PRISM Analytical Technologies

Analytical Report

Client: Eastern Washington University
319 Showalter Hall
Cheney, WA 99004

COC: 78082
Laboratory ID: 78082-1

Sampled By: Donald Johnson
Project: JFK
Location: EH&S
002 Martin Hall Cheney, WA

Client Sample ID: - JFK M04
Volume: 48 L
Date Sampled: 04/10/2019
Sample Type: TDT UU453

Received Date: 04/12/2019
Approved Date: 04/12/2019
Scanned Date: 04/15/2019
Report Date: 04/26/2019

Comp-Air Survey Analysis

Applicable methods for this analytical technique include (with relevant modifications) NIOSH 2549 and ISO 16000-6.

Comp-Air Survey Analysis Report Description

The Comp-Air (Comprehensive-Air) Survey Analysis is designed to provide additional information beyond the high quality chemical data from the air sample. This additional information may aid in interpretation of results.

Your Report is divided into several sections describing different aspects of the chemical composition of your sample.

1. **Sample Summary:** listing of some of the aggregate values from this air sample (e.g., Total VOCs).

2. **Top 5:** listing of the five highest concentration compounds in the air sample from both the quantitative TO17 and Semiquantitative Compounds (see below for a description of TO17 and Semiquantitative Compounds).

3. **TO17 Compounds:** listing of the chemical compounds characterized by EPA method TO17. Some of these are Hazardous Air Pollutants (HAPs) and others are typical of industrial/manufacturing sources. Accuracy for TO17 compounds is within ±15%.

4. **Semiquantitative Compounds:** listing of chemical compounds that have not been calibrated but have some reference information indicating the validity of the compound identification, an acceptable reference library match, or some other supporting evidence of identification. Also listed in this section are compounds that are not specificially identified but for which some information is available (e.g., C10-C12 Hydrocarbons; probably an alcohol). Instrument and media response have not been confirmed for most chemical compounds reported semiquantitatively, conferring an accuracy on the order of ±50% based on an instrument and media response of unity. Semiquantitative results should be interpreted relative to other chemical compounds.

5. **Supplemental Information: Odorants:** listing of the odor characteristics of chemical compounds present in this air sample. Almost all chemical compounds have an odor and a mixture of various chemical compounds could alter the odor characteristics. Some chemical compounds have a strong odor at relatively low concentrations so the individual chemical compound concentrations may be of secondary importance relative to the odor characteristics for odor concerns.

6. **Supplemental Information: EPA Hazardous Air Pollutants (HAPs):** listing of the chemical compounds detected in this air sample that are known or suspected to have serious health or environmental effects (also known as air toxics). HAPs include VOCs, metals, some pesticides/insecticides that are primarily semi-volatile, inorganic compounds, and very volatile organic compounds. Of the 187 compounds or groups defined as HAPs, approximately 65 are VOCs that can be detected with this analysis.

7. **Additional Information:** definitions, calculations, and other useful information.

Sample Summary

General information regarding the sample and aggregate concentrations, e.g., Total VOCs, are listed below. The top five highest concentration compounds in the air sample from both the quantitative TO17 and Semiquantitative Compounds are also listed. The full list of compounds and their concentrations in this air sample are listed later in the report and may be displayed more than once depending on the categorization of specific compounds.

Compound	Sample Concentration ng/L	Reporting Limit ng/L	Additional Information
Total VOCs	< 200	200	Total volatile organic compounds calculated based on internal standard ratio; does not include C1, C2, or methanol.

11,417 ppb

Compound	Sample Concentration ng/L	Reporting Limit ng/L	Additional Information
Total Mold VOCs (TMVOC)	< 3	3	TMVOC is an assessment of the quantity of actively growing mold in the sample location.

Top 5

The top five highest concentration compounds in the air sample from both the quantitative TO17 and Semiquantitative Compounds are listed below.

Semiquantitative Compounds

Compound	CAS	Sample Concentration ng/L	Sample Concentration ppb	Reporting Limit ng/L	RI	Additional Information
Decanal	112-31-2	2	0.3	1	1272	
Propylene glycol	57-55-6	2	0.5	1	855	

EPA Method TO-17

Compound	CAS	Sample Concentration ng/L	Sample Concentration ppb	Reporting Limit ng/L	RI	Additional Information
Ethanol	64-17-5	9.1	4.7	0.2	519	
Isopropanol	67-63-0	8.9	3.6	0.2	558	
Acetone	67-64-1	6.5	2.7	0.2	549	

TO17 Compounds

EPA Method TO17 focuses on chemical compounds that are typical of industrial/manufacturing sources, many of these compounds are also found in commercial and residential environments. Accuracy for these chemical compounds is within ±15%.

This section lists all the TO17 compounds in alphabetical order (compounds not present or with concentrations below the reporting limit are listed with '<'; compounds above the reporting limit have bold text for the Sample Concentration). The concentrations are reported in two different units for easy comparison to exposure limits or other information. The Retention Index (RI) indicates volatility relative to adjacent n-alkanes. A more detailed description of reporting units and RI can be found at the end of the report.

		Sample Concentration		Reporting Limit		
Compound	CAS	ng/L	ppb	ng/L	RI	Additional Information
Acetone	67-64-1	**6.5**	**2.7**	0.2	549	
Acetonitrile	75-05-8	< 0.1	< 0.06	0.1	574	
Acrylonitrile	107-13-1	< 0.1	< 0.05	0.1	599	
Benzene	71-43-2	**0.3**	**0.09**	0.1	697	
Bromobenzene	108-86-1	< 0.1	< 0.02	0.1	1000	
Bromochloromethane	74-97-5	< 0.1	< 0.02	0.1	668	
Bromodichloromethane	75-27-4	< 0.1	< 0.02	0.1	765	
Bromoform	75-25-2	< 0.1	< 0.01	0.1	965	
1,3-Butadiene	106-99-0	< 0.2	< 0.09	0.2	441	
tert-Butylbenzene	98-06-6	< 0.1	< 0.02	0.1	1044	
sec-Butylbenzene	135-98-8	< 0.1	< 0.02	0.1	1062	
n-Butylbenzene	104-51-8	< 0.1	< 0.02	0.1	1108	
Carbon Disulfide	75-15-0	< 0.02	< 0.007	0.02	554	
Carbon Tetrachloride	56-23-5	**0.5**	**0.08**	0.1	684	
Chlorobenzene	108-90-7	< 0.1	< 0.02	0.1	901	
Chlorodibromomethane	124-48-1	< 0.1	< 0.01	0.1	862	
2-Chloroethanol	107-07-3	< 0.1	< 0.03	0.1	764	
Chloroform	67-66-3	< 0.1	< 0.02	0.1	671	
Chloroprene	126-99-8	< 0.1	< 0.03	0.1	624	
3-Chloropropene	107-05-1	< 0.1	< 0.03	0.1	569	
2-Chlorotoluene	95-49-8	< 0.1	< 0.02	0.1	1014	
4-Chlorotoluene	106-43-4	< 0.1	< 0.02	0.1	1023	
Cyclohexane	110-82-7	< 0.1	< 0.03	0.1	677	
1,2-Dibromo-3-chloropropane	96-12-8	< 0.1	< 0.01	0.1	1190	

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Compound	CAS	Sample Concentration ng/L	Sample Concentration ppb	Reporting Limit ng/L	RI	Additional Information
1,2-Dibromoethane	106-93-4	< 0.1	< 0.01	0.1	871	
Dibromomethane	74-95-3	< 0.1	< 0.01	0.1	757	
cis 1,4-Dichloro-2-butene	1476-11-5	< 0.1	< 0.02	0.1	983	
trans 1,4-Dichloro-2-butene	110-57-6	< 0.1	< 0.02	0.1	1005	
1,3-Dichlorobenzene	514-73-1	< 0.1	< 0.02	0.1	1077	
1,4-Dichlorobenzene	106-46-7	< 0.1	< 0.02	0.1	1085	
1,2-Dichlorobenzene	95-50-1	< 0.1	< 0.02	0.1	1118	
1,1-Dichloroethane	75-34-3	< 0.1	< 0.03	0.1	621	
1,2-Dichloroethane	107-06-2	< 0.1	< 0.03	0.1	703	
trans 1,2-Dichloroethene	156-60-5	< 0.1	< 0.03	0.1	593	
1,1-Dichloroethene	75-35-4	< 0.1	< 0.03	0.1	540	
cis 1,2-Dichloroethene	156-59-2	< 0.1	< 0.03	0.1	655	
2,2-Dichloropropane	594-20-7	< 0.1	< 0.02	0.1	652	
1,2-Dichloropropane	78-87-5	< 0.1	< 0.02	0.1	750	
1,3-Dichloropropane	142-28-9	< 0.1	< 0.02	0.1	849	
1,1-Dichloropropene	563-58-6	< 0.1	< 0.02	0.1	687	
trans 1,3-Dichloropropene	10061-02-6	< 0.1	< 0.02	0.1	825	
cis 1,3-Dichloropropene	10061-01-5	< 0.1	< 0.02	0.1	789	
Diethyl ether	60-29-7	< 0.1	< 0.03	0.1	523	
1,4-Dioxane	123-91-1	< 0.1	< 0.03	0.1	756	
Ethanol	64-17-5	**9.1**	**4.7**	0.2	519	
Ethylacetate	141-78-6	**0.1**	**0.03**	0.1	656	
Ethylbenzene	100-41-4	< 0.1	< 0.02	0.1	906	
Ethylmethacrylate	97-63-2	< 0.1	< 0.02	0.1	825	
4-Ethyltoluene	622-96-8	< 0.1	< 0.02	0.1	1012	
Hexachlorobutadiene	87-68-3	< 0.1	< 0.01	0.1	1277	
Hexane (C 6)	110-54-3	**0.1**	**0.04**	0.1	604	
Isooctane	540-84-1	< 0.1	< 0.02	0.1	696	2,2,4-Trimethylpentane
Isopropanol	67-63-0	**8.9**	**3.6**	0.2	558	
Isopropylbenzene	98-82-8	< 0.1	< 0.02	0.1	971	

Compound	CAS	Sample Concentration ng/L	Sample Concentration ppb	Reporting Limit ng/L	RI	Additional Information
p-Isopropyltoluene	99-87-6	< 0.1	< 0.02	0.1	1073	
Methacrylonitrile	126-98-7	< 0.1	< 0.04	0.1	670	
Methyl methacrylate	80-62-6	< 0.1	< 0.03	0.1	753	
Methyl Tertiary Butyl Ether	1634-04-4	< 0.1	< 0.03	0.1	591	MTBE
2-Methyl-1-propanol	78-83-1	< 0.4	< 0.1	0.4	694	Isobutyl alcohol
4-Methyl-2-pentanone	108-10-1	< 0.1	< 0.03	0.1	797	Methyl isobutyl ketone (MIBK)
Methylacrylate	96-33-3	< 0.1	< 0.03	0.1	659	
Methylene Chloride	75-09-2	**0.3**	**0.09**	0.1	578	
2-Methylnaphthalene	91-57-6	< 0.1	< 0.02	0.1	1409	
Naphthalene	91-20-3	< 0.1	< 0.02	0.1	1295	
Nitrobenzene	98-95-3	< 0.1	< 0.02	0.1	1211	
Pentachloroethane	76-01-7	< 0.1	< 0.01	0.1	1050	
Propionitrile	107-12-0	< 0.1	< 0.05	0.1	664	
n-Propylbenzene	103-65-1	< 0.1	< 0.02	0.1	1003	
Styrene	100-42-5	< 0.1	< 0.02	0.1	947	
1,1,1,2-Tetrachloroethane	630-20-6	< 0.1	< 0.02	0.1	907	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.1	< 0.02	0.1	1000	
Tetrachloroethene	127-18-4	< 0.1	< 0.02	0.1	841	
Tetrahydrofuran	109-99-9	< 0.1	< 0.03	0.1	667	
Toluene	108-88-3	**0.2**	**0.06**	0.1	806	
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	**0.6**	**0.08**	0.1	538	
1,2,4-Trichlorobenzene	120-82-1	< 0.1	< 0.01	0.1	1266	
1,2,3-Trichlorobenzene	87-61-6	< 0.1	< 0.01	0.1	1318	
1,1,1-Trichloroethane	71-55-6	< 0.1	< 0.02	0.1	678	
1,1,2-Trichloroethane	79-00-5	< 0.1	< 0.02	0.1	838	
Trichloroethene	79-01-6	< 0.1	< 0.02	0.1	734	
1,2,3-Trichloropropane	96-18-4	< 0.1	< 0.02	0.1	1005	
1,3,5-Trimethylbenzene	108-67-8	< 0.1	< 0.02	0.1	1018	
1,2,4-Trimethylbenzene	95-63-3	< 0.1	< 0.02	0.1	1049	
m,p-Xylene	108-38-3; 106-42-3	< 0.2	< 0.05	0.2	914	

Compound	CAS	Sample Concentration ng/L	Sample Concentration ppb	Reporting Limit ng/L	RI	Additional Information
o-Xylene	95-47-6	< 0.1	< 0.02	0.1	945	

Compound Notes

L* Prism has no data on the recovery efficiency of this compound from the sample media. The value reported should be regarded as a qualitative result only.

Semiquantitative Compounds

Semiquantitative data includes compounds that have not been calibrated but have some reference information indicating the validity of the compound identification, an acceptable reference library match, or some other supporting evidence as part of the extensive Prism compound database.

This section lists the Semiquantitative compounds detected in this air sample above the reporting limit in alphabetical order. The concentrations are reported in two different units for easy comparison to exposure limits or other information. Note that the conversion to ppb requires the molecular weight of the chemical compound so those compounds that are non-specific (e.g., C10-C12 Hydrocarbon) do not have a concentration in ppb listed. The Retention Index (RI) indicates volatility relative to adjacent n-alkanes. A more detailed description of these terms can be found at the end of the report.

		Sample Concentration		Reporting Limit		
Compound	CAS	ng/L	ppb	ng/L	RI	Additional Information
Acetic Acid	64-19-7	1	0.5	1	700	L*
Decanal	112-31-2	2	0.3	1	1272	
Dodecanal	112-54-9	2	0.2	1	1478	
Propylene glycol	57-55-6	2	0.5	1	855	

These results pertain only to this sample as it was collected and to the items reported.
These results have been reviewed and approved by the Laboratory Director or authorized representative.

Alice Delia

Alice E. Delia, Ph.D., Laboratory Director

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Supplemental Information: Odorants

Many chemical compounds have odors associated with them, some pleasant and some unpleasant. These odors can combine to create different odors, making odor identification more difficult. The odor descriptions for the compounds reported in this air sample are listed below as well as some of the more common sources.

Compound	CAS	Conc. (ng/L)	Odor Description	Common Sources
Methylene Chloride	75-09-2	0.3	Chloroform-like	Automotive products; degreasing solvent; paint stripper; adhesive remover; aerosol propellant; insecticide
Benzene	71-43-2	0.3	Paint-thinner-like	Primarily gasoline and other petroleum products. Also some industrial solvents; printing and lithography; paints and coatings; rubber; dry cleaning; adhesives; detergents
Toluene	108-88-3	0.2	Aromatic	Gasoline; adhesives (building and arts/crafts); contact cement; solvent; heavy duty cleaner; inks; cosmetics; asphalt

Supplemental Information: EPA Hazardous Air Pollutants (HAPs)

Hazardous air pollutants, also known as toxic air pollutants or air toxics, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. Of the 187 compounds or groups defined as HAPs, approximately 65 can be detected with this analysis. Listed below are those HAPs that were detected in this air sample. For more information about HAPs visit the EPA Air Toxics website. The exposure limits listed below can also be found in the NIOSH Guide to Chemical Hazards.

Compound	CAS	Conc. (ng/L)	NIOSH TWA REL	Potential Health Effects
Methylene Chloride	75-09-2	0.3	Carcinogen	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]
Benzene	71-43-2	0.3	320 ng/L (100 ppb)	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
Toluene	108-88-3	0.2	375,000 ng/L (100,000 ppb)	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

Additional Information

Glossary of Terms

Total VOCs (TVOC): TVOC is one of the most common general air quality indicators. It allows comparison of multiple samples with each other or with target levels.
The following formula depicts the calculation that determines TVOC. Typically, TVOC includes compounds that contain between 3 and 15 carbon atoms (along with the associated hydrogen, as well as oxygen, nitrogen, sulfur, silicon, etc.), although certain compounds outside this range of carbon atoms may be included depending on the type of compound.

$$TVOC\ \left(\frac{ng}{L}\right) = \frac{\left[\frac{(A_s - A_b) \times W_s}{A_i}\right]}{L_s}$$

Where:
As – C3-C15 TIC (Total Ion Chromatogram from GC-MS) area of the sample
Ab – C3-C15 TIC area of the media blank
Ws – Weight of the internal standard added in ng
Ai – average TIC area of the internal standard peak(s)
Ls – Volume of the sample in L

CAS: The Chemical Abstract Service (CAS) assigns a unique number to chemical compounds, commonly referred to as the CAS number. This number is usually the best way to search for additional information about the compound since some compounds may have many names but only one CAS number.

Reporting Units - ng/L: Most concentrations for air samples will be reported in units of ng/L, which translates to ng of that specific chemical compound present per liter of air sampled. Concentration in ng/L is equivalent to $\mu g/m^3$.

Reporting Units - ppb: Some sections of this will have a second column with compound concentrations displayed in units of ppb (parts per billion), which are also commonly used in exposure or reference limits. The concentration in ng/L (or $\mu g/m^3$ can be converted easily to ppb using the following formula derived from the Ideal Gas Law.

$$Conc\ (ppb) = \frac{Conc\ (\frac{ng}{L}) \times 24.04(\frac{L}{mol})}{MW\ (\frac{g}{mol})}$$

Where:
Vm = Molar Volume as 24.04 L/mol at 1 atm pressure and 20 °C (68 °F)
MW = Molecular Weight in g/mol

Reporting Limit: The Reporting Limit column displays the lowest possible concentration that could be reported for that compound for that sample and analysis. Typically the reporting limit is displayed in units of ng/L but other units may be used as appropriate.

Retention Index (RI): The retention index is a means of converting a compound GC-MS retention time, which is dependent on the type of system and specific operating parameters, into an independent and universal value based on the elution of the adjacent n-alkanes. Each n-alkane is assigned a retention index based on its carbon number, e.g., pentane (C5) has a retention index of 500 and hexane (C6) has a retention index of 600, etc. For example, a hydrocarbon with a retention index of 550 would be expected to elute at the midpoint between pentane and hexane. Using the elution of the n-alkanes as the reference point allows the resulting retention index of organic compounds to be applicable across almost any GC-MS system. The non-isothermal retention index, which is most applicable to the GC-MS instruments used by Prism, can be determined using the following formula derived from the Kovats isothermal retention index.

$$RI_x = 100n + 100 \times \frac{(RT_x - RT_n)}{(RT_{n+1} - RT_n)}$$

Where:
RIx – retention index of target compound x
n – Carbon number of n-alkane eluting before the target compound x
RTx – retention time of target compound x

RTn – retention time of n-alkane eluting before target compound x
RTn+1 – retention time of n-alkane eluting after target compound x

Odor Description: Description of the odor (e.g., fruity)

HAPs: Hazardous Air Pollutants

NIOSH: National Institute for Occupational Safety and Health

TWA: Time Weighted Average

REL: Recommended Exposure Limit

Ca: Potential carcinogen

Sources for Additional Compound Information:
The compound information displayed in this report (e.g., odor description, exposure limits, etc.) is gathered from a variety of sources, including but not limited to, the NIST Chemistry Webbook, the NIOSH Pocket Guide to Chemical Hazards, the Household Products Database, the University of Akron Chemical Database, the WISER (for Emergency Responders), IRIS, ToxNet, ATSDR. Prism does not guarantee the accuracy of this information or endorse any of the views or opinions expressed.