, PA.

E. Zero Nitrogen: Airgas Northeast or equivalent

F. Summa Canisters: 3 or 6 liter, Summa passivated or silcosteel ™ for static standards. Certified clean, B/R Rasmussen, Restek, or equivalent.

2.2 ANALYSIS

A. Sample Preconcentration System: System capable of accepting up to 800 cc of whole air from a Summa canister. System must be able to cyrotrap sample, have water management capabilities and be able to integrate into a GC/MS system. An Entech Model 7000 Universal Sample Concentrator, specifically configured for TO-14A/15 is used.

B. Gas Chromatograph/Mass Spectrometer Data System: Temperature Programmable, electronic pressure controlled (EPC) Gas Chromatography system equipped with a 60 meter x 0.32 mm i.d. 1.5um film – RTX - Volatiles capillary column, (RESTEK Corp. no. 10904 or equivalent) directly interfaced to a Mass Spectrometer (Quadrapole). The Mass Spectrometer and data systems must be capable of acquiring data in either full scan mode or selected ion monitoring (SIM) modes. The system software must be capable of performing external and internal standard calibration, conducting a forward search of the most recent NIST Mass Spectral Database and provide qualitative and quantitative output for review and archive. A Hewlett-Packard 5890 Series IIGC interfaced to a Model 5972 Mass Selective Detector is in use presently.

C. Canister Cleaning System: All canisters from ambient applications are cleaned using the triple evacuation and fill technique. The elevated temperature technique as described in Section 11, paragraph 11.1.8 of Method TO-14A is utilized when canisters were used for high level VOC work (>1000ppbv). The heated technique requires an oven (Blue M-Type) operated at 105°C and a vacuum pump and gauge (30 in. Hg).

3.0 GC-MS SYSTEM PERFORMANCE CRITERIA

The appropriate operating conditions are established by loading in method TD120804 for full scan analysis or TS012405 for SIM analysis, or most current methods in use.

The analytical system is first challenged with a method blank canister containing purified humid zero-nitrogen containing 4-BFB to verify system cleanliness and mass spectral tuning. 4-BFB must meet the criteria shown in Table 1.0

Subsequent to this, a 5.0 ppbv calibration check standard is run. For SIM analysis, a 1.0 ppbv calibration check standard is run. Then, a method blank is run. All targets must be less than 0.20 ppbv to continue.

Following these runs, a laboratory control sample (LCS) is run. The targets should be +/- 30% of the actual value.

3.1 DAILY GC-MS TUNING

At the beginning of each day or prior to a calibration, the GC-MS system must be tuned to verify that acceptable performance criteria are achieved.

For tuning the GC-MS, 4-bromofluorobenzene (BFB) is introduced at a level of 10 ppbv with the Internal Standards (IS).
The key ions and ion abundance criteria that must be met are illustrated in Table 1.0 as follows:

TABLE 1.0 – GC/MS BFB CRITERIA

Mass	Ion Abundance Criteria
50	8 to 40% of mass 95
75	30 to 66% of mass 95
95	Base Peak, 100% relative abundance
96	5 to 9% of mass 95
173	<2% of mass 174
174	50-120% of mass 95
175	4 to 9% of mass 174
176	>93% but <101% of mass 174
177	5 to 9% of mass 176

Analysis cannot begin until these criteria are met.

Obtain a background corrected, averaged (minimum of the apex plus one Scan on each side of the apex) mass spectrum of the 4-bromoflourobenzene and check that all key ion criteria are met. If the criteria are not achieved corrective action is detailed as follows:

Corrective Action – GC-MS SYSTEM PERFORMANCE CRITERIA-4-BFB

If 4-BFB criteria is not meet, retune the mass spectrometer to yield masses 131 and 219 from the tuning compound PFTBA to be 39-45% of mass 69, and as close as possible to each other abundance-wise. This will adjust the masses 69, 131 and 219 in the PFTBA to yield the proper mass ratios for 4-BFB to meet the Table 1.0 criteria. This requires rerun of the 4-BFB subsequent to tuning to prove the corrective action has been successful. If BFB still does not meet criteria, notify your supervisor for continued actions.

This performance criteria must be achieved before any samples, blanks or standards are analyzed.

3.2 GC/MS CALIBRATION

3.2.1 Initial Calibration

The GC/MS system is initially calibrated in either the SCAN or SIM modes using static calibration with internal standardization.

FULL SCAN MODE

A 10.0 ppbv standard is prepared as described in Section 3.3.

From this standard, four other standards are run to allow for a five point calibration covering the range 1.0 ppbv to 20.0 ppbv for target compounds.

The specific levels for calibration include 1.0, 2.0, 5.0, 10.0 and 20.0 ppbv. These standards are introduced into the GC/MS system via the Entech cryosystem by introducing various volumes of the 10.0 ppbv standard into the system. The standard volumes of the 10.0 ppbv mix are introduced as follows:

Standard	Amount of 10.0 ppbv Mix introduced by Entech
1.0 ppbv	40.0 mls
2.0	80.0
5.0	200.0
10.0	400.0
20.0	800.0

SIM (Selected Ion Monitoring) MODE

A 2.50 ppbv standard is prepared as described in Section 3.3.

From this standard, four other standards are run to allow for a five point calibration covering the range 0.25 ppbv to 5.0 ppbv for target compounds.

The specific levels for calibration include 0.25, 0.5, 1.0, 2.5 and 5.0 ppbv. These standards are introduced into the GC/MS system via the Entech cryosystem by introducing various volumes of the 2.50 ppbv standard into the system. The standard volumes of the 2.50 ppbv mix are introduced as follows:

Standard	Amount of 1.00 ppbv Mix introduced by Entech
0.25 ppbv	40.0 mls
0.50	80.0
1.0	200.0
2.5	400.0
5.0	800.0

The calibration standards for scan or SIM mode are run after a Method Blank which has shown all target compounds at <0.20 ppbv. The laboratory artifacts methylene chloride and acetone are acceptable up to levels of 0.5 ppbv. If these are present, all sample data where methylene chloride or acetone are found are flagged with a "B".

Corrective Action- Method Blank

If the method blank detects any target compounds at > 0.20 ppbv, or methylene chloride and/or acetone at levels > 0.5 ppbv, the system is out of control. The specific corrective action includes a bake out and flush of sample lines in the ENTECH system. Rerun the method blank canister. If still out of criteria, evacuate the method blank cansiter to 27 in. Hg vacuum and pressurize with fresh humidified zero nitrogen to approximately 30 psig. Repeat this procedure two additional cycles and pressurize on last time with Humidified zero nitrogen to approximately 30 psig. Reanalyze this method blank. If criteria for the blank is still not achieved contact your supervisor.

Once the standards are run in either SCAN or SIM modes the average response factors are determined by the software and calibration table is generated. Relative Standard Deviation (RSD, %) for target compounds, should be less than 30%. It is noted that some polar species, and highly reactive species may exhibit greater % RSDs due to their stabilities in Summa canisters, or behavior with active sites in areas of the GC-MS System.

Corrective Action- Initial Calibration

The RSDs for the TO-14A and TO-15 target compounds all must be less than 30% in the initial calibration.. For the TO-14A and TO-15 compounds, if the RSD criteria is exceeded, the following corrective action is performed. The internal standard is re-prepared as directed in the standards preparation section of the SOP. The calibration mixture at 10 ppbv is also re-prepared as directed in the standards preparation section of the SOP. The five point curve is rerun. The RSDs should all be well within 30%. Should this criteria still not be met, see your supervisor for further action. For non-TO-14A or TO-15 Compounds, we target for 30% RSD, however due to the nature of the polar oxygenated species and other reactive gases, stability plays a major role in the RSD, not system performance. Should the RSD for these species be < 30% but less than 50%, it is acceptable. Any compound exhibiting >50% RSD over the calibration range is not suitable for TO-14A/15 analysis. The client is informed of such by fax from the Group Leader through the Managing Director.

3.2.2 Calibration Verification (Continuing Calibration Verification-CCV)

The GC/MS system initial calibration is verified each 24 hour period (and/or before sample analysis) with a single point calibration check standard at 5.0 ppbv (1.0 ppbv for SIM). Prior to running the standard, a system blank with 4-BFB is run to verify system cleanliness and GC/MS tuning criteria are met. Subsequent to this, the calibration check standard is run. Once the calibration check run is completed a humidified canister blank is run to again verify no carryover from the standard run.

The CCV standard response factors are compared to those of the initial calibration and the acceptance criteria is less than +/- 30% difference.

Corrective Action- Continuing Calibration Verification (CCV)

Should the % difference for TO-14A/15 compounds be > 30%, rerun the calibration check standard. If this criteria is still not met, re-prepare the internal standard mixture as directed in the SOP. Rerun the standard. If the criteria is still not met, re-prepare the calibration standard. Re-run it. If the criteria is still not met, re-run the five point calibration curve.

Subsequent to the calibration check, a method blank is run which must have < 0.2 ppbv for target compounds. See corrective actions discussed previously.

When these criteria are met, an audit sample (Laboratory Control Sample-LCS) is run. This audit sample is a certified standard from a separate source- (i.e. not the same source as that used for calibration) containing a subset of target compounds in the 5-15 ppbv range. The recovery of this LCS should be between 70-130%.

Corrective Action- LCS

Should the LCS criteria not be achieved, re-run the LCS. If the rerun is still out of the 70-130% window, contact your supervisor for further action.

3.3 Standards Preparation

The preparation of all analytical standards, including internal standards, TO14A and TO-15 standards and method blanks is documented in the TO14A/15 Standards preparation log (see Figure 3A).

Standards for calibration of TO-14A target compounds are prepared from a certified mixture of TO-14A target compounds at a 1000 ppbv nominal concentration. The standard is certified grade material and is purchased from Spectra Gas, Inc., Alpha, NJ. See Figure 1.0 attached which is a product certification sheet for the TO-14A mix.

A 10.0 ppbv TO-14A target standard is prepared by computerized gas dilution using pure humidified nitrogen as follows.

An Environics 2000 computerized gas dilution system is utilized to prepare the mixture. The diluent gas(UHP N_2) (channel 1) is set to deliver 3960 cc/min. The 1000 ppbv TO-14A standard (channel 2) is set to deliver 40 cc/min. The system is set-up to deliver a total flow of 4000 cc/min, which is routed through a humidification chamber into a Summa canister. The can is

pressurized to approx. 30 psig. This will produce a 10 ppbv working standard.

This standard is then utilized for calibration by affixing the Summa canister to the Calibration Port on the Entech 7000 concentrator.

Standard for calibration is introduced into the ENTECH software-controlled, computerized mass flow controller. The volumes of standard are adjusted to yield calibration standard concentrations of 1.0, 2.0, 5.0, 10.0 and 20.0 ppbv as detailed in Section 3.2. Use the ENTECH program "TO14CAL" to perform this initial calibration.

Internal Standards (IS) used are bromochloromethane, 1,4-Difluorobenzene, and Chlorobenzene-d5. In addition, 4-Bromofluorobenzene is included in the IS mixture. The IS mixture is purchased commercially from Spectra Gases, Inc., Alpha, NJ at a 100 ppbv nominal concentration. See Figure 2.0 for the product information and certification.

The IS is used at 10.0 ppbv in the ENTECH system. The 100 ppbv stock is transferred to a Summa canister. The canister is connected to the ENTECH system Internal Standard port where 40 cc are utilized (400 cc is "no dilution") yielding a concentration to the GC/MS of 10.0 ppbv.

TO-15 calibration standards (see Figure 3.0) are purchased from Spectra Gases of Alpha, NJ. at a 1000 ppbv concentration. (The TO14A standard contains 39 components, the TO-15 additional standard contains 25 additional components). A separate 10.0 ppbv TO-15 Additional compounds standard is prepared by Environics dilution with humidified UHP nitrogen. The diluent gas(UHP N_2) (channel 1) is set to deliver 3960 cc/min. The 1000 ppbv TO-15 standard (channel 2) is set to deliver 40 cc/min. The system is set-up to deliver a total flow of 4000 cc/min, which is routed through a humidification chamber into a Summa canister. The can is pressurized to approx. 30 psig. This will produce a 10 ppbv working standard.

This standard is then utilized for calibration by affixing the Summa canister to the Calibration Port on the Entech 7000 concentrator or position 2 on the four position autosampler. (position 1 is used for the method blank).

Standard for calibration is introduced into the ENTECH software-controlled, computerized mass flow controller. The volumes of standard are adjusted to yield calibration standard concentrations of 1.0, 2.0, 5.0, 10.0 and 20.0 ppbv as detailed in Section 3.2. Use the ENTECH program "TO15CAL" to perform this initial calibration.

Calibration for TO15 SIM is performed at 0.25, 0.50, 1.0, 2.5, and 5.0 ppbv. The standard used is a 100 ppbv stock standard purchased from Scott Gases. This stock standard is diluted to yield a 2.5 ppbv working standard prepared by Environics dilution with humidified UHP nitrogen. The diluent gas(UHP N_2) (channel 1) is set to deliver 3900 cc/min. The 100.0 ppbv TO-14A and/or TO-15 mix standard (channel 2) is set to deliver 100 cc/min. The system is set-up to deliver a total flow of 4000 cc/min, which is routed through a humidification chamber into a Summa canister. The can is pressurized to approx. 30 psig. This will produce a 2.5 ppbv working standard.

This standard is then utilized for calibration by affixing the Summa canister to the Calibration Port on the Entech 7000 concentrator or position 2 on the four position autosampler. (position 1 is used for the method blank). Section 3.2 details the ENTECH parameters. Use the ENTECH program "SIMCAL" which is preset with these specific volumes.

Should standards be needed that are not readily commercially available, 5.00 ppmv nominal concentration standards are prepared from neat materials by injection of known volumes (ul) into a GC injection port maintained at 200°C into an evacuated Summa canister . These 5.0 ppmv standards are then diluted using mass flow controllers as described previously. The outlet of the GC flow is routed into an evacuated Summa canister, which is pressurized to 30 psig +/- 1 psig. In order to prepare a 5.0 ppmv stock gaseous standard, a known volume (ul) of target compound is determined using the following equation. The information needed includes the density and molecular weight of the compound.

$$\text{ppmv} = \frac{\text{ug (liq.)} \times 24.46}{6.0\text{L} \times \text{MW} \times P_{atm}}$$

Where:

ug (liq.) is determined by: density (g/ml x vol. (ml) used =g.)
ug = g/1,000,000
6.0L is the volume of the canister
MW is the molecular weight
P_{atm}= pressure of the cansiter in atmospheres: $\frac{14.7 + 30 \text{ psig}}{14.7}$

For example, Methyl Ethyl Ketone has a density of 0.805 g/ml and a molecular weight of 72.11. To make a 5.00 ppmv standard, inject 0.34 ul (using a 1.0 ul syringe) into the GC injection port. Fill the cansiter to 30 psig. This will yield 5.08 ppmv MEK as follows:

0.34 ul MEK=0.00034 ml x 0.805 g/ml = 0.0002737 g. MEK

0.0002737 g. MEK = 273.7 ug MEK

$$\frac{273.7 \text{ ug} \times 24.46}{6.0 \times 72.11 \times 3.041} = 5.088 \text{ ppmv MEK}$$

4.0 ANALYTICAL PROCEDURES

4.1 CANISTER RECEIPT

The overall condition of each sample canister is observed. Each canister should be received with an attached sample identification tag(see Figure 4.0).

The identification tag indicates the final pressure/vacuum measured at the conclusion of sampling period. Just prior to analysis, the pressure/vacuum in the canister is measured and recorded on the sample tag. If a pressure/vacuum difference of greater than 3 psig/3 in. Hg vac. is found, the sample is considered to have leaked and a fax is sent to the client immediately upon discovery by the Group Leader. (<3 psig/in. Hg may be attributable to differences in gauges and temperatures).

Each canister pressure is recorded in the canister analysis log (see Figure 5.0) prior to analysis.

The pressure/vacuum of the canister is checked by attaching a pressure gauge to the canister inlet. The canister valve is opened briefly and the pressure (kPa, psig, or in. Hg vac.) is recorded.

If very high levels of VOCs are expected, the canister can be diluted by pressurization with zero nitrogen. When the canister pressure is increased, a dilution factor (DF) is calculated and recorded in GC/MS sequence file.

The dilution factor is determined as follows:

$$DF = \frac{Ya}{Xa}$$

Where:

Xa = canister pressure (kPa, psia) absolute before dilution
Ya = canister pressure (kPa, psia) absolutel after dilution

NOTE: psia = 14.7 + psig

All Summa canisters are analyzed in a pressurized state. Subsequent to receipt, the vacuum in the canister is recorded in the summa canister analysis log (see Fig.5.0). The canister is pressurized with UHP nitrogen to 10.0 psig. This intital dilution is calculated as follows:

For Canisters received under vacuum: Pf/Pi (where Pf and Pi are in atmospheres)

$$\frac{\text{30 in. Hg in.} - \text{in. Hg Vac. In can}}{\text{30 in. Hg}} = \text{Pressure Initial (in atmospheres)}$$

After pressurization to 10.0 psig:

$$\frac{\text{10.0 psig} + \text{14.7 psig}}{\text{14.7 psig}} = \text{Pressure final (in atmospheres)} = 1.6803 = Pf$$

$$\text{Dilution Factor} = \frac{1.6803}{Pi}$$

Example: vacuum in can (Pi) measured at 5.2 in. Hg

$$\text{Dilution factor} = \frac{1.6803\ (Pf)}{\frac{(30-5.2)}{30}} = \frac{1.6803}{0.8267} = 2.0326$$

For Canisters received under at > 0 psig: Pf/Pi (where Pf and Pi are in atmospheres)

$$\frac{14.7\text{ psig.} + \text{ psig In can}}{14.7\text{ psig}} = \text{Pressure Initial (in atmospheres)}$$

After pressurization to 10.0 psig:

$$\frac{10.0\text{ psig} + 14.7\text{ psig}}{14.7\text{ psig}} = \text{Pressure final (in atmospheres)} = 1.6803 = \text{Pf}$$

$$\text{Dilution Factor} = \frac{1.6803}{\text{Pi}}$$

Example: pressure in can (Pi) measured at 2.5 psig

$$\text{Dilution factor} = \frac{1.6803\text{ (Pf)}}{\frac{(14.7+2.5)}{14.7}} = \frac{1.6803}{1.1701} = 1.4360$$

For sample analysis, detected VOC concentrations are multiplied by the Dilution factor to determine concentration in the sampled air. This dilution Factor is input into the software batchfile.

4.2 ANALYSIS OF SAMPLES

Analysis of samples, whether in the Scan mode or SIM mode must be performed in the following **24 hour sequence** with summary criteria:

1. Method Blank (for 4-BFB criteria and targets < 0.2 ppbv)
2. 5.0 ppbv (1.0 ppbv for SIM) Continuing Calibration Verification (CCV) Standard (% Diff <30% from Initial Calibration)
3. Method Blank (targets < 0.2 ppbv)
4. Laboratory Control Sample (LCS) (± 30% of expected value)
5. Client samples
6. Sample Duplicate (< 25% RSD)
7. Sample Spike @ 5.0 ppbv (1.0 ppbv for SIM) (70-130% Recovery)

The specific analysis procedures are detailed in the following sections.

4.3. GC-MS-SCAN ANALYSIS

The analytical system should be properly assembled, humid zero gas certified, operated and calibrated for accurate VOC determination.

Before connection of the canisters to the preconcentration systems, each sample line is flushed with purified gas using ENTECH software "flush2x" routine for two full cycles.

The cryosystem is then allowed to bake for a 2 minute cycle.

The sample canisters are then connected to the inlets of the Entech Cyrotrap/GC-MS analytical system.

The ENTECH sequence file is prepared detailing the sample volumes to use. If the volume used for sample is less than 400cc., a dilution factor is

applied to the HP sequence file). No volume less than 10 cc., (1:40 dilution) is to be used. Any further dilution must be done by canister pressurization. The volume of IS used is always 40 cc for a 100 ppbv IS. The HP Chem Station sequence file is prepared and initiated subsequent to the ENTECH sequence file initiation.

Upon sample injection into the column, the MS is signaled by the computer to scan the eluting carrier gas from 35 to 260 amu, resulting in a minimum 1.5 Hz repetition rate. (This corresponds to about 10 scans per eluting chromotographic peak).

Primary identification is based upon retention time and relative abundance of eluting ions as compared to mass spectra of compounds generated on the MS system.

If required, subsequent to quantitation, the data file is subjected to a library search program to identify and semi-quantitate the non-target compound found at > 10% the intensity of the nearest internal standard.

Corrective Action- Target compounds exceeding calibration range

Should a sample contain target compounds(on an undiluted basis) which exceed the highest standard for that compound in the initial calibration curve (20 ppbv), the sample must be rerun at a dilution to get the analyte(s) within the curve. Both sets of data are included with data packages, with the diluted run reported. In addition, if the target compounds which exceed the calibration range are greater than 100 ppbv (or 5 times the highest standard), carryover may occur. In this case, the sample run after the sample at these levels must be rerun to be sure no carryover occurred. The first set of data may be discarded if carryover is shown. All data are reported and qualified as directed below:

" J " estimated value-below RL but > MDL meeting spectral criteria
" B " compound present in blank
" E " compound estimated-exceeds calibration curve

MDL Determination- Full Scan analysis (see Table 2.0 for sample MDLs)

The Method detection limit is determined annually or after significant changes to the GC/MS and/or sample introduction system occur. The MDL study is conducted by running 7 replicates of a 1.0 ppbv standard. The standard deviations of these 7 measurements for each individual component are determined. The SD is then multiplied by 3.14 to determine the MDL. The reporting limit is 3 times the MDL.

4.4 GC-MS-SIM Analysis

In order to determine trace (pptv) levels of target volatiles in ambient Environments, GC/MS/SIM methodology is employed. In the SIM (Selected Ion Monitoring) modes, only characteristic masses of selected compounds are monitored. By selectively monitoring these masses, the mass spectrometer can dwell longer on specific masses giving rise to more signal (response). In addition, background is significantly reduced thereby resulting in an increase in the signal to noise ratio.

Initial calibration is performed at 5 levels as discussed in section 3.2.

As with GC/MS/Scan, the system is verified clean with a system blank. Subsequent to this a calibration check standard at 1.0 ppbv is run. A method blank is then run before sample analysis commences. All other procedures described above will apply.

The mass spectrometer data system is programmed to monitor known retention times and related characteristic masses of the target analytes.

4.5 MDL Determination- SIM analysis (see Table 3.0 for sample MDLs)

The Method detection limit is determined annually or after significant changes to the GC/MS and/or sample introduction system occur. The MDL study is conducted by running 7 replicates of a 0.25 ppbv standard. The standard deviations of these 7 measurements for each individual component are determined. The SD is then multiplied by 3.14 to determine the MDL. The reporting limit is 3 times the MDL.

4.6 SAMPLE DILUTION

Due to the trace levels of detection achieved by both TO-14A and TO15 in scan or SIM modes, it is likely that certain samples will require dilution over and above what the ENTECH pre-concentrator can accurately provide. The ENTECH system allows for accurate introduction of as little as 10.0 ml of sample from a canister under pressure. This represents a 1:40 (40x) dilution. Any dilution required above this, involves the use of either of the following two techniques.

4.6.1 Canister Dilution by Pressurization

Once the canister has been initially pressurized to 10.0 psig as described previously, additional dilution is accomplished by allowing the canister contents to vent through the dilution system to a 2.0 psig pressure. The canister is then re-pressurized with zero-gas to 40 psig. This results in a dilution of 3.2755. If additional dilution is required, follow the same procedure by releasing the contents of the can through the dilution system to 2.0 psig, then pressurizing to 40 psig. This is an additional 3.2755 dilution, for a total dilution factor of 10.7287. If this is done a third time the resulting dilution factor is 35.1425. This, coupled with the initial dilution due to pressurizing the canister to 10 psig, and the ENTECH's ability to achieve a 40x dilution will yield a total dilution factor on the order of 2500.

Example Dilution Factor Calculation:

Canister received at 5.0 in. Hg vacuum. The canister is pressurized with zero gas to 10.0 psig. This initial dilution is 2.016. Analysis showed the need to dilute the sample further to approx. 250 x. The pressure in the canister is then released to 2.0 psig and pressurized to 40 psig. This yields a dilution factor of 2.016 x 3.2755 = 6.6034. The ENTECH is then programmed to accept 10.0 mls of this canister for a total dilution factor of 6.6034 x 40 = 264.14.

The analyst must be careful to not over-dilute the sample using this technique. Do a dilution based upon data or history of the sample, then analyze and dilute from there if necessary. Once the sample is over-diluted there is no going back.

4.6.2 Summa Canister or Tedlar Bag Dilution using Syringes

An alternate technique to canister dilution, involves withdrawing a known volume of gas from the pressurized canister or tedlar bag into a 100 mL gas tight syringe. The syringe contents (say 10 mL) are then diluted with zero gas from the dilution system. For example if 10 mL is drawn into the syringe and this is diluted to 100 mL, this is a 1:10 (10x) dilution. Coupled with the ENTECH system sampling 40 mL (the ENTECH system can accept 40 mL to 800 mL accurately from a non-pressurized system), yields a 100 x total dilution. Additional dilutions in the syringe can be done to yield high dilution factors.

5.0 CANISTER CLEANING AND CERTIFICATION

All canisters must be clean and free of any volatile organic contaminants before sample collection.

All canisters are leak tested by pressurizing them to approximately 206 kPa (30 psig) with purified, humified nitrogen). The initial pressure is measured, the

canister valve is closed, and the final pressure is checked after 24 hours. If leak tight, the pressure should not vary more than + 13.8 kPa (+/- 3 psig) over the 24 hour period.

5.1 CLEANING CANSITERS (NEW OR USED) FOR USE IN LOW LEVEL AREAS (<50 ppbv)

The canister is connected to the manifold. The vent shut-off value and the canister valve and the canister valve are opened to release any remaining pressure in the canister. The vacuum pump is started and the vent shut-off valve is then closed and the vacuum shut-off valve is opened. The canister is evacuated to 27 in. Hg and held under vacuum for 1 minute.

The vacuum and vacuum/pressure gauge shut-off valves are closed and the zero gas shut-off valve is opened to pressurize the canister with humid zero gas to approximately 206 kPa (30 psig).

The zero gas shut-off valve is closed and the canister is allowed to vent down to atmospheric pressure through the vent shut-off valve. The vent shut-off valve is closed.

At the end of the evacuation/pressurization cycle, the canister is pressurized to 206 kPa (30 psig) with humid zero gas. The cycle described is done a total of 3 times. One canister from a lot (20 or less) is then analyzed by the GC-MS analytical system. Any canister that has not tested cleaned (compared to direct analysis of humidified zero gas of less then 0.2 ppbv of targeted VOCs) must be re-cleaned.

The canister is re-attached to the cleaning manifold and is then re-evacuated to 27 in. Hg and remains in this condition until used. The canister valve is closed. The canister is removed from the cleaning system and the canister connection is Capped with a brass cap. Each canister cleaned in a lot is labeled with a batch no. (QBSxxxxxx) (xxxxxx= the date). The batch is certified clean by the analysis of one canister in the lot. All data for the lot is filed. An identification tag is attached to the neck for each canister for chain-of-custody purposes.

SPECIAL NOTATIONS FOR CANISTERS TO BE USED FOR TO15 SIM ANALYSIS

Due to the very low levels of detection for TO-15 SIM, it is recommended that every individual canister be certified clean, as opposed to a lot certification. Even though every effort is made to use specific canisters for ambient work, the integrity of the can should be documented by individual certification.

5.2 CLEANING FOR CANISTERS USED IN MEDIUM-HIGH-LOW LEVEL AREAS (>1000 ppbv)

The canisters are heated in an isothermal oven to 105°C to insure that higher molecular weight compounds are not retained on the walls of the canister. (Note: For sampling heavier, more complex VOC mixtures, the canisters should be heated to 190°C. Once heated, the canisters are evacuated to 27 in. Hg). At the end of the heating/evaluation, the canisters are pressurized with humid zero gas, excavated and filled at ambient temprature two times and analyzed. Any cansiter that has not tested clean (less than 0.2 ppbv of targeted compounds) must be re-cleaned. Once tested clean, the canisters are re-evacuated to 27 in. Hg and remain in the evacuated state until used. It is noted that canisters used in high level areas must be individually certified clean by analysis.

6.0 QUALITY ASSURANCE

For GC-MS-SCAN or GC/MS/SIM analysis the following QA criteria are Followed:

1. 3 internal standards are utilized in each analysis. The ion areas of the defined ions must be +/- 40% of the areas of the daily calibration check.

2. Before analysis of either initial calibration standards or continuing Calibration standards, a system blank is run to verify system integrity (<0.2 ppbv of targets-methylene chloride & acetone < 0.5 ppbv). This system blank contains 10.0 ppbv 4-BFB to verify tuning criteria are met.

3. Initial Calibration RSDs must be < 30%.

4. A daily continuing calibration check standard is run to verify calibration. The acceptance criteria for this standard are the % Difference must be <30% Difference from the initial calibration.

5. Subsequent to running the calibration check standard, a method blank is run to verify system integrity (<0.2 ppbv of targets-<0.5 ppbv for methylene chloride and acetone).

6. After the method blank is run, a Laboratory Control Sample is run. The LCS must have be 70-13-% of the expected values.

7. One sample per 20 is run as a duplicate for the batch. The RPD (relative percent difference) should be <25%. If the RPD is not meet at a level of 5 times the MDL, no corrective action is required. If the RPD is exceeded for compounds where the concentrations are greater than 5 times the MDL, rerun the duplicate. If criteria is still not met, no further corrective action is necessary.

8. One sample per 20 is run as a matrix spike. Spiking is performed at the 5.0 ppbv for TO14A and TO-15 full scan and at 1.0 ppbv for TO15 SIM. Spike revoeries should be 70-130 %.

7.0 DATA ARCHIVING AND RETENTION

All data files generated during data acquisition are immediately and automatically stored onto the local hard drive and the Lab Data Server into the g:\MSTO14 directory. This g: drive is immediately mirrored onto a second hard drive which is backed up to tape on a daily basis at 12 midnight.

All hard copy of data and batch QC is scanned to .pdf format files and archived on DVD-R for a period of 5 years.

8.0 SAFETY

General safety considerations and requirements are detailed in the York Laboratory Safety and Health Standard Operating Procedure No. ADMINSafety010494.

Specific safety rules applying to the conduct of this analysis for Air Volatile Organics require the following:

1. When handling liquid standards, latex gloves are required.
2. Also, when handling neat materials, a fume hood and safety glasses are required.
3. When handling samples, gloves and glasses are required.
4. Highly odorous samples must be handled in a fume hood.
5. Refer to MSDSs for specific safety/health information
6. When handling compressed gases always use a cylinder cart and be certain gases are chained appropriately.

9.0 WASTE MANAGEMENT/POLLUTION PREVENTION

Waste management procedures require the prudent use of neat materials. The ordering of neat standards must be done to minimize unused material which would result in storage of excess material. Quantities ordered should be sufficient to provide for necessary standards with consideration to shelf life. Expired gases are to be vented into a hood until empty then returned to the supplier with an EMPTY label affixed to them.

10.0 REVISION HISTORY

Revision No. 1	01/16/1992	First Issue
Revision No. 2	07/24/1994	Update to reflect TO14A
Revision No. 3	09/21/1997	Add TO-15 components
Revision No. 4	01/25/2005	Update cal. procedures for SIM

(SCAN)

1/2

Table 2

TO14 MDL Study 05/06/03

Conducted at 1.0 ppbv

Compound	TO8526	TO8527	TO8528	TO8529	TO8530	TO8533	TO8532	SD	MDL(3.14 x SD)	PQL
Dichlorofluoromethane	1.2369	1.1228	1.1695	1.0902	1.1587	1.1938	1.1412	0.047872	0.15	0.45
1,2-Dichlorotetrafluo	1.4987	1.2507	1.4607	1.2351	1.3912	1.1961	1.3402	0.116943	0.37	1.10
Chloromethane	1.6274	1.5616	1.5707	1.4997	1.5186	1.6877	1.5984	0.064324	0.20	0.61
Vinyl Chloride	1.629	1.4328	1.5189	1.4465	1.45	1.5719	1.4575	0.075107	0.24	0.71
Bromomethane	1.6432	1.495	1.5146	1.3767	1.5194	1.5258	1.4985	0.077703	0.24	0.73
Chloroethane	1.6146	1.505	1.6026	1.457	1.5914	1.6201	1.5849	0.062191	0.20	0.59
Trichlorofluoromethan	1.1967	1.0958	1.138	1.044	1.0614	1.1374	1.1151	0.051557	0.16	0.49
Freon-113	1.4765	1.3384	1.3927	1.2925	1.3653	1.4216	1.3488	0.060134	0.19	0.57
1,1-Dichloroethylene	1.3335	1.234	1.2917	1.1893	1.2538	1.2919	1.2552	0.046614	0.15	0.44
Methylene Chloride	1.4901	1.37	1.478	1.3123	1.3461	1.3658	1.3719	0.067131	0.21	0.63
1,1-Dichloroethane	1.4501	1.3421	1.4228	1.287	1.339	1.4386	1.4036	0.061137	0.19	0.58
cis-1,2-Dichloroethyl	1.5717	1.4432	1.5143	1.3603	1.4134	1.5098	1.4794	0.070632	0.22	0.67
Chloroform	1.3253	1.2309	1.2806	1.1928	1.2171	1.2794	1.2391	0.045232	0.14	0.43
1,1,1-Trichloroethane	1.1986	1.0853	1.1445	1.048	1.0836	1.1653	1.1188	0.051514	0.16	0.49
Carbon Tetrachloride	1.1561	1.0598	1.1114	1.0254	1.0427	1.1031	1.074	0.044916	0.14	0.42
1,2-Dichloroethane	1.1375	1.057	1.0923	1.0141	1.0639	1.128	1.0915	0.042701	0.13	0.40
Benzene	1.6529	1.5486	1.606	1.5004	1.5322	1.6561	1.6278	0.062033	0.19	0.58
Trichloroethylene	1.4115	1.2776	1.3468	1.2499	1.3181	1.3883	1.2691	0.06191	0.19	0.58
1,2-Dichloropropane	1.5053	1.4057	1.4467	1.3568	1.4006	1.4823	1.427	0.050788	0.16	0.48
cis-1,3-Dichloroprope	1.2512	1.1495	1.1817	1.0992	1.1386	1.2119	1.1456	0.050791	0.16	0.48
Toluene	1.5449	1.4014	1.517	1.3777	1.4131	1.4883	1.4085	0.065364	0.21	0.62
trans-1,3-Dichloropro	1.0174	0.9491	0.989	0.9234	0.9372	0.9709	0.9416	0.033068	0.10	0.31
1,1,2-Trichloroethane	1.5249	1.3796	1.4668	1.3305	1.3693	1.4858	1.4253	0.070131	0.22	0.66
Tetrachloroethylene	1.4022	1.2847	1.3532	1.2413	1.2481	1.3544	1.2509	0.06435	0.20	0.61
1,2-Dibromoethane	1.3455	1.2394	1.3051	1.2038	1.2392	1.3027	1.2317	0.051093	0.16	0.48
Chlorobenzene	1.4745	1.3736	1.4332	1.3266	1.3592	1.449	1.3615	0.055096	0.17	0.52
Ethyl Benzene	1.4556	1.3163	1.3728	1.2733	1.3256	1.4164	1.3552	0.062067	0.19	0.58
p- & m-Xylenes	1.4397	1.3173	1.3779	1.2824	1.309	1.3937	1.3238	0.05588	0.18	0.53
o-Xylene	1.4064	1.331	1.3822	1.267	1.3373	1.3902	1.3416	0.047101	0.15	0.44
Styrene	1.4652	1.3719	1.419	1.3149	1.3687	1.4292	1.348	0.051951	0.16	0.49
1,1,2,2-Tetrachloroet	1.5072	1.4153	1.4348	1.3438	1.386	1.4537	1.4369	0.051681	0.16	0.49
1,3,5-trimethylbenzen	1.3639	1.2635	1.3018	1.2324	1.2683	1.3446	1.2959	0.046322	0.15	0.44
1,2,4-trimethylbenzen	1.3522	1.2767	1.2881	1.237	1.2587	1.3481	1.2611	0.044795	0.14	0.42
1,3-Dichlorobenzene	1.4198	1.3276	1.3897	1.271	1.3259	1.4095	1.354	0.053238	0.17	0.50
1,4-Dichlorobenzene	1.547	1.4288	1.4838	1.3976	1.3773	1.4962	1.4249	0.060266	0.19	0.57
1,2-Dichlorobenzene	1.3934	1.2913	1.3292	1.2873	1.3222	1.4121	1.3311	0.04776	0.15	0.45
1,2,4-Trichlorobenzen	1.1821	1.127	1.2736	1.1907	1.1283	1.2136	1.2258	0.052676	0.17	0.50
Hexachloro-1,3-Butadi	1.2927	1.1622	1.2147	1.1173	1.1542	1.2738	1.1457	0.067513	0.21	0.64

TABLE 2 (SCAN) 2/2

TO15 Additional Compounds MDL Study

Conducted at 1.0 ppbv 05-06-03

	TO8537	TO8538	TO8539	TO8540	TO8541	TO8542	TO8543	SD	MDL	PQL
Propylene	1.773	1.7978	1.6865	1.6018	1.5896	1.6297	1.7678	0.087591	0.28	0.83
1,3-Butadiene	1.6017	1.5663	1.5602	1.4887	1.5491	1.4173	1.5084	0.06132	0.19	0.58
Vinyl Bromide	1.5905	1.5114	1.5575	1.4879	1.449	1.4348	1.4901	0.055765	0.18	0.53
Isopropanol	1.3944	1.3731	1.4086	1.4302	1.3444	1.3402	1.3453	0.035514	0.11	0.33
Acetone	1.3042	1.2803	1.3359	1.2411	1.216	1.2268	1.2736	0.043259	0.14	0.41
Allyl Chloride	1.6553	1.6053	1.6566	1.5625	1.4363	1.5546	1.487	0.082593	0.26	0.78
Carbon Disulfide	1.7576	1.6366	1.7146	1.6086	1.5593	1.5663	1.5848	0.07637	0.24	0.72
Methyl-tert-Butyl Eth	1.3501	1.2919	1.3181	1.2172	1.2036	1.2009	1.2502	0.059291	0.19	0.56
trans-1,2-Dichloroeth	1.4464	1.3623	1.4379	1.3614	1.2897	1.2886	1.3068	0.066216	0.21	0.62
n-Hexane	1.8456	1.7686	1.7715	1.7226	1.969	1.9247	1.7327	0.096537	0.30	0.91
Vinyl Acetate	1.4494	1.4157	1.4817	1.3882	1.3319	1.3291	1.3948	0.05654	0.18	0.53
Methyl Ethyl Ketone (	1.5977	1.5341	1.6143	1.4598	1.3958	1.4393	1.4925	0.081473	0.26	0.77
Ethyl Acetate	1.6005	1.5436	1.5685	1.4351	1.4492	1.4639	1.4816	0.064383	0.20	0.61
Tetrahydrofuran	1.5802	1.5574	1.6828	1.4647	1.526	1.512	1.5755	0.068571	0.22	0.65
Cyclohexane	1.6591	1.5796	1.6379	1.6411	1.5346	1.5188	1.5986	0.05443	0.17	0.51
2,2,4-Trimethylpentan	1.7391	1.593	1.6423	1.6003	1.5475	1.531	1.5234	0.075822	0.24	0.71
n-Heptane	1.6722	1.5742	1.6098	1.5406	1.4741	1.5181	1.5111	0.067226	0.21	0.63
Bromodichloromethane	1.3163	1.2275	1.2459	1.1997	1.1724	1.1556	1.1988	0.053533	0.17	0.50
Methyl Isobutyl Keton	1.3813	1.3015	1.3929	1.3158	1.2378	1.1958	1.2606	0.072734	0.23	0.69
Methyl Butyl Ketone (	0.7418	0.8366	0.7806	0.6336	0.8383	0.7016	0.7409	0.073253	0.23	0.69
Dibromochloromethane	1.2905	1.1974	1.2464	1.1873	1.1448	1.1413	1.1789	0.053888	0.17	0.51
Bromoform	1.2336	1.1837	1.2127	1.1832	1.1266	1.1168	1.1321	0.045424	0.14	0.43
4-Ethyltoluene	1.489	1.3992	1.4556	1.3854	1.3314	1.3374	1.376	0.05821	0.18	0.55
Benzyl Chloride	1.1582	1.1407	1.1688	1.085	1.0806	1.0701	1.0636	0.04464	0.14	0.42

Table 3

YORK ANALYTICAL LABORATORIES, INC.

TO-15 SIM Selected Target Volatiles MDL Determination

Study conducted at 0.25 ppbv

25-Jan-05

Results in ppbv

Target Compound	File ID TO3522	File ID TO3523	File ID TO3524	File ID TO3525	File ID TO3526	File ID TO3527	File ID TO3528	Average	Standard Deviation	MDL	Reporting Limit
Vinyl Chloride	0.27	0.27	0.28	0.28	0.27	0.28	0.27	0.274	0.005345	**0.017**	**0.050**
cis-1,2-Dichloroethylene	0.31	0.31	0.31	0.31	0.32	0.32	0.30	0.311	0.006901	**0.022**	**0.065**
Trichloroethylene	0.30	0.30	0.31	0.31	0.31	0.32	0.31	0.309	0.006901	**0.022**	**0.065**
Tetrachloroethylene	0.29	0.29	0.30	0.30	0.29	0.30	0.29	0.294	0.005345	**0.017**	**0.050**

SPECTRA GASES

Figure 1

3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811

Website: http://www.spectra-gases.com

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO:

York Analytical Laboratories Inc
120 Research Drive
Stamford , CT 06615

PAGE: 1 of 2

CERTIFICATE
OF
ANALYSIS

SGI ORDER # :	0053139		
ITEM# :	2	CYLINDER # :	AB-17988
CERTIFICATION DATE:	05/11/2004	CYLINDER PRES:	1800 psig
P.O.# :	7000	CYLINDER VALVE:	CGA 180
BLEND TYPE:	CERTIFIED	PRODUCT EXPIRATION DATE:	05/11/2005

ANALYTICAL ACCURACY: + / - 5%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Freon-12	1.00 ppm	1.02 ppm
Chloromethane	1.00 ppm	1.03 ppm
Freon-114	1.00 ppm	1.02 ppm
Vinyl Chloride	1.00 ppm	1.03 ppm
Bromomethane	1.00 ppm	1.01 ppm
Chloroethane	1.00 ppm	1.02 ppm
Freon-11	1.00 ppm	1.01 ppm
1,1-Dichloroethene	1.00 ppm	1.03 ppm
Methylene chloride	1.00 ppm	1.03 ppm
Freon-113	1.00 ppm	1.03 ppm
1,1-Dichloroethane	1.00 ppm	1.02 ppm
Cis-1,2-Dichloroethylene	1.00 ppm	1.02 ppm
Chloroform	1.00 ppm	1.03 ppm
1,2-Dichloroethane	1.00 ppm	1.05 ppm
1,1,1-Trichloroethane	1.00 ppm	1.03 ppm
Benzene	1.00 ppm	1.03 ppm
Carbon Tetrachloride	1.00 ppm	1.02 ppm
1,2-Dichloropropane	1.00 ppm	1.04 ppm
Trichloroethylene	1.00 ppm	1.04 ppm
Cis-1,3-Dichloropropene	1.00 ppm	1.06 ppm
Trans-1,3-Dichloropropene	1.00 ppm	.95 ppm
1,1,2-Trichloroethane	1.00 ppm	1.04 ppm
Toluene	1.00 ppm	1.03 ppm
1,2-Dibromoethane	1.00 ppm	1.04 ppm
Tetrachloroethylene	1.00 ppm	1.04 ppm
Chlorobenzene	1.00 ppm	1.03 ppm
Ethylbenzene	1.00 ppm	1.05 ppm
p-Xylene	1.00 ppm	1.03 ppm
m-Xylene	1.00 ppm	1.03 ppm
Styrene	1.00 ppm	1.02 ppm

USA • United Kingdom • Germany • Japan
ISO 9001

FIGURE 1 2/2

SPECTRA GASES

3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811

Website: http://www.spectra-gases.com

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO:	York Analytical Laboratories Inc 120 Research Drive Stamford , CT 06615	PAGE:	2 of 2

CERTIFICATE OF ANALYSIS

SGI ORDER # :	0053139		
ITEM# :	2		
CERTIFICATION DATE:	05/11/2004	CYLINDER # :	AB-17988
P.O.# :	7000	CYLINDER PRES:	1800 psig
BLEND TYPE:	CERTIFIED	CYLINDER VALVE:	CGA 180
		PRODUCT EXPIRATION DATE:	05/11/2005

ANALYTICAL ACCURACY: + / - 5%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
o-Xylene	1.00 ppm	1.02 ppm
1,1,2,2-Tetrachloroethane	1.00 ppm	1.02 ppm
1,3,5-Trimethylbenzene	1.00 ppm	1.01 ppm
1,2,4-Trimethylbenzene	1.00 ppm	1.00 ppm
1,3-Dichlorobenzene	1.00 ppm	1.02 ppm
1,4-Dichlorobenzene	1.00 ppm	1.00 ppm
1,2-Dichlorobenzene	1.00 ppm	1.00 ppm
1,2,4-Trichlorobenzene	1.00 ppm	1.01 ppm
Hexachloro-1,3-Butadiene	1.00 ppm	.94 ppm
Nitrogen	Balance	Balance

ANALYST: Ted Neeme

DATE: 05/11/2004

rec'd 05/12/04

USA • United Kingdom • Germany • Japan

ISO 9001

SPECTRA GASES

Figure 2

3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811
Website: http://www.spectra-gases.com

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO:

York Analytical Laboratories I
120 Research Drive
Stratford, CT 06615

rec'd 12/21/04

CERTIFICATE OF ANALYSIS

SGI ORDER # :	0063983		
ITEM# :	1	CYLINDER # :	AB-18156
CERTIFICATION DATE:	12/16/2004	CYLINDER PRES:	1800 psig
P.O.# :	7487	CYLINDER VALVE:	CGA 180
BLEND TYPE:	CERTIFIED	PRODUCT EXPIRATION DATE:	12/16/2005

ANALYTICAL ACCURACY: +/- 10%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Bromochloromethane	100 ppb	106 ppb
1,4-Difluorobenzene	100 ppb	106 ppb
Chlorobenzene-d5	100 ppb	108 ppb
4-Bromofluorobenzene	100 ppb	108 ppb
Nitrogen	Balance	Balance

ANALYST: April Chamberlain

DATE: 12/16/2004

TO15 add'l cmpds

Figure 3

SPECTRA GASES

3434 Route 22 West • Branchburg, NJ 08876 USA

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO:

York Analytical Laboratories I
One Research Drive
Stamford, CT 6906

CERTIFICATE
OF
ANALYSIS

SGI ORDER # :	0035711		
ITEM# :	1	CYLINDER # :	CC-162930
CERTIFICATION DATE:	04/17/2003	CYLINDER PRES:	2000 psig
P.O.# :	6215	CYLINDER VALVE:	CGA 350
BLEND TYPE:	CERTIFIED	PRODUCT EXPIRATION DATE:	10/17/2003

ANALYTICAL ACCURACY: + / - 5%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Propylene	1.00 ppm	.99 ppm
1,3-Butadiene	1.00 ppm	1.03 ppm
Vinyl Bromide	1.00 ppm	1.00 ppm
Acetone	1.00 ppm	1.01 ppm
Isopropyl Alcohol	1.00 ppm	1.05 ppm
Carbon Disulfide (no stability guarantee)	1.00 ppm	1.00 ppm
Allyl Chloride	1.00 ppm	1.01 ppm
Trans-1,2-Dichloroethene	1.00 ppm	1.01 ppm
Methyl Tert-Butyl Ether	1.00 ppm	.97 ppm
Vinyl Acetate	1.00 ppm	1.04 ppm
Methyl Ethyl Ketone	1.00 ppm	.97 ppm
n-Hexane	1.00 ppm	1.07 ppm
Ethyl Acetate	1.00 ppm	1.04 ppm
Tetrahydrofuran	1.00 ppm	1.04 ppm
Cyclohexane	1.00 ppm	1.04 ppm
Bromodichloromethane	1.00 ppm	1.00 ppm
1,4-Dioxane	1.00 ppm	1.00 ppm
2,2,4-Trimethylpentane	1.00 ppm	1.02 ppm
n-Heptane	1.00 ppm	1.02 ppm
Methyl Isobutyl Ketone	1.00 ppm	.98 ppm
Methyl Butyl Ketone	1.00 ppm	.94 ppm
Dibromochloromethane	1.00 ppm	1.02 ppm
Bromoform	1.00 ppm	1.00 ppm
4-Ethyltoluene	1.00 ppm	1.05 ppm
Benzyl Chloride (no stability guarantee)	1.00 ppm	1.01 ppm
Nitrogen	Balance	Balance

ANALYST: Ted Neeme

DATE: 04/17/2003

PROJECT TO14 STDS

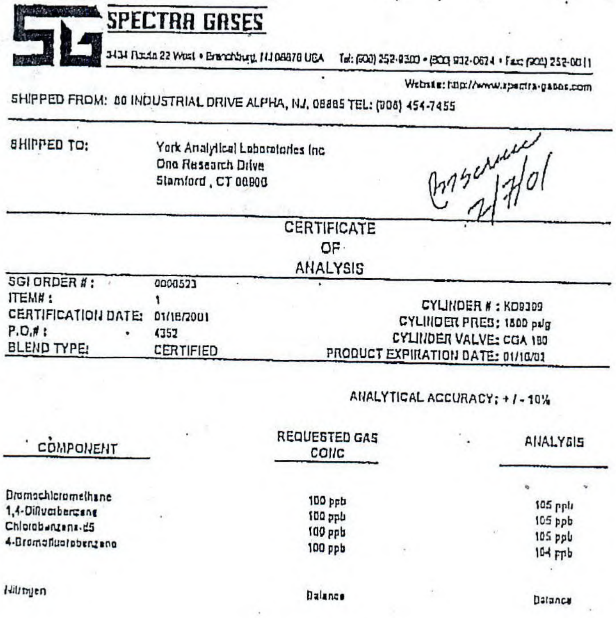
Figure 3A

02/07/01

- Prepared 39 compound TO14 std @ 10.0 ppbv from 100 ppbv TO14 std. from Spectra Gases - Cylinder no. NF1246

N_2	cc/min	→ 3600
STD @ 100 ppbv	"	400
TOTAL FLOW	"	4000

- Prepared 100 ppbv TO14 ISTD by transfer to a Summa Canister. NEW cylinder # KD9399 received 2/7/01 from Spectra gases.



SPECTRA GASES
3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811
Website: http://www.spectra-gases.com

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ, 08865 TEL: (908) 454-7455

SHIPPED TO:
York Analytical Laboratories Inc
One Research Drive
Stamford, CT 06900

Received 2/7/01

CERTIFICATE
OF
ANALYSIS

SGI ORDER # : 0000523
ITEM# : 1
CERTIFICATION DATE: 01/18/2001
P.O.# : 4352
BLEND TYPE: CERTIFIED

CYLINDER # : KD9309
CYLINDER PRES: 1800 psig
CYLINDER VALVE: CGA 180
PRODUCT EXPIRATION DATE: 01/10/03

ANALYTICAL ACCURACY: +/- 10%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Bromochloromethane	100 ppb	105 ppb
1,4-Difluorobenzene	100 ppb	105 ppb
Chlorobenzene-d5	100 ppb	105 ppb
4-Bromofluorobenzene	100 ppb	104 ppb
Nitrogen	Balance	Balance

G 2/7/01

Continued on Page

rstood By

ANALYST: ______ Ted Name DATE: 01/10/2001

Signed Date

FIGURE 3A

COPY

PROJECT TO-14 STANDARDS

Notebook No. ______

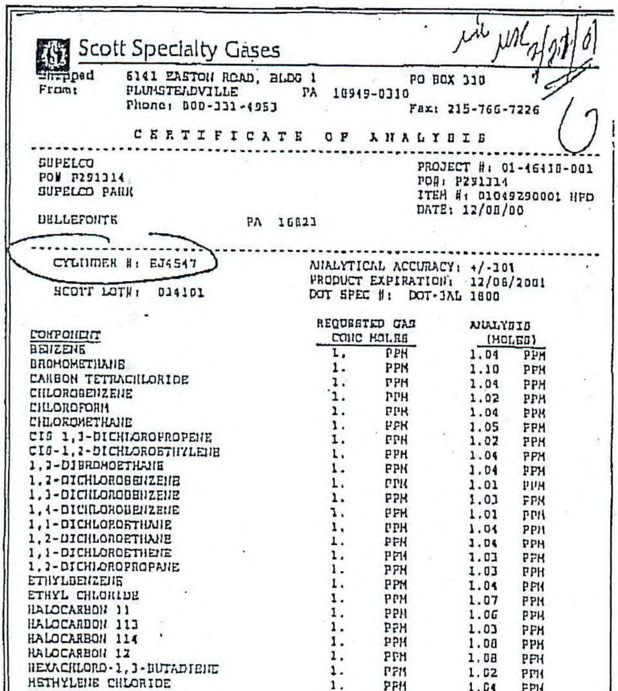
Continued From Page ______

3/21/01

– Prep'd 39 compounds TO14 mix at 10 ppbv from new stock STD @ 1000 ppbv from Scott Specialty Gases Plumsteadville, PA. Cylinder No. EJ4547. New preparation due to 1000 ppbv STD (see p.1 copy)

N_2	cc/min	3960
1000 ppbv STD	" "	40
Total Flow		4000 = 10.0 ppbv

– Prep'd TO14 ISTD by transfer from 100 ppbv cylinder #CD9399



Scott Specialty Gases

MC 3/21/01

6

Shipped From: 6141 EASTON ROAD, BLDG 1 PO BOX 310
PLUMSTEADVILLE PA 18949-0310
Phone: 800-331-4953 Fax: 215-766-7226

CERTIFICATE OF ANALYSIS

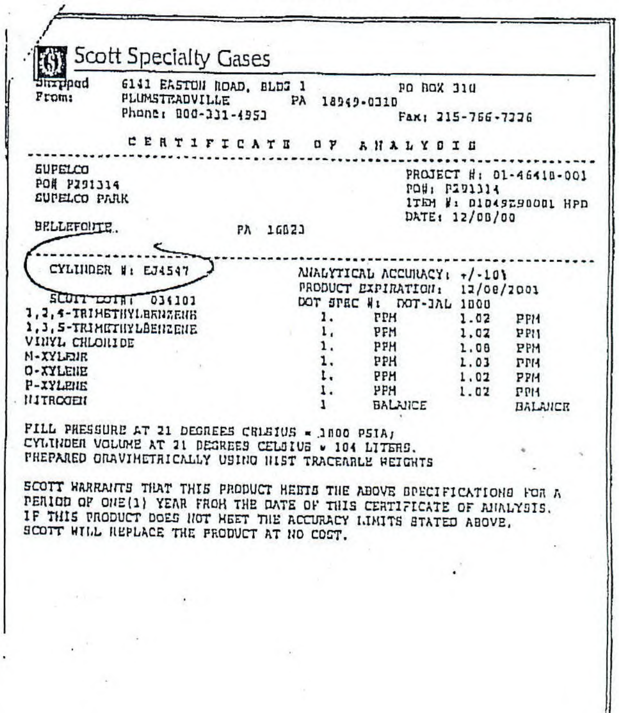
SUPELCO
PO# P291314
SUPELCO PARK
BELLEFONTE PA 16823

PROJECT #: 01-46410-001
PO#: P291314
ITEM #: 01049290001 HPD
DATE: 12/08/00

CYLINDER #: EJ4547
SCOTT LOT#: 034101

ANALYTICAL ACCURACY: +/-10%
PRODUCT EXPIRATION: 12/08/2001
DOT SPEC #: DOT-3AL 1800

COMPONENT	REQUESTED GAS CONC MOLES		ANALYSIS (MOLES)	
BENZENE	1.	PPM	1.04	PPM
BROMOMETHANE	1.	PPM	1.10	PPM
CARBON TETRACHLORIDE	1.	PPM	1.04	PPM
CHLOROBENZENE	1.	PPM	1.02	PPM
CHLOROFORM	1.	PPM	1.04	PPM
CHLOROMETHANE	1.	PPM	1.05	PPM
CIS 1,3-DICHLOROPROPENE	1.	PPM	1.02	PPM
CIS-1,2-DICHLOROETHYLENE	1.	PPM	1.04	PPM
1,2-DIBROMOETHANE	1.	PPM	1.04	PPM
1,2-DICHLOROBENZENE	1.	PPM	1.01	PPM
1,3-DICHLOROBENZENE	1.	PPM	1.03	PPM
1,4-DICHLOROBENZENE	1.	PPM	1.01	PPM
1,1-DICHLOROETHANE	1.	PPM	1.04	PPM
1,2-DICHLOROETHANE	1.	PPM	1.04	PPM
1,1-DICHLOROETHENE	1.	PPM	1.03	PPM
1,2-DICHLOROPROPANE	1.	PPM	1.03	PPM
ETHYLBENZENE	1.	PPM	1.04	PPM
ETHYL CHLORIDE	1.	PPM	1.07	PPM
HALOCARBON 11	1.	PPM	1.06	PPM
HALOCARBON 113	1.	PPM	1.03	PPM
HALOCARBON 114	1.	PPM	1.00	PPM
HALOCARBON 12	1.	PPM	1.08	PPM
HEXACHLORO-1,3-BUTADIENE	1.	PPM	1.02	PPM
METHYLENE CHLORIDE	1.	PPM	1.04	PPM
STYRENE	1.	PPM	1.07	PPM
1,1,2,2-TETRACHLOROETHANE	1.	PPM	1.03	PPM
TETRACHLOROETHYLENE	1.	PPM	1.04	PPM
TOLUENE	1.	PPM	1.04	PPM
TRANS-1,3-DICHLOROPROPENE	1.	PPM	1.10	PPM
1,1,1-TRICHLOROETHANE	1.	PPM	1.04	PPM
1,1,2-TRICHLOROETHANE	1.	PPM	1.02	PPM
TRICHLOROETHYLENE	1.	PPM	1.02	PPM
1,2,4 TRICHLOROBENZENE	1.	PPM	0.999	PPM



Scott Specialty Gases

Shipped From: 6141 EASTON ROAD, BLDG 1 PO BOX 310
PLUMSTEADVILLE PA 18949-0310
Phone: 800-331-4953 Fax: 215-766-7226

CERTIFICATE OF ANALYSIS

SUPELCO
PO# P291314
SUPELCO PARK
BELLEFONTE PA 16823

PROJECT #: 01-46410-001
PO#: P291314
ITEM #: 01049290001 HPD
DATE: 12/08/00

CYLINDER #: EJ4547
SCOTT LOT#: 034101

ANALYTICAL ACCURACY: +/-10%
PRODUCT EXPIRATION: 12/08/2001
DOT SPEC #: DOT-3AL 1800

1,2,4-TRIMETHYLBENZENE	1.	PPM	1.02	PPM
1,3,5-TRIMETHYLBENZENE	1.	PPM	1.02	PPM
VINYL CHLORIDE	1.	PPM	1.08	PPM
M-XYLENE	1.	PPM	1.03	PPM
O-XYLENE	1.	PPM	1.02	PPM
P-XYLENE	1.	PPM	1.02	PPM
NITROGEN	1	BALANCE		BALANCE

FILL PRESSURE AT 21 DEGREES CELSIUS = 1800 PSIA;
CYLINDER VOLUME AT 21 DEGREES CELSIUS = 104 LITERS.
PREPARED GRAVIMETRICALLY USING NIST TRACEABLE WEIGHTS

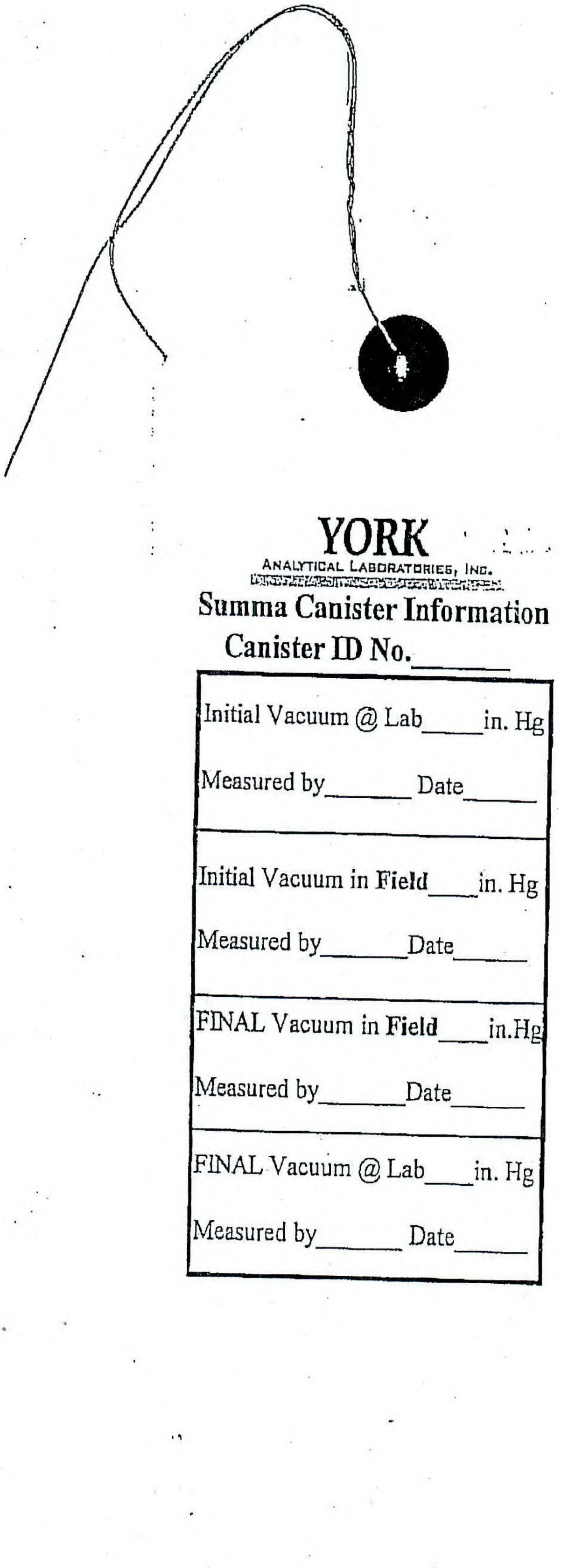
SCOTT WARRANTS THAT THIS PRODUCT MEETS THE ABOVE SPECIFICATIONS FOR A PERIOD OF ONE(1) YEAR FROM THE DATE OF THIS CERTIFICATE OF ANALYSIS. IF THIS PRODUCT DOES NOT MEET THE ACCURACY LIMITS STATED ABOVE, SCOTT WILL REPLACE THE PRODUCT AT NO COST.

LSC 3/21/01

MANUFACTURED DATE: 12/06/00 SCOTTY SIZE: HPD

ANALYST: Terrance F. Boswell
TERRANCE F. BOSWELL

Figure 4



YORK

ANALYTICAL LABORATORIES, INC.

[illegible]

Summa Canister Information

Canister ID No.______

Initial Vacuum @ Lab____in. Hg

Measured by______ Date______

Initial Vacuum in **Field**____in. Hg

Measured by______Date______

FINAL Vacuum in **Field**____in.Hg

Measured by______Date______

FINAL Vacuum @ Lab____in. Hg

Measured by______ Date______

YORK ANALYTICAL LABORATORIES, INC.

Summa Canister ENTECH 7000 TO14/TO15 Sample Log

Sample ID	Canister Pressure/Vacuum Before Analysis (psig or in. Hg vac)	Add'tl Press.for Analysis Final pressure(psig)	Dil. Factor	ALS Inlet No.	Sample Vol. Used (ml)	Total Dilution Factor	Standard Vol. Used (ml)	ISTD Vol. (ml)	Date	Analyst
020620583-21	-8.5" Hg	10.0 psig	2.35	4	400	2.35	—	40	6/25/02	
-22	-2.5	10.0	1.83	1	400	1.83	—		6/25/02	
-23	-8.5	10.0	2.35	2	400	2.35	—		6/25/02	
-24	-9.0	10.0	2.40	3	400	2.40	—		6/25/02	
-25	-10.0	10.0	2.52	4	400	2.52	—		6/25/02	
-26	-8.0	10.0	2.29	1	400	2.29	—		6/25/02	
-27	-9.5	10.0	2.46	2	400	2.46	—		6/25/02	
-28	-8.8	10.0	2.38	3	400	2.38	—		6/25/02	
-29	-9.5	10.0	2.46	4	400	2.46	—		6/25/02	
-29DUP	-9.5	10.0	2.46	4	400	2.46	—		6/25/02	
-29SPK	-9.5	10.0	2.46	4	400	2.46	200		6/25/02	
5.0ppbV CCV	—	—	—	—	—	—	200		6/25/02	
020620568-02	[TEDLAR]	— (1:10 syringe)	1:100	1	40	100x	—		6/25/02	
MBLK	—	—	—	/	400		—		6/26/02	
5ppbV CCK	—	—	—	—	—	—	200		6/26/02	
MBLK	—	—	—	/	400	—	—		6/26/02	
LCS	—	—	—	/	20	—	—		6/26/02	
020620583-30	-7.5	10.0	2.24	/	400	2.24	—		6/26/02	
-31	-6.5	10.0	2.15	2	400	2.15	—		6/26/02	
-32	-10.0	10.0	2.52	3	400	2.52	—		6/26/02	
-33	-9.0	10.0	2.40	4	400	2.40	—	↓	6/26/02	

Figure 5

FIGURE 5

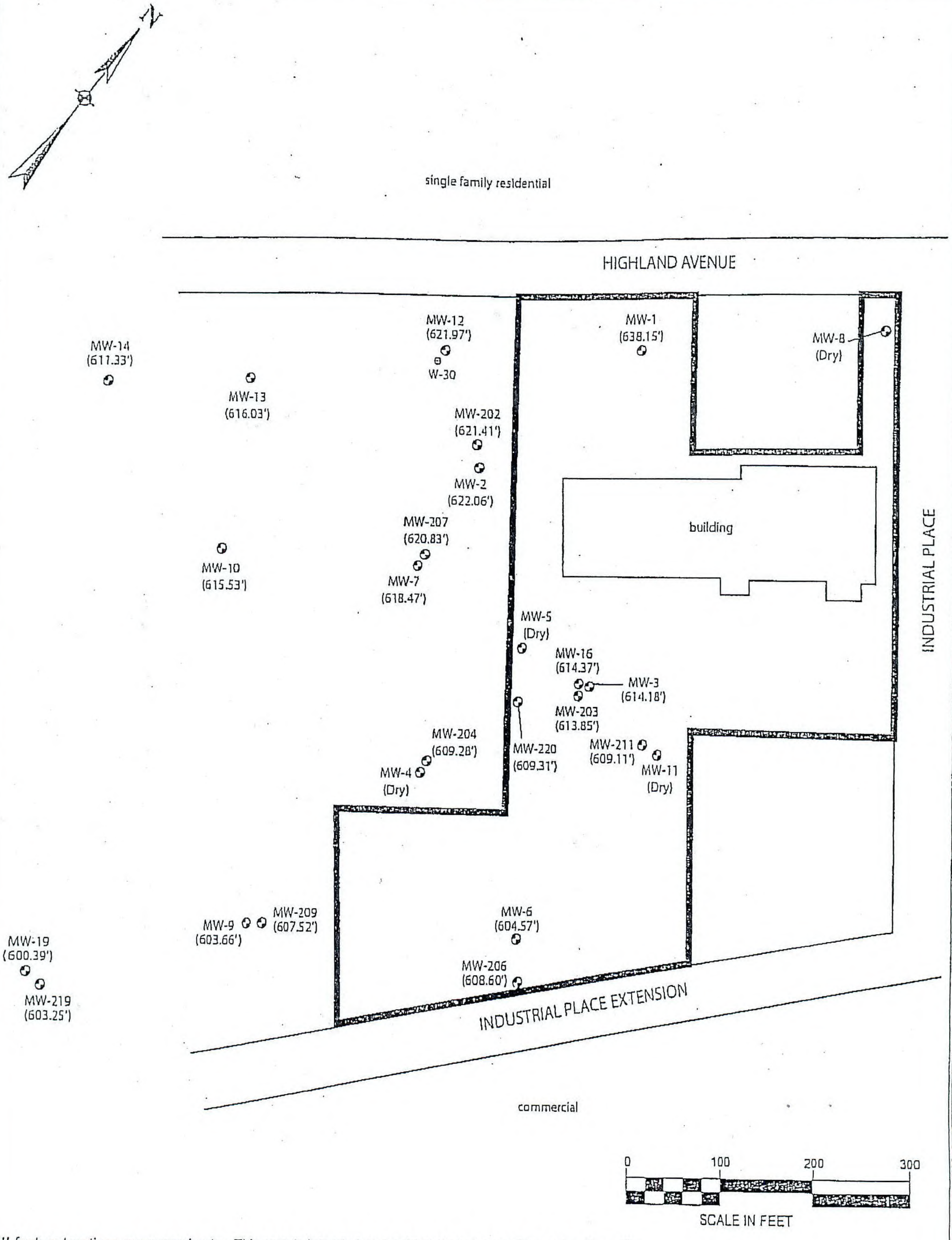
2/2

SUMMA Canister Cleaning/Preparation Log

Lot No.	Canister No.	Date Prepared	Initials	Final Vacuum @ 27" Hg(check)
QBS050902	York S14	05/09/02	SW	✓
↓	York S01	↓	↓	✓
↓	York S16	↓	↓	✓
↓	York S02	↓	↓	✓
↓	York S10	↓	↓	pres. for testing
↓	York S12	↓	↓	✓
↓	York S06	↓	↓	✓
↓	York S03	↓	↓	✓
↓	GCi#2	↓	↓	✓
↓	York S08	↓	↓	✓
↓	York S23	↓	↓	✓
↓	York S10	↓	↓	✓
QBS052002	York S05	05/20/02	SW	✓
	York S23			pres. for testing
QBS060402	York S03	06/04/02	SW	✓
QBS061702	York S03	06/17/02	SW	✓
↓	York S07	↓	↓	✓
↓	York S05	↓	↓	✓
↓	York S09	↓	↓	✓
↓	York S08	↓	↓	pres. for testing
	York S15			

APPENDIX D

Groundwater Elevations Map



All feature locations are approximate. This map is intended as a schematic to be used in conjunction with the associated report, and it should not be relied upon as a survey for planning or other activities.

Groundwater Elevations Map

General Switch Property
City of Middletown
Orange County, New York

Legend:

▬ subject property border

○ monitoring well location (elevation based on 10/2005 data)

ESI File: LM97145.41

January 2006

Scale as shown

Appendix D

APPENDIX E

Decision Matrices

Soil Vapor/Indoor Air Matrix 1

WORKING DRAFT 02.23.05

SUBJECT TO CHANGE

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.25	0.25 to < 2.5	2.5 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures — and — Monitor	4. MITIGATE — or — Take reasonable and practical actions to identify source(s) and reduce exposures — and — Monitor
5 to < 50	5. No further action	6. Monitor	7. Monitor	8. MITIGATE
50 to < 250	9. Monitor	10. Monitor	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

No further action: Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take steps to identify source(s) and reduce exposures: The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed).

Monitor as appropriate: Monitoring is needed to confirm concentrations in the indoor air have not increased due to changes in pressure gradients (e.g., deterioration of building foundation) or to evaluate temporal trends for relevant environmental data. Monitoring may also be needed to verify that existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are minimizing potential effects associated with soil vapor intrusion. The type and frequency of monitoring is determined on a site-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 1

This matrix provides guidance on actions that should be taken to address current and potential exposures related to soil vapor intrusion. To use the matrix accurately as a tool in the decision-making process, the following must be noted:

[1] The matrix is generic. As such, it may be necessary to modify recommended actions to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or site-specific conditions (e.g., proximity of building to identified subsurface contamination) for the protection of public health. Additionally, actions more conservative than those specified within the matrix may be implemented at any time. For example, the decision to implement more conservative actions may be based on a comparison of the costs associated with resampling or monitoring to the costs associated with installation and monitoring of a mitigation system.

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude the need to investigate possible sources of vapor contamination, nor does it preclude the need to remediate contaminated soil vapors or the source of soil vapor contamination.

[3] Extreme care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples must be analyzed by methods that can achieve a minimum reporting limit of 0.25 microgram per cubic meter for indoor and outdoor air samples, and typically 1 microgram per cubic meter for subsurface vapor samples.

[4] Sub-slab vapor and indoor air samples are typically collected during the heating season since soil vapor intrusion is more likely to occur when a building's heating system is in operation and air is being drawn into the building. If samples are collected during other times of the year, it may be necessary to resample during the heating season to evaluate exposures accurately.

[5] When current exposures are attributed to sources other than vapor intrusion, the agencies must be provided documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

Soil Vapor/Indoor Air Matrix 2

WORKING DRAFT 02.23.05 SUBJECT TO CHANGE

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 3	3 to < 30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures — and — Monitor	4. MITIGATE — or — Take reasonable and practical actions to identify source(s) and reduce exposures — and — Monitor
100 to < 1,000	5. Monitor	6. Monitor	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

No further action: Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take steps to identify source(s) and reduce exposures: The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed).

Monitor: Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is an interim measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 2

This matrix provides guidance on actions that should be taken to address current and potential exposures related to soil vapor intrusion. To use the matrix accurately as a tool in the decision-making process, the following must be noted:

[1] The matrix is generic. As such, it may be necessary to modify recommended actions to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or site-specific conditions (e.g., proximity of building to identified subsurface contamination) for the protection of public health. Additionally, actions more conservative than those specified within the matrix may be implemented at any time. More conservative actions are often cost-based (e.g., the cost of additional sampling versus the cost of mitigation) rather than health-based.

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude the need to investigate possible sources of vapor contamination, nor does it preclude the need to remediate contaminated soil vapors or the source of soil vapor contamination.

[3] Extreme care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples must be analyzed by methods that can achieve a minimum reporting limit of 3 micrograms per cubic meter.

[4] Sub-slab vapor and indoor air samples (basement and lowest occupied living space) are typically collected during the heating season since soil vapor intrusion is more likely to occur when a building's heating system is in operation and air is being drawn into the building. If samples are collected during other times of the year, it may be necessary to resample during the heating season to evaluate exposures accurately.

[5] When current exposures are attributed to sources other than vapor intrusion, the agencies must be provided documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

Kiera

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

RECEI

NOV 1 3 2007

Divisi

eau C

ental Remediation

NOV - 7 2007

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Paul H. Ciminello
President
Ecosystems Strategies, Inc.
24 Davis Avenue
Poughkeepsie, NY 12603

Re: Wallkill Well Field Site
Middletown, New York

Dear Mr. Ciminello:

This letter pertains to the *Indoor Air Monitoring Plan for the Second Round of Indoor Air Quality Testing* (the "Work Plan"), as dated October 22, 2007 and as submitted (electronically) on October 22, to the U.S. Environmental Protection Agency (EPA).

The Work Plan was prepared by Ecosystems Strategies, Inc. (ESI), and was submitted to the EPA on behalf of Laurwal Holding Corporation, the potentially responsible party with respect to the Wallkill Well Field Site (the "Site").

Please be advised that the EPA has reviewed the Work Plan, and that the EPA hereby advises ESI that the Work Plan is approved without further modification. ESI shall now proceed to confirm the proposed schedule to conduct the indoor air monitoring, *i.e.*, during the week of December 3, 2007, and to advise the EPA as to such confirmation.

ESI should also return to the EPA a final version of the Work Plan both in an electronic format and as a hard copy.

Internet Address (URL) • http://www.epa.gov

If you have any immediate questions or comments on the information contained in this letter, you may contact me at 212-637-4280.

Sincerely yours,

Paul J. Olivo
Project Manager
Wallkill Well Field Site

cc: W. Stern - Laurwal Holding Corporation
M. Baker - Salans, Hertzfeld

bcc: M. Wieder - USEPA
C. Metz - USEPA
R. Krauser - USEPA
L. Warner - MPI
D. Auld - MPI
K. Becker - NYSDEC