**Lockheed M[illegible]Program Administrator**

Land Restoration Program
Land Management Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230

Subject: Transmittal of the Block I Building A and Building A Basement Vapor-Intrusion Investigation Report
Lockheed Martin Corporation; Middle River Complex
2323 Eastern Boulevard, Middle River, Baltimore County, Maryland

Dear Mr. Carroll:

For your review please find enclosed two hard copies with a CD of the above-referenced document. This document provides additional information regarding possible vapor-intrusion pathways and groundwater conditions in the Block I Building A basement at the Lockheed Martin Corporation Middle River Complex in Middle River, Maryland. We respectfully request to receive Maryland Department of the Environment's approval by November 14, 2016.

Please let me know if you have any questions. My office phone is (301) 548-2227.

Sincerely,

Lynnette Drake
Remediation Project Lead, Environmental Remediation

cc: (via email without enclosure)
Gary Schold, MDE
Mark Mank, MDE
Christine Kline, Lockheed Martin
Norman Varney, Lockheed Martin
Tom Blackman, Lockheed Martin
Dave Brown, MRAS
Michael Martin, Tetra Tech

# Block I Building A and Building A Basement Vapor-Intrusion Investigation Report Lockheed Martin Middle River Complex 2323 Eastern Boulevard Middle River, Maryland

Prepared for:

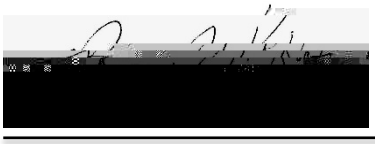
Lockheed Martin Corporation

Prepared by:

Tetra Tech, Inc.

October2016

Michael Martin, P.G.
Regional Manager



Ronald Kotun, Ph.D.
Project Manager

# TABLE OF CONTENTS


| Section | | Page |
|---|---|---|
| ACRONYMS | | iii |
| 1 | INTRODUCTION | 1-1 |
| 2 | SITE BACKGROUND | 2-1 |
| 2.1 | SITE HISTORY | 2-1 |
| 2.2 | PREVIOUS INVESTIGATIONS | 2-1 |
| 2.2.1 | Initial Investigations | 2-1 |
| 2.2.2 | Recent Observations of Elevated Contaminant Concentrations in Building A Basement | 2-3 |
| 3 | INVESTIGATION APPROACH AND METHODOLOGY | 3-1 |
| 3.1 | SITE ACCESS, NOTIFICATIONS AND PERMITS | 3-2 |
| 3.2 | UTILITY CLEARANCE | 3-3 |
| 3.3 | PERMANENT SUB-SLAB-VAPOR MONITORING-POINT INSTALLATION | 3-3 |
| 3.4 | SUB-SLAB SAMPLING AND ANALYSIS | 3-5 |
| 3.4.1 | Collection of Sub-Slab-Sns | 3-[(B)-i[(S)ons |

3.4

# ACRONYMS

| | |
|---|---|
| ACM | asbestos-containing material |
| COC | chain of custody |
| DCA | dichloroethane |
| DCE | dichloroethene |
| DQO | data quality objective |
| EESH | energy, environment, safety, and health |
| EGIS | environmental graphical information system |
| ESH | environment, safety and health |
| FTMR | field-task modification request |
| GC/MS | gas chromatograph/mass spectrometer |
| HASP | health and safety plan |
| IA | indoor air |
| IAQ | indoor airquality |
| IDW | investigation-derivedwaste |
| LMCPI | LMC Properties, Inc. |
| Lockheed Martin | Lockheed Martin Corporation |
| µg/m$^3$ | microgram(s) per cubic meter |
| MDE | Maryland Department of the Environment |
| MPL | mechanical prototype laboratory |
| MRC | Middle River Complex |
| MTBE | methyl-tertiary-butyl ether |
| PCE | tetrachloroethene |
| ppb | part(s) per billion |
| PM | project manager |
| PPE | personal protective equipment |
| QA | quality assurance |
| QC | quality control |
| SSD | sub-slab depressurization |
| SSDS | sub-slab-depressurization system |
| SV | sub-slab vapor |
| TCA | trichloroethane |
| TCE | trichloroethene |

| | |
|---|---|
| Tetra Tech | Tetra Tech, Inc. |
| TMB | trimethylbenzene |
| USEPA | United States Environmental Protection Agency |
| UST | underground storage tank |
| VC | vinyl chloride |
| VI | vapor intrusion |
| VLS | vertical-launch system |
| VMP | vapor monitoring point |
| VOC(s) | volatile organic compound(s) |

Section 1

# Introduction

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech, Inc. (Tetra Tech) has

sources, and their possible effect on indoor air quality (IAQ) in Building A and the Building A basement. This report is organized as follows:

Section 2—Site Background: Briefly describes site history and previous investigations.

Section 3—Investigation Approach and Methodology: Presents the technical approaches to field activities and data management and describes the field methodologies employed.

Section 4—Results: Presents the field program results.

Section 5—Conclusions and Recommendations: Summarizes the investigation findings and provides recommendations.

Section 6—References

Section 2

# Site Background

## 2.1 SITE HISTORY

The Middle River Complex (MRC) land parcels owned by LMC Properties, Inc. (LMCP) are undergoing extensive site characterization studies to support remedial decisions under the supervision of the Maryland Department of the Environment (MDE) and, for some parcels, the United States Environmental Protection Agency (USEPA). Ongoing environmental characterization of the MRC has identified subsurface soil and groundwater contamination from volatile organic compounds (VOCs) under or near occupied workspaces (Tetra Tech, Inc. [Tetra Tech], 2006). If a complete pathway exists from the subsurface into a building, these compounds could volatilize and migrate into the workspace. Other subsurface indoor sources could also possibly affect contaminant concentrations in indoor air (IA), including emissions from process chemicals, building materials, and other sources, as well as ambient (outdoor) air contributions.

## 2.2 PREVIOUS INVESTIGATIONS

Ongoing environmental characterizations of the MRC have identified subsurface soil and groundwater impacts from VOCs under or close to occupied workspaces (Tetra Tech, 2006). Vapor-intrusion-related investigations from 2007 through 2015 confirm the presence of detectable concentrations of volatiles in both IA and sub-slab soil vapor.

### 2.2.1 Initial Investigations

In August 2006, Lockheed Martin Corporation (Lockheed Martin) sampled sub-slab vapor (SV) beneath the Building A basement (Figure 2-1) and plating shop. (Tetra Tech, 2006). These locations were selected because VOC contamination had been observed in monitoring wells near the building foundation; these concentrations may be indicative of conditions beneath the building. Analytical results from the SV sampling, as well as other site-specific information, were used as inputs for a subsurface vapor-

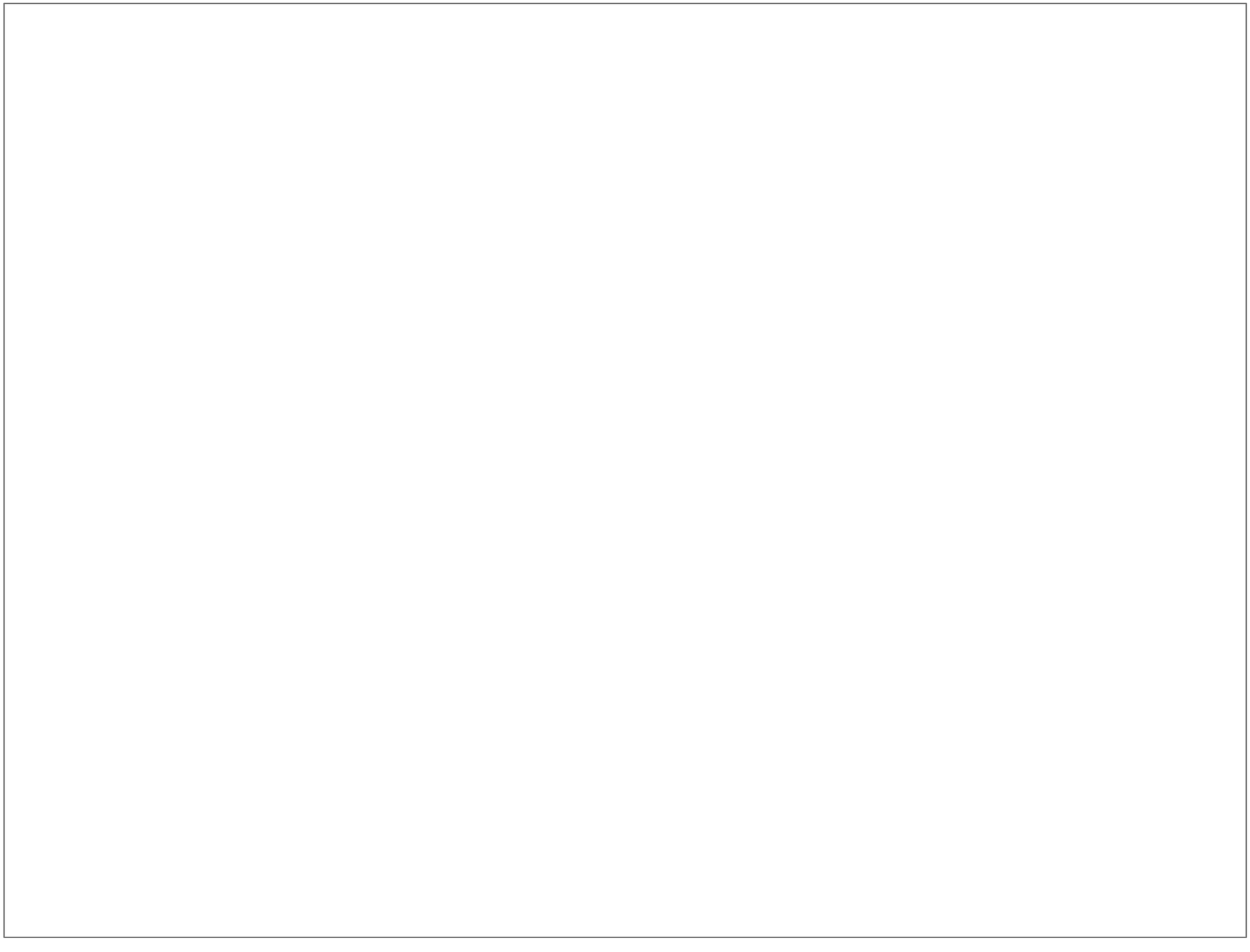
that human health risks due to inhalation of indoor air were at or below MDE-United States Environmental Protection Agency (USEPA) threshold values (Tetra Tech, 2006). However, because of the uncertainties inherent in modeling, a supplemental indoor air quality (IAQ) program was proposed to observe whether VOC contaminants were in indoor air, and, if so, whether they could be associated with subsurface VOC contamination at levels that exceed human health risk limits.

IAQ data for the chemicals of concern are compared to risk-based screening levels derived using conservative (i.e., represented as more protective of human health and the environment) USEPA default exposure assumptions and toxicity values. Screening-level concentrations are based on the risk levels acceptable to, and described in, MDE's Voluntary Cleanup Program guidance (i.e., a $1\times10^{-5}$, or a one in 100,000 excess lifetime cancer risk and/or a non-cancer hazard quotient of 1). Past analyses indicate that migration of SV into indoor air may be occurring in limited locations.

demimnec4()po(s)-1(um)-(m)-1b(e)4(an)- vn i(a)4(2( of) a)(u(um)-(m)-1on.J -0.0j -0.0EMC /P <</MCID
Trichloroetef j 0.43od(h)2(lo)26 0 T1ont8nd7-6.9ae ( r)5 ay-11(es52( b)-8(a)6(n)2(s)1(ttio)m8(g)-8n)2(a)

2.2.2

Round 20 indicates that the slab source continues to contribute TCE to indoor air, despite the presence of the air



## 3.1 SITE ACCESS, NOTIFICATIONS AND PERMITS

Before beginning work, Tetra Tech provided notification and coordinated access arrangements through Lockheed Martin Security, EMCOR (site maintenance), and MRA Systems, Inc. to gain access to Building 4 and its basement. Tenants at the MRC were informed and updated about the vapor intrusion investigation at the LMC Properties, Inc. (LMCPI) weekly meetings. LMCPI was also notified of the tasks and schedule. Site access, clearance, notifications/approvals, and documentation conformed to the provisions of Lockheed Martin's Remediation Contractor's Environment, Safety and Hntnte h7(L)]TJvSHe bga, Cntsions 2,(a)-6(r)3(ty)57( 1, 2w -3(L)11(M)24(

in the Building A basement, where no permanent site workers were present. One new VMP was installed on the main floor of Building A and sampled without disruption to ongoing site activities.

## 3.2 UTILITY CLEARANCE

The VMP locations were cleared of subsurface utilities before any intrusive field activities began. This included locations beneath the main floor of Building A, beneath the floor of the Building A basement, and behind the eastern wall of the Building A basement. In addition to calling in a "Miss Utility" ticket, a private utility-locating service (Enviroscan, Inc.) marked all underground utilities and anomalies within the areas of the VMP sampling locations.

Tetra Tech followed the procedures outlined in the Corporate Staff Procedure-28, "Digging Projects." Enviroscan used standard utility-locating equipment representing the best available technology. Examples of the equipment used include a Fisher TW-6 electromagnetic pipe and cable locator/tracer, a RadioDetection® cable-avoidance tool and Genny pipe and cable locator/tracer, a RadioDetection® RD4000 multi-frequency pipe and cable tracer, and a Geophysical Survey Systems, Inc. (GSSI) subsurface-interface radar system (GSSI SIR 2000) ground-penetrating radar. Utilities located were marked on the ground and the wall with the appropriate paint color corresponding to each unique utility. In high traffic areas adjacent to active workstations, such as the Building A main floor, utilities were not marked on the ground with paint. Alternate methods of recording the utility clearance (e.g., using removable tape, recording utility and VMP locations in the site logbook) were used.

Standard utility-locating methods are not sufficiently effective because subsurface metal (rebar) and voids below the floor and behind the wall are present, or because large pieces of equipment and stored metal materials were present. In these cases, alternative methods (e.g., line tracing) were used to effectively identify and mark any utilities. Boring locations were offset based on the results of the subsurface utility surveys as g c o r ( t ) - 2 ( a

all aspects of asbestos, was consulted before any intrusive work began. No ACM was present at any of the

## 3.4 SUB-SLAB SAMPLING AND ANALYSIS

An SV sample was collected from each of the new Vapor Pin™ sampling locations on April 1, 2016. Each sample was collected over a one-hour period using pre-conditioned Summa® canisters. Samples were collected using protocols identified in USEPA Method Compendium Toxic Organics (TO-15), and analyzed for volatile organic compounds (VOC) (USEPA, 1999). Subslab soil-vapor samples were collected in accordance with standard operating procedures developed by the USEPA Environmental Response Team for soil vapor sampling (USEPA, 1996), and methodologies developed by the USEPA Office of Research and Development (USEPA, 2004).

After sampling was complete, each canister was closed and sent to-site laboratory (TestAmerica, Inc., Knoxville, Tennessee) under proper chain of custody procedures. Each sample was submitted for analysis by USEPA Method TO-15. The current version of the analytical parameter list for indoor air, subslab vapor, and background monitoring was agreed upon by the team in 2013, and is presented in Section 3.4.2. Following receipt of the analytical data, the data were validated by an independent chemist in accordance with USEPA Region 3 protocols. All data were

Sampling was not performed any sooner than 20 minutes following purging, to allow subsurface conditions to equilibrate. Samples were collected by opening the valve on the canister and allowing outside air to enter the canister at the rate set by the controller. The controllers were calibrated in the laboratory and shipped to the field with sufficient flow rate to maintain the necessary vacuum pressure in the canister for the one hour sampling interval. Summa

- chloroform
- dichlorodifluoromethane
- 1,1-
- 1,2,4-trichlorobenzene
- 1,1,1-trichloroethane (1,1,1-TCA)

(Log 955 through Log 996) were collected from various floor and wall features in the Building A

### 3.7.2 Sampling Information

Data from field measurements were recorded using the appropriate log sheets, as per Tetra Tech standard operating procedures. Reduction of field data entailed summarizing and presenting the data in tabular form. Reducing laboratory data entailed manipulating raw instrument output data into reportable results. Laboratory data were verified by the group supervisor and by the laboratory's quality control/documentation department.

### 3.7.3 Project Data Compilation

The analytical laboratory generated an Adobe Acrobat® portable document format (PDF) file of the analytical data packages, as well as an electronic database deliverable. The electronic database was checked against the PDF file provided by the laboratory and updated as required, based on data qualifier flags applied during data validation. Data generated during implementation of the sampling and analysis plan were incorporated into the MRC environmental graphical information system (EGIS) database. All data (such as units of measure and chemical nomenclature) were checked to maintain consistency with the project database.

### 3.7.4 Geographical Information System

The data management system for this effort consists of a relational database and EGIS to manage environmental information pertaining to MRC. The relational database stores chemical, geological, hydrogeological, and other environmental data collected for the MRC environmental investigations. The EGIS is built from the relational database and contains subsets of the larger data pool. Using the EGIS, environmental data were posted on base maps to represent the information graphically for this report.

## 3.8 DATA REVIEW

Data from the laboratory were entered into a sample database and evaluated against risk-based criteria. Data validation (evaluating data completeness, holding times, calibrations, precision, accuracy, laboratory- and field-blank contamination, and detection limits) was completed by the Tetra Tech chemical data validation group in Pittsburgh, Pennsylvania concurrent with the data evaluation. These reviews are based on the USEPA Region III Modifications to the National Functional Guidelines for Data Review (USEPA,

Data from this sampling event consist of air sample chemical results. Data validation reports and COC are in Appendix D as PDF files on compact disc. The data were validated as acceptable for their intended uses (i.e., risk screening and risk assessment), except for data that were qualified as unreliable (UR flag). For this data validation, the following data qualifiers (flags) were applied to the chemical results presented in this report:

- J The analyte is considered present in the sample. However, the value is estimated and may not be accurate or precise. In this program, samples were qualified with "J" because quantitation was above the method detection limit but below the laboratory reporting limit.
- U The analyte is not detected at the detection limit left of the letter.
- UJ The analyte is not detected; however, the quantitation or detection limit may be inaccurate or imprecise.

The data qualifiers above appear in the chemical results tables and figures in Section 4 and in Appendix D.

Table

exceeded its screening level (2,567 µg/m$^3$) at this location. SV TCE exceedances were observed in the duplicate samples collected from location SV74-A (580 and 840 µg/m$^3$), and in a sample collected from the Building A basement floor, near a floor grate that exhibited elevated TCE concentrations during a previous IA survey conducted using a gas chromatograph/mass spectrometer (GC/MS].). An SV TCE exceedance also occurred at location SV68-A

TABLE 4-1

SUB-SLAB VAPOR SAMPLING RESULTS, BUILDING A AND BUILDING A BASEMENT
LOCKHEED MARTIN MIDDLE RIVER COMPLEX, MIDDLE RIVER, MARYLAND


| | LOCATION | | | Target Shallow Soil | | SV-168-A | SV-169-A | SV-170-A | SV-171-A | SV-172-A | SV-173-A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | SAMPLE ID | | | Gas Concentration | | SV-168-A | SV-169-A | SV-170-A | SV-171-A | SV-172-A | SV-173-A |
| | SAMPLE DATE | | | (µg/m3) [1] | | | | | | | |
| | Volatile organic compounds (µg/m3) | | | | | | | | | | |
| | 1,1,1-TRICHLOROET(TA)36.9(BL)-10s.GMPc-8.733333780J | | | | | | | | | | |
| ca | 180 J | 0.48 U | 0.2 U | 22 J | 0.4 U | 42 | | | | | |
| ca | 16000 | 0.98 J | 0.28 U | 700 | 2.3 J | 1100 | | | | | |
| nc | 210 U | 2 U | 0.84 U | 14 U | 1.7 U | 11 U | | | | | |
| nc | 370 UJ | 3.4 U | 1.4 UJ | 25 UJ | 2.9 UJ | 20 U | | | | | |
| nc | 160 U | 3.6 J | 0.61 U | 11 U | 2.6 J | 8.3 U | | | | | |
| nc | 97 U | 0.92 U | 0.38 U | 6.7 U | 0.77 U | 5.2 U | | | | | |
| nc | | | | | | | | | | | |
| | | | | | [2] | 160 U | 1.5 U | 0.64 U | 11 U | 1.3 U | 8.7 U |
| | BENZENE | | | 533 | ca | 93 U | 1.4 J | 0.37 U | 6.4 U | 0.8 J | 5 U |
| | CARBON TETRACHLORIDE | | | 667 | ca | 120 U | 1.1 U | 0.47 U | 8.2 U | 0.94 U | 6.4 U |
| | CHLORODIFLUOROMETHANE | | | 7333333 | nc | 67 U | 1.6 J | 2 | 4.6 U | 1.9 J | 3.6 U |
| | CHLOROFORM | | | 177 | ca | 290 J | 1.2 J | 0.71 J | 12 J | 1.4 J | 14 J |
| | CIS-1,2-DICHLOROETHENE | | | -- | -- | 520 | 1.1 U | 0.48 U | 100 | 2.7 J | 170 |
| | DICHLORODIFLUOROMETHANE | | | 14667 | nc | 170 U | 2.1 J | 2.1 | 12 U | 2.8 J | 9.1 U |
| | ETHYLBENZENE | | | 1633 | ca | 150 U | 3.9 J | 0.59 U | 10 U | 3.5 | 7.9 U |
| | METHYL TERT-BUTYL ETHER | | | 15667 | ca | 310 U | 2.9 U | 1.2 U | 21 U | 2.5 U | 17 U |
| | METHYLENE CHLORIDE | | | 86667 | nc | 570 U | 5.4 U | 2.7 J | 39 U | 4.5 U | 31 U |
| | NAPHTHALENE | | | 120 | ca | 270 U | 2.5 U | 1.2 | 18 U | 2.1 U | 14 U |
| | TETRACHLOROETHENE | | | 6000 | nc | 140 U | 1.3 U | 0.54 U | 9.4 U | 1.1 U | 7.4 U |
| | TOLUENE | | | 733333 | nc | 570 U | 20 | 2.3 U | 39 U | 16 | 31 U |
| | TOTAL XYLENES | | | 14667 | nc | 130 U | 23 | 0.52 U | 9 U | 20 | 8.3 J |
| | TRANS-1,2-DICHLOROETHENE | | | -- | -- | 100 U | 0.94 U | 0.4 U | 6.9 U | 0.79 U | 7.7 J |
| | TRICHLOROETHENE | | | 293 | nc | 42000 | 2.6 | 0.38 U | 2500 | 45 | 5100 |
| | VINYL CHLORIDE | | | 933 | ca | 94 U | 0.88 U | 0.37 U | 6.4 U | 0.74 U | 5 U |

TABLE 4-1

SUB-SLAB VAPOR SAMPLING RESULTS, BUILDING A AND BUILDING A BASEMENT
LOCKHEED MARTIN MIDDLE RIVER COMPLEX, MIDDLE RIVER, MARYLAND


Notes: All sample concentrations are in micrograms per cubic meter (µg/m$^3$)

Shaded cells indicate a concentration greater than risk-based screening level

µg/m$^3$ = micrograms per cubic meter

-- = not available

J = estimated value

U = nondetect

UJ = non-detected value is estimated

ca = screening value based on carcinogenic effects

nc = screening value based on noncarcinogenic effects

(1) Screening values derived in accordance with Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (November 2002). Screening values are equal to United States Environmental Protection Agency (USEPA) Industrial Air Screening Values divided by an attenuation factor of 0.03, and correspond to a target cancer risk level of 1.0E-05.

(2) Value is for 1,2,3-trimethylbenzene.

TABLE 4-2

PORTABLE GC/MS SURVEY RESULTS, BUILDING A BASEMENT
LOCKHEED MARTIN MIDDLE RIVER COMPLEX, MIDDLE RIVER, MARYLAND

| Sample ID | Date | TCE reading (ppb) | TCE reading (µ |
|---|---|---|---|

Section 5

# Conclusions and Recommendations

## 5.1 CONCLUSIONS

Tetra Tech, Inc. (Tetra Tech) has conducted a vapor intrusion investigation of Building A and the Building A basement in Tax Block at the Middle River Complex (MRC) (owned by LMC Properties, Inc.) in Middle River, Maryland. This investigation sought to evaluate whether volatile organic compounds (VOCs) in sub-

pollutants on-

the breathing zone, proximate to the floor grate near column D26, had a trichloroethene concentration above the indoor air screening level.

## 5.2 RECOMMENDATIONS

Results of the vapor intrusion investigations in Building A basement led to the following recommendations:

- Continued operation of the sub-slab depressurization systems in Building A.
- Consult with EMCOR, the on-site maintenance contractor, to obtain more information about the underground drainage and piping network in the basement.
- Evaluate ways to reduce trichloroethene concentrations in the Building A basement. Trichloroethene may result from venting through storm drains, tunnels, or trenches as well as from beneath the floor slab.
- Consider methods to seal select floor features (sump pits, cover plates and drains), thus mitigating migration of trichloroethene and other volatile organic compounds into indoor air. The high concentration of trichloroethene detected above a nearby floor grate suggests that the drain might be a preferential vapor intrusion pathway. Therefore, sealing the floor drain (if sealing does not cause other problems) might further reduce indoor air concentrations -3(O)12(RO)12(RO Tw hl)-2(or)3(o)-10(e) sl13.72nt.

x Iatea Tw [(Ad)-4(egai)-4( o)-1ell a

This page intentionally left blank.

Section 6

# References


1. Lockheed Martin Corporation, 2009. U.S. Department of Energy, Environment, Safety, and Health (EESH) Remediation Waste Management Procedure ERCP 03, Revision 4, effective April 17.

2. Lockheed Martin Corporation, 2014. Remediation Contractor's ESH Handbook, Revision 2, effective May 1.

3. Maryland Department of the Environment (MDE), 2006. Voluntary Cleanup Program Guidance Document. Environmental Restoration & Redevelopment Program, Maryland Department of the Environment. March.

4. Tetra Tech, Inc. (Tetra Tech), 2005. Site Characterization Report. Lockheed Martin Middle River Complex. Revision 1. Prepared by Tetra Tech, Inc., Germantown, Maryland for Lockheed Martin Corporation, Bethesda, Maryland. May.

5. Tetra Tech, Inc. (Tetra Tech), 2015. Indoor Air Quality and Sub-Slab Vapor Sampling Work Plan, Rounds 20 through 23, Buildings A, B and C, Lockheed Martin Middle River Complex. Prepared by Tetra Tech, Inc., Germantown, Maryland for Lockheed Martin Corporation, Bethesda, Maryland. September.

6. United States Environmental Protection Agency (USEPA), Region 3, 1993. Region I Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses. April.

7. United States Environmental Protection Agency (USEPA) Region III, 1994. Region III Modifications to the National Functional Guidelines for Organic Data Review. September.

8. United States Environmental Protection Agency (USEPA), 1996. Soil-Gas Sampling Standard Operating Procedure #2042. United States Environmental Protection Agency Environmental Response Team, 1996 REV 0.0. May.

9. United States Environmental Protection Agency (USEPA), 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).

# APPENDIX A—SUB-SLAB AIR -SAMPLING LOG SHEETS

# APPENDIX B—PORTABLE GC/MS SURVEY-DATA LOG SHEETS

# APPENDIX C—PORTABLE GC/MS

Photo 6 – Broad view of three features (cover plate, sump pit, and floor drain) with elevated trichloroethene detections using the Frog 4000™ near column D24.

Photo 7 – Photo of Frog 4000™ portable GC/MS unit used to conduct survey.

# APPENDIX D—DATA-VALIDATION REPORT

| | | | |
|---|---|---|---|
| **TO:** | **M. MARTIN** | **DATE:** | **APRIL 25, 2016** |
| **FROM:** | **L. GANSER** | **COPIES:** | **DV FILE** |

**SUBJECT:** **ORGANIC DATA VALIDATION – VOC**
**LOCKHEED MARTIN CORPORATION (LMC) – MIDDLE RIVER CENTER (MRC)**
**SDG 140-4707-1**

**SAMPLES:** 11/Soil Vapor/VOC

| | | | | |
|---|---|---|---|---|
| SV-168-A | SV-169-A | SV-170-A | SV-171-A | SV-172-A |
| SV-173-A | SV-174-A | SV-175-A | SV-176-A | SV-177-A |
| SV-DUP-A | | | | |

Overview

The sample set for LMC - MRC, SDG 140-4707-1 consisted of eleven (11) soil vapor samples. All samples were analyzed for select Volatile Organic Compounds (VOC). One field duplicate sample pair was included in this SDG: SV-174-A / SV-DUP-A.

Notes

The following samples were analyzed for VOCs at dilution, resulting in elevated detection limits for nondetected compounds:

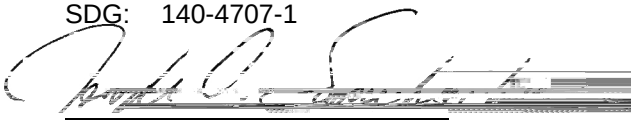
| Sample | Dilution |
|---|---|
| SV-168-A | 30.37 |
| SV-169-A | 3.57 |
| SV-171-A | 3.47 |
| SV-173-A | 13.56 |
| SV-175-A | 125.78 |

1,1,1-Trichloroethane was detected in a laboratory method blank at the following maximum concentrations:

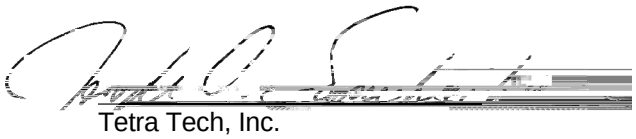
| Compound | Maximum Concentration | Action Level |
|---|---|---|
| 1,1,1-Trichloroethane(1) | 0.0136 ppb | 0.068 |
| 1,1,1-Trichloroethane(1) | 0.0743 µg/m3 | 0.3715 |

1 – Affecting all samples, except SV-169-A and SV-173-A.

An action level of 5X the maximum contaminant level has been used to evaluate sample data for blank contamination. Dilution factor, if applicable, was taken into consideration when evaluating for blank contamination. No action was taken as detected results for 1,1,1-trichloroeth



for Tetra Tech, Inc.
Leanne M. Ganser
Environmental Scientist/Data Validator



Tetra Tech, Inc.
Joseph A. Samchuck
Data Validation Manager

Attachments:

**Appendix A**

Qualified Analytical Results

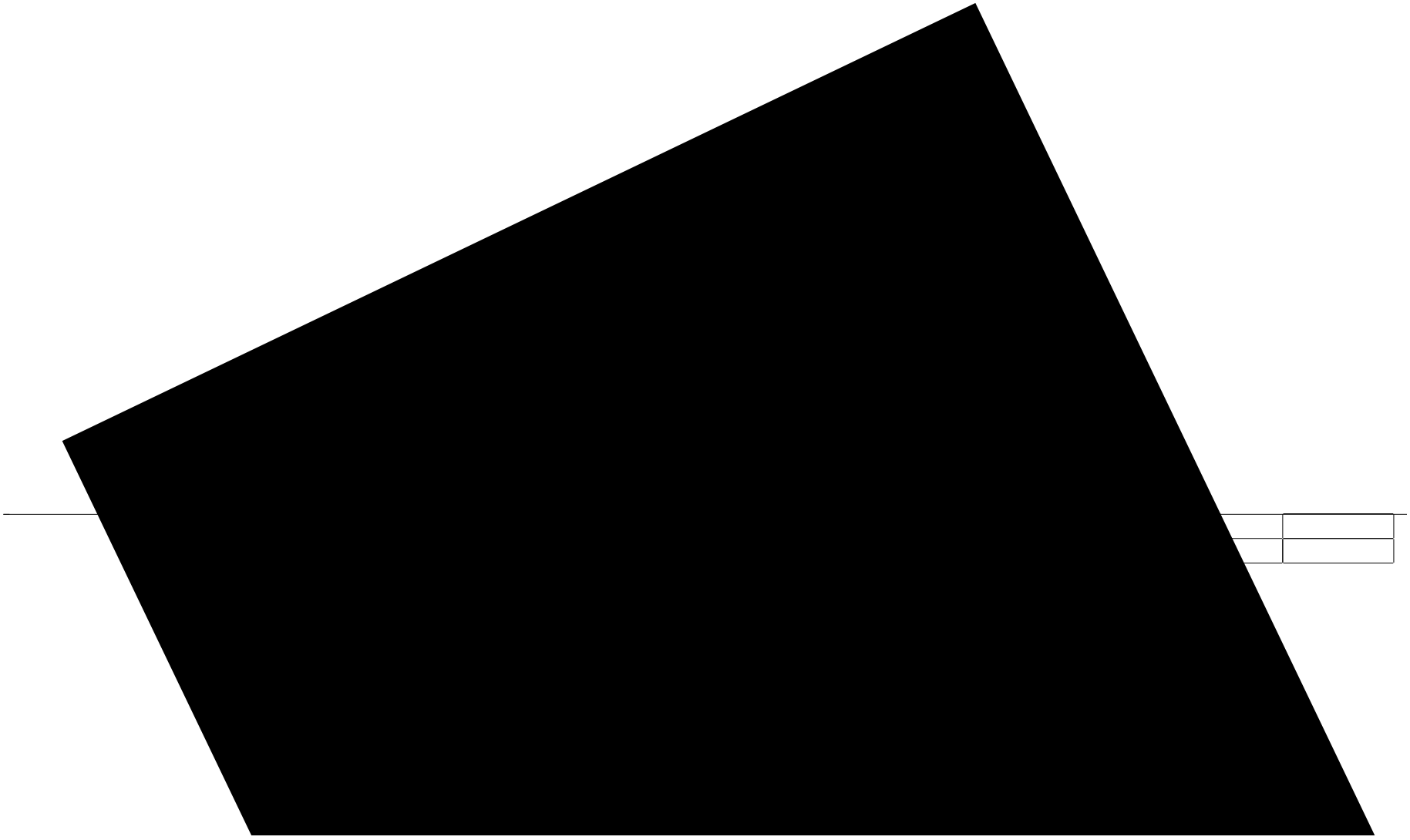
**Qualifier Codes:**

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01 = GC/MS Tuning Noncompliance
D = MS/MSD Recovery Noncompliance
E = LCS/LCSD Recovery Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = ICP PDS Recovery Noncompliance; MSA's r < 0.995
K = ICP Interference - includes ICS % R Noncompliance
L = Instrument Calibration Range Exceedance
M = Sample Preservation Noncompliance
N = Internal Standard Noncompliance
N01 = Internal Standard Recovery Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R = Surrogates Recovery Noncompliance.96T e(c)-508209.09.96Tf 1 0 0 1 56652 38889 Tm

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 580 | | | | | | |
| 0.74 | U | | 5 | U | | 1.9 | U | | 230 | U | | |

/ET 0.0 0.0 0.0 RG 05515Td 2212.7300 68.72000.0 0.300 68.0.0 0.0 0.0 RG 0.25 w [] 0 d 0[.0]1Td 220 48.023.7275Td 68752228.0.0 0.0 0.0 RG 0.25 w [] 0 d 0[.0]1Td 48.023.727 Td 68752228.0.0 840

89 0.0 rg 689ET 0.0 0.0 0.0 RG 05515Td 68760.73.7275Td 2.724.2229 0.0 rg 689ET 0.0 0.0 0.0 RG 0551872 3.60.73.727 Td 724.2229 0.0 840



**Appendix B**

Results as Reported by the Laboratory

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Knoxville | Job No.: 140-4707-1

SDG No.:

Client Sample ID: SV-169-A | Lab Sample ID: 140-4707-1

Matrix: Air | Lab File ID: RD07P112.D

Analysis Method: TO 15 LL | Date Collected: 04/01/2016 13:14

Sample wt/vol: 150(mL) | Date Analyzed: 04/08/2016 02:48

Soil Aliquot Vol: | Dilution Factor: 3.57

Soil Extract Vol.: | GC Column: RTX-5 ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 4612 | Units: ug/m3

| CAS NO. | COMPOUND NAME | MOLECULAR WEIGHT | RESULT | Q | RL | MDL |
|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | 78.11 | 1.4 | J | 3.0 | 0.87 |
| 56-23-5 | Carbon tetrachloride | 153.81 | ND | | 6.0 | 1.1 |
| 75-45-6 | Chlorodifluoromethane | 86.47 | 1.6 | J | 3.4 | 0.63 |
| 67-66-3 | Chloroform | 119.38 | 1.2 | J | 4.6 | 0.87 |
| 156-59-2 | cis-1,2-Dichloroethene | 96.94 | ND | | 3.8 | 1.1 |
| 75-71-8 | Dichlorodifluoromethane | 120.91 | 2.1 | J | 4.7 | 1.6 |
| 75-34-3 | 1,1-Dichloroethane | 98.96 | ND | | 3.9 | 0.48 |
| 107-06-2 | 1,2-Dichloroethane | 98.96 | ND | | 3.9 | 0.92 |
| 75-35-4 | 1,1-Dichloroethene | 96.94 | 0.98 | J | 3.8 | 0.66 |
| 100-41-4 | Ethylbenzene | 106.17 | 3.9 | J | 4.1 | 1.4 |
| 75-09-2 | Methylene Chloride | 84.93 | ND | | 8.3 | 5.4 |
| 1634-04-4 | Methyl tert-butyl ether | 88.15 | ND | | 17 | 2.9 |
| 91-20-3 | Naphthalene | 128.17 | ND | | 2.5 | 2.5 |
| 127-18-4 | Tetrachloroethene | 165.83 | ND | | 6.5 | 1.3 |
| 108-88-3 | Toluene | 92.14 | 20 | | 5.4 | 5.4 |
| 156-60-5 | trans-1,2-Dichloroethene | 96.94 | ND | | 3.8 | 0.94 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 181.45 | ND | | 7.1 | 3.4 |
| 71-55-6 | 1,1,1-Trichloroethane | 133.41 | ND | | 5.2 | 0.78 |
| 79-00-5 | 1,1,2-Trichloroethane | 133.41 | ND | | 5.2 | 1.4 |
| 79-01-6 | Trichloroethene | 131.39 | 2.6 | | 2.6 | 0.90 |
| 526-73-8 | 1,2,3-Trimethylbenzene | 120.19 | ND | | 4.7 | 2.0 |
| 95-63-6 | 1,2,4-Trimethylbenzene | 120.20 | 3.6 | J | 4.7 | 1.5 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 120.20 | ND | | 4.7 | 1.5 |
| 75-01-4 | Vinyl chloride | 62.50 | ND | | 1.2 | 0.88 |
| 1330-20-7 | Xylenes, Total | 106.17 | 23 | | 8.3 | 1.2 |

| CAS NO. | SURROGATE | %REC | Q | LIMITS |
|---|---|---|---|---|
| | | 105 | CAS NO. | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: _____ Job No.: _____

_____

Client Sample ID: _____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____ _____

_____ _____

_____ _____

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Knoxville | Job No.: 140-4707-1

SDG No.:

Client Sample ID: SV-DUP-A | Lab Sample ID: 140-4707-11

Matrix: Air | Lab File ID: GD06P114.D

Analysis Method: TO 15 LL | Date Collected: 04/01/2016 00:00

Sample wt/vol: 11(mL) | Date Analyzed: 04/07/2016 01:09

Soil Aliquot Vol: | Dilution Factor: 1

Soil Extract Vol.: | GC Column: RTX-5 ID: 0.32(mm)

% Moisture: | Level: (low/med) Low

Analysis Batch No.: 4620 | Units: ug/m3

| CAS NO. | COMPOUND NAME | MOLECULAR WEIGHT | RESULT | Q | RL | MDL |
|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | 78.11 | ND | | 12 | 3.3 |
| 56-23-5 | Carbon tetrachloride | 153.81 | ND | | 23 | 4.3 |
| 75-45-6 | Chlorodifluoromethane | 86.47 | ND | | 13 | 2.4 |
| 67-66-3 | Chloroform | 119.38 | 11 | J | 18 | 3.3 |
| 156-59-2 | cis-1,2-Dichloroethene | 96.94 | 31 | | 14 | 4.3 |
| 75-71-8 | Dichlorodifluoromethane | 120.91 | ND | | 18 | 6.1 |
| 75-34-3 | 1,1-Dichloroethane | 98.96 | 9.4 | J | 15 | 1.8 |
| 107-06-2 | 1,2-Dichloroethane | 98.96 | ND | | 15 | 3.5 |
| 75-35-4 | 1,1-Dichloroethene | 96.94 | 71 | | 14 | 2.5 |
| 100-41-4 | Ethylbenzene | 106.17 | ND | | 16 | 5.3 |
| 75-09-2 | Methylene Chloride | 84.93 | ND | | 32 | 21 |
| 1634-04-4 | Methyl tert-butyl ether | 88.15 | ND | | 66 | 11 |
| 91-20-3 | Naphthalene | 128.17 | ND | | 9.5 | 9.5 |
| 127-18-4 | Tetrachloroethene | 165.83 | ND | | 25 | 4.9 |
| 108-88-3 | Toluene | 92.14 | ND | | 21 | 21 |
| 156-60-5 | trans-1,2-Dichloroethene | 96.94 | ND | | 14 | 3.6 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 181.45 | ND | | 27 | 13 |
| 71-55-6 | 1,1,1-Trichloroethane | 133.41 | 36 | B | 20 | 3.0 |
| 79-00-5 | 1,1,2-Trichloroethane | 133.41 | ND | | 20 | 5.2 |
| 79-01-6 | Trichloroethene | 131.39 | 840 | | 9.8 | 3.4 |
| 526-73-8 | 1,2,3-Trimethylbenzene | 120.19 | ND | | 18 | 7.6 |
| 95-63-6 | 1,2,4-Trimethylbenzene | 120.20 | ND | | 18 | 5.6 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 120.20 | ND | | 18 | 5.8 |
| 75-01-4 | Vinyl chloride | 62.50 | ND | | 4.6 | 3.4 |
| 1330-20-7 | Xylenes, Total | 106.17 | ND | | 32 | 4.7 |

| CAS NO. | SURROGATE | %REC | Q | LIMITS |
|---|---|---|---|---|
| 460-00-4 | 4-Bromofluorobenzene (Surr) | 101 | | 60-140 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Knoxville  Job No.: 140-4707-1

SDG No.:

Client Sample ID: SV-174-A  Lab Sample ID: 140-4707-6

Matrix: Air  Lab File ID: GD06P109.D

Analysis Method: TO 15 LL  Date Collected: 04/01/2016  13:30

Sample wt/vol: 20(mL)  Date Analyzed: 04/06/2016  20:55

Soil Aliquot Vol:  Dilution Factor: 1

Soil Extract Vol.:  GC Column: RTX-5  ID: 0.32(mm)

% Moisture:  Level: (low/med) Low

Analysis Batch No.: 4620  Units: ppb v/v

| CAS NO. | COMPOUND NAME | MOLECULAR WEIGHT | RESULT | Q | RL | MDL |
|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | 78.11 | ND | | 2.0 | 0.58 |
| 56-23-5 | Carbon tetrachloride | 153.81 | ND | | 2.0 | 0.38 |
| 75-45-6 | Chlorodifluoromethane | 86.47 | 0.41 | J | 2.0 | 0.38 |
| 67-66-3 | Chloroform | 119.38 | 2.0 | | 2.0 | 0.38 |
| 156-59-2 | cis-1,2-Dichloroethene | 96.94 | 6.5 | | 2.0 | 0.60 |
| 75-71-8 | Dichlorodifluoromethane | 120.91 | ND | | 2.0 | 0.68 |
| 75-34-3 | 1,1-Dichloroethane | 98.96 | 2.1 | | 2.0 | 0.25 |
| 107-06-2 | 1,2-Dichloroethane | 98.96 | ND | | 2.0 | 0.48 |
| 75-35-4 | 1,1-Dichloroethene | 96.94 | 14 | | 2.0 | 0.35 |
| 156-60-5 | trans-1,2-Dichloroethene | 96.94 | 1.7 | J | 2.0 | 0.17 |

2 Tr [(71-43-2) Tj78 0 Td (Benzene) Tj.8 0 Td (6.5) T

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: Job No.: 140-4707-1

SDG No.:

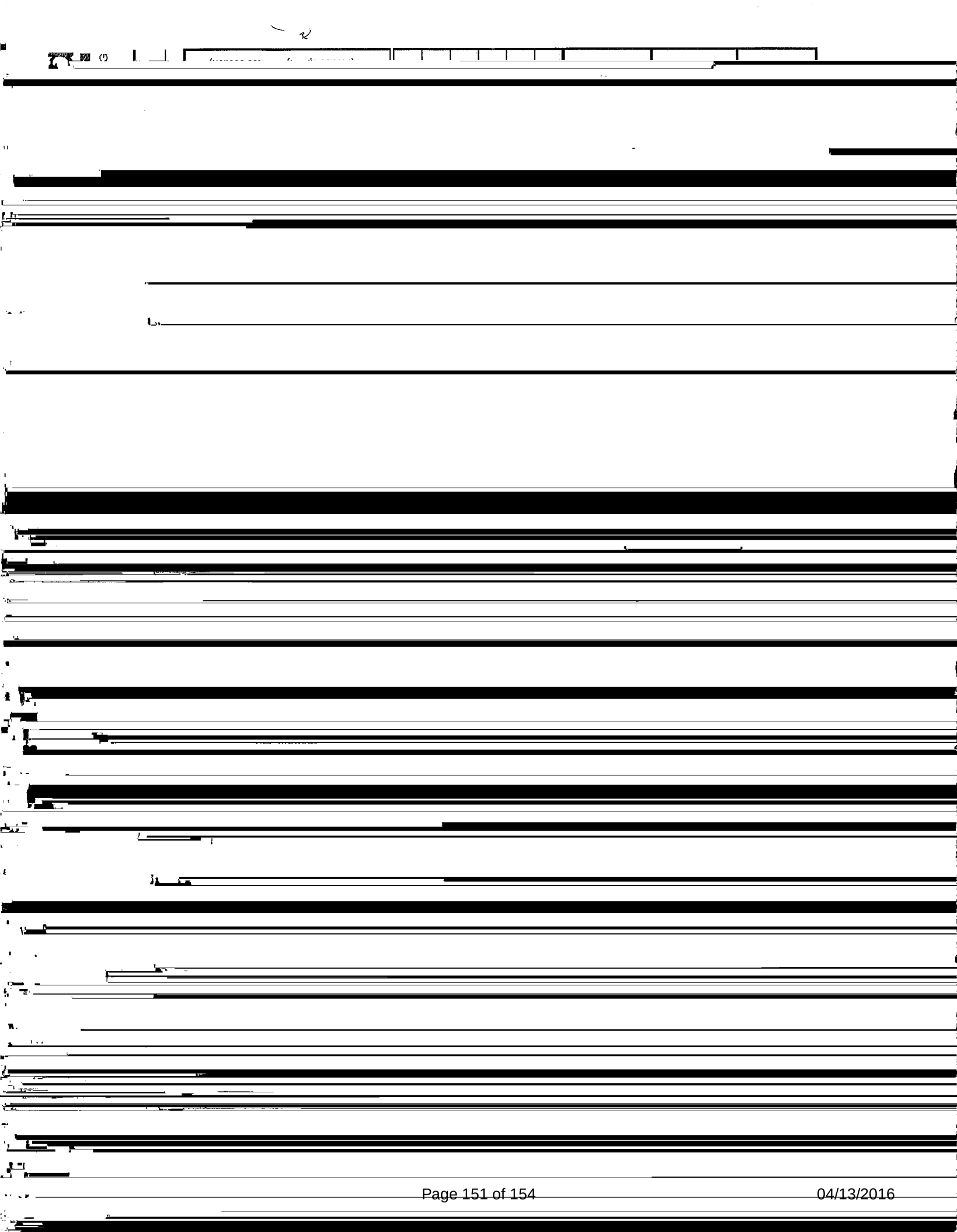
Client Sample ID: SV-DUP-A Lab Sample ID: 140-4707-11

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

**Appendix C**

Support Documentation



# Login Sample Receipt Checklist

**Login Number: 4707**
**List Number: 1**
**Creator: Wilson, Ken**

**List Source: TestAmerica Knoxville**

| Question | Answer | Comment |
|---|---|---|

# Method TO15 Low Level

---

## Volatile Organic Compounds - Low level (GC/MS) by Method TO 15

# QC Association Summary

Client: Tetra Tech, Inc.
Project/Site: Middle River - MRC Building A VMP

TestAmerica Job ID: 140-4707-1

## Air - GC/MS VOA

### Analysis Batch: 4612

| Lab Sample ID | Client Sample ID | Prep Type | Matrix | Method | Prep Batch |
|---|---|---|---|---|---|
| 140-4707-1 | SV-169-A | Prrmple ID | Air | TO 15 LLPrep Type | |

| | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

FORM VI
AIR - GC/MS VOA BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1 Analy Batch No.: 4097

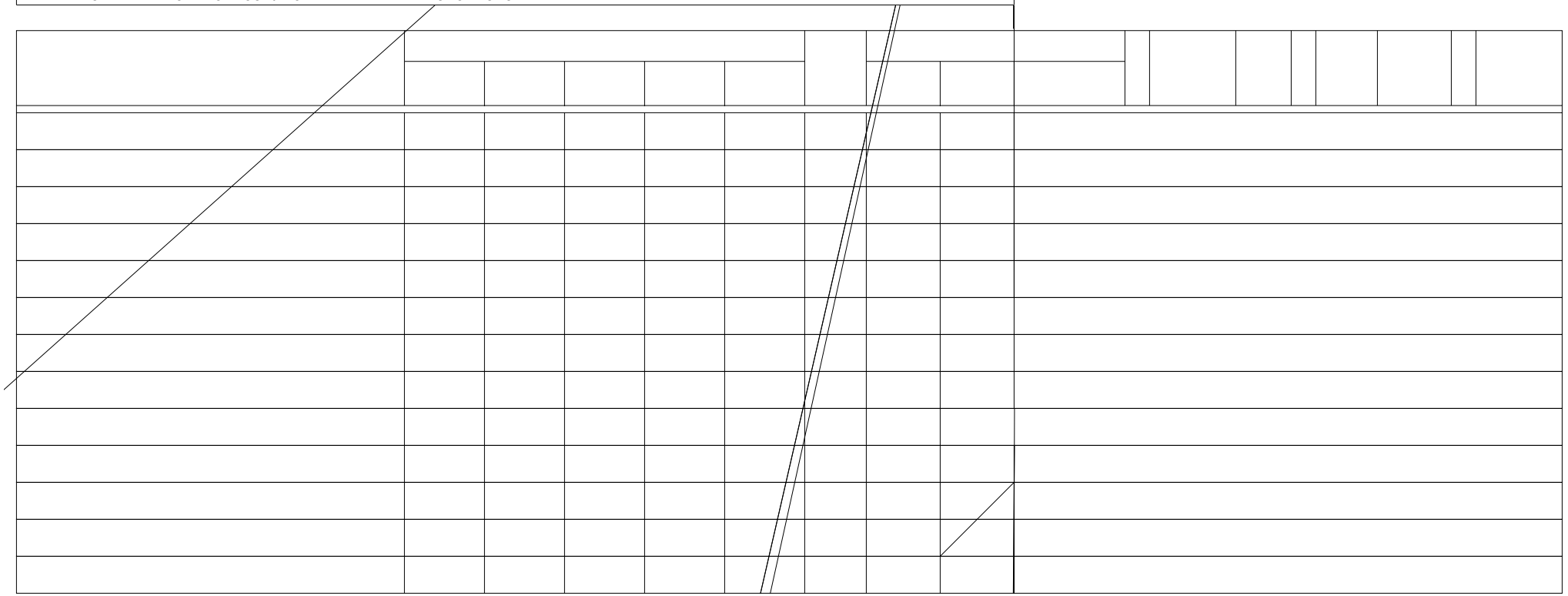
SDG No.:

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm) Heated Purge: (Y/N) N

Calibration Start Date: 01/07/2016 19:02 Calibration End Date: 01/08/2016 00:44 Calibration ID: 457

Calibration Files:

| LEVEL: | LAB SAMPLE ID: | LAB FILE ID: |
|---|---|---|
| Level 1 | IC 140-4097/2 | GA07ICL1.D |
| Level 2 | IC 140-4097/3 | GA07ICL2.D |
| Level 3 | IC 140-4097/4 | GA07ICL3.D |
| Level 4 | IC 140-4097/5 | GA07ICL4.D |
| Level 5 | IC 140-4097/6 | GA07ICL5.D |
| Level 6 | ICIS 140-4097/7 | GA07ICL6.D |
| Level 7 | IC 140-4097/8 | GA07ICL7.D |
| Level 8 | IC 140-4097/9 | GA07ICL8.D |
| Level 9 | IC 140-4097/10 | GA07ICL9.D |



FORM VI
AIR - GC/MS VOA BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1 Analy Batch No.: 4097

SDG No.:

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm) Heated Purge: (Y/N) N

Calibration Start Date: 01/07/2016 19:02 Calibration End Date: 01/08/2016 00:44 Calibration ID: 457

| ANALYTE | RRF | | | | | CURVE TYPE | COEFFICIENT | | | # | MIN RRF | %RSD | # | MAX %RSD | R^2 OR COD | # | MIN R^2 OR COD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LVL 1 LVL 6 | LVL 2 LVL 7 | LVL 3 LVL 8 | LVL 4 LVL 9 | LVL 5 | | B | M1 | M2 | | | | | | | | |
| 2-Butanone (MEK) | +++++ 0.5346 | +++++ 0.5106 | 0.5262 0.4277 | 0.5084 0.5274 | 0.6169 | Ave | | 0.5217 | | | | 10.6 | | 30.0 | | | |
| Hexane | +++++ 0.9295 | +++++ 0.8693 | 1.0811 0.8775 | 0.9097 0.7571 | 0.8144 | Ave | | 0.8912 | | | | 11.4 | | 30.0 | | | |
| Isopropyl ether | +++++ 3.8331 | 4.1451 3.4870 | 3.7503 2.9876 | 3.4760 3.2877 | 3.8451 | Ave | | 3.6015 | | | | 10.1 | | 30.0 | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

FORM VI
AIR - GC/MS VOA BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1 Analy Batch No.: 4097

SDG No.:

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm) Heated Purge: (Y/N) N

Calibration Start Date: 01/07/2016 19:02 Calibration End Date: 01/08/2016 00:44 Calibration ID: 457

| | | |
|---|---|---|
| | | |

FORM VI
AIR - GC/MS VOA BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1 Analy Batch No.: 4097

SDG No.:

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm) Heated Purge: (Y/N) N

Calibration Start Date: 01/07/2016 19:02 Calibration End Date: 01/08/2016 00:44 Calibration ID: 457

FORM VI
AIR - GC/MS VOA BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1 Analy Batch No.: 4097

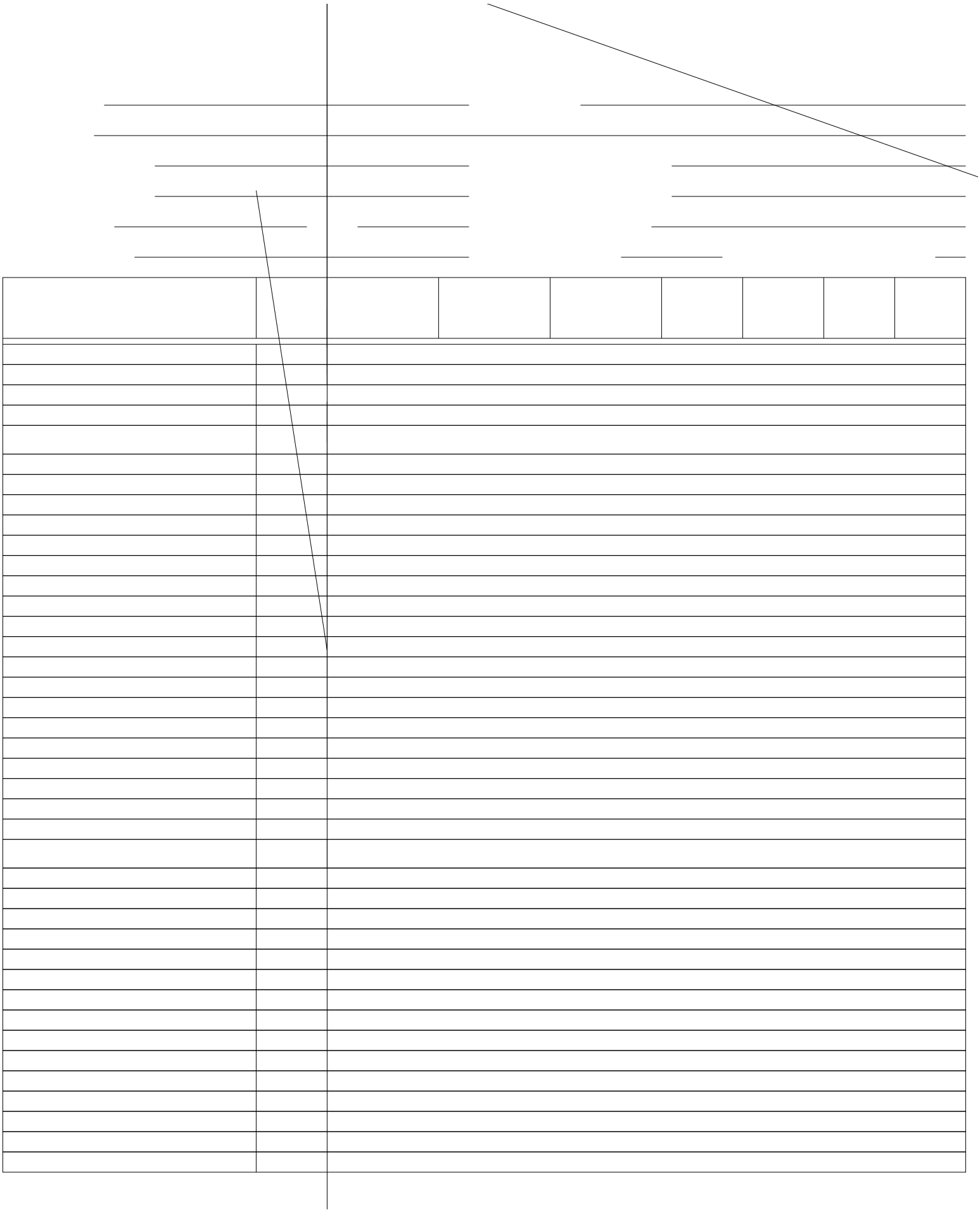
SDG No.:

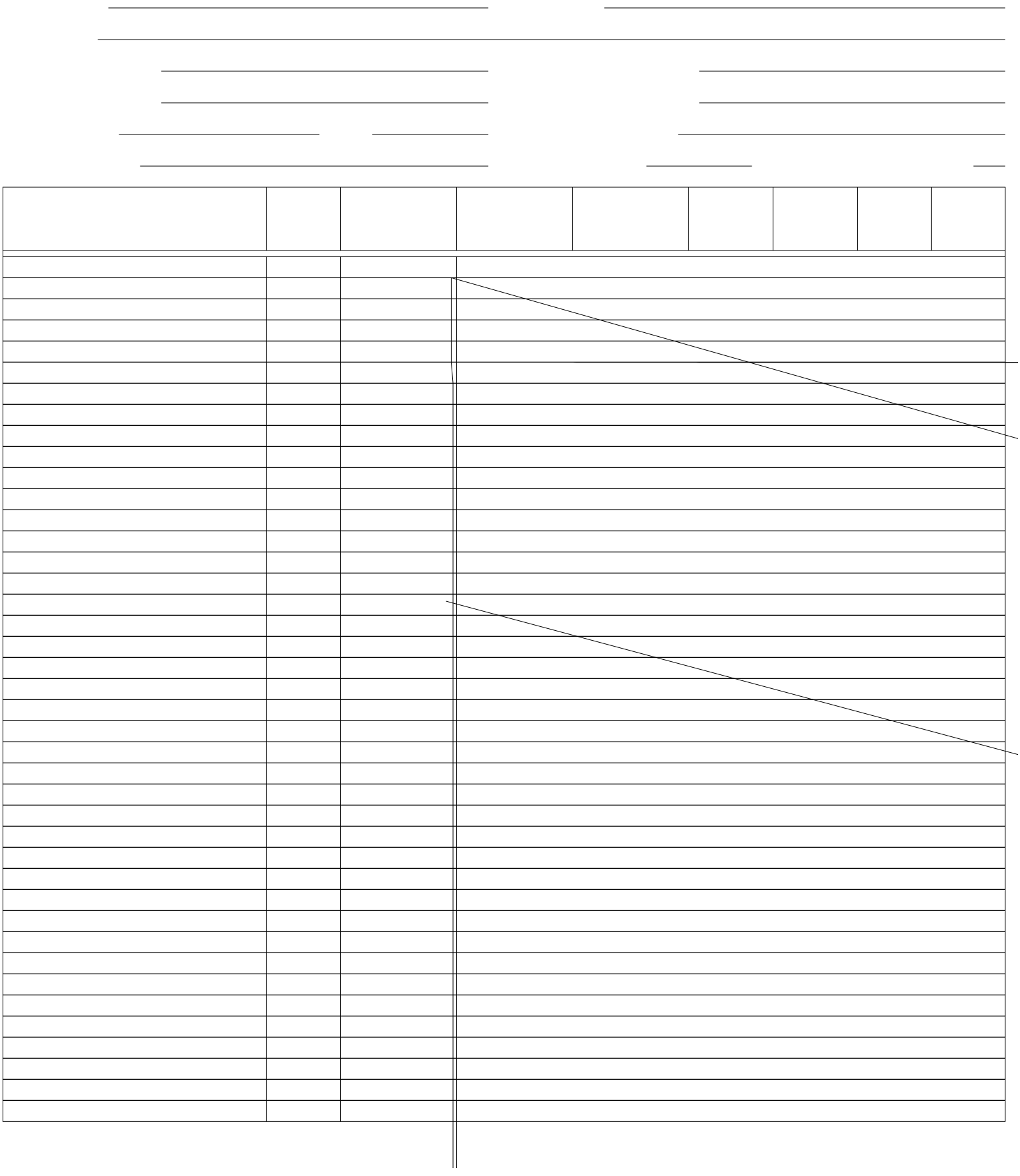
Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm) Heated Purge: (Y/N) N

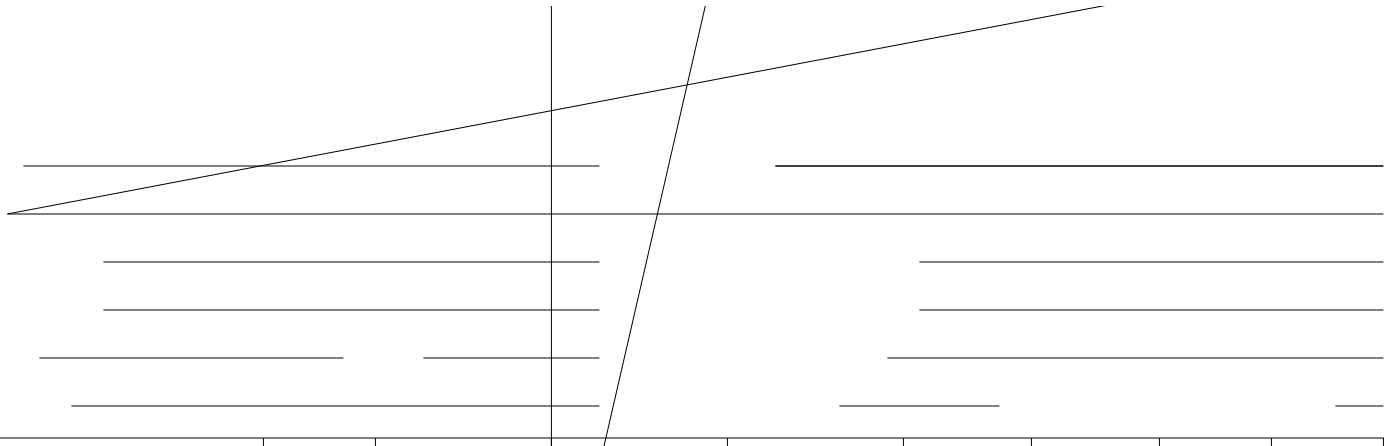
Calibration Start Date: 01/07/2016 19:02 Calibration End Date: 01/08/2016 00:44 Calibration ID: 457

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

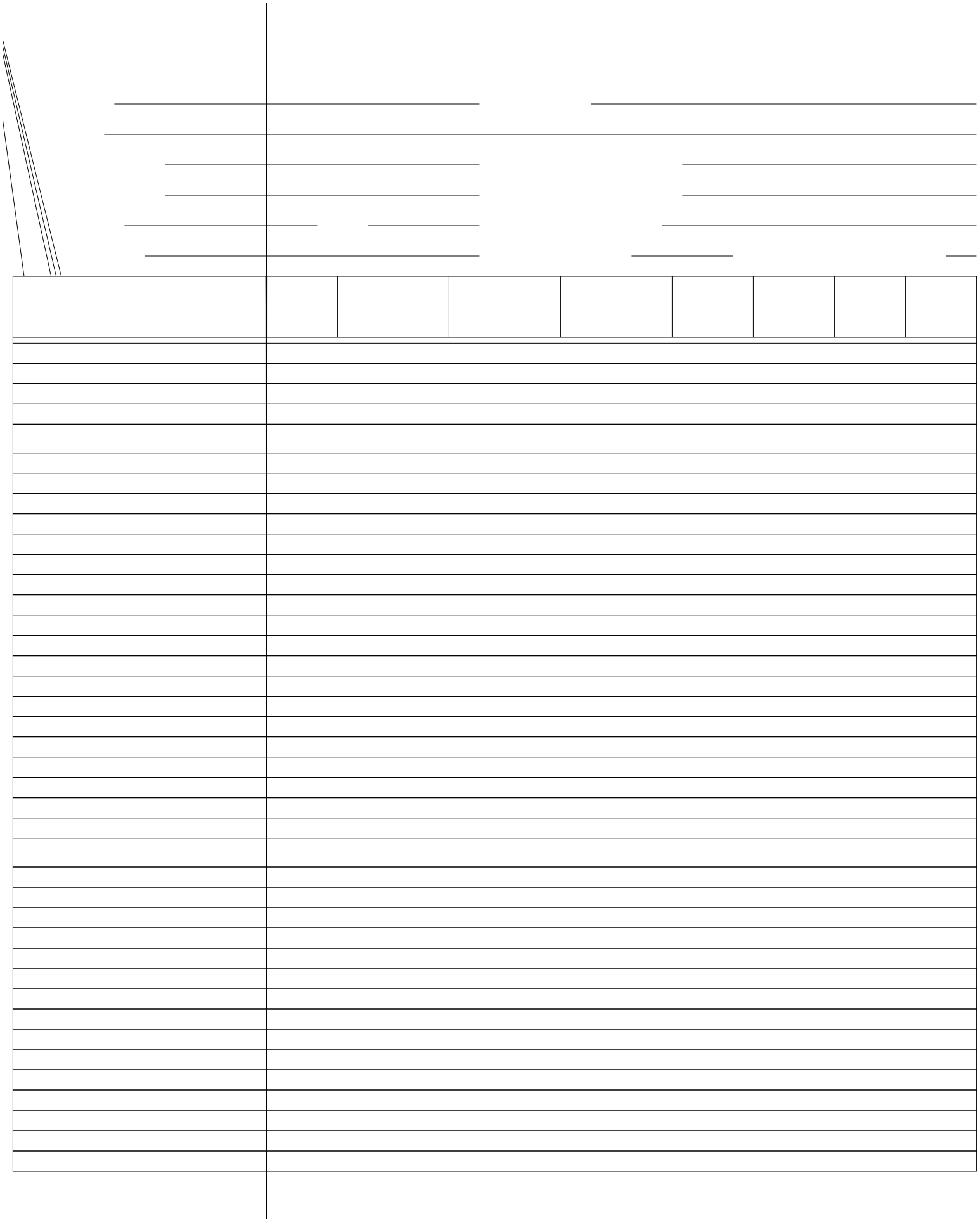


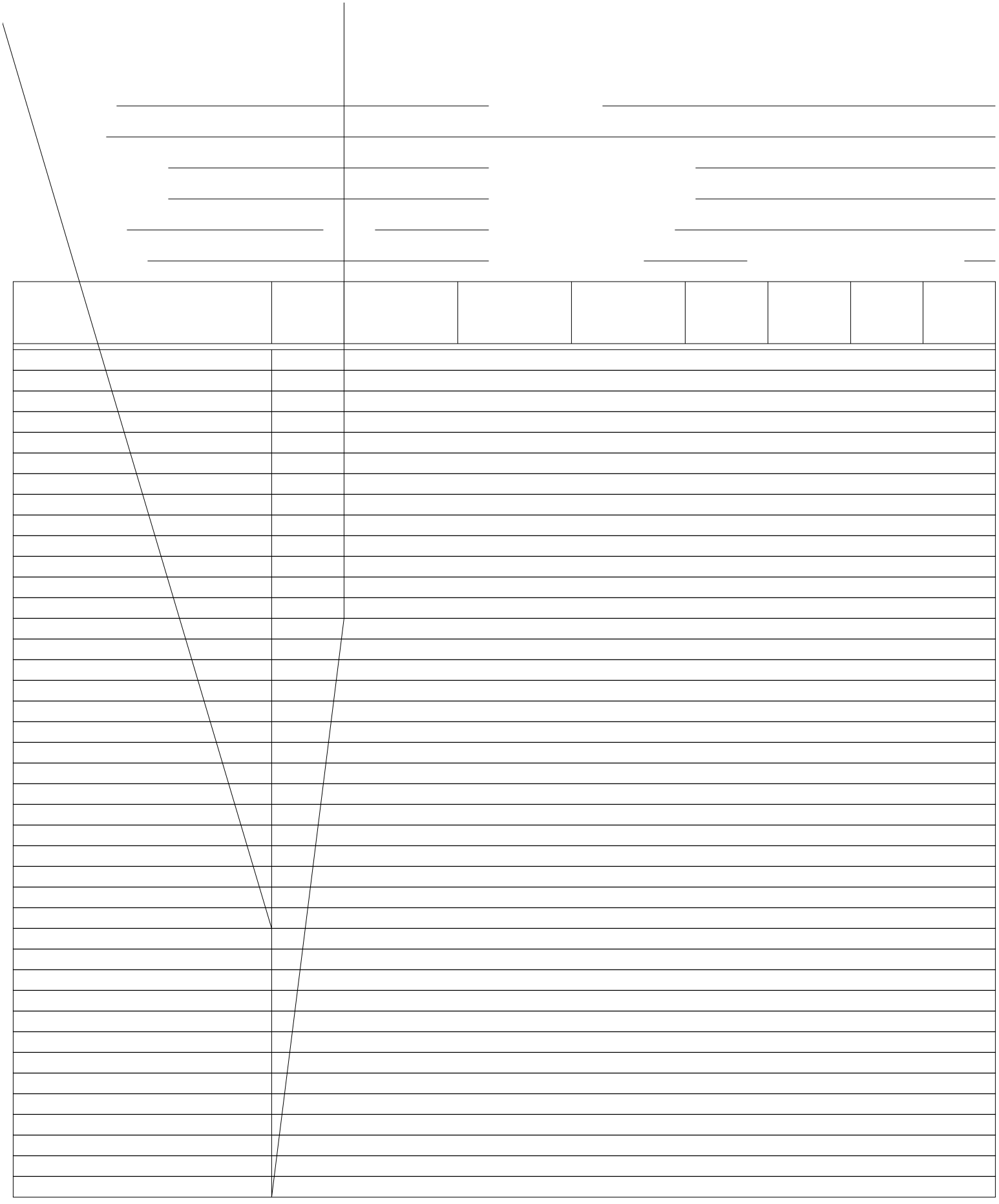


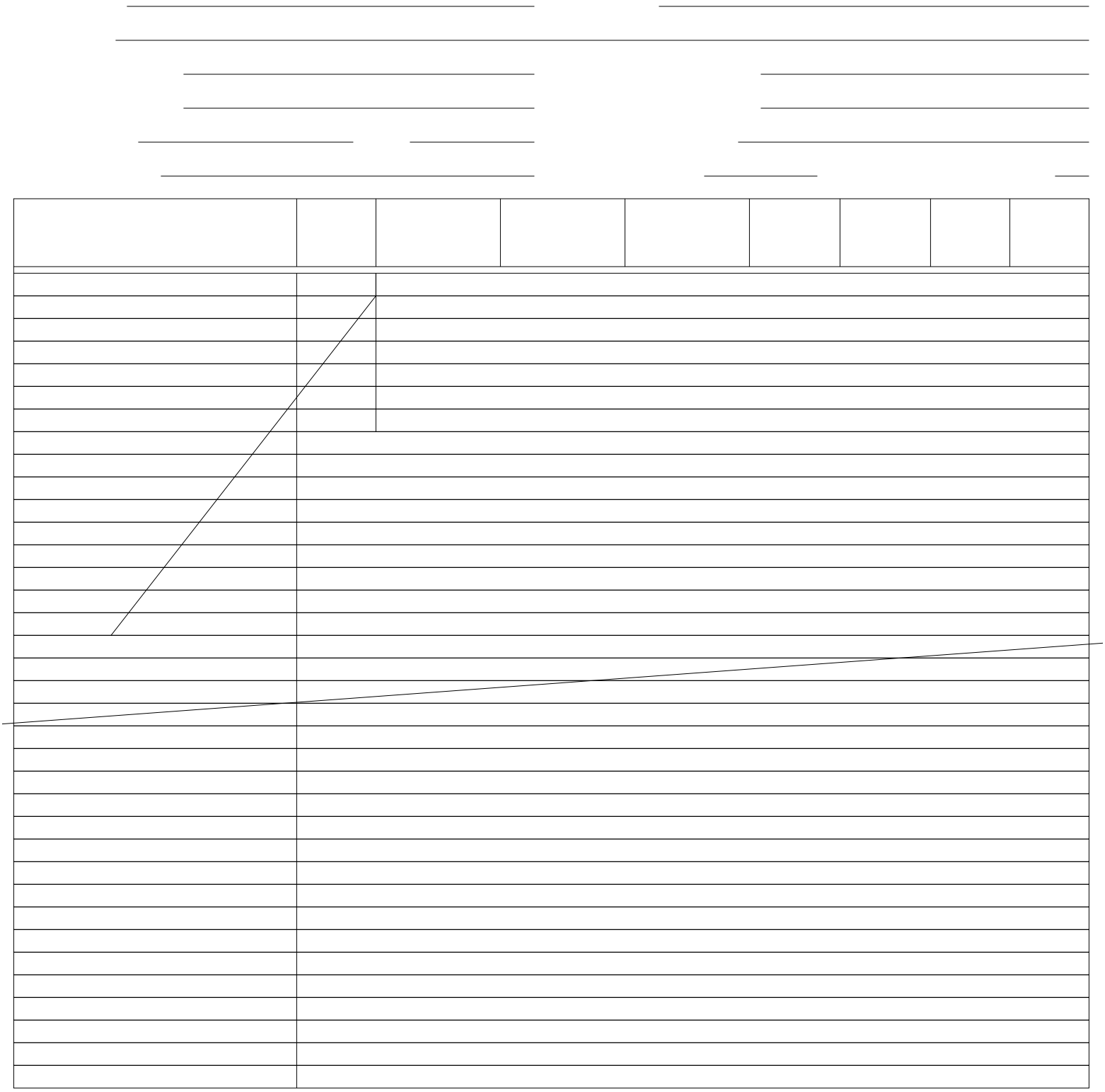


| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

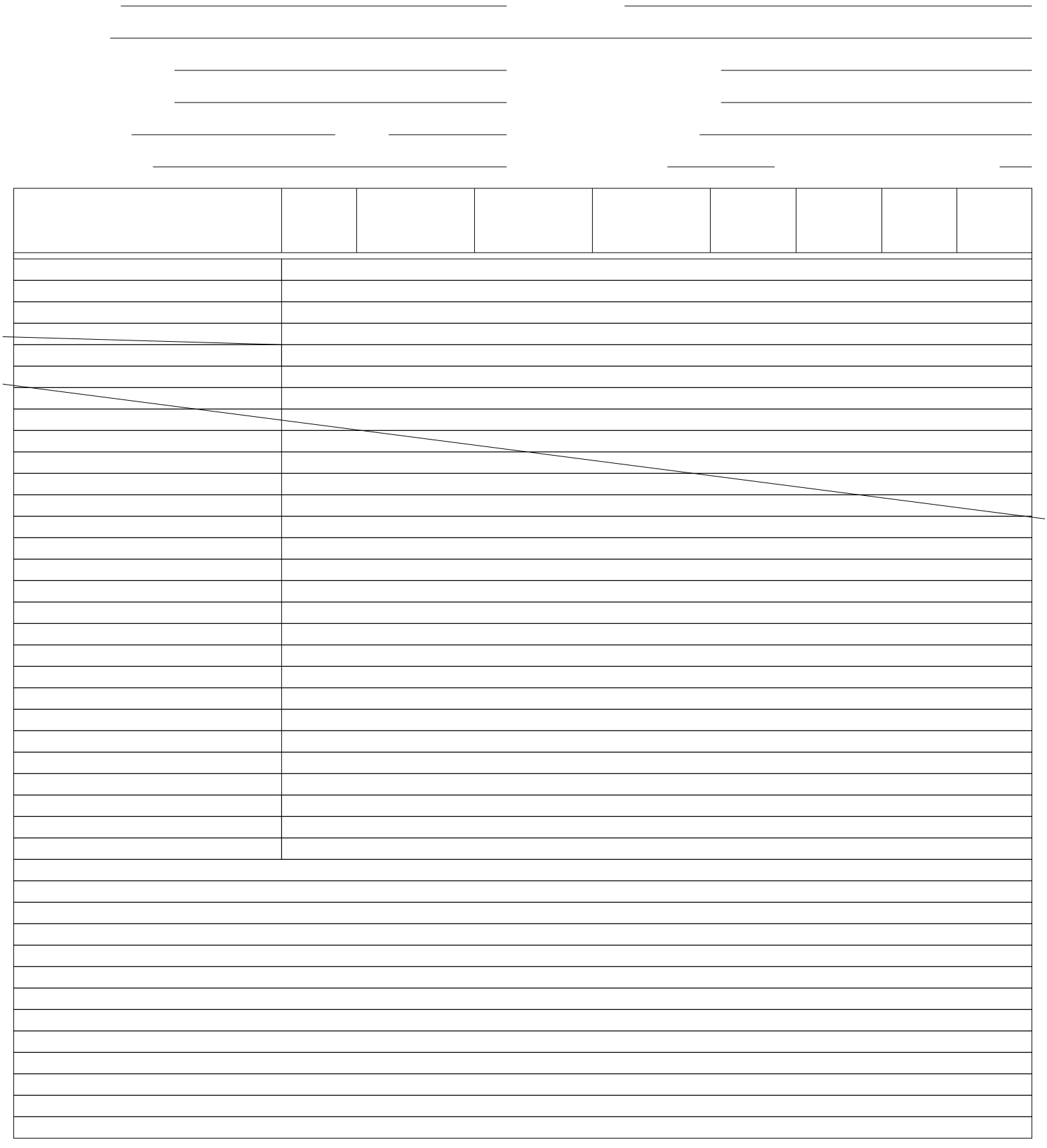
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

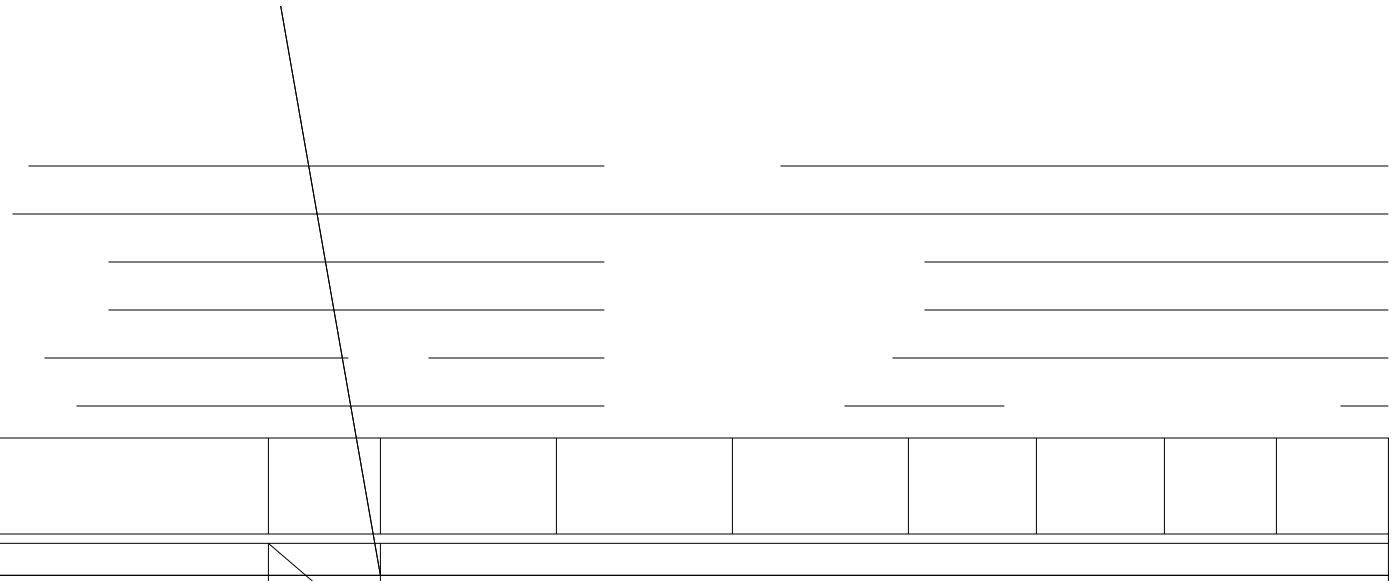






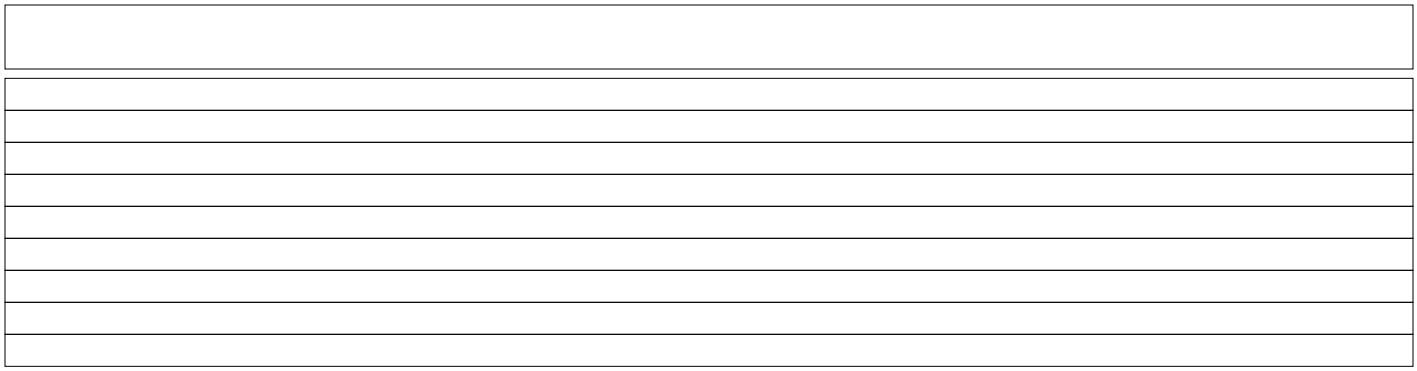
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

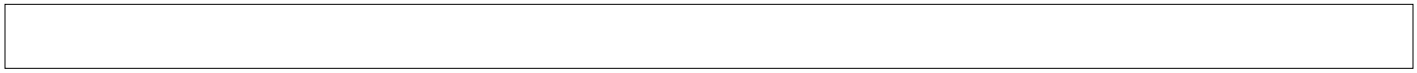




| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |





| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM IV
AIR - GC/MS VOA METHOD BLANK SUMMARY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Instrument ID: Date Analyzed:

GC Column: ID:

FORM I
AIR - GC/MS VOA ORGANICS ANALYSIS DATA SHEET

Lab Name: TestAmerica Knoxville  Job No.: 140-4707-1

SDG No.:

Client Sample ID:  Lab Sample ID: MB 140-4613/4

Matrix: Air  Lab File ID: R500MLD08.D

Analysis Method: TO 15 LL  Date Collected:

Sample wt/vol: 500(mL)  Date Analyzed: 04/08/2016 12:40

Soil Aliquot Vol:  Dilution Factor: 1

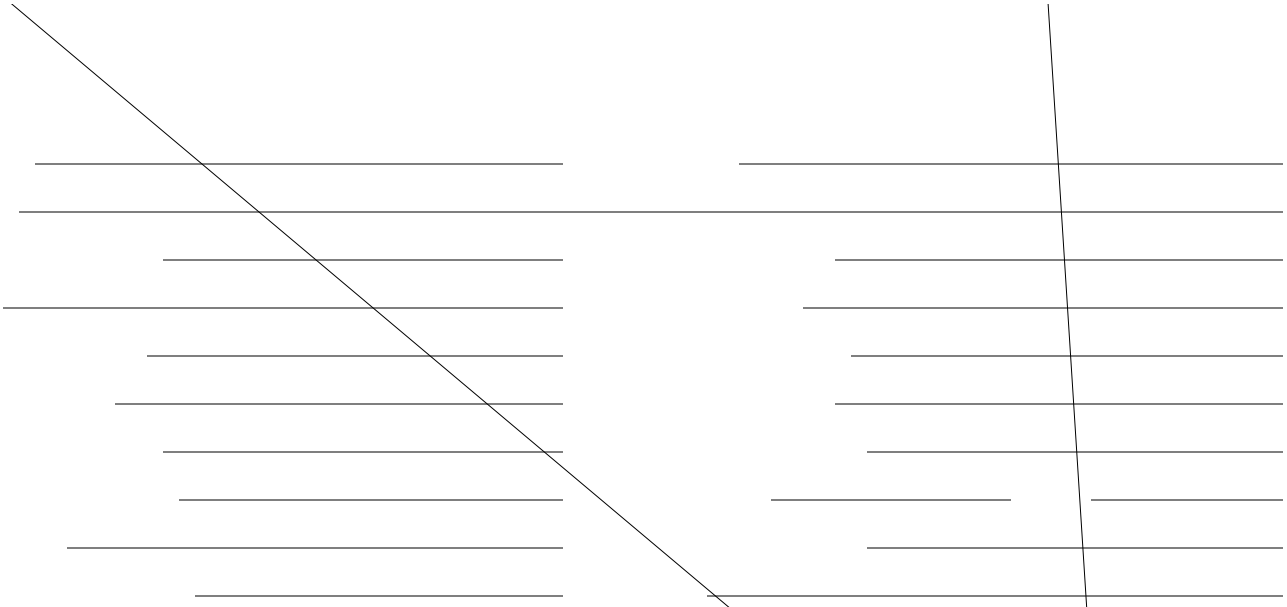
Soil Extract Vol.:  GC Column: RTX-5 ID: 0.32(mm)

% Moisture:  Level: (low/med) Low

Analysis Batch No.: 4613  Units: ppb v/v

| CAS NO. | COMPOUND NAME | MOLECULAR WEIGHT | RESULT | Q | RL | MDL |
|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | 78.11 | ND | | 0.080 | 0.023 |
| 56-23-5 | Carbon tetrachloride | 153.81 | ND | | 0.080 | 0.015 |
| 75-45-6 | Chlorodifluoromethane | 86.47 | ND | | 0.080 | 0.015 |
| 67-66-3 | Chloroform | 119.38 | ND | | 0.080 | 0.015 |
| 156-59-2 | cis-1,2-Dichloroethene | 96.94 | ND | | 0.080 | 0.024 |
| 75-71-8 | Dichlorodifluoromethane | 120.91 | ND | | 0.080 | 0.027 |
| 75-34-3 | 1,1-Dichloroethane | 98.96 | ND | | 0.080 | 0.010 |
| 107-06-2 | 1,2-Dichloroethane | 98.96 | ND | | 0.080 | 0.019 |
| 75-35-4 | 1,1-Dichloroethene | 96.94 | ND | | 0.080 | 0.014 |
| 100-41-4 | Ethylbenzene | 106.17 | ND | | 0.080 | 0.027 |
| 75-09-2 | Methylene Chloride | 84.93 | ND | | 0.20 | 0.13 |
| 1634-04-4 | Methyl tert-butyl ether | 88.15 | ND | | 0.40 | 0.068 |
| 91-20-3 | Naphthalene | 128.17 | ND | | 0.040 | 0.040 |
| 127-18-4 | Tetrachloroethene | 165.83 | ND | | 0.080 | 0.016 |
| 108-88-3 | Toluene | 92.14 | ND | | 0.12 | 0.12 |
| 156-60-5 | trans-1,2-Dichloroethene | 96.94 | ND | | 0.080 | 0.020 |
| 120-82-1 | 1,2,4-Trichlorobenzene | 181.45 | ND | | 0.080 | 0.039 |
| 71-55-6 | 1,1,1-Trichloroethane | 133.41 | ND | | 0.080 | 0.012 |
| 79-00-5 | 1,1,2-Trichloroethane | 133.41 | ND | | 0.080 | 0.021 |
| 79-01-6 | Trichloroethene | 131.39 | ND | | 0.040 | 0.014 |
| 526-73-8 | 1,2,3-Trimethylbenzene | 120.19 | ND | | 0.080 | 0.034 |
| 95-63-6 | 1,2,4-Trimethylbenzene | 120.20 | ND | | 0.080 | 0.025 |
| 108-67-8 | 1,3,5-Trimethylbenzene | 120.20 | ND | | 0.080 | 0.026 |
| 75-01-4 | Vinyl chloride | 62.50 | ND | | 0.040 | 0.029 |
| 1330-20-7 | Xylenes, Total | 106.17 | ND | | 0.16 | 0.024 |

| CAS NO. | SURROGATE | %REC | Q | LIMITS |
|---|---|---|---|---|
| 460-00-4 | 4-Bromofluorobenzene (Surr) | 95 | | 60-140 |



| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

FORM II
AIR - GC/MS VOA SURROGATE RECOVERY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Matrix: Air Level: Low

GC Column (1): RTX-5 ID: 0.32(mm)

| Client Sample ID | Lab Sample ID | BFB # |
|---|---|---|
| SV-169-A | 140-4707-1 | 105 |
| SV-170-A | 140-4707-2 | 105 |
| SV-172-A | 140-4707-3 | 103 |
| SV-173-A | 140-4707-4 | 97 |
| SV-171-A | 140-4707-5 | 101 |
| SV-174-A | 140-4707-6 | 105 |
| SV-175-A | 140-4707-7 | 101 |
| SV-175-A DL | 140-4707-7 DL | 100 |
| SV-176-A | 140-4707-8 | 106 |
| SV-177-A | 140-4707-9 | 97 |
| SV-168-A | 140-4707-10 | 97 |
| SV-DUP-A | 140-4707-11 | 101 |
| | MB 140-4612/8 | 95 |
| | MB 140-4613/4 | 95 |
| | MB 140-4620/7 | 107 |
| | LCS 140-4612/1006 | 102 |
| | LCS 140-4613/1002 | 103 |
| | LCS 140-4620/1002 | 110 |

| | QC LIMITS |
|---|---|
| BFB = 4-Bromofluorobenzene (Surr) | 60-140 |

# Column to be used to flag recovery values

FORM II TO 15 LL

FORM III
AIR - GC/MS VOA LAB CONTROL SAMPLE RECOVERY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Matrix: Air Level: Low Lab File ID: RCCVD07-LCS.d

Lab ID: LCS 140-4612/1006 Client ID:

| | | | % REC | QC LIv3ricj43i506 REC | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

FORM III
AIR - GC/MS VOA LAB CONTROL SAMPLE RECOVERY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Matrix: Air Level: Low Lab File ID: RCCVD08-LCS.d

Lab ID: LCS 140-4613/1002 Client ID:

| COMPOUND | SPIKE ADDED (ppb v/v) | LCS CONCENTRATION (ppb v/v) | LCS % REC | QC LIMITS REC | # |
|---|---|---|---|---|---|
| Benzene | 2.00 | 2.06 | 103 | 70-130 | |
| Carbon tetrachloride | 2.00 | 2.32 | 116 | 70-130 | |
| Chlorodifluoromethane | 2.00 | 2.19 | 110 | 60-140 | |
| Chloroform | 2.00 | 2.08 | 104 | 70-130 | |
| cis-1,2-Dichloroethene | 2.00 | 2.01 | 100 | 70-130 | |
| Dichlorodifluoromethane | 2.00 | 1.79 | 89 | 60-140 | |
| 1,1-Dichloroethane | 2.00 | 2.13 | 107 | 70-130 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

FORM III
AIR - GC/MS VOA LAB CONTROL SAMPLE RECOVERY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Matrix: Air Level: Low Lab File ID: GCCVD05C-LCS.d

Lab ID: LCS 140-4620/1002 Client ID:

| COMPOUND | SPIKE ADDED (ppb v/v) | LCS CONCENTRATION (ppb v/v) | LCS % REC | QC LIMITS REC | # |
|---|---|---|---|---|---|
| Benzene | 1.99 | 1.91 | 96 | 70-130 | |
| Carbon tetrachloride | 1.99 | 1.97 | 99 | 70-130 | |
| Chlorodifluoromethane | 1.99 | 2.37 | 119 | 60-140 | |
| Chloroform | 1.99 | 2.17 | 109 | 70-130 | |
| cis-1,2-Dichloroethene | 1.99 | 1.90 | 95 | 70-130 | |
| Dichlorodifluoromethane | 1.99 | 2.19 | 110 | 60-140 | |
| 1,1-Dichloroethane | 1.99 | 2.21 | 111 | 70-130 | |
| 1,2-Dichloroethane | 1.99 | 2.13 | 107 | 70-130 | |
| 1,1-Dichloroethene | 1.99 | 1.75 | 88 | 70-130 | |
| Ethylbenzene | 1.99 | 1.95 | 98 | 70-130 | |
| Methylene Chloride | 1.99 | 1.72 | 87 | 70-130 | |
| Methyl tert-butyl ether | 1.99 | 2.06 | 103 | 60-140 | |
| Naphthalene | 1.99 | 1.94 | 98 | 60-140 | |
| Tetrachloroethene | 1.99 | 1.79 | 90 | 70-130 | |
| Toluene | 1.99 | 1.98 | 99 | 70-130 | |
| trans-1,2-Dichloroethene | 1.99 | 1.78 | 90 | 70-130 | |
| 1,2,4-Trichlorobenzene | 1.99 | 1.37 | 69 | 60-140 | |
| 1,1,1-Trichloroethane | 1.99 | 2.19 | 110 | 70-130 | |
| 1,1,2-Trichloroethane | 1.99 | 1.91 | 96 | 70-130 | |
| Trichloroethene | 1.99 | 1.52 | 76 | 70-130 | |
| 1,2,3-Trimethylbenzene | 1.99 | 1.92 | 96 | 70-130 | |
| 1,2,4-Trimethylbenzene | 1.99 | 1.81 | 91 | 70-130 | |
| 1,3,5-Trimethylbenzene | 1.99 | 1.64 | 82 | 70-130 | |
| Vinyl chloride | 1.99 | 2.13 | 107 | 70-130 | |
| Xylenes, Total | 5.97 | 5.92 | 99 | 70-130 | |

# Column to be used to flag recovery and RPD values

FORM III TO 15 LL

FORM VIII
AIR - GC/MS VOA INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Sample No.: ICIS 140-4097/7 Date Analyzed: 01/07/2016 22:35

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm)

Lab File ID (Standard): GA07ICL6.D Heated Purge: (Y/N) N

Calibration ID: 457

| | | CBM | | DFB | | CBZ | |
|---|---|---|---|---|---|---|---|
| | | AREA # | RT # | AREA # | RT # | AREA # | RT # |
| INITIAL CALIBRATION MID-POINT | | 322829 | 8.64 | 1493910 | 10.82 | 1450262 | 15.57 |
| UPPER LIMIT | | 451961 | 8.97 | 2091474 | 11.15 | 2030367 | 15.90 |
| LOWER LIMIT | | 193697 | 8.31 | 896346 | 10.49 | 870157 | 15.24 |
| LAB SAMPLE ID | CLIENT SAMPLE ID | | | | | | |
| ICV 140-4097/12 | | 352705 | 8.63 | 1664982 | 10.81 | 1587818 | 15.56 |

CBM = Chlorobromomethane (IS)
DFB = 1,4-Difluorobenzene
CBZ = Chlorobenzene-d5 (IS)

Area Limit = 60%-140% of internal standard area
RT Limit = ± 0.33 minutes of internal standard RT

# Column used to flag values outside QC limits

FORM VIII TO 15 LL

FORM VIII
AIR - GC/MS VOA INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Sample No.: CCVIS 140-4620/2 Date Analyzed: 04/06/2016 12:02

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm)

Lab File ID (Standard): GCCVD05C.D Heated Purge: (Y/N) N

Calibration ID: 457

| | | CBM | | DFB | | CBZ | |
|---|---|---|---|---|---|---|---|
| | | AREA # | RT # | AREA # | RT # | AREA # | RT # |
| 12/24 HOUR STD | | 582303 | 8.62 | 3005155 | 10.78 | 2818077 | 15.54 |
| UPPER LIMIT | | 815224 | 8.95 | 4207217 | 11.11 | 3945308 | 15.87 |
| LOWER LIMIT | | 349382 | 8.29 | 1803093 | 10.45 | 1690846 | 15.21 |
| LAB SAMPLE ID | CLIENT SAMPLE ID | | | | | | |
| LCS 140-4620/1002 | | 582303 | 8.62 | 3005155 | 10.78 | 2818077 | 15.54 |
| MB 140-4620/7 | | 589622 | 8.61 | 2927576 | 10.78 | 2618611 | 15.53 |
| 140-4707-2 | SV-170-A | 666443 | 8.61 | 3482257 | 10.78 | 3086236 | 15.53 |
| 140-4707-5 | SV-171-A | 6197. -12 Td (140-4707-5) (6197. -12S%99V97.2 0 Td ( 10.0I ( | | | | | |
| 8.62 | 10.76197. -12S%99V97 15.53 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

CBM = Chlorobromomethane (IS)
DFB = 1,4-Difluorobenzene
CBZ = Chlorobenzene-d5 (IS)

Area Limit = 60%-140% of internal standard area
RT Limit = ± 0.33 minutes of internal standard RT

# Column used to flag values outside QC limits

FORM VIII TO 15 LL

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

FORM VIII
AIR - GC/MS VOA INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Sample No.: CCVIS 140-4612/6 Date Analyzed: 04/07/2016 10:48

Instrument ID: MR GC Column: RTX-5 ID: 0.32(mm)

Lab File ID (Standard): RCCVD07.D Heated Purge: (Y/N) N

Calibration ID: 393

| | | CBM | | DFB | | CBZ | |
|---|---|---|---|---|---|---|---|
| | | AREA # | RT # | AREA # | RT # | AREA # | RT # |
| 12/24 HOUR STD | | 263672 | 8.43 | 1341763 | 10.60 | 1210696 | 16.82 |
| UPPER LIMIT | | 369141 | 8.76 | 1878468 | 10.93 | 1694974 | 17.15 |
| LOWER LIMIT | | 158203 | 8.10 | 805058 | 10.27 | 726418 | 16.49 |
| LAB SAMPLE ID | CLIENT SAMPLE ID | | | | | | |
| LCS 140-4612/1006 | | 263672 | 8.43 | 1341763 | 10.60 | 1210696 | 16.82 |
| MB 140-4612/8 | | 295122 | 8.42 | 1489214 | 10.60 | 1292113 | 16.82 |
| 140-4707-1 | SV-169-A | 197399 | 8.42 | 1012948 | 10.60 | 947412 | 16.82 |
| 140-4707-4 | SV-173-A | 301060 | 8.42 | 1515453 | 10.60 | 1384919 | 16.81 |

CBM = Chlorobromomethane (IS)
DFB = 1,4-Difluorobenzene
CBZ = Chlorobenzene-d5 (IS)

FORM VIII
AIR - GC/MS VOA INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1

SDG No.:

Sample No.: CCVIS 140-4613/2 Date Analyzed: 04/08/2016 10:46

Instrument ID: MR GC Column: RTX-5 ID: 0.32(mm)

Lab File ID (Standard): RCCVD08.D Heated Purge: (Y/N) N

Calibration ID: 393

| | | CBM | | DFB | | CBZ | |
|---|---|---|---|---|---|---|---|
| | | AREA # | RT # | AREA # | RT # | AREA # | RT # |
| 12/24 HOUR STD | | 278226 | 8.42 | 1424449 | 10.60 | 1279349 | 16.82 |
| UPPER LIMIT | | 389516 | 8.75 | 1994229 | 10.93 | 1791089 | 17.15 |
| LOWER LIMIT | | 166936 | 8.09 | 854669 | 10.27 | 767609 | 16.49 |
| LAB SAMPLE ID | CLIENT SAMPLE ID | | | | | | |
| LCS 140-4613/1002 | | 278226 | 8.42 | 1424449 | 10.60 | 1279349 | 16.82 |
| MB 140-4613/4 | | 298151 | 8.42 | 1497293 | 10.60 | 1296299 | 16.81 |
| 140-4707-3 | SV-172-A | 219155 | 8.41 | 1125811 | 10.60 | 1026206 | 16.81 |
| 140-4707-9 | SV-177-A | 320829 | 8.41 | 1624780 | 10.60 | 1498791 | 16.81 |

CBM = Chlorobromomethane (IS)
DFB = 1,4-Difluorobenzene
CBZ = Chlorobenzene-d5 (IS)

Area Limit = 60%-140% of internal standard area
RT Limit = ± 0.33 minutes of internal standard RT

# Column used to flag values outside QC limits

FORM VIII TO 15 LL

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# Summa Canister Dilution Worksheet

Client: Tetra Tech, Inc.

Job No.: 140-4707-1

| Lab Sample ID | Canister Volume (L) | Preadjusted Pressure ("Hg) | Preadjusted Pressure (atm) | Preadjusted Volume (L) | Adjusted Pressure (psig) | Adjusted Pressure (atm) | Adjusted Volume (L) | Initial Volume (mL) | Dilution Factor | Final Dilution Factor | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140-4707-1 | 1 | -4.1 | 0.86 | 0.86 | 30.6 | 3.08 | 3.08 | | 3.57 | 3.57 | 04/06/16 13:04 | Barlozhetskaya, Anna F |
| 140-4707-4 | 1 | -4.0 | 0.87 | 0.87 | 30.8 | 3.10 | 3.10 | | 3.57 | 3.57 | 04/06/16 13:04 | Barlozhetskaya, Anna F |
| 140-4707-4 | 1 | 0.0 | 1.00 | 1.00 | 41.1 | 3.80 | 3.80 | | 3.80 | 13.56 | 04/07/16 12:36 | Barlozhetskaya, Anna F |
| 140-4707-5 | 1 | -3.3 | 0.89 | 0.89 | 30.7 | 3.09 | 3.09 | | 3.47 | 3.47 | 04/06/16 13:04 | Barlozhetskaya, Anna F |
| 140-4707-7 | 1 | -3.5 | 0.88 | 0.88 | 32.4 | 3.20 | 3.20 | | 3.63 | 3.63 | 04/06/16 13:51 | Barlozhetskaya, Anna F |
| 140-4707-7 | 1 | 0 | 1.00 | 1.00 | 32.7 | 3.22 | 3.22 | | 3.22 | 11.70 | 04/06/16 13:53 | Barlozhetskaya, Anna F |
| 140-4707-7 | 1 | 0 | 1.00 | 1.00 | 33.0 | 3.24 | 3.24 | | 3.24 | 37.97 | 04/06/16 13:54 | Barlozhetskaya, Anna F |
| 140-4707-7 | 1 | 0 | 1.00 | 1.00 | 34.0 | 3.31 | 3.31 | | 3.31 | 125.78 | 04/06/16 13:55 | Barlozhetskaya, Anna F |
| 140-4707-10 | 1 | -2.9 | 0.90 | 0.90 | 30.8 | 3.10 | 3.10 | | 3.43 | 3.43 | 04/06/16 15:16 | Barlozhetskaya, Anna F |
| 140-4707-10 | 1 | 0.0 | 1.00 | 1.00 | 21.7 | 2.48 | 2.48 | | 2.48 | 8.49 | 04/06/16 15:17 | Barlozhetskaya, Anna F |
| 140-4707-10 | 1 | 0.0 | 1.00 | 1.00 | 37.9 | 3.58 | 3.58 | | 3.58 | 30.37 | 04/06/16 15:18 | Barlozhetskaya, Anna F |

**Formulae:**

Preadjusted Volume (L) = ( Preadjusted Pressure ("Hg) + 29.92 "Hg * Vol L ) / 29.92 "Hg

Adjusted Volume (L) = ( Adjusted Pressure (psig) + 14.7 psig * Vol L ) / 14.7 psig

Dilution Factor = Adjusted Volume (L) / Preadjusted Volume (L)

**Where:**

29.92 "Hg = Standard atmospheric pressure in inches of Mercury (“Hg)

14.7 psig = Standard atmospheric pressure in pounds per square inch gauge (psig)

Sample Calc

Sample Calc

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

Report Date: 07-Apr-2016 11:39:58 Chrom Revision: 2.2 04-Mar-2016 14:36:24

Sample Calc

TestAmerica Knoxville
Target Compound Quantitation Report

| | | | | | |
|---|---|---|---|---|---|
| Data File: | \\ChromNA\Knoxville\ChromData\MG\20160405-2724.b\GD06P113.D | | | | |
| Lims ID: | 140-4707-A-10 | Lab Sample ID: | 140-4707-10 | | |
| Client ID: | SV-168-A | | | | |
| Sample Type: | Client | | | | |
| Inject. Date: | 07-Apr-2016 00:27:30 | ALS Bottle#: | 13 | Worklist Smp#: | 18 |
| Purge Vol: | 500.000 mL | Dil. Factor: | 30.3700 | | |
| Sample Info: | 140-4707-a-10@30.37 | | | | |
| Misc. Info.: | G040616,TO15,140-0002724-018 | | | | |
| Operator ID: | 403648 | Instrument ID: | MG | | |
| Method: | \\ChromNA\Knoxville\ChromData\MG\20160405-2724.b\MG_TO15.m | | | | |
| Limit Group: | MSA TO14A_15 Routine ICAL | | | | |
| Last Update: | 07-Apr-2016 11:39:35 | Calib Date: | 08-Jan-2016 00:44:30 | | |
| Integrator: | RTE | ID Type: | Deconvolution ID | | |
| Quant Method: | Internal Standard | Quant By: | Initial Calibration | | |
| Last ICal File: | \\ChromNA\Knoxville\ChromData\MG\20160107-2458.b\GA07ICL9.D | | | | |
| Column 1 : | RTX-5 ( 0.32 mm) | | Det: MS SCAN | | |
| Process Host: | XAWRK003 | | | | |
| First Level Reviewer: tajh | | Date: | [illegible] | | |

| Compound | Sig | RT (min.) | Adj RT (min.) | Dlt RT (min.) | Q | Response | OnCol Amt |
|---|---|---|---|---|---|---|---|

Sample Calc

FORM VI
AIR - GC/MS VOA BY INTERNAL STANDARD - INITIAL CALIBRATION DATA
CURVE EVALUATION

Lab Name: TestAmerica Knoxville Job No.: 140-4707-1 Analy Batch No.: 4097

SDG No.:

Instrument ID: MG GC Column: RTX-5 ID: 0.32(mm) Heated Purge: (Y/N) N

Calibration Start Date: 01/07/2016 19:02 Calibration End Date: 01/08/2016 00:44 Calibration ID: 457

| | | |
|---|---|---|
| | | |

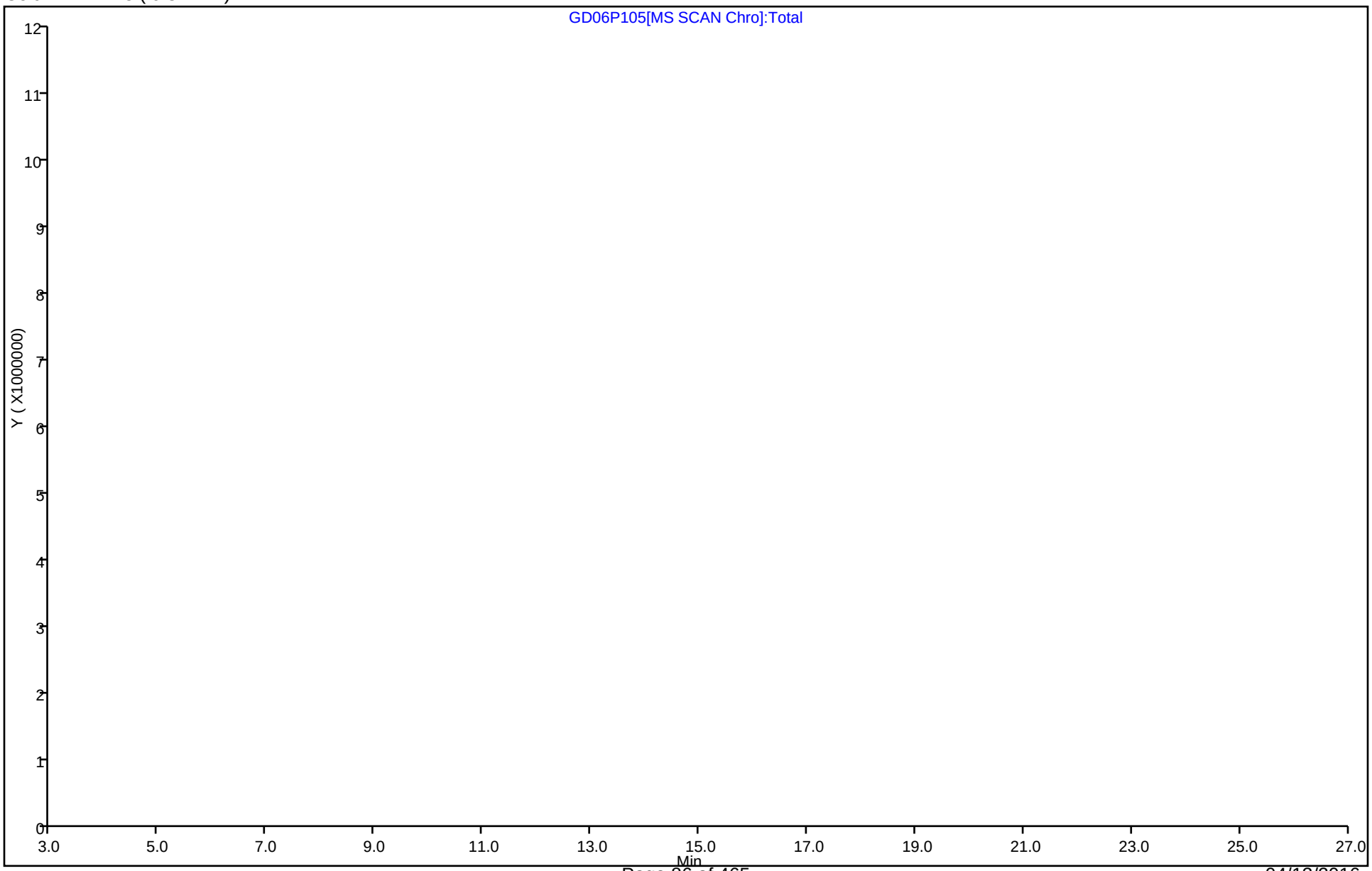
Report Date: 07-Apr-2016 11:39:45 Chrom Revision: 2.2 04-Mar-2016 14:36:24

TestAmerica Knoxville

Data File: \\ChromNA\Knoxville\ChromData\MG\20160405-2724.b\GD06P105.D

| | | | | | |
|---|---|---|---|---|---|
| Injection Date: | 06-Apr-2016 18:07:30 | Instrument ID: | MG | Operator ID: | 403648 |
| Lims ID: | 140-4707-A-2 | Lab Sample ID: | 140-4707-2 | Worklist Smp#: | 9 |
| Client ID: | SV-170-A | | | | |
| Purge Vol: | 500.000 mL | Dil. Factor: | 1.0000 | ALS Bottle#: | 5 |
| Method: | MG_TO15 | Limit Group: | MSA TO14A_15 Routine ICAL | | |

Column: RTX-5 ( 0.32 mm)



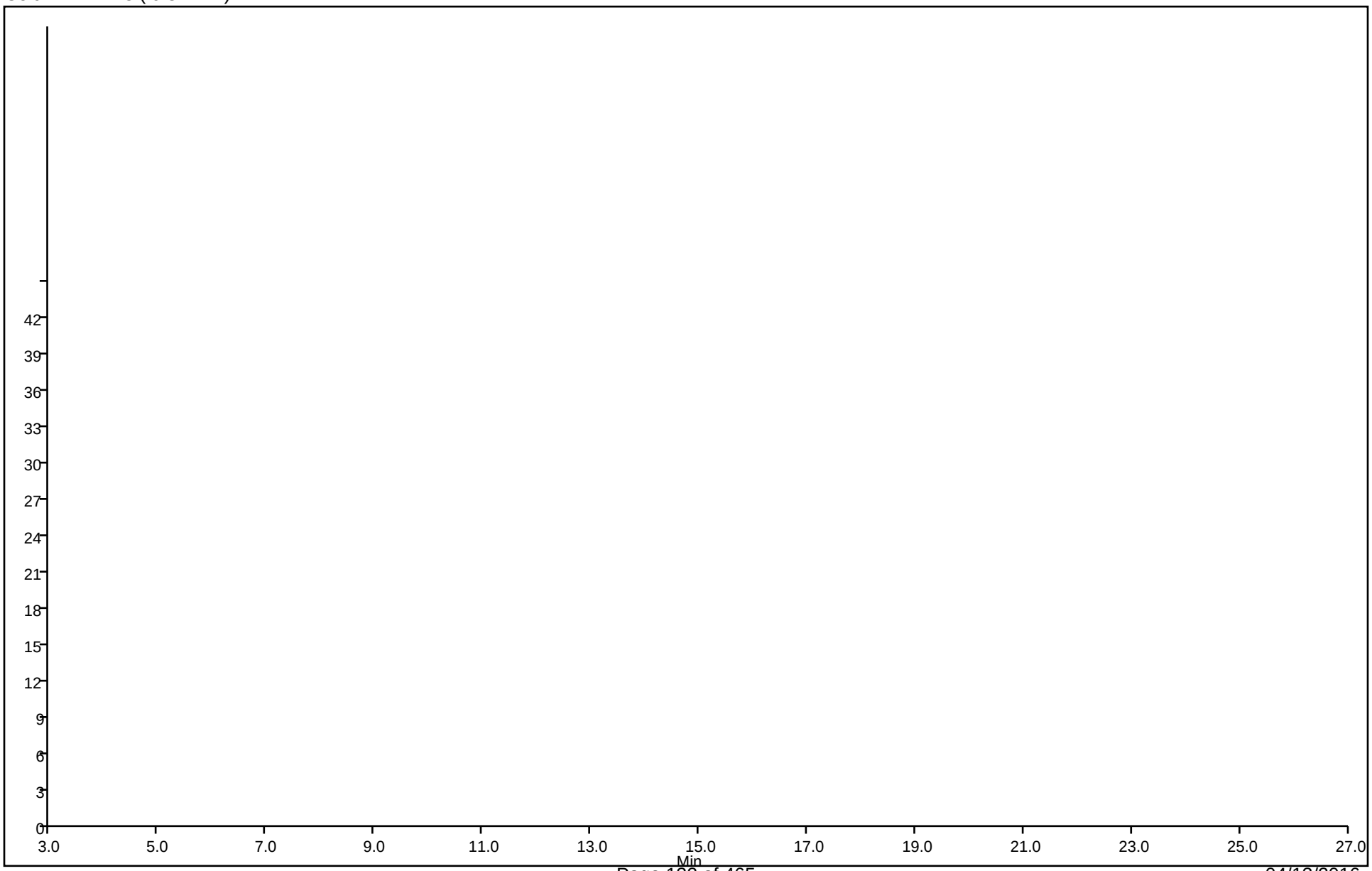
Report Date: 07-Apr-2016 11:39:49 Chrom Revision: 2.2 04-Mar-2016 14:36:24

TestAmerica Knoxville

Data File: \\ChromNA\Knoxville\ChromData\MG\20160405-2724.b\GD06P109.D

| | | | | | |
|---|---|---|---|---|---|
| Injection Date: | 06-Apr-2016 20:55:30 | Instrument ID: | MG | Operator ID: | 403648 |
| Lims ID: | 140-4707-A-6 | Lab Sample ID: | 140-4707-6 | Worklist Smp#: | 13 |
| Client ID: | SV-174-A | | | | |
| Purge Vol: | 500.000 mL | Dil. Factor: | 1.0000 | ALS Bottle#: | 9 |
| Method: | MG_TO15 | Limit Group: | MSA TO14A_15 Routine ICAL | | |

Column: RTX-5 ( 0.32 mm)



Report Date: 07-Apr-2016 11:39:53 Chrom Revision: 2.2 04-Mar-2016 14:36:24

TestAmerica Knoxville

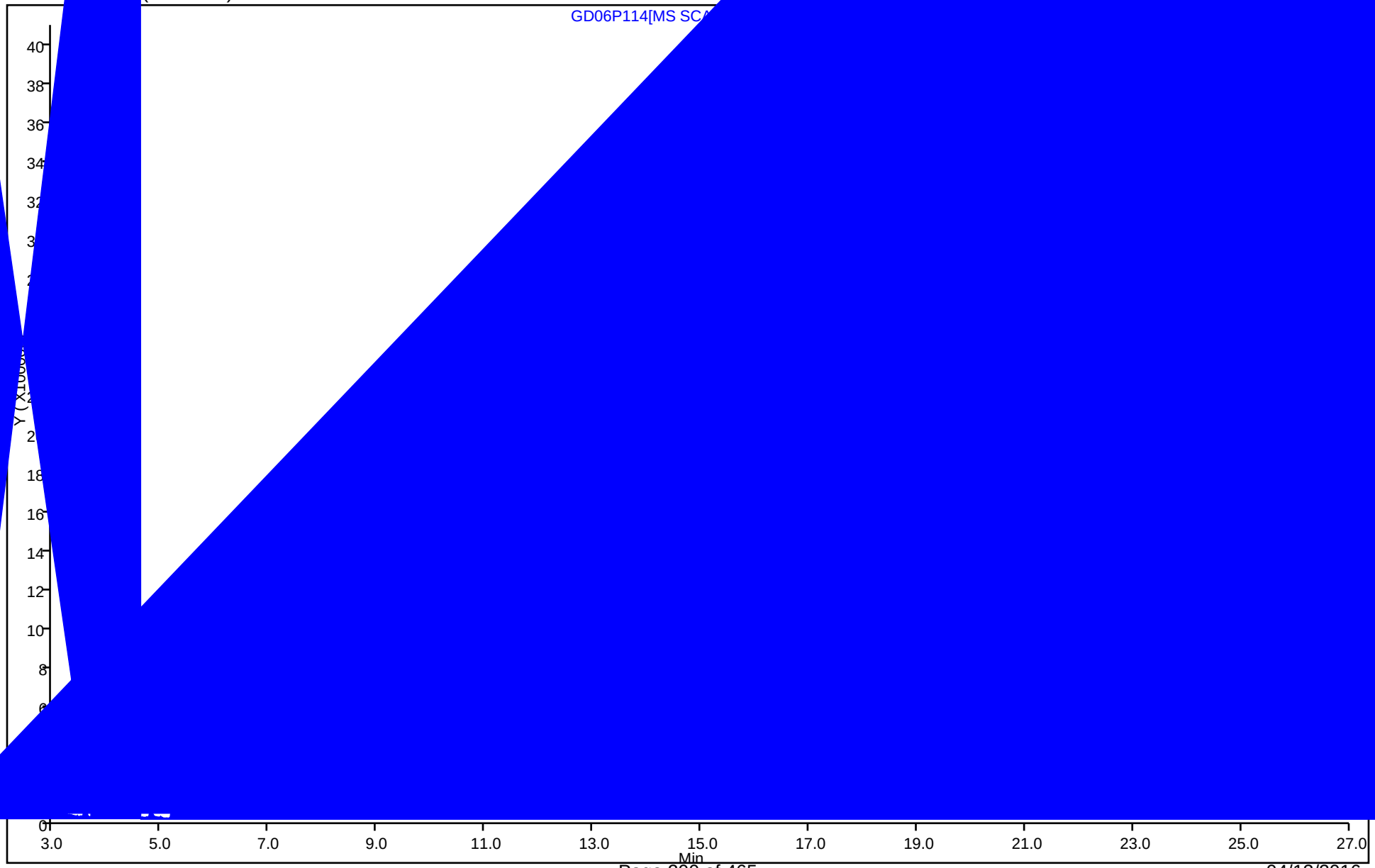
| | | | | | |
|---|---|---|---|---|---|
| Data File: | \\ChromNA\Knoxville\ChromData\MG\20160405-2724.b\GD06P111.D | | | | |
| Injection Date: | 06-Apr-2016 22:19:30 | Instrument ID: | MG | Operator ID: | 403648 |
| Lims ID: | 140-4707-A-8 | Lab Sample ID: | 140-4707-8 | Worklist Smp#: | 15 |
| Client ID: | SV-176-A | | | | |
| Purge Vol: | 500.000 mL | Dil. Factor: | 1.0000 | ALS Bottle#: | 11 |
| Method: | MG_TO15 | Limit Group: | MSA TO14A_15 Routine ICAL | | |
| Column: RTX-5 ( | | | | | |

Report Date: 07

Data File:

| | | | | | |
|---|---|---|---|---|---|
| Injection | 07-Apr-2016 01:09:30 | | | Operator ID: | 403648 |
| Lims ID: | 140-4707-A-11 | Lab Sample ID: | 140-4707-11 | Worklist Smp#: | 19 |
| Client ID | SV-DUP-A | | | | |
| Purge V | 500.000 mL | Dil. Factor: | 1.0000 | | |
| Method | MG_TO15 | Limit Group: | MSA TO14A | | |
| Column | ( 0.32 mm) | | | | |

GD06P114[MS SCA



Report Date: 08-Apr-2016 10:17:36 Chrom Revision: 2.2 04-Mar-2016 14:36:24

TestAmerica Knoxville

| | | | | | |
|---|---|---|---|---|---|
| Data File: | \\ChromNA\Knoxville\ChromData\MR\20160404-2719.b\RD07P113.D | | | | |
| Injection Date: | 08-Apr-2016 03:40:30 | Instrument ID: | MR | Operator ID: | |
| Lims ID: | 140-4707-A-4 | Lab Sample ID: | 140-4707-4 | Worklist Smp#: | 24 |
| Client ID: | SV-173-A | | | | |
| Purge Vol: | 500.000 mL | Dil. Factor: | | | |

Report Date: 11-Apr-2016 11:27:28 Chrom Revision: 2.2 04-Mar-2016 14:36:24

TestAmerica Knoxville

| | | | | | |
|---|---|---|---|---|---|
| Data File: | \\ChromNA\Knoxville\ChromData\MR\20160404-2720.b\RD08P108.D | | | | |
| Injection Date: | 08-Apr-2016 22:40:30 | Instrument ID: | MR | Operator ID: | |
| Lims ID: | 140-4707-A-3 | Lab Sample ID: | 140-4707-3 | Worklist Smp#: | 15 |
| Client ID: | SV-172-A | | | | |
| Purge Vol: | 500.000 mL | Dil. Factor: | 1.0000 | ALS Bottle#: | 8 |
| Method: | MR_TO15 | Limit Group: | MSA TO14A_15 Routine ICAL | | |

Column: RTX-5 ( 0.32 mm)