Laboratory Procedure Manual

Analyte: **Selected Group of Volatile Organic Compounds**

Matrix: **Air Badge**

Method: **GC/MS**

Method No.:

Revised:

as performed by: *Clayton Laboratories*

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Important Information for Users

Clayton Laboratories periodically refines these laboratory methods. It is the responsibility of the user to contact the person listed on the title page of each write-up before using the analytical method to find out whether any changes have been made and what revisions, if any, have been incorporated.

Public Release Data Set Information

This document details the Lab Protocol for NHANES 1999–2000 data.

A tabular list of the released analytes follows:

Lab Number	Analyte	SAS Label
Lab21	LBXZBZ	Benzene (µg/cubic meter)
	LBXZCF	Chloroform (µg/cubic meter)
	LBXZEB	Ethylbenzene (µg/cubic meter)
	LBXZTE	Tetrachloroethene (µg/cubic meter)
	LBXZTO	Toluene (µg/cubic meter)
	LBXZTI	Trichloroethene (µg/cubic meter)
	LBXZOX	o-Xylene (µg/cubic meter)
	LBXZXY	m,p-Xylene (µg/cubic meter)
	LBXZDB	1,4-dichlorobenzene (µg/cubic meter)
	LBXZMB	MTBE (µg/cubic meter)

1. SUMMARY OF TEST PRINCIPLE AND CLINICAL RELEVANCE

A selected group of volatile organic compounds in vapor form are measured by a modification of Method 7 of the Occupational Safety and Health Administration of the U. S. Dept. of Labor (OSHA). (1)The method has been modified to use 3M 3520 Organic Vapor Monitors (OVM) (manufactured without glued-on labels) as the sampling media and gas chromatography/mass spectrometry (GC/MS) as the detection device.(2) Sampling times have been extended for additional sensitivity. The vapors are quantified by desorption from the collection media with a solution of carbon disulfide and acetone, and identified and measured against a standard curve on the GC/MS. The GC/MS is operating in the selected-ion-monitoring mode (SIM) for additional sensitivity.

2. SAFETY PRECAUTIONS

All solvents used in this procedure are flammable. Use standard laboratory safety precautions. Carbon disulfide is toxic and an acute fire and explosion hazard (flash point = –30°C); all work with carbon disulfide must be performed in a hood.

3. COMPUTERIZATION; DATA SYSTEM MANAGEMENT

Raw data for all analysis is captured by the EnviroQuant software of the GC/MS instrument. Data files (raw and processed) are stored in a directory unique to the sample and instrument on the Laboratory Information Management System (LIMS) server. Data is backed up to tape storage each night by the Network Administrator, and kept on the LIMS server for approximately 6 months.

When the raw and processed data has been released by the instrument analyst peer reviewer, the data is available to the Project Manager (PM) for final calculations. Final calculations are performed by copying the processed data into a set of Excel templates that are stored in the PM's user directory on the laboratory's Novell server. Each group of samples (shipment) is stored in a separate Excel workbook. Each sample's data is stored on a separate tabbed page in the workbook, identified by the unique NHANES number of the sample. The Excel templates are used to generate a comma delimited ASCII file that is transmitted electronically to the NHANES staff when the data is released by the PM. All data for the project is stored on the Novell server and is backed up to tape each night by the Network Administrator.

4. SPECIMEN COLLECTION, STORAGE, AND HANDLING PROCEDURES; CRITERIA FOR SPECIMEN REJECTION

Samples are collected by the NHANES staff, sent by overnight delivery, and received at Clayton by the sample receiving staff. The samples are taken out of the cooler and the identification marks on the samples are compared to the paper manifest included with the samples. If the number of samples and identification numbers match the paper manifest, the samples are logged into the Clayton LIMS. If there are discrepancies, the PM is notified and the problems are resolved by communication with the NHANES staff.

This procedure generates a unique Clayton work order number for each shipment and a unique sample number for each sample. These numbers have a one-to-one equivalency with the unique NHANES shipment number and the unique individual monitor number generated by the NHANES staff, respectively.

Each sample receives a label with the numbers from the Clayton LIMS system. The group of samples from a single shipment is placed in a plastic bag and stored in the GC/MS laboratory in refrigerator 43 or 44, which are maintained at 4°C.

The data from an electronic manifest transmitted to the PM by NHANES is compared to the LIMS information generated from the paper manifest. Discrepancies (if any exist) are resolved by communication with the NHANES staff.

5. PROCEDURES FOR MICROSCOPIC EXAMINATIONS; CRITERIA FOR REJECTION OF INADEQUATELY PREPARED SLIDES

Not applicable for this procedure.

6. EQUIPMENT AND INSTRUMENTATION, MATERIALS, REAGENT PREPARATION, CALIBRATORS (STANDARDS), AND CONTROLS

A. Instrumentation

Hewlett Packard 5890 Series II Plus GC with cryogenic cooling capability and a Hewlett Packard 5972 MSD with EnviroQuant software.

B. Materials

Syringes:

25 mL SGE purge and trap syringe (SGE International, Part # 009462) or equivalent
SGE 007250 500 µL gas-tight syringe
SGE 006250 25 µL gas-tight syringe
SGE 009462 25 mL purge and trap syringe
Hamilton 701 10 µL syringe
Hamilton 7105NWG 5 µL syringe with Chaney adapter
SGE 031911 septum valves for syringes

Vials:

1.5 mL amber crimp seal vials – Sun International 200-002
11 mm crimp seals T/S septa – National Scientific C4011-11A
2.0 mL amber screw cap vials with T/S septa – HP 5182-0558
40 mL amber vial – VWR Scientific 15900-024
1 mL micro reaction vial – Supelco Cat. # 3-3293
15 mm Mininert valve – Supelco Cat. # 3-3301

Teflon-coated needle-nose forceps
Sonicator – Branson B-33 or equivalent
Carbon disulfide – Aldrich Cat. # 42,464-1
Acetone B&J Specto CLP grade – VWR Scientific BJ-010-1
Argon, High Purity
Argon Enclosure Hood (Custom Built) 2.5 feet × 2 feet × 2 feet (l×w×h)

C. Reagent Preparation

(1) Extraction Solvent:
The extraction solvent is prepared by mixing 2:1 v/v acetone and carbon disulfide. The mixed solvent should be prepared fresh for each batch of samples to be extracted. The same mixed solvent is used for preparing working standards. The sequence of steps in the preparation of the mixed solvent for extraction (2:1 v/v acetone carbon disulfide) is as follows:

- 20 cc of acetone are transferred to a separate 40-mL amber vial using a syringe that is dedicated to acetone transfer.
- 10 cc of carbon disulfide is withdrawn directly from the original container using a syringe dedicated to carbon disulfide transfer. This 10-cc aliquot is then transferred to the vial containing the acetone.

(2) Surrogate Working Solution 5000 µg/mL 4-bromofluorobenzene

A working solution of 5000 µg/mL of 4-bromofluorobenzene (BFB) is prepared by withdrawing 200 µL of a 25,000 µg/mL standard solution of BFB in methanol and transferring to a 1.5 mL clear glass vial with a Teflon-lined septum cap. 800 µL of the acetone/carbon disulfide mixed solvent is added. This surrogate standard should be kept refrigerated.

(3) 2:1 v/v Acetone Carbon Disulfide with Surrogate

A 30 µL aliquot of the surrogate working solutions mix is transferred to 30 mL of 2:1 acetone/CS2 mixed solvent in a vial.

D. Standards Preparation

100 µg/mL Stock Internal Standard
The stock internal standard is a solution of bromochloromethane, 1,4-difluorobenzene, and chlorobenzene-d5 in methanol at 1000 µg/mL each (Supelco Cat. # 4-8835). A working internal standard solution is prepared by mixing 100 µL of the stock solution with 900 µL of the 2:1 acetone/carbon disulfide mixed solvent to obtain 100 µg/mL final concentration.

External Standard Solutions
The working standard solutions are 0.1, 0.5, 2.0, 5.0, 10.0, and 20.0 (except for m-,p-xylene that do not separate chromatographically and, therefore, are at twice the concentration and 1,3-butadiene that is at a higher level [0.5 to 100 µg/mL]), prepared fresh for each analysis batch.

Both standards are kept in a freezer at –20°C.

Two stock standard solutions are used:

(1) a custom volatile (AccuStandard Part # S-2081-R5-10X) mix of benzene, carbon tetrachloride, chloroform, chloroprene, 1,4-dichlorobenzene, methylene chloride, styrene, tetrachloroethylene, toluene, methyl tert-butyl ether, mixed xylenes, trichloroethylene, and ethylbenzene, in carbon disulfide at a concentration of 2000 µg/mL; and

(2) 1,3-butadiene in methanol at (AccuStandard, Part # S-406A-10X) also at 2000 µg/mL.

(a) Stock 1: A stock standard of the mixed volatiles is prepared by withdrawing 100 µL of the concentrated solution and transferring to a 1.0 mL micro-reaction vial (Supelco Cat. # 3-3293) fitted with a Mininert valve. A 900 µL aliquot of the acetone/carbon disulfide mixed solvent is added. This working standard is stored at –20°C when not in use, and discarded after 1 month if not used completely.

(b) Stock 2: (10 µg/mL) a second stock standard is prepared by transferring 100 µL of Stock 1 into a 2 mL micro-reaction vial fitted with a Mininert valve, followed by 50 µL of the concentrated 2000 µg/mL 1,3-butadiene standard, then 20 µL of 5000 µg/mL BFB, and diluted by adding 1830 µL of the 2:1 acetone/carbon disulfide mixed solvent using a 1 mL gas tight syringe. Stock 2 can be used over a 1-week period and should be stored at –20°C.

(c) Stock 2A: (20 µg/mL) a third stock standard is prepared by transferring 100 µL of Stock 1 into a 2 mL micro-reaction vial fitted with a Mininert valve, followed by 50 µL of the concentrated 2000 µg/mL 1,3-butadiene standard, then 20 µL of 5000 ug/mL BFB, and diluted by adding 915 µL of the 2:1 acetone/carbon disulfide mixed solvent using a 1 mL gas-tight syringe. Stock 2 can be used over a 1-week period and should be stored at –20°C.

Working standards are prepared fresh using 1.5 mL amber autosampler vials fitted with Teflon/silicon/Teflon septa screw tops with glass inserts. The standards are prepared one at a time and capped immediately as follows:

- (0.1 µg/mL) 4 µL Stock 2 + 396 µL mixed solvent are added together in a 1 mL Mininert vial
- (0.5 µg/mL) 20 µL Stock 2 + 380 µL mixed solvent are added together in a 1 mL Mininert vial
- (2.0 µg/mL) 80 µL Stock 2 + 320 µL mixed solvent are added together in a 1 mL Mininert vial
- (5.0 µg/mL) 200 µL Stock 2 + 200 µL mixed solvent are added together in a 1 mL Mininert vial
- (10.0 µg/mL) 400 µL Stock 2 and no additional solvent in a 1 mL Mininert vial
- (20.0 µg/mL) 400 µL Stock 2A and no additional solvent in a 1 mL Mininert vial

E. Preparation of Quality Control Material

Quality control materials consist of unused 3M 3520 OVMs that are either fortified with the analytes of interest, or analyzed as blank samples. The OVMs are fortified by removing the Teflon diffusion screen, placing a piece of filter paper on the spacer plate, and injecting the appropriate amount of stock standards to reach the concentration required. The plastic elution cap is then applied and the monitor is allowed to sit for 16–24 hr under refrigeration. These monitors are used as Laboratory Control Samples (LCS) or as positive controls.

7. CALIBRATION AND CALIBRATION VERIFICATION PROCEDURES

Linearity will be demonstrated by a six-point calibration curve. After the establishment of linearity (either % relative standard deviation (RSD) <20 over working range or 0.995 correlation coefficient), a continuing calibration check (CCC) sample is run every 10th injection. The CCC is one of the standards (usually the middle) from the initial six-point curve.

The CCC must be within 20% agreement of the initial calibration. After each CCC and before samples are analyzed, a laboratory solvent blank is analyzed. Calculations will be based on an average response factor, and sample values will be corrected for extraction efficiencies.

Response factors for benzene and toluene are corrected for blank contribution. Three solvent blanks are averaged, and the average area count is subtracted from each level of the curve. An average subtracted response factor is generated and this response factor is used to calculate the concentration of the contamination. This concentration is added to each level of the curve, and the corrected average response factor is calculated.

8. PROCEDURE OPERATING INSTRUCTIONS; CALCULATIONS; INTERPRETATION OF RESULTS

A. Sample Preparation

Each charcoal pad is carefully removed from the holder and transferred to labeled vials. The vials are labeled with the unique sample number assigned to the sample by the LIMS system. The pad is removed using needle-nose Teflon-coated or stainless steel forceps, and is carefully folded with the aid of a similar pair of forceps so it fits through the neck of the 1.8-mL amber vial. This procedure is carried out in a positive pressure argon filled cabinet.

The vial is then capped and set aside in the cabinet. Once all the pads have been transferred to vials, each vial is then reopened; one mL of the mixed solvent CS2/acetone (1:2) solution with surrogate is added (using a dedicated gas-tight syringe) and the vial is then tightly capped and place on a holding sample tray. When all the pads in a batch of samples to be extracted are prepared in this manner, the tray is placed in an ultrasound bath, and enough water with a small amount of crushed ice is added to reach the solvent meniscus but not touching the bottom of the vial caps.

The pads are then extracted by sonication for 40 minutes. Field blanks, and laboratory blanks are

similarly treated. Sample extracts are kept refrigerated in extract refrigerator 42 hr in the same vials until they are analyzed.

B. GC/MS Settings

Typical instrument conditions are:

GC Column: Restek XTI-5 FSCC 30 m × 0.25 mm with 1-µ film thickness fused Silica capillary column

GC Parameters: Sample Washes 1
Sample Pumps 3
Injection Volume 1.0 µL
Syringe Size 10.0 µL
Plunger Speed Fast

Temperature Program: 10°C, hold for 5 minutes, ramp at 10°C /minute to 140°C.
Injection volume = 1µL

MS Parameters:
Mode: Selected ion monitoring (SIM) injection
Splitless time 0.5 minutes.
Injection port: 200 °C
Carrier: Helium
EPC Parameters: Initial pressure 15 psi for 0.1 minutes, burst 40 psi for 0.5 minutes, back to 15 psi, then ramp 1 psi/min to 32 psi and hold
Detector B (Transfer): 280 °C
Detector: MS Detector on 0.01 minute, MS Detector off 1.70 minute, MS Detector on 4.76 minutes

SIM Parameters:

Group 1	Time	0.00 – 10.50 Minutes		
	Ions	39.0	54.0	53.0
		88.0	84.0	49.0
		86.0	73.0	83.0
		85.0	130.0	128.0
		57.0	41.0	
Group 2	Time	10.50 – 114.0 Minutes		
	Ions	114.0	117.0	119.0
		130.0	132.0	95.0
		78.0	88.0	63.0
		97.0		
Group 3	Time	13.5 – End of Run		
	Ions	117.0	119.0	164.0
		166.0	91.0	92.0
		106.0	95.0	174.0
		104.0	78.0	146.0
		148.0	111.0	82.0
		129.0	131.0	176.0

Mass Spec Detector Time	0.01 On
	2.50 Off
	6.00 On

C. Operation

An initial curve is processed before each run of samples is processed. A run is considered a consecutive series of sample analyses processed with no down time on the instrument of more than 24 hours. The typical run sequence consists of the:

(1) Initial six-point curve run in ascending order
(2) Several laboratory solvent blanks (3 minimum)
(3) Ten sample injections (samples include field samples, field blanks, field positive controls)
(4) Laboratory control samples (LCS, LCSD), laboratory blanks, and laboratory duplicate injections
(5) Continuing calibration check (the 2.0 µg/ml standard)
(6) Solvent blank

Repeat Steps 3, 4, 5, and 6 until all samples are analyzed

After extraction, 5 µL of the internal standard mix is transferred to an autosampler vial with glass insert followed by 100 µL of each extract for a total volume of 105 µL. The extract vials are recapped and stored in a refrigerator. The vials/inserts with the analytical samples are tightly capped with crimp-on Teflon-lined septum caps and placed in the autosampler tray of the HP 5890 GC, and the analytical sequence is started.

D. Quality Control Materials

Blank badges from the same lot as the samples and laboratory control samples (LCS) are analyzed along with each run of samples.

E. Recording of Data

Data is recorded automatically by the EnviroQuant software of the GC/MS instrument. The data files are sequentially numbered, and the header information fields of the files contain both the LIMS generated sample numbers, and the NHANES transmitted identification numbers for each sample.

The data is stored on a partition of the laboratory's NT server that is unique to each mass spectrometer and is identified by the identification number of the mass spectrometer. For example the 2073rd data file generated on instrument 7G would be numbered G2073 and would be stored as \\cnt-nts-01\massspec\7g\Data\G2073.

This data is automatically backed up each night by the Network Administrator.

F. Replacement and Periodic Maintenance of Key Components

Key components for the analysis that requires routine maintenance are the column liner and septum and the head of the GC column. Liners and septum are changed at the beginning of every analytical sequence and the data is recorded in the laboratory notebook. Instrument flows are checked at the same time. Other maintenance is recorded in a maintenance notebook that is kept for each instrument.

G. Preliminary Calculations

The EnviroQuant software on the GC/MS instrument identifies the compounds by retention time windows and characteristic ions. A QUANT report is generated for each sample, along with an Internal Standard and Surrogate Summary Report (ISSSR) for each sample. The ISSSR shows whether the surrogate standard was within limits and whether each internal standard was within acceptance windows. The QUANT report lists compounds identified in the sample and the amount in the injection in nanograms.

The analyst reviews each identified compound and examines the integration performed by the instrument. If the analyst determines that the integration was not correct, the analyst performs a

manual integration on the peak of interest. The data system records the manual integration and marks the data file as manually integrated.

The analyst also determines if the identified compound was found at a level above the linearity determined for the system. If any compound exceeds the linearity, the analyst schedules the sample to be reanalyzed with a dilution appropriate to bring the data within the linearity range.

The peer review analyst reviews the integrations, and initials the ISSSR along with the original analyst. In some cases, the peer review is performed by the Project Manager at the time of final calculations.

H. Final Calculations

Final sample calculations are performed by pasting the instrument data directly into a set of Excel templates that have been created for this project. These templates carry out the following calculations.

Front and back pads average blank loadings are subtracted from the front and back pad results respectively. All data from blank badges run with the samples are pooled and used for background subtraction. Data from the front sections of the badges are pooled separately from the backs and maintained in a separate template.

Data for the front and back pads are combined according to the formula provided by the badge manufacturer – 3M.(3) The only modification to the calculation is that the units are in nanograms not micrograms, and the final values are in $\mu g/m^3$ not mg/m^3.

The formula is:

$$\text{Conc } (\mu g/m^3) = \frac{(\text{Mass Front} + 2.2 \times \text{Mass Back}) \times A}{r \times t \text{ (minutes)}}$$

Mass Front = Mass Front – Avg. Blank Mass Front
Mass Back = Mass Back – Avg. Blank Mass Back
A = Calculation Constant supplied by 3M for each analyte
r = recovery coefficient
t = sampling time (exposure) in minutes

Final reported values are recovery corrected with recovery coefficients that must be determined in each laboratory performing the analysis according to the 3M sample guide.

9. REPORTABLE RANGE OF RESULTS

The eluted concentrations of the organic vapors are calculated from the area of the characteristic ion measured in the sample compared to the area of the characteristic ions measured in the initial linearity curve using an internal standard procedure. The linearity differs slightly for the different compounds, but is linear in the range of 1–20 µg. Samples that exceed 20 µg for any component are diluted sufficiently to be brought into the middle of the linear range, and then reanalyzed.

Elution detection limits were determined by two methods, depending on whether the compound of interest was found to have a contribution from the blank pads. If the compound appeared in the blank pads, the detection limit was determined to be the 99% confidence level Student-t value times the standard deviation of the pooled blank badge data. If the compound did not appear in the blank pads, the detection limit was determined to be the 99% confidence level Student-t value times the standard deviation of a series of standards injected at the 1 µg level.

The reported method detection limits were calculated from the elution detection limits, the 3M sampling rate constants, the laboratory derived desorption efficiencies, and the assumption of a 48-hour sampling period. Reported pad limits of detection are:

Analyte	MDL from blks (µg)	MDL from Std (µg)	DE	3M A Value	Pad MDL µg/m^3
1,3-butadiene		0.446	0.991	23.4	3.658
2-Chloro-1,3-butadiene		0.057	0.903	31.1	0.677
Methylene chloride	1.411		1.034	26.4	12.504
Methyl tert-butyl ether		0.081	1.011	30.4	0.846
Chloroform		0.045	1.029	29.9	0.450
Carbon tetrachloride		0.085	1.082	33.1	0.900
Trichloroethene	0.038		1.118	32.2	0.383
Benzene	0.185		1.023	28.2	1.774
Tetrachloroethene	0.022		1.064	35.3	0.257
Toluene	0.399		1.156	31.8	3.808
Ethylbenzene	0.022		1.012	36.	0.277
Styrene		0.042	0.533	34.6	0.953
m-,p-xylene	0.040		1.050	36.6	0.480
o-xylene	0.030		0.890	36.6	0.434
1,4-dichlorobenzene		0.038	0.533	36.0	0.882

10. QUALITY CONTROL (QC) PROCEDURES

One LCS and one blank badge is analyzed with each run of samples. One continuing calibration verification standard (CCV) and one solvent blank is analyzed after every ten samples. Every sample has a surrogate standard added as part of the elution solvent.

The initial curve is considered valid if all compounds have <20% RSD over the working range. Each CCV is considered valid if there is less than a 20% difference between the response factor calculated from the CCV and the average response factor calculated from the initial curve.

Surrogate standards must fall within an acceptance window set from the pooled initial data sets. Surrogate limits will be recalculated semi-annually.

Control limits have been established for the LCS samples from the initial seventeen LCS samples.

The system is declared “out-of-control” if any compound in the initial curve exceeds the 20% RSD limit. The system is declared “out of control” if any compound in the CCV exceeds the 20% RPD limit.

Data is considered suspect if the result of any compound in the LCS exceeds the established control limits.

11. REMEDIAL ACTION IF CALIBRATION OR QC SYSTEMS FAIL TO MEET ACCEPTABLE CRITERIA

If the system is declared “out-of-control” for an initial curve, the physical system is examined to determine the reason for the problem.

- The injection port on the gas chromatograph may need maintenance.

- The mass spectrometer source may need to be cleaned.
- The standards may need to be re-prepared from stocks.

No samples are run until the system is brought back into control and an initial curve passes the acceptance criteria.

If the system is declared “out of control” for a CCV, all samples analyzed after the last acceptable CCV are considered invalid and need to be re-analyzed. The same criteria performed for the initial curve out-of-control are examined.

If the results for any compound in a sample exceed the highest standard in the initial curve, the extract is diluted an appropriate amount so that it will not exceed the linearity range, and the sample is reanalyzed. The results for the compound that exceeded linearity are calculated from the diluted injection, while the results for the compounds that did not exceed linearity are calculated from the initial injection.

12. LIMITATIONS OF METHOD; INTERFERING SUBSTANCES AND CONDITIONS

Interfering substances are substances found in the extraction solvents or the OVM pads that are being determined by the method. They are corrected by a blank subtraction process described in the calculation section. Compounds with retention times and characteristic ions that are similar to the compounds of interest can also interfere. When an interference is suspected, ratios of secondary ions can be compared to the standards or full scan mass spectrometry can be employed to determine if an interferent is present.

If the material is present in the desorption solvent at levels comparable to the samples, it will appear at equal levels in the front and back pad, and will be flagged as an invalid measurement because the back pad will exceed 50% of the value of the front pad.

13. REFERENCE RANGES (NORMAL VALUES)

There are no reference ranges for this type of testing.

14. CRITICAL CALL RESULTS (PANIC VALUES)

There are no critical call results for this type of testing.

15. SPECIMEN STORAGE AND HANDLING DURING TESTING

All exposed OVMs must be kept refrigerated (4°C). Standards are kept in a freezer (–10°C). Extracts are kept refrigerated (4°C). Badges are equilibrated to room temperature before extraction.

16. ALTERNATE METHODS FOR PERFORMING TEST OR STORING SPECIMENS IF TEST SYSTEM FAILS

There are no alternate methods of analysis for samples on OVMs. If the analytical system fails, the samples are stored until the system is available.

17. TEST RESULT REPORTING SYSTEM; PROTOCOL FOR REPORTING CRITICAL CALLS (IF APPLICABLE)

Sampling data is sent to the laboratory electronically by the NHANES laboratory. Sample identification numbers, types, and sampling times are sent in a CSV data file attached to an email notification. Sample

tracking data is stored in the LIMS server.

Data is captured by the EnviroQuant software on the Hewlett-Packard Gas Chromatograph/Mass Spectrometer system. The data is stored on the laboratory data server and processed on the PC by the project manager. Final results are reported to NHANES by electronic transmission of a CSV formatted data file.

Initial calibration curves are evaluated by the "Response Factor Report" generated by the EnviroQuant system. Continuing calibration standards are evaluated by the "Evaluate Continuing Calibration Standards Report" generated by the EnviroQuant system. Individual sample quality control data is recorded by the EnviroQuant system on the "Internal Standard and Surrogate Summary Report".

18. TRANSFER OR REFERRAL OF SPECIMENS; PROCEDURES FOR SPECIMEN ACCOUNTABILITY AND TRACKING

Records of sample tracking from the LIMS server and data file captured by the EnviroQuant server are stored on CD-ROM for archival storage. All sample identification is numeric and is not traceable in this laboratory to any individual.

REFERENCES

1. Organic Vapors, Method 07, OSHA Sampling and Analytical Methods Manual.
2. Morandi MT, Stock TH. Personal Exposures to Toxic Air Pollutants. Vol. 2. Houston: University of Texas; 1998.
3. Organic Vapor Monitor Sampling and Analysis Guide – Organic Vapor Monitors 3520/3530, October 1998.