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ARCADIS

Revised Ambient Air Monitoring Work Plan North Shore Towers Golf Course

Former Unisys Facility
Great Neck, New York

PREPARED FOR

Lockheed Martin Corporation

ARCADIS

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REVISED
AMBIENT AIR MONITORING WORK PLAN
NORTH SHORE TOWERS GOLF COURSE

FORMER UNISYS FACILITY
GREAT NECK, NEW YORK

INTRODUCTION

Provided below is the revised Ambient Air Monitoring Work Plan for the North Shore Towers Golf Course prepared by ARCADIS G&M, Inc., on behalf of the Lockheed Martin Corporation (LMC). The revised work plan addresses comments provided by the New York State Department of Environmental Conservation (NYSDEC) in its November 5, 2001 comment letter. To aid in your review of the revised work plan, deleted text is shown in strikethrough format, and new text is shown in italic font.

ARCADIS G&M, Inc. (AGM), on behalf of Lockheed Martin Corporation (LMC), will conduct an ambient air monitoring program at the North Shore Towers golf course located in Floral Park, New York. Testing will be conducted for the following chemicals of potential concern (COPC) identified in the Baseline Human Health Risk Assessment: chloroform; 1,1-dichloroethylene; cis-1,2-dichloroethylene; trans-1,2-dichloroethylene; 1,1-dichloroethane; Freon 113; tetrachloroethylene (perchloroethylene); *toluene*; and trichloroethylene. The testing is being conducted as a result of the NYSDEC's and the New York State Department of Health's (NYSDOH) requests for air sampling to supplement the results of the draft Baseline Human Health Risk Assessment. AGM will conduct the ambient air monitoring program in accordance with standard United States Environmental Protection Agency (USEPA) methods, as described in this work plan. Detailed method sampling and analytical procedures for determining COPC in ambient air are described in the USEPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air – Second Edition, Method TO-14A. Air Toxics Ltd., located in Folsom, California will provide analytical services for analysis of air samples. Additionally, a groundwater sample from the North Shore Tower golf course supply well will also be collected on the same day as the air samples. The groundwater sample will be submitted to Severn-Trent Laboratories (STL) in Monroe, Connecticut for analysis of the COPCs using NYSDEC ASP Method 95-1.

SOURCE DESCRIPTION

The North Shore Towers golf course is located in Floral Park, New York. The spray irrigation system is designed to irrigate the golf course, which borders the North Shore Towers buildings. The *site layout*, irrigation system ~~area~~ *water main, and the proposed air monitoring locations are* shown on Figure 1. ~~; the dashed lines represent the main water source.~~ Ambient concentrations of volatile organic compounds (VOC) releases during spray irrigation were estimated as part of the site draft Baseline Human Health Risk Assessment using a combination of near-field box and vapor emissions modeling. Data generated from the proposed ambient air monitoring program will supplement the modeling, with the objective ~~of increasing certainty in the conclusions of the draft Baseline Human Health Risk Assessment.~~ *to gather additional information about measurable concentrations of VOCs in the air as a result of irrigation at the North Shore Towers golf course.*

TESTING PARAMETERS

The intent of the testing program is to quantify concentrations of COPCs in ambient air as a result of spray irrigation activities. The sampling program will be a one-day on-site event, which will be conducted in each of four golf course quadrants. A test duration of approximately 1.5 hours per quadrant will be used, and will allow for an integrated sample to include the periods before, during, and after sprinkler operation. To ensure coverage of a representative portion of the golf course, air samples will be collected on the *fourth fairway, and the* ~~sixth,~~ second, *fourteenth,* fifteenth, and sixteenth tees. *In addition, the sample locations at the fourth fairway and the fourteenth tee will serve to monitor ambient air quality between the golf course and the adjacent residential community (to the south) and Long Island Jewish Hospital, respectively.* The exact sample locations will vary depending on site access and the meteorological conditions during the day of testing; however, at each of the proposed locations, a sample will be collected from a location that is generally upwind and downwind of a specific sprinkler head. Factors that may influence volatilization of COPCs are atmospheric pressure, wind speed, and wind direction. Throughout the day, wind speed and wind direction are generally light and variable in the early morning hours reaching a finite direction of constant speed in the late morning. Under these conditions, there is sufficient time to collect data while maintaining upwind/downwind orientation to the sampling test locations. Sampling will not be performed if there is significant precipitation during the test period. *Every effort will be made to complete this sampling program before the end of the current irrigation season. The schedule for the collection of air samples will be kept flexible so that we can work around unexpected conditions and/or inclement weather. The sampling program will be planned for a time when no significant precipitation is expected, and sampling will immediately be rescheduled if the planned sampling date has to be postponed due to precipitation. Furthermore, a sufficient supply of sampling equipment (including Summa canisters and flow control valves) will be available on-site so that equipment failure/deficiencies do not affect the sampling schedule. If an unanticipated equipment problem or other event causes a postponement, the sampling program will immediately be rescheduled.*

Upwind sample locations will be selected with the objective of characterizing the local background ambient air quality for the specific period of time that the samples will be collected. The downwind locations will be chosen to represent air quality downwind of the spray irrigation system and to reflect the quality of the air potentially impacting the groundskeeper and residents of the North Shore Towers. *Additionally, the proposed sample locations at the fourth fairway and fourteenth tee were selected to monitor air quality near the borders with the adjacent residential community and Long Island Jewish Hospital, respectively.* Depending on site access, one downwind location may also be selected near a North Shore Towers building air conditioning intake. The upwind/downwind selections will be *made on* the day of testing at which time meteorological conditions and site observations will influence the specific sample locations. Once testing commences, the sample locations will not be changed. To minimize the potential for water vapor to affect the air samples being collected, the sample containers (i.e., Summa canisters) will be placed a minimum distance from the sprinkler head being tested of tw*ice* the watering radius of the sprinkler head.

Additionally, a groundwater sample from the North Shore Tower golf course supply well will also be collected on the same day as the air samples. The groundwater sample will be submitted to Severn-Trent Laboratories (STL) in Monroe, Connecticut for analysis of the COPCs using New York State Department of Environmental Conservation ASP Method 95-1.

SAMPLING METHODOLOY

VOLATILE ORGANIC COMPOUND AIR SAMPLE COLLECTION

The target COPCs designated above will be collected in a Summa canister in accordance with the instructions of USEPA Method TO-14A The canister is cleaned and evacuated to an initial vacuum at the analytical laboratory. The canister vacuum is used to *induce* the sample gas into the canister without the need for sampling pumps or other equipment. A vacuum gauge, flow controller and a 10-micron filter are connected to the Summa canister and used to remove particulate matter, maintain the desired sample rate and monitor canister pressure during sampling. A brass plug is used when not sampling to ensure that there is no loss of vacuum due to a valve accidentally being opened. To collect the sample, the initial vacuum gauge reading is checked and recorded on the Sample Log form, and the sample valve is opened. The pre-set flow control orifice maintains the sample flow rate for a 1.5-hour test period. At approximate 15-minute intervals during the test period, the time/date, vacuum gauge readings, ambient temperature, and wind direction *will also be recorded on the Sample Log. The following additional information will also be recorded on the Sample Logs for each sample location: time irrigation began and ended, and the distance and orientation (i.e., upwind or downwind) of the sample canister to the sprinkler head being monitored.* At the end of the sampling period, the vacuum/pressure gauge valve on the sampler is closed. The vacuum gauge, flow controller, and filter are disconnected from the canister and the canister is labeled. The Chain-of-Custody form is completed and the upwind and downwind canisters are shipped, in separate containers, via overnight courier to Air Toxics, Ltd. in Folsom, California for analysis. *Air Toxics, Ltd. is a NYSDOH ELAP certified laboratory for the analyses specified in this work plan; ELAP certification documentation will be provided as part of the final report.* As described in the Quality Assurance/Quality Control section of this work plan, one duplicate sample and two trip blanks will also be collected and submitted for laboratory analysis.

VOLATILE ORGANIC COMPOUND GROUNDWATER SAMPLE COLLECTION

One groundwater sample from the North Shore Tower golf course supply well will be collected the same day as air sampling. The groundwater sample will be collected in accordance with sampling methods previously approved by the NYSDEC for the biannual groundwater monitoring required under the Operable Unit 1 (OU-1) Record of Decision (ROD) for the site. As described in the Quality Assurance/Quality Control section of this work plan, the groundwater sample and one trip blank will be shipped, via overnight courier, to STL in Monroe, Connecticut for analysis. *STL is a NYSDOH ELAP certified laboratory for the analyses specified in this work plan; ELAP certification documentation will be provided as part of the final report.*

ANALYTICAL PROCEDURES

VOLATILE ORGANIC COMPOUND AIR SAMPLE ANALYSIS

Chemical analyses for air samples will be performed in accordance with the USEPA Method TO-14A (low-level detection, GC/MS Standard Ion Mode [SIM]) *as described in "Determination of Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters With Subsequent Analysis By Gas Chromatography."* Prior to analysis, the canisters are pressurized to 5 psig using UHP dry nitrogen gas. Since the samples arrive at a slight vacuum, this results in a dilution of the field sample prior to analysis.

The sample is introduced into the gas chromatograph and analyzed by mass spectroscopy following the procedures described in the attached Air Toxics SOP #6 " Analysis of Volatile Organic Compounds in Summa Polished Canisters" (see Appendix A).

The lowest achievable analytical reporting limits are planned for this project. The analysis will follow standard EPA Method TO-14A protocols but *will also* include analysis by SIM post processing of the analytical data. Laboratory reporting limits for the COPC using Method TO-14A (low-level detection, GC/MS SIM) are provided on Table 1.

VOLATILE ORGANIC COMPOUND GROUNDWATER SAMPLE ANALYSIS

In accordance with NYSDEC-approved protocols, chemical analyses for groundwater samples will be performed in accordance with NYSDEC Method 95-1.

QUALITY ASSURANCE/QUALITY CONTROL

To ensure the generation of sufficiently high quality data from both field sampling and laboratory analysis, the following quality assurance (QA) procedures will be performed, in addition to the Air Toxics, Ltd. Quality Assurance Plan and lab standard operating procedures (SOP's) included in Appendix A

1. Pre- and post-sampling measurements with a certified mass flow controller for flow verification of the sampling system will be performed with each test run.
2. Canisters will be leak tested before sample collection, the pressure not varying more than ± 13.8 kPa over a 24-hour period.
3. All canisters will be certified clean before sample collection.

4. Chain-of-custody forms will be initiated by Air/Compliance Consultants, Inc. (ACCI) and will accompany all field samples and blanks in transit to Air Toxics, Ltd., located in Folsom, California for analysis. The site name, sample location, sample number, date and time of collection will be recorded on the forms. Chain-of-custody forms will track samples through all phases of field collection, extraction, and analysis.
5. One duplicate air sample will be collected and analyzed to evaluate the accuracy of the laboratory analysis.
6. A trip blank will accompany the sample shipments (groundwater and air samples - one trip blank per shipping container) to the laboratory, and will be analyzed by the laboratory to evaluate the possibility of sample contamination during the shipping process.

SUMMARY

ARCADIS G&M will conduct ambient air monitoring for LMC located in Great Neck, New York. The sampling site will be the North Shore Towers golf course located in Floral Park, New York. The testing will be conducted in accordance with a request from the NYSDEC and the NYSDOH. AGM will be testing for the following COPCs: chloroform; 1,1-dichloroethylene; cis-1,2-dichloroethylene; trans-1,2-dichloroethylene; 1,1-dichloroethane; Freon 113; tetrachloroethylene; *toluene*; and trichloroethylene. These chemicals could potentially be released into the atmosphere from the water spray irrigation system.

Air sample collection and analysis of these contaminants will be performed according to USEPA Method TO-14A. The results of this sampling program will be summarized in a *report and used as part of the Human Health Risk Assessment* to characterize potential impacts to ambient air quality. The report will *include a discussion of the results, tabulated analytical results, copies of Sample Logs and Chain-of-Custody forms, copies of laboratory ELAP certification, and scaled figures for each sample location showing the location of the sprinkler head monitored, the approximate watering radius of the* *sprinkler, and the location of the sample canisters with respect to the sprinkler head.* A preliminary testing date will be set after NYSDOH approval of this work plan.

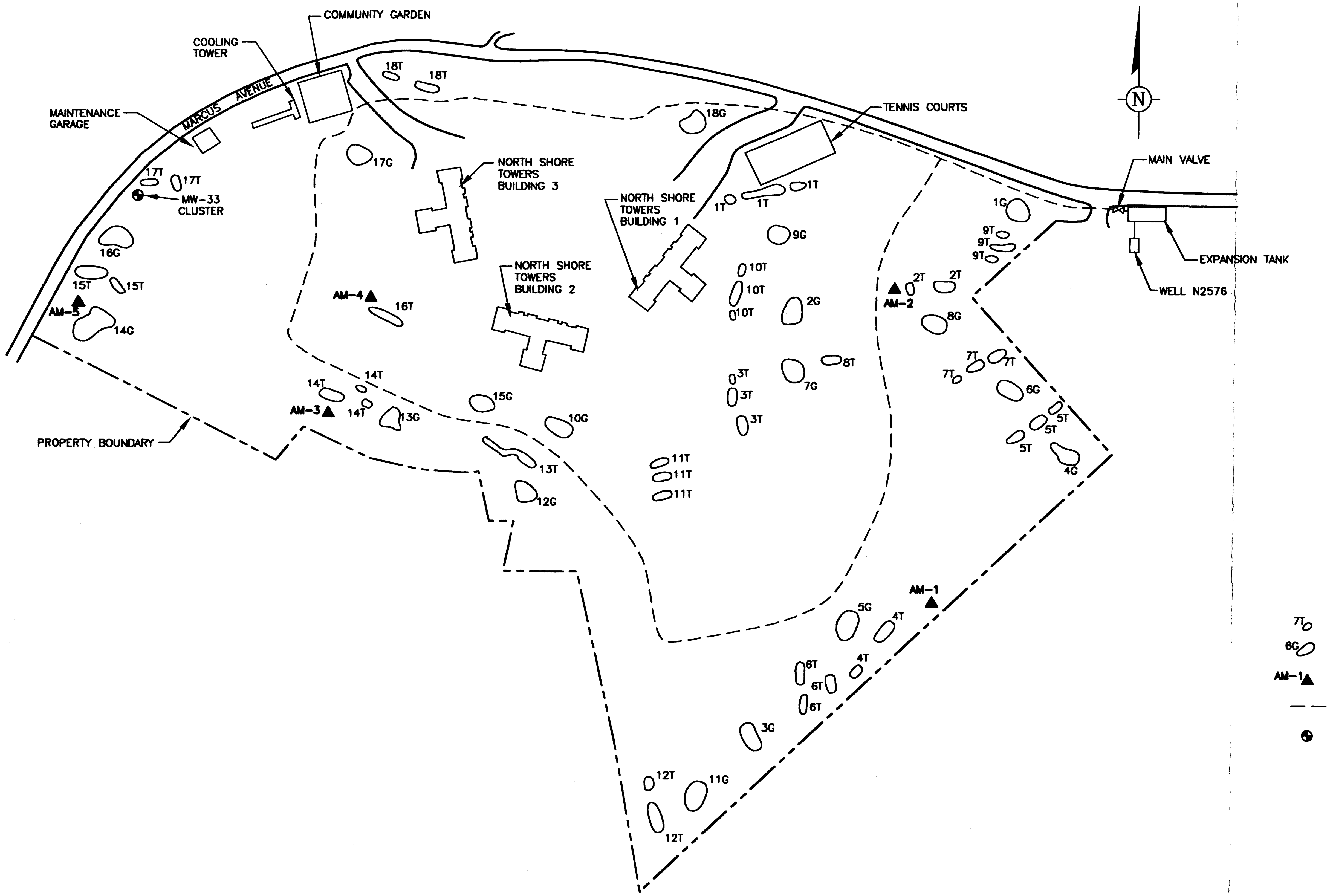
Based on the scope of work outlined in this work plan the following air samples will be collected: *five* ~~four~~ upwind, *five* ~~four~~ downwind, one duplicate downwind, one air conditioning intake, and two trip blank samples. Additionally, one groundwater sample will be collected from the North Shore towers golf course supply well and one trip blank will also be taken. This approach yields a total of *16* ~~14~~ samples.

Table 1. Laboratory Reporting Limits for Air Samples, Former Unisys Facility, Great Neck, New York.

Chemical	Analytical Method TO-14A[1] Reporting Limits[2] (ppb_v)	Analytical Method TO-14A[1] Reporting Limits[2] (ug/m^3)
Chloroform	0.020	0.099
1,1 - dichloroethane	0.020	0.082
1,1 - dichloroethene	0.010	0.040
cis - 1,2 - Dichloroethene	0.020	0.081
trans - 1,2 - Dichloroethene	0.100	0.403
Freon 113	0.020	0.156
Tetrachloroethene	0.020	0.138
Toluene	0.020	0.077
Trichloroethene	0.020	0.109

1. Analytical Method TO-14A, low-level detection, GC/MS, SIM.
2. Sample detection limit will be impacted by dilution during sample pressurization.

SIM	Standard Ion Mode.
ppb_v	Part per billion by volume.



KEY

7T⬭ TEE LOCATION AND DESIGNATION

6G⬭ GREEN LOCATION AND DESIGNATION

AM-1▲ PROPOSED AIR SAMPLE LOCATIONS

— — WATER MAIN (LOCATION APPROXIMATE)

⊕ MW-33 LOCATION AND DESIGNATION OF EXISTING MONITORING WELL CLUSTER

SCALE: 1"=300'-0"

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS G&M

NORTH SHORE TOWERS AND
GOLF COURSE
FLORAL PARK, NEW YORK

LOCKHEED MARTIN CORPORATION
GREAT NECK, NEW YORK

DRAWN A.G.	DATE 11/8/01	PROJECT MANAGER N. BENOWITZ	DEPARTMENT MANAGER
LOCATIONS OF PROPOSED AIR SAMPLES		LEAD DESIGN PROF.	CHECKED N.B.
		PROJECT NUMBER NY001227.002.05	DRAWING NUMBER 1

\PROJECT\LOCKHEED_MARTIN\GREAT_NECK\CAD\GOLF_AIR_SAMPLES.DWG 1=300

APPENDIX A

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ARCADIS

@ AIR TOXICS LIMITED
STANDARD OPERATING PROCEDURE

ANALYSIS OF VOLATILE ORGANIC COMPOUNDS IN Summa^{TM} POLISHED CANISTERS

EPA METHODS TO-14/TO-14A/TO-15

SOP #6

Revision Date:	6/02/00
Revision #:	15
Reason for Revision:	External Use

Updated By:				
	Signature	Print	Title	Date
Technical Review:				
	Signature	Print	Title	Date
QA Review:				
	Signature	Print	Title	Date
Laboratory Director:				
	Linda L. Freeman			Date

1.0 SCOPE AND APPLICATION

The procedures in this SOP describe the use of EPA Methods TO-14/TO-14A/TO-15 to determine the concentration of volatile organic compounds in ambient air using an evacuated stainless steel Summa canister. This SOP details the GC/MS procedures and the required QC for volatile analysis. A list of target compounds can be found in *Appendix A*.

2.0 METHOD SUMMARY

2.1 Description

EPA Methods TO-14/TO-14A/TO-15 describe techniques for the analysis of airborne VOCs collected as whole air samples in stainless steel canisters. Up to 0.5 liters of air is withdrawn from the canister through a mass flow controller and is either cryofocused via liquid Argon or concentrated using a multisorbent bed. The focused air sample is then flash heated through a hydrophobic drying system which removes water from the sample stream prior to analysis by full scan GC/MS. For low level analysis, a cryogenic valve is employed to cold trap the gases onto the GC column. Cooling is achieved through the use of Liquid Nitrogen.

A summary of the method QC can be found in the *Appendix A*.

2.2 Deviations

Modifications to EPA Methods TO-14/TO-14A/TO-15 used to carry out the analyses of air samples can be found in Table 1.

3.0 HEALTH AND SAFETY

Normal laboratory safety precautions must be used when preparing standards from neat materials for this method and when analyzing samples. These precautions include working in a fume hood, wearing eye protection, and wearing a laboratory coat when handling neat materials. Also, precautions must be taken to avoid skin contact with neat materials. Refer to the compound specific MSDS for additional information. Care must also be taken when handling syringes to ensure that a needle stick does not occur.

4.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

An air sample is collected in an evacuated stainless steel Summa canister or Tedlar bag. Upon receipt, the canisters will be between ca. 10" Hg vacuum and ambient pressure. Canister receipt vacuum/pressure is reported on the first page of the data report. If abnormal conditions exist the project contact is notified by the sample custodian or a client service representative before analysis can begin. Data from such samples will be qualified. Prior to analysis, the canister is pressurized to 5 psig for 6 L canisters and 15 psig for 1 L canisters. Samples are

1. Summary of Method Modifications

Requirement	TO-14	TO-14A	TO-15	ATL Modifications
Sampling/concentrator system	Nafion Drier	Nafion Drier	Multisorbent concentrator	Multisorbent concentrator
Canister cleaning - clean air supply	Cryogenic Trap	Cryogenic Trap	Cryogenic Trap	Use of Humidified UHP Air
Canister certification	Pressurize w/humidified zero air.	Pressurize w/humidified zero air.	Pressurize w/humidified zero air.	Pressurize w/dry UHP nitrogen
Sample load volume	400 mL	400 mL	Not mandated	Up to 0.5 liter
Blank	Humid air blank	Humid air blank	Humid air blank	Humid air blank for standard analysis. Dry air blank for low level analysis.
Blank acceptance criteria	< 0.2 ppbv	< 0.2 ppbv	< DL	< DL
BFB absolute abundance criteria	Within 10% of that from previous day.	Within 10% of that from previous day.	Not addressed	CCV surrogate recoveries demonstrate stability from one day to the next
BFB acceptance criteria	SW-846 Protocol	SW-846 Protocol	CLP protocol	SW-846 protocol
Concentration of IS spike	Not specified	Not specified	10 ppbv	25 ppbv for TO-14; 10 ppbv for low level
Dilutions for initial calibration	Dynamic dilutions or static using canisters.	Dynamic dilutions or static using canisters.	Dynamic dilutions or static using canisters.	Syringe dilutions
Flow rates/operating parameters				Optimized. See procedures section.
ICAL RRF %RSD acceptance criteria	Not specified	Not specified	30% or less, 40% or less for up to two compounds	30% or less for standard compounds, 40% or less for non-standard and polar compounds
IS recoveries	Not specified	Not specified	Within 40% of mean over ICAL for blanks, and w/in 40% of daily CCV for samples.	Within 40% of CCV recoveries for blank and samples.
IS RTs	Not specified	Not specified	Within .33 min from most recent calibration (either ICAL or daily)	Within 0.5 min of RT in daily CCV
Daily CCV	Not specified	Not specified	70 - 130%	Standard compounds: 70 - 130% for at least 90%; Non-standard and polar compounds: 60 - 140% for at least 80%
RF for quantitation	From ICAL	From ICAL	From daily CCV	From ICAL
Canister leak check	24 hour, positive pressure	24 hour, positive pressure	24 hour, positive pressure	20 min, vacuum check
MSD scan range	18 - 250 amu	18 – 250	35 - 300 amu	35 - 350 amu

		amu		

stored in the sample cage in the main laboratory. Analysis must occur within 3 days for Tedlar bags and 30 days for canisters.

5.0 INTERFERENCES AND POTENTIAL PROBLEMS

Interferences to this method generally include high levels of carbon dioxide, water and/or heavy hydrocarbons. High levels of CO_2 in the samples can cause freezing of the trap and thus a flow drop on the sample interface. When this occurs a smaller amount of sample is collected resulting in higher dilution factors. Very high levels of moisture in the samples cause erratic internal standard and surrogate responses and therefore likely erratic target compound responses. When a sample has high levels of heavy hydrocarbons, the analyst may have to dilute the sample more than the target compound level requires, ensuring the system is not contaminated.

6.0 EQUIPMENT/APPARATUS

6.1 List of Equipment

- Column: RTX-624 105 m x 0.53mm Megabore ™column (Restek)
- Gas Chromatograph: Hewlett-Packard 6890 equipped with Electronic Pressure Control & a split/splitless injection port, & for low level analysis, a cryo valve
- Mass Spectrometer: Hewlett-Packard 5973
- HP Chemstation Software for Data Acquisition
- Thru-Put Target Software (UNIX Operating System) for Data Analysis
- NIST/NBS54.1K Library Search Software
- Certified NIST Traceable VOC blends - Scott Specialty Gases
- Aldrich Chemical High Purity Neat Standards
- Tedlar Bags (1L, 3L, and 10L) SKC
- Ultra High Purity Helium (Local Supplier)
- Liquid Nitrogen (Local Supplier)
- Laboratory designed focusing interface
- Laboratory designed drying system
- Tylan Mass Flow Control Module (1 to 100 mL/min air)
- Edwards Vacuum Pump
- Laboratory Designed Heated Dynamic Gas Dilution Manifold - based on Porter flow controllers and Sierra digital flow sensors for calibration and diluent gases
- Laboratory Designed Canister Receiving Station equipped with high-resolution vacuum/pressure gauge and diluent gas inlet.
- Laboratory-designed automated sampler

Analysis is carried out on a GC/MS system equipped with a packed column injection port, a Megabore™ inlet adapter, a J & W DB-624 column and a Hewlett-Packard Mass Selective Detector. Cryofocusing is used in low level TO-14 analysis for better compound separation and sharper peak shape.

7.0 CALIBRATION AND QUALITY CONTROL PROCEDURES

7.1 Tuning Criteria

A daily (at the start of every 24 hours, or every 12 hours if project requires) tune check with 4-bromofluorobenzene is achieved by directly injecting 2 µL of the BFB check standard into the GC in accordance with SW-846 tuning criteria. Analysis cannot proceed unless all criteria of the tune check are met.

7.2 Calibration Procedures

Calibration of the GC/MS is achieved via the internal standard technique. The concentrations used for standard analysis typically range from 0.5 to 200 ppbv for standard TO-14 compounds, and 5.0 to 200 ppbv for non-standard and polar compounds. The concentrations used for low level analysis typically range from 0.1 to 40 ppbv for standard TO-14 compounds, and 0.5 to 40 ppbv for non-standard and polar compounds.

The percent relative standard deviations (%RSD) for all standard TO-14 compounds must be ≤ 30%, and for all non-standard and polar compounds, must be ≤ 40%. Otherwise a new initial calibration curve is performed.

In those instances where the RSD for one or more analytes exceeds 30%, the average of the RSD values is determined by summing the RSD value for each analyte and dividing by the total number of analytes. Calibration curve is considered acceptable if the mean RSD for all analytes in the calibration is ≤ 30%.

7.3 Independent Source Calibration Verification

An independently-prepared (i.e., same vendor, different lot number*) standard containing all target compounds is analyzed after each initial curve, to verify that the standards are correct and the calibration is accurate.

* *Currently only one company reliably prepares VOC gas standards. Therefore, for the standard TO-14 compounds, there are no options to obtain a second source standard (i.e., a standard from a different vendor). In addition, for the non-standard and polar compounds, the independently prepared standard is prepared by a second ATL analyst, using the same neat standards as the primary standard.*

7.4 Continuing Calibration Verification (CCV)

A continuing calibration verification (CCV) is performed at the start of each day and, if required by a specific project, every 12 hours. This is an analysis of the primary source mid-level calibration standard that has been loaded through the mass flow controller. If the CCV fails to meet the performance criteria then system maintenance should be performed and the test repeated. If the system still fails the calibration check, a new 5 point calibration curve is performed.

Certain projects have different CCV acceptance criteria (e.g., $\leq$ 25% for 100% of compounds). A specific list of target analytes is requested when the CCV acceptance criteria required differ than the ATL standard criteria noted above.

Software Verification: A manual verification of the computer-generated results is performed on one randomly chosen target compound for each CCV.

7.5 Laboratory Control Spike (LCS)

When required for specific projects, a mid-level spike using a subset of the independent source standard is analyzed daily prior to sample analysis. If the stated criteria are not met, the system is checked and the standard re-analyzed. In the event that the criteria cannot be met, the instrument is re-calibrated.

7.6 Internal Standards

1.0 mL of the IS blend is injected into the canister interface as each standard, blank, and sample is being loaded. The final concentration is 25 ppbv for each of the following:

Bromochloromethane
Chlorobenzene-d_5
1,4-Difluorobenzene

If the ISs in a sample do not pass the acceptance criteria, the sample must be reanalyzed unless obvious matrix interference is documented. If the ISs are within limits in the re-analysis, the second analysis will be reported. If the ISs are out-of-limits a second time, then the data is reported from the first analysis and the matrix effect narrated in the laboratory narrative included with the data report. Upon request, the data from the matrix effect confirmation analysis is provided to the client.

7.7 Surrogates

One mL of the surrogate blend is injected into the canister interface as each standard, blank, and sample is being loaded. The acceptance limits for surrogate recoveries are 70 to 130%. The final concentration is 25 ppbv for each of the following:

1,2-Dichloroethane-d_4
Toluene-d_8
4-Bromofluorobenzene.

If the surrogate recoveries for a sample are outside of these limits, the sample is reanalyzed unless an obvious matrix interference is documented. If the surrogate recoveries are within limits in the re-analysis, the second analysis will be reported. If the surrogate recoveries are out-of-limits a second time, the data from the first analysis will be reported with a narrative indicating the acceptance criteria for surrogate recoveries were exceeded. Upon request, the data from the matrix effect confirmation analysis is provided to the client.

7.8 Laboratory Blank

A humidified blank (> 20 RH at 25°C) is analyzed after the CCV at the beginning of each day and at least once in every 24 hour shift. A blank is also analyzed in the event saturation-level concentrations* are incurred to demonstrate that contamination does not exist in the chromatographic system. The acceptance criterion for laboratory blanks is a result less than the laboratory detection limit *(Appendix A)*.

The laboratory blank submitted for low level analysis is a dry air blank, which is more representative of the conditions of ambient air samples.

7.9 Laboratory Duplicates

A duplicate sample analysis is performed on 10% of the samples. The relative percent difference (RPD) between the two analyses must be ≤ 25% for all compounds detected at greater than 5 times the detection limit.

8.0 CALCULATIONS

8.1 Response Factor

$$\text{Relative Response Factor (RRF)} = \frac{\text{Area of Compound}}{\text{Area of Int. Standard}} \times \frac{\text{Conc. Int. Standard (ppbv)}}{\text{Conc. of Compound (ppbv)}}$$

8.2 Sample Results

$$\begin{array}{l}\text{Results Calculation}\\ \text{(ppbv on-column)}\end{array} = \frac{\text{Area of Compound in Sample}}{\text{Area of Int. Standard in Sample}} \times \frac{\text{Conc. Int. Standard (ppbv)}}{\text{ICAL RRF*}}$$

* *The average RRF from the initial calibration curve is used to quantitate results.*

ppbv in sample = ppbv on-column X Dilution factor

Note: The dilution factor includes canister pressurization dilution and any subsequent dilution required to ensure all results are within the instrument calibration range.

8.3 Total Petroleum Hydrocarbon (TPH) and Non-Methane Organic Compound (NMOC) calculations by GC/MS:

An area percent report is generated and evaluated based on the total area for an individual sample. This total value is used to calculate both TPH and NMOC. Before the final values are processed certain peaks must be subtracted out of the total area. These peaks include CO_2 and system peaks, and in the case of TPH any chlorinated compounds.

NMOC is typically referenced to either hexane (MW=86) or heptane (MW=100). The response factors for these compounds are generated from a one-point calibration that is analyzed once per month per instrument. The mathematical formula for deriving the response factor is as follows:

$$\begin{array}{l}\text{Response Factor}\\ \text{(hexane/heptane)}\end{array} = \frac{\text{Total ion area of the compound}}{\text{Concentration of the compound}}$$

$$\text{Sample Result} = \frac{\text{Total ion chromatographic area}}{\text{RF}} \times \text{Dilution factor of the sample}$$

The total ion chromatographic area is qualified in two ways. First, as discussed above, any system peaks are subtracted from the area. Second, the internal standard and surrogate areas are summed from the lab blank. This value is subtracted from the total area before the final calculation is processed.

TPH is calculated in much the same manner with the exception that a response factor of gasoline (MW=100) is used to calculate a final referenced value. Again, a one-point calibration is run once per month per instrument, and this response factor is used to calculate a final concentration. As stated above, any chlorinated peaks are subtracted from the final area before the calculation is processed. The mathematical formula to calculate TPH is as follows:

$$\text{Sample Result} = \frac{\text{Total ion chromatographic area}}{\text{RF of gasoline}} \times \text{Dilution factor of the sample}$$

9.0 SAMPLE ANALYSIS

9.1 Analytical Batch

The analytical batch is defined as the number of samples analyzed in one analytical day. The number of samples analyzed in one analytical day varies depending on the number of samples received for a particular project, the age of the samples upon receipt, the sample holding times (three days for Tedlar bag samples and 30* days for Summa canister samples), and the project-specific QC requirements.

* *Some projects require a 14-day holding time for canister samples.*

Samples are logged into a work order as noted on the chain-of-custody. As many samples on one work order as physically possible are analyzed within one analytical batch. If samples extend to more than one analytical batch, appropriate QC will be reported.

9.2 Analytical Sequence

Initial 24 hour period:	*Subsequent 24 hour period:*
BFB Tune Check	BFB Tune Check
Detection Limit Verification	CCV
Initial Calibration	LCS - if required by project
Independent Calibration Check	Laboratory Blank
Laboratory Blank	Samples
Samples	

The "Subsequent 24 hour" sequence is followed every 24 hour period (every 12 hours when specified by the project) that samples are analyzed, until the system is found to be out of calibration.

10.0 REFERENCES

EPA Method TO-14
Methods for Determination of Toxic Organic Compounds in Air, EPA Methods, Revision 1 June, 1988.

EPA Method TO-14A
Compendium of Methods for Determination of Toxic Organic Compounds in Air, EPA Methods, Second Edition, January 1997. *EPA/625/R-96/010b*

EPA Method TO-15
Compendium of Methods for Determination of Toxic Organic Compounds in Air, EPA Methods, Second Edition, January 1997. *EPA/625/R-96/010b*

SW-846 Method 8000B
Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Final Update III, Revision 1, December, 1996.

Volatile Organic Analysis of Ambient Air in Canisters - *Draft Method*
USEPA Contract Laboratory Program, Revision VCAA01.0, December 1991

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Appendix A

Detection and QC Limits

Table A-1. Method TO-14/TO-15 (Standard Compounds)

Analyte	DL (ppbv) Low Level/ Standard	Low Point of Curve (ppbv) Low Level/ Standard	QA Acceptance Criteria	
			Accuracy Limits (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,1,2-Trichloroethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,1-Dichloroethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,1-Dichloroethene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,2,4-Trichlorobenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,2,4-Trimethylbenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,2-Dibromoethane (EDB)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,2-Dichlorobenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,2-Dichloroethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,2-Dichloropropane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,3,5-Trimethylbenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,3-Dichlorobenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
1,4-Dichlorobenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Benzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Bromomethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Carbon Tetrachloride	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Chlorobenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Chloroethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Chloroform	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Chloromethane	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Chlorotoluene (Benzyl Chloride)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
cis-1,2-Dichloroethene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
cis-1,3-Dichloropropene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Dichloromethane (Methylene Chloride)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Ethylbenzene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Freon 11 (Trichlorofluoromethane)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Freon 113 (Trichlorotrifluoroethane)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Freon 114	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Freon 12 (Dichlorodifluoromethane)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Hexachlorobutadiene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
m,p-Xylene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Methyl Chloroform (1,1,1-Trichloroethane)	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
o-Xylene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Styrene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Tetrachloroethene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Toluene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
trans-1,3-Dichloropropene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Trichloroethene	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25
Vinyl Chloride	0.1 / 0.5	0.1 / 0.5	70 - 130	± 25

Continued

Table A-1 Method TO-14/TO-15 (continued)
(Non-Standard and Polar Compounds)

Analyte	DL (ppbv) Low Level/ Standard	Low Point of Curve (ppbv) Low Level/ Standard	QA Acceptance Criteria	
			Accuracy Limits (%R)	Precision Limits (Max. RPD)
1,3-Butadiene	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
1,4-Dioxane	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
2-Butanone (Methyl Ethyl Ketone)	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
2-Hexanone	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
4-Ethyltoluene	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
4-Methyl-2-Pentanone (MIBK)	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Acetone	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Bromodichloromethane	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Bromoform	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Carbon Disulfide	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Cyclohexane	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Dibromochloromethane	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Ethanol	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Heptane	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Hexane	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Isopropanol	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Methyl t-Butyl Ether (MTBE)	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Propylene	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Tetrahydrofuran	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
trans-1,2-Dichloroethene	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25
Vinyl Acetate	0.5 / 2.0	0.5 / 2.0	60 – 140	± 25

Table A-2. Internal Standards (I.S.)

Analyte	Accuracy Limits (%R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table A-3. Surrogates

Analyte	Accuracy Limits (%R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
4-Bromofluorobenzene	70 – 130

Table A-4. Summary of Calibration and QC Procedures for Methods TO-14/TO-15 (Volatile Organic Compounds)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours, or every 12 hours if project Requires	SW - 846 tune criteria	Correct problem then repeat tune
5 Point Calibration	Prior to sample Analysis	%RSD ≤ 30% for all "Standard" compounds and %RSD ≤ 40% for all "Non-standard" compounds	Correct problem then repeat initial calibration curve
Independent Source Calibration Verification	After each initial Calibration curve	Recoveries for 90% of "Standard" compounds must be ± 30%; for 80% of "Non-standard" compounds recoveries must be ± 40%.	Investigate the problem and if warranted, analyze a new analytical curve for the out-of-limits compounds
Continuing Calibration Verification (CCV)	At the start of each day and, if required by a Specific project, every 12 hours	%D ≤ 30% for 90% of "Standard" compounds; %D ≤ 40% for 80% of the "Non-standard" compounds	Perform maintenance and repeat test. If the system still fails the CCV, perform a new 5 point calibration curve
LCS (Subset of Target Compounds	Daily prior to sample Analysis, when required for specific projects	%D ≤ 30% for 90% of "Standard" compounds; %D ≤ 40% for 80% of the "Non-standard" compounds	Check the system and reanalyze the standard. Re-prepare the standard if necessary. Recalibrate the instrument if the criteria cannot be met.
Laboratory Blank	After the CCV	Results less than the laboratory detection limit (Tables A-1 & 2).	Inspect the system and reanalyze the blank.
Internal Standard (IS)	As each standard, Blank, and sample is Being loaded	Retention time (RT) for the blanks and samples must be within ± 0.5 min of the R.T. in the CCV The IS area must be within ± 40% of the CCV's IS area for the blanks and samples	**For blanks:** inspect the system and reanalyze the blank **For samples:** reanalyze the sample unless obvious matrix interference is documented. If the IS are within limits in the re-analysis, report the second analysis. If IS are out-of-limits a second time, report data from first analysis and narrate
Surrogates	As each standard, blank, and sample is being loaded	70 - 130%	**For blanks:** inspect the system and reanalyze the blank **For samples:** reanalyze sample unless obvious matrix interference is documented. If the %R are within limits in the re-analysis, report the second analysis. If %R are out-of-limits a second time report data from first analysis and narrate.
Laboratory Duplicates	10% of the samples	RPD ≤ 25% for detections > 5 X's the DL.	Reanalyze the sample a third time. If the limit is exceeded again, investigate the cause and bring the system back to working order. If no problem is found on the system, flag the data

Appendix B

BFB Tune Criteria

4-BROMOFLUOROBENZENE KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	Base Peak, 100% Relative Abundance
96	5 to 9% of mass 95
173	< 2% of mass 174
174	> 50% of mass 95
175	5 to 9% of mass 174
176	>95% but < 101% of mass 174
177	5 to 9% of mass 176

Appendix C

Standard Reporting Format