AIR EMISSIONS FROM NATURAL GAS EXPLORATION AND MINING IN THE BARNETT SHALE GEOLOGIC RESERVOIR

by

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DEDICATION

I dedicate this study to the children of the Energy Revolution and to those who have come have come before me and those who will come after me.

The Prophecy of the Seventh Generation is on the horizon and the Ten Indian Commandments will be your guide.

Always remember, “We do not inherit the Earth from our Ancestors, we borrow it from our children.” —Native American Proverb

ACKNOWLEDGEMENTS

In acknowledgement of their contribution and assistance on this study I would like to thank all the members of my committee. Professors, your contribution will be remembered for my lifetime. Dr. Melanie Sattler, quiet and brilliant, has amazed me with her sincere commitment to the environment and to our field of science. I am honored to have had the opportunity to study under her. Dr. James Grover, who initially intimidated the daylights out of me, provided depth of knowledge and expertise that was critical for a successful study. His time and assistance is gratefully appreciated. Dr. Andrew Hunt, whom I have come to know well and look forward to many years of working together on particulate matter. Dr. John Holbrook, your knowledge of the industry has been particularly helpful and I have been inspired to reach further in my understanding of earth's processes. Dr. Jeff Howard, your work is just beginning in the area of planning. I trust with your knowledge and understanding you will take your career to unlimited heights. You were all chosen, not because you are easy on doctoral candidates, quite the opposite. You were chosen because you would not allow anything less than quality to leave your offices.

I wish to thank my parents, who taught me to be aware of the environment and to respect Mother Earth. For without her, we are nothing. To my children, all six of them: Sophia, David, Nikolai thank you for understanding that sometimes commitment to the greater good must come before the individual. Nicholas, Tanner and Sam, thank you for allowing me to participate in your lives. To all my kids, you make me proud; but never forget the importance of taking care of the environment. As Great Gramma Ruby would say, "…Or, I will haunt you from the grave," God bless her soul, you know I will. To my sister, if I had designed the perfect sister, I could not have made you any better. I look forward to days of shopping ahead of us. To my husband, my friend, my strength, thanks will never be enough. I look forward to growing young

with you and making up for lost time. Thank you for standing by me and for your encouragement. I am honored to call you my best friend.

April 1, 2011

ABSTRACT

AIR EMISSIONS FROM NATURAL GAS EXPLORATION AND MINING IN THE BARNETT SHALE GEOLOGIC RESERVOIR

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This study evaluates air emissions from natural gas mining and production in the Barnett Shale within the Dallas/Fort Worth Metroplex. Due to advances in horizontal drilling and hydraulic fracturing, natural gas production in the Barnett Shale increased from 3 wells in 2000 to almost 8,000 wells in six Metroplex counties by 2008. Currently, information regarding emissions from natural gas production, particularly regarding hazardous air pollutants, is lacking; this information is particularly important given that drilling and production is occurring in highly urbanized areas. The objectives of this study were thus:

- To identify the 'fingerprint' of chemicals associated with natural gas production in the Barnett Shale through passive air monitoring; and
- To correlate the presence of the fingerprint chemicals to methane and to each other.

Air sampling was conducted at 36 sampling sites in 6 counties, resulting in 50 sets of monitoring data for subsequent statistical analysis. Passive samples were collected using summa canisters with 24-hour flow valves according to ASTM Method D-1357. Canister

contents were analyzed for Toxic Organics (TO-14A), Tentatively Identified Compounds (TICs) and Light Hydrocarbons by Gas Chromatography/Mass Spectrometer Analysis (GC-MS).

Statistical analysis confirmed a statistically significant probability that other chemicals will be present with methane including toluene, m&p xylenes, dichlorodifluoromethane, benzene, o-xylene, chloromethane, ethylbenzene, C12hydrocarbon, 1,2,3-trimethylbenzene and carbon disulfide.

A Pearson's correlation coefficient identified strong relationships between toluene and m&p xylene ($r = 0.85$), benzene and toluene ($r = 0.89$), benzene and xylene ($r = 0.86$).

A Principal Component Analysis (PCA) identified specific chemicals associated with 2 significant factors. These factors were strongly associated to specific natural gas mining and production processes, including fracking, flaring, venting, compression, and tanks holding produced water/condensate, and injection of produced water into wells. An ANOVA F-test confirmed a significant difference of specific chemicals related to compression with a p-value of >0.05.

Many of the chemicals identified in this study are hazardous air pollutants (HAPs), and are known/suspected carcinogens, mutagens, developmental toxicants and neurotoxicants. Thus, use of dispersion modeling is advisable to develop safe setback distances between natural gas drilling/production facilities and critical receptors, such as schools.

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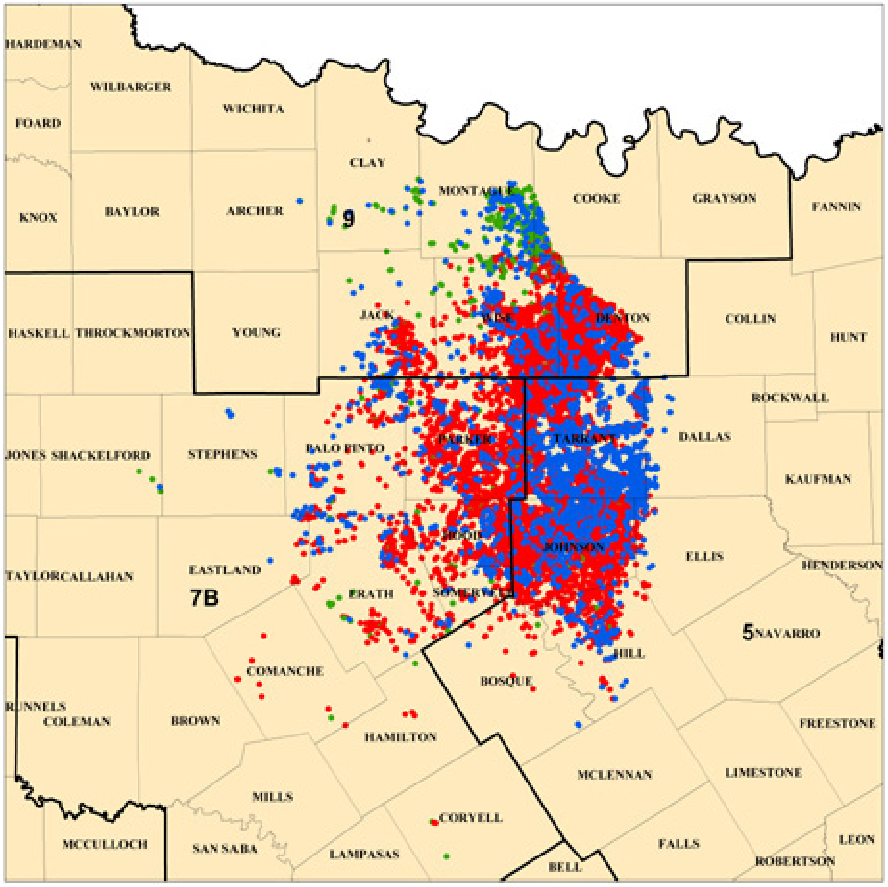
INTRODUCTION

1.1 Air Pollutants from Natural Gas Production in the Barnett Shale

Natural gas production in the Texas Barnett Shale is currently generating considerable interest due to potential adverse environmental impacts. Due to advances in horizontal drilling, natural gas production in the Barnett Shale increased from three (3) horizontal wells in 2000 to almost 8,000 wells in six counties of the Dallas Fort Worth Metroplex by 2008 (Powell Barnett Shale Newsletter, 2008). Drilling permits issued in 2008 alone for all counties of the Barnett Shale exceeded 4,000, totaling over 11,000 new permits from 2004-2008 (Armendariz, 2009). Production more than doubled between 2005 and 2007 alone, increasing from 500 billion cubic feet (bcf) to more than 1100 bcf (Armendariz, 2009). Figure 1.1 shows gas wells and drilling permits (permitted but not necessarily producing) in the North Central Texas region. Natural gas production in the Barnett Shale has significantly increased since 2005 with the new technologies in hydraulic fracturing and horizontal drilling.

The author has measured air pollutants in the vicinity of sites related to natural gas mining and exploration within the Barnett Shale, including the processes of drilling, fracturing, compression and production. In addition, Texas Commission on Environmental Quality (TCEQ) and Titan Engineering, Inc. conducted ambient air quality studies confirming the presence of previously unidentified fugitive emissions emanating from natural gas production sites (“Barnett Shale Formation,” 2009; Titan Engineering, 2010). Many of the measured pollutants are hazardous air pollutants (HAPs), precursor chemicals that contribute to the formation of tropospheric ozone, and greenhouse gases (GHG). Compounds have been identified through independent air testing to include



Legend

Green = Oil Wells Red = Gas Wells Blue: Drilling Permits

Figure 1.1 Texas Barnett shale production (Texas Railroad Commission).

- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), which are HAPs;
- Sulfide compounds (carbonyl sulfide, dimethyl disulfide, and others, which are HAPs);
- Other HAPs, including styrene and 1,2,4-trimethylbenzene;
- Carbon dioxide (CO_2);
- Methane;
- Carbon monoxide (CO); and
- Oxides of nitrogen (NOx; Guven, 2009).

A study that the author performed for the city of DISH, Texas in 2009, identified HAPs with carcinogenic and neurotoxic capability in emissions emanating from compressors, tank batteries, and control equipment (Wolf Eagle Environmental, 2009). Certain neurodevelopmental disorders such as autism, attention deficit disorder, and subclinical brain dysfunction (and retardation) have been linked to many of the measured HAPs (Grandjean & Landrigan, 2006). Many of the disorders and diseases from exposure to carcinogenic and neurotoxic compounds can have life-long health consequences, with severe financial implications to the family, school districts, health care system and the state. Within the City of Fort Worth, as well as other communities, natural gas facilities have been placed adjacent to schools and child care centers, exposing children and women of child-bearing age to potentially damaging chemicals.

Most of the HAPs measured in the vicinity of natural gas sites are also volatile organic compounds (VOCs), which are precursors to ground-level ozone formation, along with oxides of nitrogen. Dr. Al Armendariz, Director of U.S. EPA Region 6, estimated oil and gas emissions within the Barnett Shale to contribute an additional 113.94 tons per day or 5,088.10 tons per year, additional VOCs to regional atmospheric concentrations (Armendariz, 2009).

Carbon monoxide is a criteria pollutant, and carbon dioxide and methane (CH_4) are greenhouse gases. Since natural gas is primarily methane, fugitive emissions of this compound are potentially significant. The increase of methane concentration in the atmosphere has been identified by the U.S. EPA as the second largest contributor to global warming (U.S. Environmental Protection Agency, 2006). Methane is a potent GHG with a half life of seven (7) years in the atmosphere.

1.1.2 Study Objective

A review of the literature reveals a lack of peer-reviewed scholarly research concerning measurements of emissions from natural gas drilling sites. Government reports or other information concerning the topic is also lacking, as will be described in more detail in Chapter 2. The objective of this study was thus to identify and quantify toxic/HAP emissions from activities

related to natural gas exploration and mining operations in the Barnett Shale play. Air samples from various natural gas pad sites were collected and analyzed for concentrations of compounds. Specific objectives are:

- To identify chemicals associated with natural gas production in the Barnett Shale through passive air monitoring;
- To correlate the presence of other chemicals to the presence of methane using Pearson's Correlation;

Using Principal Component Analysis (PCA), to identify relationships between the chemicals found in ambient samples.

1.1.3 Overview of Dissertation Organization

The rest of this dissertation is organized as follows. Chapter 2 presents the history and background information related to the recent expansion of natural gas mining and urban drilling in the Barnett Shale. The literature review discusses previous air emission studies performed in the Barnett Shale. Chapter 3 describes the study's methodology and the procedural steps in ambient air monitoring performed in this study. Chapter 4 presents the results of the monitoring and statistical analysis. Chapter 5 concludes with a discussion of policy implications and recommends future work related to the study.

CHAPTER 2

BACKGROUND

2.1 History and Geology of the Barnett Shale

The Barnett Shale geologic formation is named after John W. Barnett, who homesteaded land in San Saba County, Texas in the 1800s. A geological mapping expedition in the early 20th century identified a surface deposit of black shale in the bank of a creek on Barnett's land. The surface outcropping of shale found in the creek became known as the Barnett Shale. The Barnett Shale deposit has varying depths from the surface outcropping in San Saba County, shown in Figure 2.1, to approximately 8,000 feet deep in the Core Area located beneath the Dallas/Fort Worth Metroplex (Earth System Science Education Alliance Course, 2009).

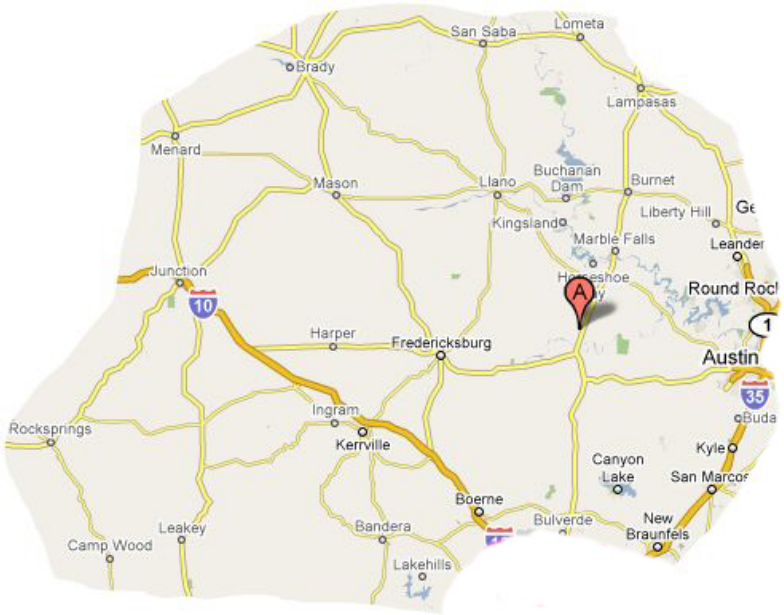


Figure 2.1 San Saba County: Location of the surface outcropping of the Barnett Shale. http://www.hillcountryportal.com/Images/Icons/HillCountryMap-FH.JPG

The Mississippian Barnett Shale play ("Barnett Shale") is a geologic rock formation identified as the largest natural gas reservoir in Texas and one of the largest plays in the United States. The formation encompasses over 54,000 square miles stretching from North Texas to Southern Oklahoma. As shown in Figure 2.2, the Barnett Shale lies beneath twenty-one (21) counties in North Texas. Nine (9) of the counties in the play encompass the Dallas/Fort Worth Metroplex (Armendariz, 2009).

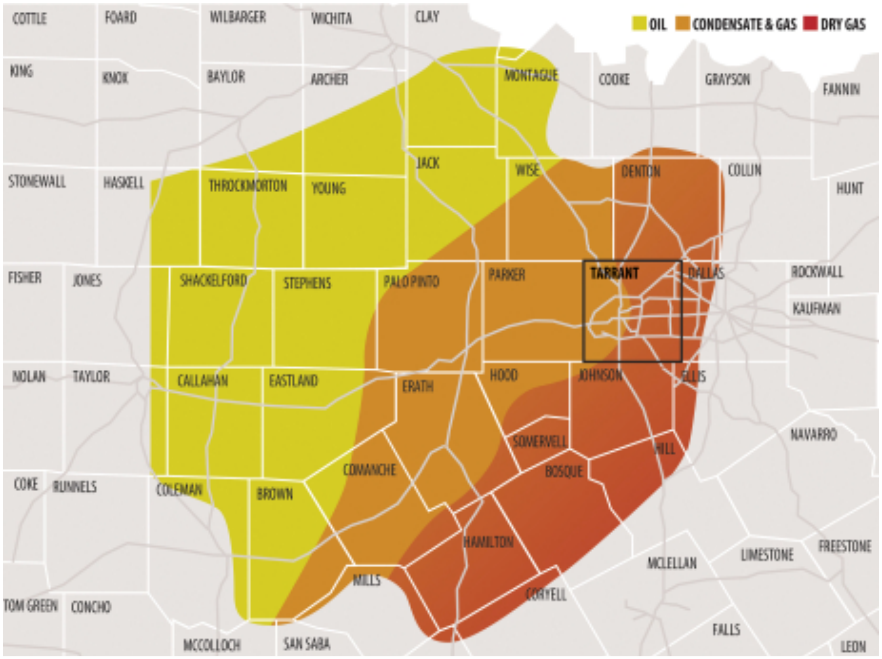


Figure 2.2 Counties encompassing Barnett Shale geologic formation.
http://oilshalegas.com/sitebuildercontent/sitebuilderpictures/barnettshale.jpg

Many of these counties have been designated by the EPA as ozone nonattainment areas. They include Dallas, Tarrant, Denton, Parker, Johnson, Ellis, Collin, Rockwall, and Kaufman counties.

2.1.1 Geologic Timescale of the Barnett Shale

Geologic formations are named according to their geologic timescale. The Mississippian Barnett Shale is identified as one of the subperiods of the Carboniferous Period, as shown in Figure. 2.3 below.

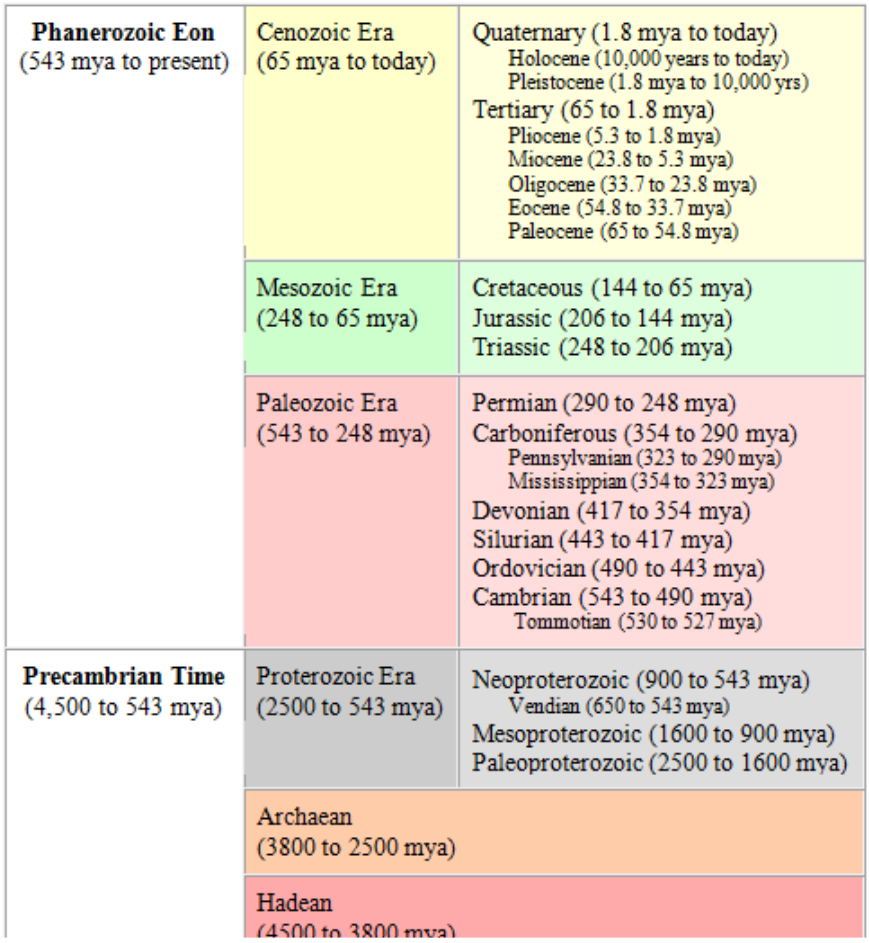


Figure 2.3 Geologic time scale of Paleozoic Era
http://www.ucmp.berkeley.edu/help/timeform.html

The Pennsylvania and Mississippian subperiods occurred approximately 328 to 359 million years ago (Ma), with the Mississippian being the older of the two (Palmer, Geissman, & Reibolt, 2002). The Carboniferous Period occurred during the Paleozoic Era, and was named for the beginning of coal forming deposits from coal bearing rock layers.

2.1.2 Basins of the Barnett Shale

The Barnett Shale has two primary 'basins' or reservoirs: the Hardeman of Southern Oklahoma, and the Fort Worth Basin of North Texas. Within these basins are deposits rich in oil and natural gas, commonly called "fields." The Newark East Field is considered the largest gas

producing field within the Barnett Shale play and lies in the Fort Worth Basin (Jarvie, Hill, Pollastro, Claxton, & Bowker, 2004). It is known as the “Core Area” of the Basin. The Core Area is the location in the Basin where the hydrocarbon formation is the thickest in natural gas deposits, estimated between 450 and 900 feet, and has the highest British Thermal Units (BTU) heat value or potential energy production. The Core Area lies directly beneath the Dallas/Fort Worth Metroplex as shown in Fig. 2.4. The Barnett Shale is considered a fractured shale gas (FSG) because of the way the rock formation naturally forms fractures or microfractures, as shown in Fig 2.5.

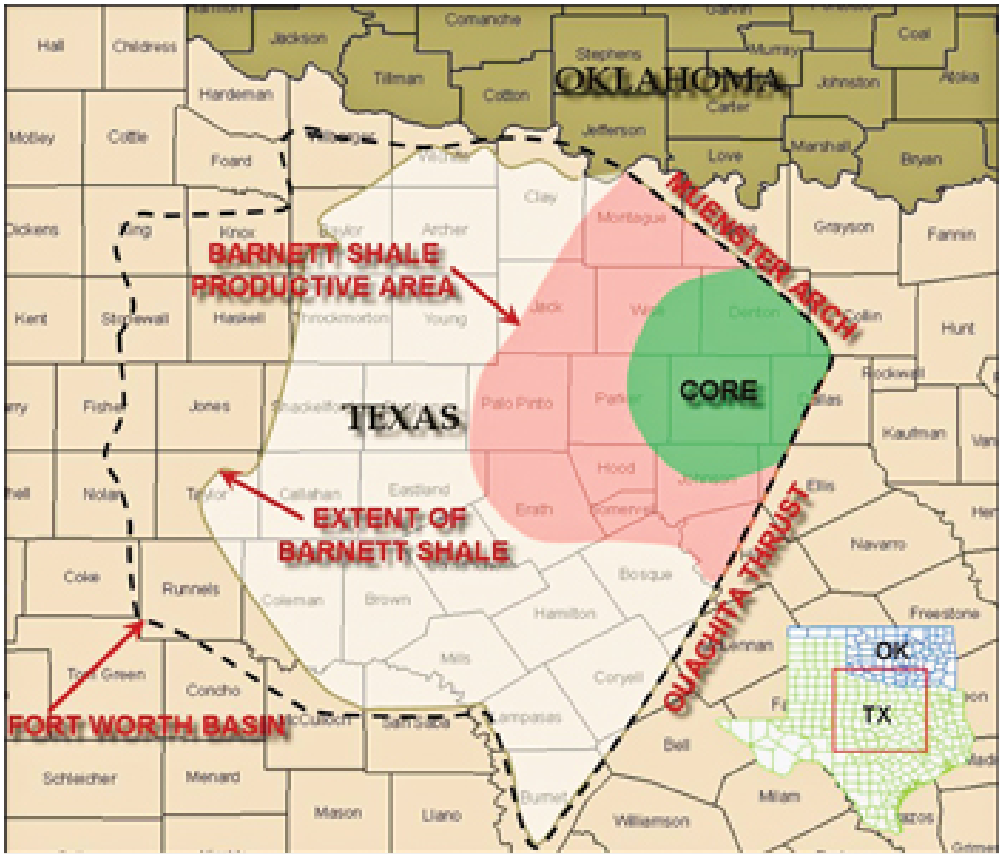


Figure 2.4 Core area of the Barnett Shale. http://www.worldoil.com/uploadedimages/Issues/Articles/Aug-2010/10-08-Barnett-Kulkarni-Fig-03.jpg

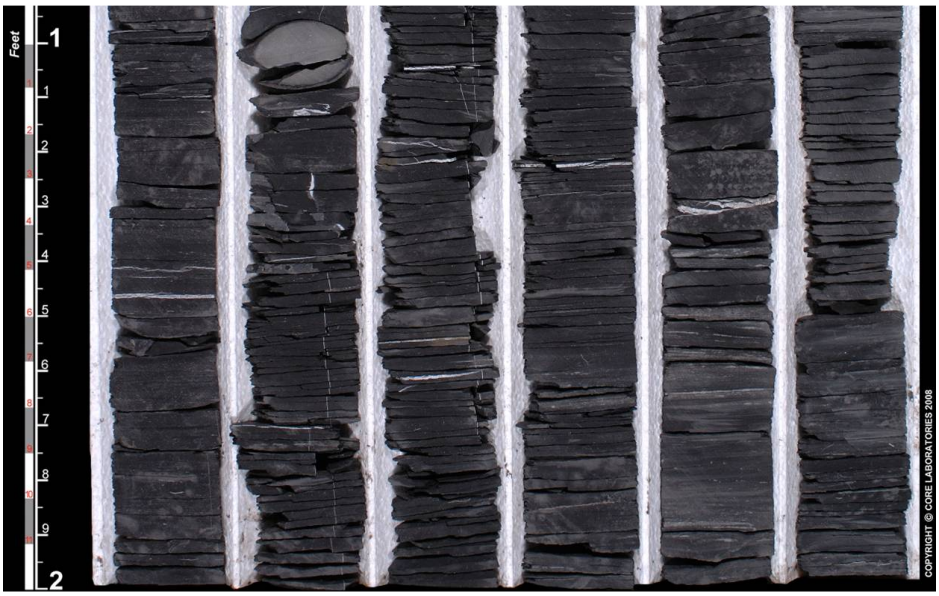


Figure 2.5 Core samples of microfractures within the Barnett Shale.
http://www.spec2000.net/17-specshgas.htm

The Barnett Shale formation has been estimated by industry sources to hold approximately 2.5 trillion cubic feet (TCF) of natural gas reserves within its shale (Oil Shale Gas, 2010). However, the United States Geological Society (USGS) performed a geology-based assessment of the reservoir and estimated a mean of 26.7 TCF of undiscovered natural gas, 98.5 million barrels of undiscovered oil and 1.1 billion barrels of undiscovered natural gas liquids (NGL; U.S. Geological Survey, 2003).

2.1.3 Barnett Shale: Conventional Versus Unconventional Deposits

Geologic deposits in the Fort Worth basin are shale rock formations rich in organic matter and characterized as unconventional gas formation. A ‘conventional’ gas formation forms a pool of gas between layers of rock, which can be mined through conventional vertical drilling as shown in Figure 2.6. An ‘unconventional’ reservoir of gas accumulates in fine-grained shale rock formations and is contained within microfractures or held by clay particles. Unconventional gas formations are so named because they cannot be extracted using traditional extraction techniques. Horizontal drilling provides the only technological means to economically extract

gas within these reservoirs (Oil and Gas Field Technical Term Glossary, n.d.). Unconventional gas formations include fractured shale gas (FSG), tight gas sands (TGS), basin center gas (BCG), shallow basin methane (SBM) and coalbed methane (CBM).

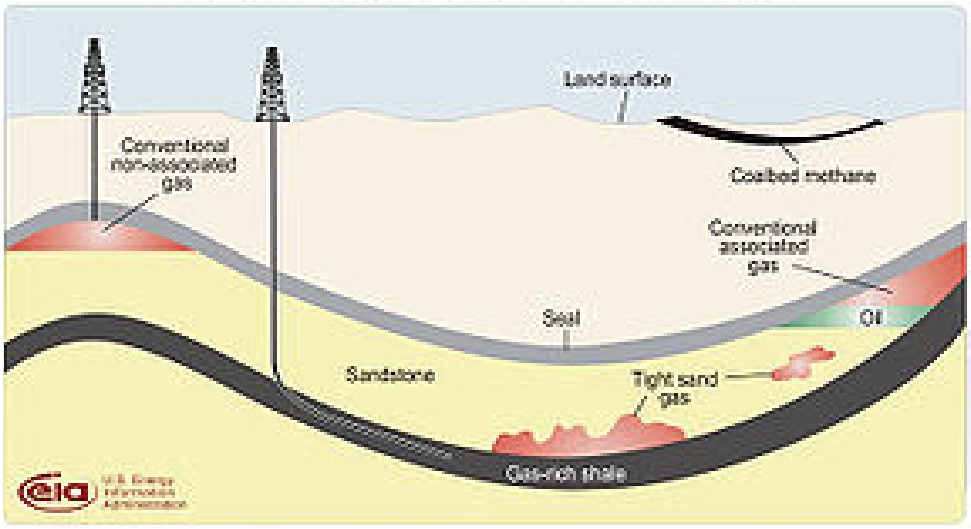


Figure 2.6 Schematic geology of natural gas resources.
U.S. Energy Information Administration. http://eia.gov

2.2 Horizontal Drilling and High-Volume Slick Water Hydraulic Fracturing

According to the Natural Gas Supply Association the first patent for horizontal drilling was issued to Robert E. Lee in 1891, using a drainhole for a vertical well. The first recorded true horizontal oil well was completed in 1929 near Texon, Texas (U.S. Department of Energy, 1993). These techniques were rudimentary at best with little practical application until the early 1980's, when advancements in technology and completion and production techniques, allowed for a more financially feasible implementation with increased production potential.

Typical gas shale has low permeability and requires hydraulic fracturing in order to release the gas from the shale. Production of gas from shale has only become possible with the development of high-volume, slick water hydraulic fracturing (HVSWHF or "hydrofracking" see 2.3.1.2), and advanced horizontal drilling techniques. Production in the Newark East Field showed exponential growth from 2001-2006 due to these technological advancements, as

shown in Figure 2.7. Prior to 2003, the shale was predominantly vertically drilled. In 2003, 198 horizontal well permits were filed within the first six months alone (Kuuskraa, 2010). The greatest increase was seen at the height of natural gas prices (2007-2008) when a (50%) increase in producing wells occurred in just one year from 1,100 to 1,605 wells. With natural gas prices in decline from 2009-2010 there has been a decrease in both wells drilled and wells brought on line for production compared to 2008 statistics.

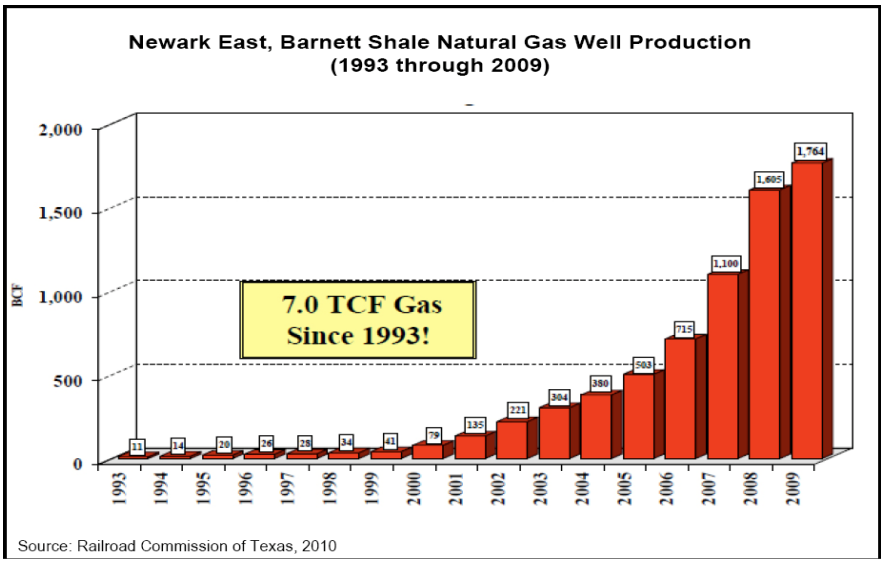


Figure 2.7 Barnett Shale production increase 1993-2009. Kuuskraa VA. Advanced Resources International Arlington,VA. Presentation: The Start of Gas Shale Revolution. Case Study #1, Barnett Shale. Prepared for the Gas Shale Development Workshop. Beijing, China, April 2010.

According to V.A. Kuuskraa (2010) at the Advanced Resource International Gas Shale Development Workshop in Beijing, China 2010, the Newark East field during 2001-2003 saw only 76 horizontal wells successfully drilled in the Core Area, for a total of 2,329 vertical and horizontal wells. In 2004–2006 1,008 horizontals were successfully completed for a total of 5,720 vertical and horizontal completions. In 2007-2008 1,810 horizontal wells were successfully completed, for a total of 10,145 vertical and horizontal completions. Approximately 1,764 wells were completed in 2009, for a total of 13,740 well completions across the Barnett.

2.3 Stages of Development in Natural Gas Extraction and Production

Natural gas has been heralded by the oil and gas industry as “the cleanest of the fossil fuels, .used in many ways to help reduce the emissions of pollutants into the atmosphere.” (Natural Gas Organization, 2007). This statement does not appear to be based on the complete assessment of emissions from all activities related to natural gas production, from mineral extraction to distribution. Combustion of “refined” natural gas may produce lower emissions than combustion of coal, but unrefined by-pass natural gas is the most commonly used source of energy for pad sites and compression engines and likely a significant contributor to atmospheric emissions.

Natural gas development can be broken down into four (4) main processes: (1) Extraction, (2) Processing, (3) Transportation, and (4) End Use Distribution. Each of the processes is unique in its energy requirements, technology and environmental impacts. This study will focus on stationary source emissions from the extraction and processing.

2.3.1 Extraction Process

Extraction of natural gas begins with the examination of core samples and characteristic determinants (Total Organic Carbon, Thermal Maturity, Vitrinite Reflectance, Wet or Dry, Sour or Sweet, etc.) to determine if the underlying geologic formation is viable for production. Prior to any extraction, the geologic formation is thoroughly investigated both chemically and physically with 3-D images and geologic modeling. The extraction process begins only when all factors support a productive field and mineral rights are secured. Once the location is chosen, the land is cleared of vegetation, roadways built for the heavy equipment and a pad site developed. Although the process of establishing the pad site and roadways contribute to air pollution from particulate matter and diesel combustion from heavy equipment, the majority of the emissions are produced from activities related to the extraction or mining process.

2.3.1.1 Drilling a Well

The drill rig bores the hole or well into the underlying gas shale. A horizontal or directional well is bored in a similar manner to a vertical well, with the exception of when the

bore angles or begins a horizontal direction in to the underlying shale reservoir as shown in Figure. 2.8. The drill rig bores a hole through the rock to the desired depth and angles into the shale where the deposits lie. A cement casing is then installed along the length of the shaft to prevent commingling of subsurface aquifers and natural gas reservoirs during extraction.

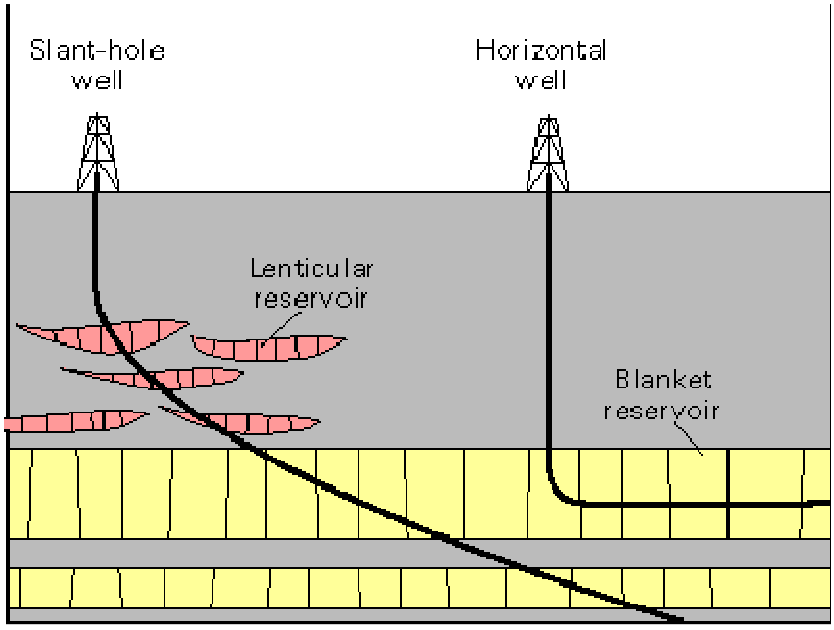


Figure 2.8 Horizontal or slant-hole drilling operation.
http://www.horizontaldrilling.org/drilling.gif

2.3.1.2 Well Stimulation Process

After the cement casing is installed, a wireline is inserted into the casing and an electrical current sent down the wireline, which ignites a charge and perforates the cement casing fracturing the shale. The process using controlled explosives is often referred to by industry as “seismic events” but is actually a controlled subsurface explosion.

To further stimulate well production, fracturing (“fracking” or “fracing”) of the underlying geologic formation can be implemented. Fracking commonly involves use of water (“water-frac”), although carbon dioxide has also been used. Fracking fluid is not just water; it is referred to in the industry as “slick water.” The fracking water is treated with numerous chemicals

(disinfectants, surfactants and detergents, etc.) prior to being forced into the well under high pressure. This water often is extremely slippery due to the chemicals added to the water, hence the term ‘slick water.” High Volume Slick Water Hydraulic Fracturing (HVSWHF) is a method of stimulating gas production by injecting water, a proppant (sand) and chemicals, down the casing under extremely high pressure, further cracking the rock formation. This allows the gas to escape from the micropores and flow in to the well casing and up to the well head. The fractures remain open from the proppant (usually sand) being forced in to the fracture, allowing for the gas to flow to the well. The purpose of slick water is to prevent the drill bit from becoming encumbered by soil and rock, often leading to breakage and preventing introduction of hydrocarbon-eating bacteria. Slick water is a proprietary mixture of chemicals in water. Dr. Theo Colburn, Founder and President of The Endocrine Disruption Exchange (TEDX), has identified over 278 different chemicals used by the industry in creation of slick water. Her work has documented the health effects associated with exposure to the chemicals used in fracking fluids (TEDX, 2011). Despite concern for exposure and the potential for health effects, drilling companies have not been required to provide information or Material Safety Data Sheets (MSDS) on the composition of slick water.

It takes approximately 1,000,000 gallons of water for every well drilled or every well restimulated (“workover”). A new 12-stage process introduced by Advanced Resources Intl., in April 2010 in China claims to provide more effective horizontal well completions with higher yields per well with lower damage; however, this 12-stage process requires 18,000 barrels of water per stage (756,000 gallons/stage) for a total water usage of 9,072,000 gallons per well (Kuuskraa, 2010). The wells are then put on line after cleaning out the fracking fluid (flowback), stimulating the methane and associated gases to reach the surface. The well head is secured in place, and the production process begins.

2.3.2 Processing and Compression of Natural Gas

Unrefined natural gas from the wellhead is composed of methane and associated hydrocarbons (ethane, propane, butane, pentanes, etc.) often referred to as Natural Gas

Liquids (NGLs), hydrogen sulfide, carbon dioxide, water and other compounds. Natural gas must go through several separation processes prior to being compressed and sent through pipe lines to a gathering station for further processing. Dissolved natural gas must be separated from the oil in which it is dissolved. This process of separation occurs at the pad site. Condensate from the gas stream is also separated out from the methane and associated light hydrocarbons. The condensate is a saleable product and highly valued for its' use in the petroleum industry. Produced water is removed by a separation process, but water vapor in natural gas solution is more difficult to remove and requires absorption dehydration with either a glycol or solid-dessicant dehydration performed at the pad site. Sulfur and carbon dioxide are removed through an amine process. Sulfur exists as hydrogen sulfide in natural gas and is both highly corrosive and dangerous. Sulfur compounds can be processed at a sweetening plant and sold as elemental sulfur. A by-pass gas fueled compressor then compresses the natural gas, sending it through the pipelines to a gathering station for further refinement.

According to the National Petroleum Council (NPS) Global Oil and Gas Study, unconventional gas technology has significant and immediate need for improvement in:

- Improved understanding of hydraulic fracturing in horizontal wells so that designs can be improved;
- Reducing the impact of operations on the environment by reducing waste, reducing noise, and by using smaller drilling pads and adequate handling of wastewater;
- Reducing volume of water produced. Efficient handling and environmentally safe and low-impact disposal is needed;
- Processing and utilization of produced water such that it is no longer 'viewed' as a waste stream but as a valuable product for agricultural and industrial use and for all well drilling and completion needs (Holditch et al., 2007).

It is clear from the above industry statements that this is an evolving technology with need for better understanding and research of shale formations and additional development of technologies and methodologies required for success.

2.3.3 Sources of Emissions from Natural Gas Extraction and Processing

The natural gas mining process has numerous potential sources of emissions, including:

- Off-road vehicle combustion and particulate matter emissions during pad site construction;
- Combustion emissions during the drilling process;
- Production of HAPs, GHGs, and VOCs from the fracking process;
- Venting of methane and HAPS, GHGs and VOCs from the well closure; and
- Multiple sources of emissions from the production of natural gas including methane, HAPS, GHGs, VOCs, heavy metals and particulate matter.

Chemicals used in the fracking process as well as the processing and compression processes are of primary concern as they may be ultimately released as airborne contaminants during the flowback and production processes. In addition, many of the geologic characteristic determinants of gas deposits can be directly linked to potential surface exposure.

2.4 Geologic Characteristic Determinants of Hydrocarbon Deposits in the Newark East Field

Time, temperature, pressure and organic material are the key ingredients leading to the creation of hydrocarbon deposits. Organic matter can be composed of either marine life or plant material. The type of hydrocarbons produced in a geologic formation, whether oil or gas, is directly related to the type of organic material present (Total Organic Carbon “TOC”) and the Thermal Maturity of the organic matter. Thermal Maturity can be measured through a technique called vitrinite reflectance and is a measure of the maturity of the organic matter and its potential to produce hydrocarbon deposits. The Barnett Shale’s organic matter is primarily derived from plant material.

2.4.1 Total Organic Carbon

Natural gas is stored in shale rock either as a free gas occupying pore space or absorbed gas stored in organic matter. Gas shales are organic matter deposits with a minimum Total Organic Carbon (TOC) of 0.5%. TOC has varying degrees of thermal maturity. The amount of organic material available to convert into hydrocarbons is determined by TOC percent and is often referred to as kerogen. Kerogen is a mixture of organic chemical compounds that forms organic matter in rock and is considered the main source of TOC. Kerogen is usually readioactive, containing high levels of uranium salts. Gas shales with significant absorbed gas, like the Barnett Shale, are often very radioactive (>150 API units). When heated, the kerogen releases natural gas. There is a linear relationship between the percent of TOC and gas content in a formation. The percent of TOC present is not the only indicator of hydrocarbon formations, however (Jarvey et al., 2004).

2.4.2 Thermal Maturity

As shown in Table 2.1., thermal maturity determines if the deposits are rich in oil, gas or too immature to produce a hydrocarbon product. It allows prediction of the type of hydrocarbons present in the deposit, the amount of hydrocarbons present and the proper timing for hydrocarbon expulsion. The more thermally mature a deposit becomes, the greater the chance of producing gas.

Table 2.1 Stages of thermal maturity

Stage of thermal maturity	Temperature	Process	Product
Immature	<60°C	Bacterial and plant organic matter converted to kerogens and bitumen	Methane generated by microbial activity
Mature	60°C -160℃	Rock generates and expels most of its' oil	Oil
Postmature	>160℃	Postmature for oil/mature for gas	Gas

Thermal maturation is a major factor in determining the production of oil or gas in a geologic formation. The Core Area of the Barnett has varying thermal maturation, resulting in both oil and gas production. During thermal maturation, the geologic formation becomes porous and permeable, allowing transformation of liquid hydrocarbon (oil) into a gas (natural gas). The resulting microfractures in the rock formation are where natural gas is then trapped. Thermal maturity is measured by examining cores samples in a laboratory and analyzing their vitrinite reflectance (Ro). Oil deposits, unlike natural gas, tend to form at lower temperatures, creating more aliphatic hydrocarbon compounds.

2.4.3 Production of Aliphatic and Aromatic Compounds and Thermal Maturation

Aliphatic compounds consist of carbon and hydrogen atoms formed without a benzene ring. They may be joined by single bonds (known as alkanes), double bonds (known as alkenes) or triple bonds (known as alkynes). The carbons in an aliphatic compound can be joined together in straight chains, branched chains, alicyclic or non-aromatic rings. Most aliphatic compounds are flammable. The simplest of all aliphatic alkanes is methane (CH_4), the predominant hydrocarbon in natural gas. Other alkane compounds found in natural gas include ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}). Many other elements can be bound to the carbon backbone of aliphatic compounds, including sulfur, oxygen, nitrogen and chlorine.

Aliphatic hydrocarbons with double bonds are called alkenes. Alkene compounds found in natural gas include ethene (C_2H_4), propene (C_3H_6), 1-pentene (C_5H_{10}) and 1-butene (C_4H_8). An intermediate of ethylene from alkylation is ethyl benzene which is a precursor to styrene. Ethylene oxide, a metabolite of ethylene, is the raw material in the production of surfactants used by the natural gas industry. Other metabolites include ethyl toluene, 1,4-hexadiene and ethylanilines, which are used in the production of polystyrene. Ethylene undergoes oxidation by palladium to produce acetaldehyde. Halogenation and hydrohalogenation of ethylene produces ethyl dichloride, ethyl chloride and ethylene dibromide. Addition of chlorine molecules by oxychlorination produces polyvinyl chloride, trichlorethylene, methyl chloroform, ethyl bromide and polyvinyl lidiene.

Aliphatic hydrocarbons with triple bonds are called alkynes. The simplest of all alkynes is acetylene, created by the partial combustion of methane. It is also a side product of ethylene during the hydrocarbon cracking process ("cracking") is the process where complex heavy hydrocarbons or kerogens are broken down into smaller molecules like light hydrocarbons by breaking the carbon to carbon bond). It is unstable and explosive.

Further heating or 'cracking' of organic matter to natural gas is thought to take place at higher temperatures, which also forms higher concentrations of aromatic hydrocarbon compounds, known as Polycyclic Aromatic Hydrocarbons (PAHs; Whelan & Farrington, 2002). Polycyclic Aromatic Hydrocarbons are also referred to as Poly Aromatic Hydrocarbons or Polynuclear Aromatic Hydrocarbons (PAHs). PAHs are any class of organic molecules consisting of three or more benzene rings fused in a linear, angular or cluster arrangement. They are formed from incomplete combustion of organic matter in fossil fuels.

PAHs were one of the first atmospheric species to be identified as carcinogenic by the U.S. EPA. The U.S. EPA has since identified many PAHs as carcinogenic, mutagenic and teratogenic chemicals to humans. Benzene, although not technically classified as a PAH because it contains just one benzene ring, not multiple, has been identified by the U.S. EPA as a carcinogen for decades (U.S. EPA, 2007).

In a recent report from Cornell University, (Howarth 2010) greenhouse gas emissions from high volume slick water hydraulic fracturing (HVSWHF) obtained natural gas were estimated to be 60% more than emission from diesel fuel or gasoline and may have similar releases of GHG when compared to coal, due to direct combustion, indirect combustion and methane leaks (Howarth, 2010).

2.4.4 Vitrinite Reflectance

Vitrinite is the most common component of coal. Vitrinite is a maceral, or microscopic organic component found in coal analogous to mineral. A mineral is a naturally occurring solid chemical substance formed through geologic processes with specific physical properties in an ordered atomic structure, whereas a maceral is the microscopic product of the plant cell-wall

and woody tissues. Vitrinite reflectance (Ro) is a measurement of the thermal maturity of the petroleum source rock, as shown in Figure 2.9. The macerals have a shiny appearance resembling glass (vitreous). By measuring the vitrinite reflectance of the organic components of the source rock (kerogens), an indication of the thermal maturity of the petroleum source rock can be determined. This allows predictions of the amount of oil or gas contained within a particular reservoir. It is measured in units of reflectance or % Ro. Source rock with a Ro of <0.6% is too immature to generate hydrocarbons, 0.6-1.0 %Ro indicates the presence of oil, 1.0-1.4 %Ro indicates wet gas and >1.4-2.0 %Ro indicates dry gas. Maturity is highly variable within a geologic formation and can even vary within a field. Gas concentrations of hydrocarbon compounds can be equally as variable.

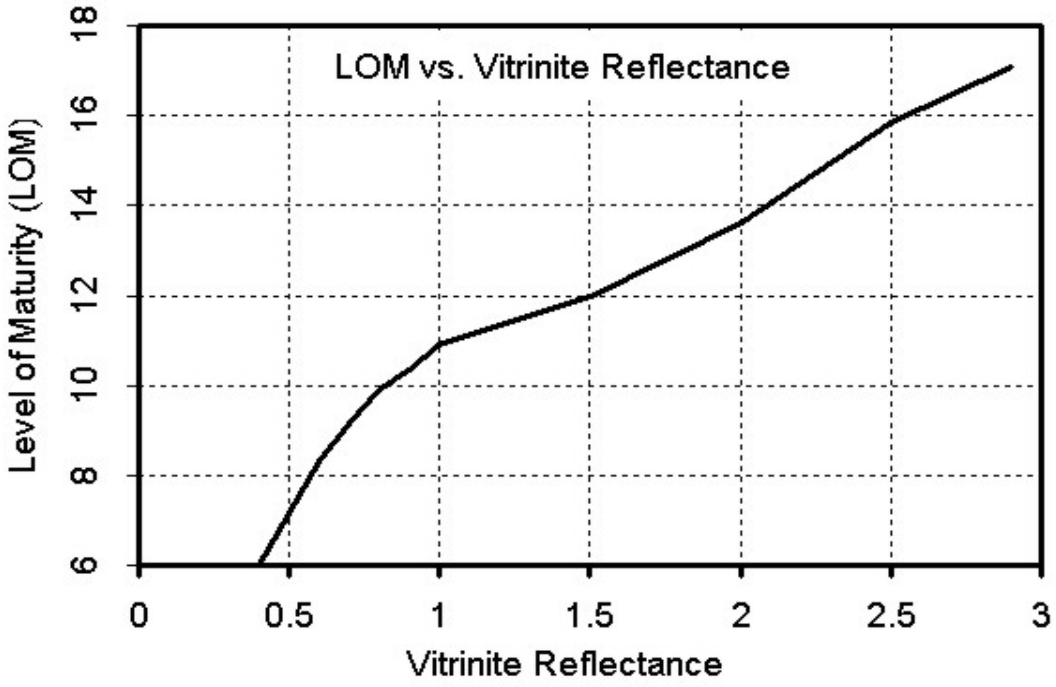


Figure 2.9 Thermal maturity of organic matter: Higher LOM reduces calculated TOC.
http://www.spec2000.net/11-vshtoc.htm

2.4.5 Wet Gas Versus Dry Natural Gas

While formation of natural gas can vary tremendously within a formation, a natural gas deposit can be referred to by two (2) general characteristics. It is defined as "wet or dry," identifying the amount of natural gas liquids or condensate present in the formation, and either "sweet or sour," identifying the content of sulfides in the formation (discussed in the next section). The majority of oil generation occurs between the 60 - 120 °C and from 0.6 %Ro - 1.0 %Ro. Natural gas generation starts at 60 – 120 °C but may continue as high as 200° C. Natural gas produced in the lower range (60°-120℃) is ref erred to as a "wet gas" and contains a lower concentration of methane (generally <85%) and a higher concentration of other compounds, including carbon dioxide, hydrogen sulfide, nitrogen, oxygen and water. Wet is not an indicator of water but rather an indicator of the presence of hydrocarbon compounds other than methane. Condensate is a mixture of low-density hydrocarbons in natural gas liquids (NGL) that can be condensed out of the raw gas by reducing the temperature of the raw gas below the hydrocarbon dew point. It is a highly saleable product.

Gas produced in the higher temperature range (120℃ - 200℃) can be considered a "dry gas," > 85% methane. It forms late in the thermal maturation and contains less condensable hydrocarbons compared to wet gas. However, this is not the only factor determining whether the deposit is a dry or wet gas; each area must be geologically analyzed and interpreted through basin modeling analyzing the level or gradient of maturity. Further tests are performed to determine the heat capacity of the formation. Table 2.2 compares different gas shales in the United States, indicating the different factors that must be evaluated to determine the content and maturity of hydrocarbon deposits.

The quality of the gas is based upon its calorific capacity measured in British Thermal Units (BTU). The calorific capacity is defined as the amount of heat supplied (in Joules) to a certain mass of a substance (in kg) so that the temperature of it increases (in Kelvin). The higher BTUs are economically preferred because they have a greater capacity to produce energy units. Unconventional natural gas calorific values can range between 1050 to 1300 BTU.

Table 2.2 Characteristics of Gas Shales in the Unites States

Property	Barnett	Ohio	Antrim	New Albany	Lewis
Depth (ft)	6,500–8,500	2,000–5,000	600–2,200	500–2,000	3,000–6,000
Gross thickness (ft)	200–300	300–1,000	160	180	500–1,900
Net thickness (ft)	50–100	30–100	70–120	50–100	200–300
Bottomhole temperature (°)	200	100	75	80–105	130–170
TOC (%)	4.5	0.0–4.7	1–20	1–25	0.45–2.5
$\%R_o$	1.0–1.3	0.4–1.3	0.4–0.6	0.4–1.0	1.60–1.88
Total porosity (%)	4–5	4.7	9	10–14	3.0–5.5
Gas-filled porosity (%)	2.5	2.0	4	5	1–3.5
Water- filled porosity (%)	1.9	2.5–3.0	4	4–8	1–2
K_h (md-ft)	0.01–2	0.15–50	1–5,000	NA	6–400
Gas content, scf/ton	300–350	60–100	40–100	40–80	15–45
Adsorbed gas (%)	20	50	70	40–60	60–85
Reservoir pressure (psi)	3,000–4,000	500–2,000	400	300–600	1,000–1,500
Pressure gradient (psi/ft)	0.43–0.44	0.15–0.40	0.35	0.43	0.20–0.25
Well costs ($1,000)	450–600	200–300	180–250	125–150	250–300
Completion costs ($1,000)	100–150	25–50	25–50	25	100–300
Water production (Bwpd)	0	0	5–500	5–500	0
Gas production (Mcf/ton)	100–1,000	30–500	40–500	10–50	100–200
Well spacing (acres)	80–160	40–160	40–160	80	80–320
Recovery factors (%)	8–15	10–20	20–60	10–20	5–15
Gas-in-place (Bcf/section)	30–40	5–10	6–15	7–10	8–50
Reserves (MMcf)	500–1,500	150–600	200–1,200	150–600	600–2,000
Historic production area basis for data	Wise Co., TX	Pike Co., KY	Otsego Co., MO	Harrison Co., IN	San Juan & Rio Arriba Co., NM

The Barnett Shale is rich in “wet gas” and therefore contains a higher BTU. However, the Core Area tends toward dry gas, although it is not completely void of natural gas liquids or condensate.

Methane in a natural gas deposit is quantified as an overall percent in relationship to the natural gas liquids. The Barnett Shale has been stated to be approximately 85% methane, with the remaining 15% possessing other volatile organic compounds (i.e. butane, ethane, propane, benzene) produced water and natural gas liquids. It has been characterized by

industry as a “dry, sweet gas” with virtually no condensate or water. Thermal maturity, which is measured in a lab through core samples by vitrinite reflectance (Ro), can identify whether a field contains wet or dry gas. A report by Pickering Energy Partners, Inc. identified a dry gas with a vitrinite reflectance of >1.4 which, according to the same report, varies significantly across the Barnett Shale. Producers in the Barnett Shale have portrayed the Newark East field as a dry gas producing little to no condensate or water. This portrayal does not coincide with the Pickering Report, field operations or the presence of field equipment as identified during this study. Furthermore, industry has not been required to support their claims and permitting applications by providing petrophysical analysis, nor has such data been provided for unbiased scientific review. This had led to controversy arising over what may be the misrepresentation of actual petrophysical data related to the presence of condensate and produced water in the Barnett Shale (Pickering Energy Partners, 2005).

2.4.6 Sweet Versus Sour Gas

The presence of hydrogen sulfide gases in natural gas deposits is the definer of whether a gas is determined to be either ‘sweet’ or ‘sour’. Natural gas can contain numerous gas compounds, including carbon dioxide (0-8%), nitrogen (0-0.2%), oxygen (0-5%), hydrogen sulfide (0-5%), and rare gases (trace elements of helium, argon, neon, xenon). Sour gas earns the name of ‘sour’ due to the presence of hydrogen sulfide in any significant amount. Sour gas is sometimes called acid gas, but this is not a correct use of the terminology according to the petroleum industry. Acid gas can contain any concentration of acidic gases including carbon dioxide; however, it would be incorrect to call it a sour gas if it did not contain significant amounts of hydrogen sulfide. Sour gas must be put through a ‘sweetening’ process where hydrogen sulfide and mercaptan compounds are removed. Hydrogen sulfide compounds are highly corrosive and cause degradation of distribution lines as well as foul equipment. The by-products of capturing hydrogen sulfide include sulfuric acid and elemental sulfur, both of which are saleable products.

2.4.7 Associated Versus Non-associated Gas

Natural gas can be produced from crude oil wells, condensate wells or dry natural gas wells. Gas produced from crude oil wells forms in a pocket either above the crude oil, or dissolved into the crude oil. This type of gas is referred to as an 'associated gas'. Natural gas from either gas wells or condensate wells is called 'non-associated gases' (Encyclopedia Britannica Online, 2010). Natural gas condensates produced from non-associated gases are liquid at ambient temperature and can have numerous hydrocarbon compounds (ethane, propane, butane, isobutene, pentanes etc.). When refined, they are referred to as Natural Gas Liquids (NGL) or Light Gas Liquids (LGL) and are used to provide raw materials for oil refineries to further produce solvents, paint thinners, glues and plastics, and to enhance the recovery process of oil in oil producing wells (Natural Gas Organization, 2010).

2.5 Environmental Impacts of Natural Gas Extraction and Processing

The uniqueness of the Barnett Shale play is that much of the untapped gas lies beneath residential and commercial communities already developed in the Dallas Fort Worth metropolitan area. Conflict has arisen over the desire of mineral owners to exercise their rights to their minerals over the right of the surface owners, amidst the needs of growing population centers in the Dallas Fort Worth Metroplex. In addition, high population growth and the need for expanding residential developments within gas rich areas in and around the city of Fort Worth conflict with the desire of the gas industry to explore and mine mineral reserves. With technological advances in horizontal drilling, urban areas have become the target of industry's exploration.

Concerns have been raised over potential environmental impacts from the fracking and drilling process. These include:

- Potential for destabilization of underlying rock underneath existing structures,
- Effect on municipal infrastructure,
- High volume use of water,

- Impact to aquifers from unsuccessful well completions,
- Potential for migration of drilling mud,
- Aquifer contamination from chemicals in the drilling mud,
- Air and odor emissions.

Although natural gas drilling is not new to Texas, drilling in an under residential communities “urban drilling” has become a hotbed of controversy due to the lack of municipal restrictions on appropriate setbacks, noise ordinances and the inability to enforce emissions standards on the natural gas producers. Urban drilling is a new phenomenon with no scientific basis for municipal setbacks and no previous long-term pilot study to examine the many effects that urban drilling can have on human populations and the community as a whole. In regions where urban drilling has been allowed, property values have seen a sharp decline, which may be a factor of perception as well as concern for exposure to emissions from neighborhood industrial refineries.

2.5.1 Air Emissions from Natural Gas Extraction and Processing

A review of the literature reveals a lack of peer-reviewed scholarly research concerning measurements of emissions from natural gas compressor stations. A 2006 study conducted by Eastern Research Group for Houston Advanced Research Center included a field survey of compressor engine sizes and types in the eastern part of Texas (Burklin & Heaney, 2006). The study estimated total VOC emission for gas production facilities using EPA AP-42 emissions factors, but did not include estimates for specific HAPs.

In January of 2009, Dr. Al Armendariz developed a white paper with calculations of concentrations from smog-forming compounds (NOx and VOCs), greenhouse gases and air toxic chemicals (Armendariz, 2009). Emissions calculations were estimated from emission quantities provided to TCEQ by operators and emission factors from EPAs AP-42 document. The AP 42 Compilation of Air Pollutant Emission Factors is a document first published by the U.S. Public Health Service in 1968 and since revised numerous times. It is a compilation of

representative values that attempt to quantify pollutants in ambient air from an industrial activity (U.S. EPA, 2010). In essence, these factors are averages of data available and only provide an estimate of emissions. In addition, the AP-42 factors have been calculated using refined natural gas rather than by-pass natural gas direct from the wellhead which powers all the nonelectric compressors in the Barnett Shale. This gas has been piped directly from the wellhead with few impurities removed. The unrefined fuel may lead to higher emissions of harmful pollutants. It may also add wear and tear on all the equipment, shortening the life of the equipment.

Several recent studies funded by the oil and gas industry have used improper field testing methodologies and thus have produced unreliable results (Hamilton & Tramm, 2011; Titan Engineering, 2010). Several factors likely undermined the validity of the data, including advanced site selection by municipalities, advanced notification to the natural gas producers of the testing, improper height of testing equipment, improper length of emissions monitoring, and improper siting of testing equipment (upwind from a facility rather than downwind).

After publication of the DISH study, TCEQ embarked on three-phase testing in DFW area (TCEQ, 2009). Concentrations were often measured for 15-to 30- minute intervals, which is not an adequate collection time for assessing health impacts, since concentrations may vary substantially depending on meteorology and industrial processes (equipment downtime, pressure releases and regular venting). In addition, many facilities had advanced notice prior to TCEQ's testing, presumably allowing for facilities to alter or minimize their normal operating volume.

Several studies examined individual chemical compounds found in natural gas emissions and identified the chemical's potential for adverse human health, but failed to link the exposure to these chemicals with natural gas emissions from pad sites or compression stations (Hayes, Songnian, Dosemeci, & Linet, 2001; Merigan, Wood, Zehl, & Eskin, 1988). U.S. Department of Health and Human Services, 2000.). This may be due to the fact that non-occupational exposures to these compounds still are not being recognized as a potential factor

in human populations not working in this industry. EPA's database of publications provided limited research related to the exposure of urban populations to fugitive emissions from natural gas facilities, due to the fact that drilling in urban areas in Texas is a recent phenomenon with no scientific basis or study addressing the effect of exposure to industrial pollutants on residential communities.

2.6 Study Objectives

Given the lack of information regarding emissions from natural gas extraction and processing, particularly regarding hazardous air pollutants, the objectives of this study are:

- To identify chemicals associated with natural gas mining and production in the Barnett Shale through passive air monitoring;
- To correlate the presence of other chemicals to the presence of methane using Pearson's Correlation;
- Using Principal Component Analysis (PCA), identify relationships between the chemicals found in ambient air sampling.

The potential of exposure of sensitive populations (e.g., children, geriatric population and women of child-bearing age) to carcinogenic and neurotoxic compounds emanating from activities related to natural gas mining has become a great concern with the increased presence of urban drilling. Placing mining operations near sensitive populations may cause disorders and diseases that can have life-long health consequences both to families and to the health care system of the State. The information in this study will provide further data to support the development of health protective standards for protection of human populations and future generations from the deleterious effect of carcinogenic and neurotoxic emissions from natural gas operations.

CHAPTER 3

METHODOLOGY

3.1 Study Question

The primary question examined in this study is “Can the presence of methane, the primary product of natural gas mining, be an indicator chemical for the presence of other volatile organic compounds? In other words, by determining the presence of methane, are we able to statistically determine and anticipate the presence of other volatile organic compounds?” Initially, the question appears elementary however; a review of literature revealed a lack of peer-reviewed scholarly research investigating this question or corresponding statistical analysis of the association of natural gas chemicals. In addition, the few studies that have been performed have failed either to monitor for the presence of methane, or to perform the proper laboratory analysis of samples for recognition of volatile organic compounds and compounds of sulfur known to be present in geologic formations of shale (TCEQ, 2009). This study will provide valuable data to determine the presence of potentially harmful compounds associated with activities related to natural gas mining and production (“urban drilling”).

3.2 Ambient Air Monitoring

Ambient air monitoring of pollutants from natural gas production facilities was performed across the Barnett Shale geologic formation. Pollutant concentrations were measured at sixty-eight (68) locations near natural gas facilities in the Barnett Shale around the Dallas Fort Worth Metroplex from 2008–2010. Random selection of the sampling locations was not possible. Random selection would have required identifying all permitted natural gas well sites located within the study area and then performing a random selection of sites where sampling could occur, assuming that all locations would agree to and allow sampling at the identified random location. In this study, locations tested were identified by clients that requested monitoring due

to concern for their environment or for health exposure. Although sample collection was prompted by client's concerns, there was no confirmation prior to sampling that the sites involved were indeed exposed to emission from well operations. Air monitoring occurred in counties in and around the DFW area, including: Parker, Tarrant, Denton, Johnson, Wise and Somerville counties. An overview of locations monitored is provided in Figure 3.1 below.

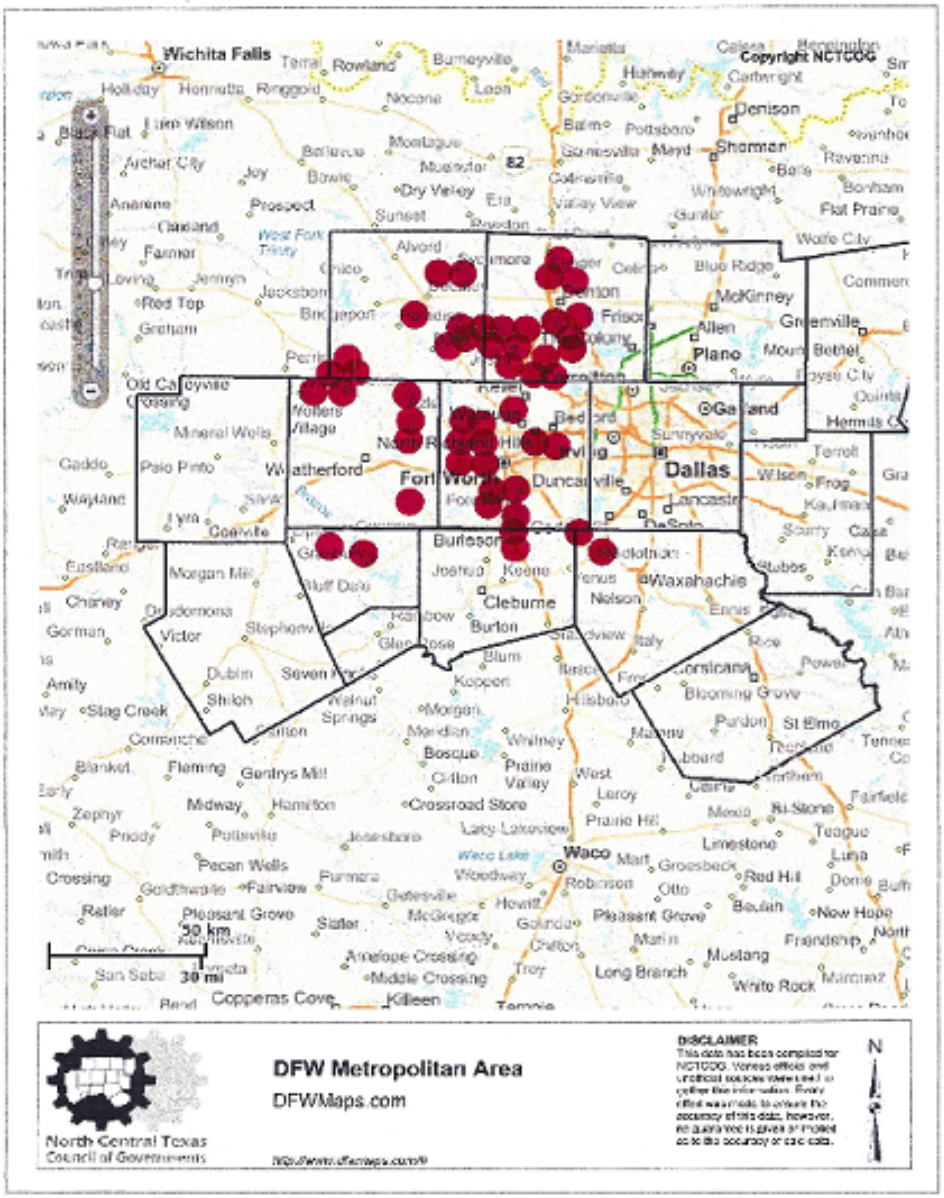


Figure 3.1 Sample locations in the Barnett Shale

The locations can be compared to a map below that identifies permitted well sites, shown in Figure 3.2. The red dots identify permitted natural gas wells within the Barnett Shale. The blue dots indicate that drillers hit large amounts of water while drilling for natural gas (so called water wells). An overview of the aquifer (Trinity Outcrop and Downdip) provides a visual relationship to heavy natural gas mining in relation to aquifers.

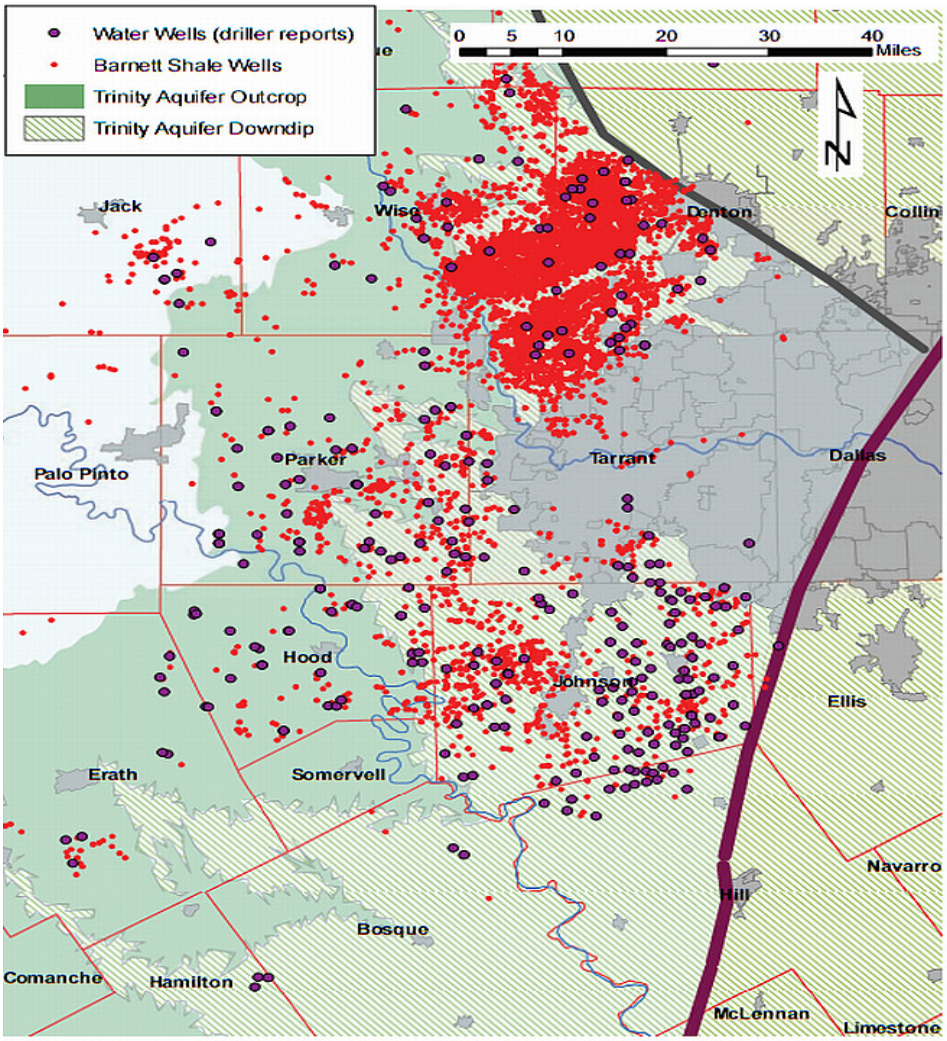


Figure 3.2 Permitted natural gas wells in the Barnett Shale.

When the two maps are compared, sampled locations appear to be representative of the counties in which urban drilling is currently occurring with the exception of Denton County,

which was slightly higher in monitored locations. This would not be unexpected as Denton County, which lies under the Core Area of the Barnett Shale, is one of the heaviest producing natural gas areas in the DFW Metroplex.

Of the original sixty-eight (68) locations monitored, four (4) locations were sampled using the grab sample field method and not monitored using 24-hour flow regulators (certified mass flow 24-hour meter). These locations were eliminated from the final statistical analysis due to the difference in field monitoring protocol. Of the sixty-four remaining locations, fourteen (14) of the samples were not analyzed by the laboratory for the presence of methane and were thus were not included in the final analysis. Fifty (50) samples remained for statistical analysis. Of the fifty (50) locations, nine (9) were sampled more than once over the two (2) year period.

Field sampling is considered a blend of technical expertise and an art form in the environmental business. While an understanding of the use and limitations of technical air monitoring equipment is paramount in performing proper collection, an understanding of the complex interactions between topography, constantly changing weather conditions (including wind speed and direction) and environmental factors that may affect collection is critical in the proper siting of the sampling equipment at a location. Proper equipment placement in the field includes a prior understanding of the general topography of the area prior to testing. An aerial photograph of all locations was evaluated prior to sampling and topographic influences identified. This included knowing the elevation of the site, the topography of the specific location tested as well as the surrounding topography that might influence collection, and location of streams, rivers, and lakes. Locations of buildings, tree canopy or dense vegetation may also affect collection abilities. Buildings or structures can affect wind, causing a downdraft effect. All Summa gas collection canisters were placed in open unforested areas when possible with no obstructions to wind and away from non-natural gas emission sources that may be present at the sites. The canisters were placed downwind, when possible from the facilities in the area. Access to secure downwind sampling locations on private property was not always possible.

The time of year the locations were sampled varied, but all seasons were well represented with the exception of QT 4 (September, October, November) which was slightly underrepresented. Table 3.1 summarizes this information. Column 1 identifies the county in which the monitoring occurred. Column 2 identifies the site sampled. Column 3 is the unique identifier assigned to each sample site. The number of times each site was sampled is given in Column 4, and the time of year the sample was taken is provided in Column 5.

The time of year has been divided in quarters aligned with seasonal changes rather than a calendar or financial quartile. Quarter 1 (QT1) represents samples taken in December, January and February. Quarter 2 (QT2) represents samples taken in March, April and May. Quarter 3 (QT3) represents samples taken in June, July and August. Quarter 4 (QT4) represents samples taken in September, October and November.

Sample locations used passive air sampling performed using certified sterilized, evacuated and pressurized stainless steel 6-liter Summa canisters. All locations were sampled using 24-hour flow regulators (certified mass flow 24-hour meter). The flow valves are regulated to allow for continuous sampling over a 24-hour period. Multiple industrial processes present at natural gas pad sites have variable emission sources and episodic maintenance schedules that may result in offline or equipment downtime. In addition, many of the processes have pressure release events that occur periodically throughout a 24-hour period, resulting in short-term maximum peak emissions concentrations. Grab samples commonly used by state agencies represent 15, 20 or 60 second or 30 minute snapshots in time. This sampling captures a minute picture when compared to a 24-hour sampling period. The potential for missing peak releases of emissions greatly increases with the use of grab sampling, when compared to 24-hour sampling periods. 24-hour sampling times are best representative of a constant exposure, particularly important to assessing the impact of emissions on children. Children are often less mobile than adults during a 24-hour period attending schools near their residence. Placement of industrial processes within an area where children are exposed to emissions both in their residence and

Table 3.1 Seasonal representation of samples

County	Site	Identifier	# times sampled	Time of year sampled			
				QT1 DJF	QT2 MAM	QT3 JJA	QT4 SON
Parker	A	101	1			1	
Parker	B	102	1		1		
Parker	C	103	1		1		
Parker	D	138,147	2	1	1		
Parker	E	140	1	1			
Parker	F	148	1		1		
Parker	G	157	1			1	
Parker	H	159	1			1	
Tarrant	A	116,121	2		1	1	
Tarrant	B	117,119	2		1	1	
Tarrant	C	118,120	2		1	1	
Tarrant	D	131	1	1			
Tarrant	E	158	1			1	
Tarrant	F	160	1			1	
Tarrant	G	161	1				1
Johnson	A	130	1		1		
Johnson	B	136	1	1			
Johnson	C	150	1			1	
Johnson	D	151, 164	2			1	1
Johnson	E	153	1		1		
Johnson	F	166	1				1
Denton	A	122	1			1	
Denton	B	123	1			1	
Denton	C	124,154	2			2	
Denton	D	125,155,129	3	1		2	
Denton	E	126	1			1	
Denton	F	127	1			1	
Denton	G	128	1			1	
Denton	H	133	1	1			
Denton	I	134	1	1			
Denton	J	137	1	1			
Denton	K	152	1			1	
Denton	L	156,162	2			1	1
Denton	M	163,169,168	3	2			1
Denton	N	165	1			1	
Somerville	A	149	1		1		
Wise	A	141	1	1			
Wise	B	142	1		1		
Wise	C	169	1	1			

school needs to be carefully evaluated, as this presents a prolonged chemical exposure for children.

Sampling procedures followed American Society for Testing and Materials (ASTM) Method D-1357 *Standard Practice for the Sampling of Ambient Atmosphere.* All canisters were obtained from the same certified air testing laboratory for consistency (GD Air Testing, Inc. 551 N. Plano Parkway, #429, Richardson, TX). The canisters were certified with a canister number and canister batch number from the laboratory verifying proper sterilization, evacuation and pressurization. Canister locations were verified by GPS coordinates. The initial time of depressurization (opening) was noted and recorded on the Chain of Custody form. Upon completion of sampling, the hand valve was closed, brass cap secured and time of closure noted. At the time of canister retrieval, canisters were inspected for damage or dents that could impact quality of sample. No dents or damage to any canisters were noted. Canisters were then returned to the laboratory in a timely fashion to insure quality of sample with proper chain of custody.

Ambient air captured in the canisters was analyzed by three separate laboratory tests: Toxic Organics (TO-14A) Volatile Organic Compound (VOC) analysis; Tentatively Identified Compounds (TIC) analysis; and Light Hydrocarbons by Automated Gas Chromatography/Mass Spectrometer Analysis using Hewlett-Packard (Agilent). Gas Chromatography/Mass Spectrometer Analysis (GC-MS) is considered to be a “gold standard” for forensic substance identification. The gas chromatograph using a capillary column can separate different molecules in a sample as it travels the length of the column. Chemicals have different retention times (time it takes for the chemical to be separated out of the sample). The mass spectrometer compares the ionized chemical to a library of chemical ion spectra comparing the results with high accuracy. The TO-14A test is performed to capture a broad range of volatile organic compounds that have been tested and determined to be stable when stored in subatmospheric pressurized canisters. The Compendium Method TO-14A approved target list is provided in

Appendix A. Identification of Tentatively Identified Compounds allows reporting of compounds that the instrumentation can detect but that the analysis is not targeting specifically. Only TICs with 70% confidence or greater were included. Light Hydrocarbon analysis is designed to capture hydrocarbons in the C1-C6 range which the normal TO-14A process may not able to detect. This would include compounds of ethane, methane, propane, and butane, which are smaller hydrocarbons. The sensitivity of the laboratory instruments must be set lower in order to be effective in detection of these compounds.

Meteorological conditions on the date of testing were retrieved from the National Climatic Data Center Quality Controlled Local Climatological Data website (www.ncdc.noaa.gov). The meteorological data recorded at the closest airport to each ambient air sampled locations was uploaded to Excel for data management. Variables retrieved from the Quality Controlled Location Climatological Database includes: date, station name, station ID, visibility, temperature (low, hi and average), wind speed (mph; low, hi and average), wind direction, wind gusts (mph), total precipitation, relative humidity (%, averaged) and sky conditions. The data is provided in Appendix B: Meteorological Summary for Air Sampling Dates in the Barnett Shale. Ambient air monitoring occurred throughout the year and is representative of varying atmospheric conditions and seasonal variations. The lowest temperature recorded was 26 °F., with the high of 104°F. Wind speed va ried from 0 mph to 26 mph, with wind gusts exceeding 17 mph recorded at 35 out of 50 sampling events (70%). Relative humidity was consistent for the area with a low of 30% to a high of 90%. Sky conditions were predominantly clear, but 8 out of 50 sampling events (16%) had a precipitation event occurring during the test period. Precipitation during an air monitoring event can diminish the concentrations measured during the test.

Variability in meteorological conditions results in variability of chemical concentrations; however, concentrations cannot be assumed to be always lower in the winter months when compared to summer months. Although evaporative emissions increase during summer

months, meteorological conditions that concentrate pollutants, such as stable conditions, may occur more frequently during winter months. According to peer reviewed articles concentrations of PAHs have been reported to actually be higher in the winter months as compared to the summer months under certain conditions.[44]

A complete examination of atmospheric chemical reactions among measured pollutants is not within the scope of this dissertation. Interactions of primary chemicals present in natural gas (methane, benzene, toluene, ethylbenzene, m- and p-xylenes, compounds of sulfur, etc.) can produce many secondary compounds. Stack sampling was not performed and is not the preferred methodology in assessing a non-occupational exposure of human populations to ambient concentrations.

3.3 Ambient Air Monitoring Database

The laboratory results along with sampled location information were uploaded to Excel for data management. The complete database with all chemicals identified from the laboratory analysis has been included in Appendix C: Air Sampling Locations and Laboratory Results 2008-2010. Column 1 of the database consists of a coded numerical identifier for each monitored site. The exact location by street address and resident name was not identified due to requirements for confidentiality. Column 2 consists of the number of sampled locations for final statistical analysis. Column 3 provides the date that the sampling event began. All sampling events can be assumed to be 24-hour periods, although the actual time the sampling event began varied during the day (a.m. vs. p.m.). Column 4 represents the county in which the sampling event occurred. Many of the counties listed (Parker, Tarrant, Denton, Johnson Wise) are counties identified by the U.S. EPA as part of the DFW ozone non-attainment areas. These specific counties have been heavily mined for natural gas since 2005. Column 5 identifies the laboratory number of the can used at the site during ambient air monitoring. Column 6 contains the unit of measurement of the chemical analysis provided by laboratory results. Column 7 - 108 lists the laboratory results of the chemical concentrations found in ambient air samples. All the

chemicals are listed in parts per billion by volume (ppbv) unless otherwise identified in row one along with their name. The top row of the database identifies the name of the chemicals found through laboratory analysis as present in the samples. The order in which the chemicals are listed in the top row does not have any particular significance. An effort was made to contain like chemicals together for sequencing (C1-C13 hydrocarbon). Methane was listed as the first chemical as the study question involves comparison of the presence of methane to the rest of the chemical constituents identified in the laboratory analysis. The columns containing results for methane, butane, propane and ethane have been highlighted as a reminder that these chemicals are listed in parts per million by volume (ppmv) rather than ppbv. Although the original laboratory results were provided in both units of micrograms per cubic meter ($\mu g/m^3$) and ppmv or ppbv; the units of $\mu g/m^3$ were eliminated in order for the statistical package to run the statistical analysis.

The chemical constituents identified for each sampling event (in ppbv) were uploaded into the database in Appendix C in their associated chemical column. If laboratory results indicated a 'non-detect (ND)' for a chemical, this indicated that the specific chemical was not detected at or above the laboratory detection limit. In analytical chemistry, the detection limit is the lowest quantity of a substance distinguished from the absence of a substance (blank value) with a confidence limit predetermined. The Practical Quantitation Limit (PQL) has been defined at the laboratory and is based upon accepted laboratory procedures. It varies from chemical to chemical and test to test and cannot be assumed to be constant for each test. The PQL is determined at the time of running the method blank or Quality Control (QC). The numerical value of the lower PQL is the lowest limit that a chemical is able to be detected through acceptable laboratory procedures for that specific date and test. An 'ND' cannot be assumed to be a true zero. Hence, if the laboratory results indicated ND, the PQL was included in the database.

In assessing how often chemical constituents are seen in the presence of methane, a table of frequency was developed for all chemicals present in laboratory results. Many of the chemical constituents appeared infrequently in samples but are included in the final statistical analysis in this study. The frequency table is included in Section 4.0 Results.

The equipment at natural gas production sites can vary widely. In order to evaluate all potential sites of influence or emission sources possibly affecting the monitoring location, three Zones of Influence represented by circular rings around the monitored locations at three (3) different spacing were analyzed. The zones were loosely aligned with municipal setback regulations. A 200- foot ring in diameter was the closest zone of influence was identified, followed by a 2,000 foot and 5,280 foot (1 mile) ring zone. The number of natural gas production sites was identified and the technology present on any site within the measured circle at the time of testing was inventoried. Equipment inventoried included the number of wells, tanks, compressors, and separators present within each Zone. Appendix D provides the complete list of equipment within the associated Zones of Influence. Column 4 includes the number of times the sampling sites were tested through the study period. Column 5 is a summary of the equipment identified within the 200 foot Zone of Influence, followed by Column 6 with equipment inventory within the 2,000 foot Zone. Column 7 includes equipment within 5,280 feet diameter of the Zone. It is important to note that natural gas equipment on a pad site (production site) can be moved and is not always static. The type of equipment present is generally based on the volume of production at the natural gas well (million cubic feet [MCF]) on the pad site. Although specific equipment can vary with engineering design specific to natural gas mining and production, the primary categories of equipment contributing large emissions include wells (drilling, fracking, flaring, venting), compression equipment, tanks for holding light gas liquids (LGL) and natural gas liquids (NGL), condensate or produced water. Other equipment contributing emissions include amine units, separators, and fuel tanks, but, since this equipment

is more difficult to inventory at each site it was not included as a primary emission source or inventoried equipment.

3.4 Statistical Analysis

The initial question translated statistically would be “Given that methane is present at a given concentration, does that indicate that Chemical A, B, C, etc is also present at some concentration?” In order to answer the statistical question posed in this study, only sites samples for methane were analyzed. As stated, of the sixty-eight (68) sampled locations, sampling events that did not use 24-hour flow meters and therefore could be considered “grab samples” were eliminated from the study for consistency of data. Additional sites where methane was not analyzed by the laboratory (fourteen sites) were not considered for statistical analysis and were deleted since the study question is interested in the presence of other chemicals assuming that methane is already present. Using this rationale a total of fifty (50) sites were considered for final statistical analysis. Summary statistics were calculated to determine basic statistical information related to chemical constituents. The minimum values, maximum values, median values, mean value, and standard deviation for each chemical were calculated. The number of times the chemical was a ND according to laboratory results was determined, with the results presented in Chapter 4, 4.1 Summary Statistics.

The probability that various chemicals were present given the presence of methane was calculated by counting the number of times each chemical was present at each site, in any amount, among the fifty (50) sites with detectable methane readings. Calculations were performed in Excel (Microsoft Office 2004) and R 2.12.0.

An ‘event’ was defined as the number of times a chemical was present. Statistical analysis of the probability of an ‘event’ occurring was defined as the number of times the event occurred over the number of times that the experiment was performed (site where methane was detected).

3.4.1 Pearson's Correlation

Further statistical analysis was performed using a Pearson's product-moment correlation coefficient (Pearson's correlation coefficient or Pearson's r) to determine the strength ofrelationship between the concentration of methane and the concentration of other volatile organic compounds. The Pearson correlation coefficient is a measure of the strength of the linear relationship, linear correlation or linear dependence between two variables X and Y; in this study methane (X) and another chemical (Y). The result provides a value between +1 and -1 which measures the strength of the linear dependence between two variables. For this analysis, all non-detect observations were coded to the detection limit. The concentration data were strongly skewed for many chemicals, so all concentrations were transformed to natural logarithms prior to calculating correlations.

3.4.2 Principal Components Analysis

To provide a more in depth analysis of the relationships of chemicals to methane and chemicals to each other, a Principal Components Analysis (PCA) was performed using the statistical program Statistica®. A PCA is a statistical technique used to analyze data where several variables are measured for each observation (here, each sampling site). It possesses the ability to identify relationships between variables and is useful to evaluate correlations between several variables simultaneously. PCA is a powerful tool for the analysis of data sets with a large number of variables.

The objective is to use one set of variables (in this case the chemical data in columns) to predict another and determine which variables predict another. It is a preferred statistical method for examining variable interactions previously undefined. PCA is able to project or predict selected variables (chemicals) based on information gained from observations of other variables, and can be of assistance in identifying the most useful variable to include in monitoring programs.

A PCA summarizes the data and allows identification of dominant patterns in the data (outliers, trends, etc). PCA determines pattern within the data sets and provides the ability to

visualize the data in such a way as to emphasize similarities and differences among observations (here, among the sample sites). With PCA, data is transformed from a large set of related variable to a smaller set of uncorrelated variables. The newly created variables are called Principal Components (PC). Each PC creates an axis in multidimensional space calculating the distance between samples. Each variable contributes to the PC with a corresponding coefficient. A high coefficient indicates a strong contribution of the original variable to the PC. Plotting the coefficients of original variables on the PC axes allows for visualization of how the variables contribute to differences and similarities among samples. PCA provides a comprehensive statistical analysis and ability to identify and evaluate the relationships present in a dataset with a large number of variables. For this analysis, all non-detect observations were coded to the detection limit. The concentration data were strongly skewed for many chemicals, so all concentrations were transformed to natural logarithms prior to calculating correlations.

CHAPTER 4

RESULTS

4.1 Analytical Objectives and Site Characteristics

Samples from fifty (50) sampling events were included in statistical analyses. The analyses focused on the following questions:

- What chemicals are present at what concentrations in ambient air samples at sites typical of properties in the Dallas-Fort Worth metropolitan area near gas wells?
- What are the relationships among the concentrations of various chemicals in ambient air samples at sites typical of properties in the Dallas-Fort Worth metropolitan area near gas wells?
- Are concentrations of other chemicals associated with that of methane, the primary product of natural gas production?
- Do patterns of correlation among particular compounds provide signatures of emissions associated with different aspects of gas well operations?

Ambient air samples for this study were obtained at sites where property owners requested air sampling due to their concerns about emissions from nearby gas wells. Thus the data do not arise from a random sampling of sites exposed to such emissions from well operations in the Dallas-Fort Worth metropolitan area. To assess whether the sample sites are representative of potential exposure to such emissions, a random sample of thirty (30) locations in the City of Fort Worth was selected to determine the average distance to a well site within the City of Fort Worth. The City of Fort Worth was selected as the largest city in the Metroplex with urban drilling and the one with the most complete access to information on zoning. Dallas currently has no pad sites developed within the city and could not be used for comparison.

In randomly selected locations, the average distance to a well site was identified to be at 2,350 feet with a standard deviation of 1,730 feet. In the evaluation of equipment within the Zones of Influence associated with locations where ambient air samples were obtained, the distance from the sample site to the nearest natural gas facility was calculated in three Zones of Influence (200 foot, 2,000 foot and 5,280 foot). In all, 39 sites in the Barnett Shale were sampled at least once. Within the 200 foot Zone of Influence, 11 of 39 sites (28%) had wells, 7 of 39 sites (18%) had tanks and 5 of 39 sites (13%) had compressors present. Within the 2,000 foot Zone of Influence 24 of 39 sites (62%) had wells present, 19 of 39 sites (49%) had tanks present, 16 of 39 sites (41%) had compressors present. In the 1 mile Zone of Influence; 38 of 39 sites (97%) had wells present, 36 of 39 sites (92%) had tanks present and 31 of 39 sites (79%) had compressors present. Compared to the average of randomly selected sites, many of the sampled sites were below the average distance to a well site and thus were likely to be closer to impacts from natural gas sites.

4.1.1 Concentration of Chemical in Ambient Air

Standard summary statistics were computed to answer the first research question concerning concentrations of chemicals in ambient air samples from sites in the Dallas/Fort Worth metropolitan area near gas wells (Table 4.1). The minimum and maximum concentration of each chemical, the median value, mean, standard deviation and number of ND results are summarized. Several of the chemicals showed a wide range between the minimum and maximum values. High maximum values (in ppbv) were recorded for methane (457), benzene (592), toluene (276), trimethylbenzene (366), 2-methylbutane (3620), 3-methylhexane (2300), C5 hydrocarbon (6780), C7 hydrocarbon (2390), C8 hydrocarbon (1420), and methacrolein (1710). Methane, benzene, toluene, 2-methylbutane, 3-methylhexane, C5, C7, C8 hydrocarbon and methacrolein, each had a single site observation with a higher concentration than other observations. Trimethylbenzene had several high observations of high concentration, although, the maximum value corresponded to the same ambient air sampling event where several other

Table 4.1 Summary statistics

CAS #	Chemical	Min ppbv	Max ppbv	Median ppbv	Mean ppbv	*SD*	#ND
74828	Methane (ppmv)	1.9	457	2.7	11.99	63.58	1
71432	Benzene	0.6	592	0.89	18.53	83.75	11
67663	Chloroform	0.2	2.58	0.3	0.45	0.46	45
74873	Chloromethane/Methyl chloride	0.25	5.33	0.6	0.68	0.71	17
75718	Dichlorodifluoromethane (F12)	0.25	1.13	0.45	0.48	0.17	9
76142	Dichlorotetrafluoroethane (F114)	0.2	1	0.3	0.36	0.17	47
107062	1,2-Dichloroethane (EDC)	0.2	1	0.3	0.34	0.15	49
75092	Dichloromethane/Methylene chloride	0.2	1	0.3	0.34	0.15	49
100414	Ethylbenzene	0.2	113	0.53	4.42	16.03	21
87683	Hexachlorobutadiene	0.25	2.6	0.7	0.73	0.46	43
100425	Styrene	0.2	43.4	0.37	1.91	6.22	26
79345	1,1,2,2-Tetrachloroethane	0.2	2.06	0.3	0.37	0.28	49
127184	Tetrachlorethene (PCE)	0.2	2.43	0.3	0.33	0.39	47
108883	Toluene/Methyl benzene	0.34	276	2.55	19.45	48.77	2
71556	1,1,1-Trichloroethane (TCA)	0.2	1	0.3	0.34	0.15	50
79005	1,1,2-Trichloroethane	0.2	1	0.3	0.34	0.15	50
108678	1,3,5-Trimethylbenzene	0.2	9.95	0.59	1.43	2.12	25
95636	1,2,4-Trimethylbenzene	0.2	60.4	0.4	3.45	10.79	27
120821	1,2,4-Trichlorobenzene	0.28	13.5	0.67	1.12	1.93	41
79016	Trichlorethene (TCE)	0.2	60.9	0.3	1.58	8.48	47
75694	Trichlorofluoromethane (F11)	0.2	1	0.3	0.34	0.15	45
1330207	m&p Xylene	0.25	221	1.68	15.69	43.1	7
95476	o-Xylene	0.2	39.4	0.85	3.19	6.7	15
75150	Carbon disulfide	0.7	103	4	11.75	20.5	22
463581	Carbonyl disulfide	0.3	36.7	1.41	4.22	7.1	40
924920	Dimethyl disulfide	0.3	200	1.93	15	31.56	29
20333395	Methyl ethyl disulphide	0.3	145	1.78	11.18	24.27	29
611143	Ethylmethyl benzene	0.3	42.8	1.4	3.15	6.74	47
2179604	Methyl propyl disulfide	0.3	41.6	1.4	2.59	5.71	49
110816	Diethyl disulfide	0.3	32.7	1.5	3.15	5.92	45
53966362	Ethyl, methylethyl disulfide	0.3	46.7	1.4	3.68	8.87	46
3658808	Dimethyl trisulfide	1.2	46.3	1.52	8.02	14.86	36
30453317	Ethyl n-propyl disulfide	0.3	25.2	1.4	2.25	3.48	48
95636	Trimethyl benzene	0.3	366	1.4	15.18	58.39	46
1120214	Undecane	0.3	72	1.4	3.05	9.88	49
2082613	1-Methyl propenylbenzene	0.3	51	1.4	2.63	6.96	49
112403	Dodecane	0.3	29	1.4	2.19	3.91	49

Table 4.1 - continued

CAS #	Chemical	Min ppbv	Max ppbv	Median ppbv	Mean ppbv	SD	#ND
767599	1-Methyl-1H Indene	0.3	79	1.4	3.19	10.86	49
768490	2-Methyl propenyl benzene	0.3	95.9	1.4	3.53	13.22	49
103651	Propyl benzene	0.3	23.5	1.4	2.08	3.16	49
25340174	Diethyl benzene	0.3	93.4	1.4	4.14	13.56	48
19876	Methyl-methylethylbenzene/methyl-cumene	0.3	84.7	1.4	3.31	11.65	48
110189	Tetramethyl benzene	0.3	36.4	1.4	2.76	5.69	48
91203	Napthalene/Trimethylbicyclo2.2.1 heptane	0.3	30.3	1.4	2.5	4.27	47
109068	Methyl pyridine	0.3	210	1.4	5.81	29.18	49
108485	Diemethyl pyridine/Aldrich	0.3	47.2	1.4	2.56	6.43	49
100710	Ethyl pyridine	0.3	69.4	1.4	3	9.52	49
78784	2-Methylbutane	0.3	3620	1.41	88.04	507.51	44
109660	Pentane	0.3	198	1.41	7.73	28.59	45
108087	2,4-Dimethylpentane	0.3	50	1.4	2.61	6.82	49
963772	Methyl cyclopentane	0.3	22	1.4	2.4	3.75	48
591764	2-Methylhexane	0.3	35.3	1.4	2.71	5.44	48
565593	2,3-Dimethylpentane	0.3	98	1.4	3.57	13.51	48
589344	3-Methylhexane	0.3	2300	1.4	49.02	321.63	46
108872	Methyl cyclohexane	0.3	38	1.4	2.42	5.15	48
540841	2,2,4-Trimethylpentane	0.3	17	1.4	1.95	2.29	49
	C3 Hydrocarbon	0.3	51.4	1.5	5.57	9.7	42
	C4 Hydrocarbon	0.3	137	1.4	6.6	21.61	45
	C5 Hydrocarbon	0.3	6780	1.65	145.24	947.97	30
	C6 Hydrocarbon	0.3	294	1.6	18.06	51.83	30
	C7 Hydrocarbon	0.3	2390	1.5	56.64	333.96	38
	C8 Hydrocarbon	0.3	1420	1.5	39.44	199.78	38
	C9 Hydrocarbon	0.3	761	1.41	19.78	106.43	42
	C10 Hydrocarbon	0.3	191	1.5	11.75	30.7	37
	C11 Hydrocarbon	0	53.6	1.4	3.92	9.51	46
	C12 Hydrocarbon	0.3	395	5	23.81	59.1	23
	C13 Hydrocarbon	0.3	231	1.57	10.88	35.03	40
76641	Acetone	0.3	20.7	1.4	2.04	2.81	49
74986	Propane (ppmv)	1	62.9	1.4	2.97	8.65	48
106978	Butane (ppmv)	1	69	1.4	2.95	9.45	48
74840	Ethane (ppmv)	1	34.6	1.4	2.24	4.66	49
75285	Isobutane	0.3	34	1.5	3.95	6.38	39
79925	Camphene	0.3	5.2	1.4	1.65	0.81	49

Table 4.1 - continued

CAS #	Chemical	Min ppbv	Max ppbv	Median ppbv	Mean ppbv	SD	#ND
592574	Cyclohexadiene	0.3	7.1	1.4	1.76	1.1	49
103651	Propynyl benzene	0.3	7.2	1.4	1.74	1.13	49
226666	Diethyl trisulfide	0.3	8.23	1.41	2.14	1.62	44
513359	Methyl butane	0.3	16	1.4	1.93	2.16	49
2511957	Dimethylcyclopropane	0.3	29	1.4	2.19	3.91	49
75832	Dimethylbutane/neoheptane	0.3	15	1.4	1.91	2.03	49
107835	Methylpentane/isohexane	0.3	199	1.4	6.1	27.79	48
110543	Hexane	0.3	35	1.4	2.46	4.81	48
138863	Limonene	0.3	12.9	1.4	2.14	2.15	47
	Dimethylpentatnone	0.3	42.8	1.4	2.47	5.82	49
	Bromohexene	0.3	5.2	1.4	1.69	0.84	49
3728550	Ethylmethylcyclohexane	0.3	6.1	1.4	1.82	1.15	48
4316658	Trimethylhexene	0.3	11.9	1.4	1.85	1.64	49
1072168	Dimethyloctane	0.3	20.4	1.4	2.02	2.74	49
7785708	1-R-alpha-pinene/2-Pinene /2.6.6Trimethylbicyclo[3.3.1]hept-2-ene	0.3	29	1.4	2.18	3.91	49
108102	Methyl isobutal ketone	0.3	5.2	1.4	1.64	0.79	50
496117	Indane	0.3	15.2	1.4	1.9	2.06	49
590738	2,2-Dimethylhexane	0.3	168	1.4	4.97	23.3	49
251412	Thieno[3,2] thiophene	0.3	56.5	1.5	5.18	10.7	44
78853	Methacrolein	0.3	1710	1.4	35.74	239.18	49
106467	1,4-Dichlorobenzene	0.2	4.43	0.3	0.55	0.66	45
591764	Methylhexane	0.3	25	1.4	2.11	3.66	46
75694	Trichlorofluoromethane	0.3	5.2	1.4	1.64	0.79	49
75456	Difluorochloromethane	0.3	45	1.4	2.51	6.12	48
137631	Tetramethylcylclopentane	0.3	9.24	1.4	1.79	1.33	49
4926787	Ethyl methyl cyclohexane	0.3	5.68	1.4	1.78	1.04	48
6069983	Methyl methylethyl cyclohexane	0.3	6.17	1.4	1.73	1.01	49
543599	Chloropentane	0.3	5.2	1.4	1.65	0.8	49
592574	1,3-Cyclohexadiene	0.3	5.8	1.4	1.73	0.98	49
60779240	Methyl n-butyl disulfide	0.3	15.5	1.4	1.92	2.1	49
72437640	Propyl n-butyl disulfide	0.3	14.6	1.4	1.9	1.98	49
629196	Dipropyl disulfide	0.3	23.1	1.4	2.07	3.11	49

chemicals had their maximum value. The one observation with unusually high concentrations of several chemical constituents can possibly distort statistical analyses and was evaluated for elimination during the statistical analysis. However, no information suggested errors in field collection or chemical analysis, so these data were retained for further statistical analysis. Due to skew resulting from this and other unusually high observations, subsequent analyses were conducted with logarithmically transformed data. The median concentration may be a better indicator of the typical concentration that is the mean for these skewed data. Minimum values in the table typically were the Practical Quantitative Limits (PQL) of laboratory results.

Several chemicals were detected in only one sampling event (49 ND) out of 50 sample events). Chemicals with 2 detected results out of 50 were also present (48 ND out of 50 sampling events). Despite the high skew that results from such data, the occurrence and concentrations observed for these chemicals might convey useful information; therefore, for the purpose of this study were retained for the initial statistical analysis. Because these analyses require quantitative data and cannot handle large numbers of missing values, concentrations were coded at the PQL for observations reported as ND.

4.1.2 Correlations Among Concentrations of Chemicals in Ambient Air Samples

Further statistical analysis was performed using a Pearson's product-moment correlation coefficient to determine the strength of the relationship between the concentrations of chemicals in ambient air samples, focusing on the correlations of methane with other volatile organic compounds. Pearson's correlation coefficient was calculated for all compounds that were present at 50% or more of the sites to minimize the impact of missing (or undetectable) measurements. A natural log transformation was applied to the measurements of each chemical to further reduce the influence of skew in the data.

The correlation matrix for all compounds which were present at detectable levels in at least 50% of the sampling events shows several strong correlations (Figure 4.1). Notable correlation coefficients include that between benzene and toluene at r = 0.89, and benzene to

	Methane	Benzene	Chloro methane	Dichloro difluoro methane	Toluene	M&P-xylene
Methane	1					
Benzene	-0.0757	1				
Chloromethane	-0.2843	0.0723	1			
Dichlordifluoro-methane	-0.2022	-0.0791	-0.0999	1		
Toluene	-0.1219	0.8927	0.1292	-0.1324	1	
M&P Xylene	0.0169	0.8658	0.0686	-0.1368	0.9543	1
C12hydrocarbon	-0.1806	0.1823	-0.1746	0.2925	0.1744	0.257

Figure 4.1 Pearson's correlation all compounds regardless of the presence of methane

m- and p- xylene at r = 0.86. Toluene (methylbenzene) was also highly correlated to m- and p-xylene (1,3-dimethylbenzene and 1,2-dimethylbenzene), with r = 0.95.

Evaluation of the full correlation matrix identified several pairs of chemicals with very high correlations approaching 1; for this sample size (n=50), correlations that exceed 0.2787 are significant at $\alpha = 0.05$. Several correlations estimated at 1.00 are presented in Table 4.2 below. In addition to the chemicals correlated at 1.0, numerous chemicals were highly correlated at >0.90, with several at 0.99. The complete database is provided in Appendix E.

Some of the high correlations and the strong relationships indicated among these chemicals likely arise from similarities in their chemical structures. For example, dodecane is a liquid hydrocarbon and undecane is also. Similarities in other hydrocarbons involve substitutions at different molecular positions (e.g. 1,1,1-trichloroethane and 1,1,2-trichloroethane). Interestingly, 1,1,1-trichloroethane is more commonly known as methyl chloroform and is an industrial solvent, and industrial solvents are commonly used in natural gas mining and production processes. `

The concentrations of numerous chemical constituents significantly correlated to that of methane (Table 4.3). These include chemicals likely to be present in natural gas and or to be

Table 4.2 Chemical correlations at 1.0; when *n* = 50

Chemical	Correlation alpha = 0.05	Chemical
1,2 Dichloroethane	1.0	Dichloromethane
	1.0	1,1,1 Trichloroethane
	1.0	1,1,2 Trichloroethane
Dichloromethane	1.0	1,1,1 Trichlorethane
	1.0	1,1,2 Trichloroethane
Undecane	1.0	1 -Methyl propenylbenzene
	1.0	Dodecane
	1.0	1-Methyl-1H Indene
	1.0	2 Methyl propenylbenzene
	1.0	Propylbenzene
Methyl pyridine	1.0	Diemethyl pyridine
	1.0	Ethyl pyridine
	1.0	Trichloromonofluoromethane
	1.0	Chloropentane
2,4 Dimethylbenzene	1.0	2,3 Dimethylbenzene
Dimethyl butane	1.0	Methyl butane
	1.0	Dimethylcyclopropane
	1.0	Methyl hexane
Methyl Isobutane	1.0	Methy pyridine
	1.0	Diemethyl pyridine
	1.0	Ethyl pyridine
	1.0	Trichloromonofluoromethane
	1.0	Chloropentane
Methyl n-butyl disulfide	1.0	Propyl n- butyl disulfide
	1.0	Dipropyl disulfide

Table 4.3 Correlation of methane to chemicals constituents

Chemical	To methane correlated	Chemical	
Methane	1.00	Trimethyl hexane	0.37
Methacrolein	0.90	Dimethyl butane	0.37
Ethane	0.86	2,3-Dimethylpentane	0.37
3-Methyl hexane	0.81	Tetramethyl cyclopentane	0.36
C5 Hydrocarbon	0.68	Methyl butene	0.36
C9 Hydrocarbon	0.68	Methyl cyclopentane	0.36
2-Methyl butane	0.64	Hexachlorobutadiene	0.36
1,1,1-Trichloroethane (TCA)	0.58	2,2-dimethylhexane	0.35
1,1,2-Trichloroethane	0.58	Tetrachloroethene (PCE)	0.35
1,2-Dichloroethane (EDC)	0.58	C4 hydrocarbon	0.34
Dichloromethane (Methylene chloride)	0.58	Dimethyloctane	0.34
C7 Hydrocarbon	0.55	Methyl n-butyl disulfide	0.34
C8 Hydrocarbon	0.55	Propyl n-butyl disulfide	0.34
Trichlorofluoromethane (F-11)	0.53	Dimethyloctane	0.34
Methyl pyridine	0.49	Methyl hexane	0.33
Dimethyl pyridine	0.49	Indane	0.33
Ethyl pyridine	0.49	Propynyl butane	0.33
Trichloromonofluoromethane	0.49	C6 hydrocarbon	0.33
Chloropentane	0.49	1,2,4-Trichlorobenzene	0.33
methyl isobutal ketone	0.49	Dimethylcyclopropane	0.32
Camphene	0.48	2-Methylhexane	0.32
Dichlorotetrafluoroethane (F114)	0.47	Dipropyl disulfide	0.31
Bromohexene	0.46	Dodecane	0.30
1,3 Cyclohexadiene	0.45	1-R-alpha-pinene	0.29
Trimethylpentane,2,2,4	0.45	Dimethyl pentane	0.29
Propane	0.42	Hexane	0.29
Ethylmethyl cyclohexane	0.40	Diethyl trisulfide	0.29
Methyl methylethyl cyclohexane	0.40	Propyl benzene	0.29
Ethylmethylcyclohexane	0.40	Chloroform	0.29
Methyl cyclopentane	0.40	Methyl propyl disulfide	0.28
Cyclohexadiene	0.40		
2,4-Dimethylpentane	0.40		
Cyclohexadiene	0.38		
Acetone	0.38		

used in the extraction of natural gas. All the correlations in question are positive, indicating that many chemicals increase in concentration as methane increases in concentration. Given the sample size (n = 50), any correlation exceeding 0.2788 is significant at $\alpha = 0.05$. Chemical highly correlated to the presence of methane included: methacrolein, ethane, 3-methyl hexane, 2-methyl butane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,2-dichloroethane, dichloromethane, trichlorofluoromethane and C5,7,8,9 hydrocarbons. Chemicals significantly correlated to the presence of methane and indentified as HAPs by U.S. EPA included: 1,1,1-trichloroethane (methyl chloroform), 1,1,2-trichloroethane, 1,2-dichloroethane (ethylenedichloride), dichloromethane (methylene chloride), methyl isobutyl ketone (hexone), 2,2,4-trimethylpentane, hexachlorobutadiene, tetrachloroethene, 1,2,4-trichlorobenzene, hexane and chloroform.

4.1.3 Principal Components Analysis

4.1.3.1 PCA Analysis: Chemical Constituents

The findings that concentrations of several chemicals tend to increase when methane concentration increases suggests that these samples captured emissions from nearby gas well operations. To further examine relationships among the concentrations of chemicals found in these samples, a Principal Components Analysis (PCA) was performed on their correlations, with the goal of determining whether potential signatures could be identified for gas well emission or even for emissions associated with particular well operation.

The objective of a PCA is to take a large set of variables and derive synthetic variables (Factors) summarizing patterns of correlation in the original variables. Each variable contributes to the Factor with an according coefficient. Plotting the coefficients of original variables on the Factor axes allows a visualization of how variables contribute to differences and similarities among samples. In a PCA, the first Factor is calculated as the linear combination of the original variables that maximizes variance among samples. Mathematically, this is accomplished by finding the largest eigenvalue of the correlation matrix for the data. The first Factor is then the corresponding eigenvector. Its eigenvalue measures the amount of the total variance that is

expressed on the first Factor axis. A second Factor is then calculated from the eigenvector corresponding to the second-largest eigenvalue. It expresses as much of the remaining variance in the data as possible, subject to the constraint that the second Factor is uncorrelated to the first. Subsequent Factors are similarly calculated from eigenvalues and eigenvectors, so that they are uncorrelated with previous factors. The total number of PCA Factors is limited by the smaller of the number of original variables or the number of samples.

The eigenvalues are calculated in decreasing order, and cumulatively the first few of the PCA Factors calculated express most of the variance in the data, and thus summarize dominant patterns and relationships among samples. For these data, the first three PCA Factors express almost half (47%) of the variance, while the first ten express about three quarters (76%) of the variance (Table 4.4).

Table 4.4 Eigenvalues

	Eigenvalue	% total variance	Cumulative eigenvalue %	Cumulative %
1	32.44	30.90	32.44	30.90
2	10.38	9.88	42.82	40.78
3	6.76	6.44	49.58	47.22
4	6.10	5.81	55.68	53.03
5	5.16	4.91	60.84	57.94
6	4.86	4.62	65.69	62.56
7	4.15	3.95	69.84	66.52
8	3.67	3.50	73.51	70.01
9	3.45	3.29	76.96	73.30
10	2.77	2.64	70.73	75.94

The top 3 Factors accounted for close to 50% of the variance, so further analysis focuses on them. Chemicals that contributed strongly to PCA Factor 1, with coefficients >0.8, all had negative coefficients (Table 4.5), and the highest positive coefficients were less than 0.2. Chemicals that contributed strongly to PCA Factor 2 all had positive coefficients (Table 4.6),

Table 4.5 Chemicals associated with factor 1

	Factor 1
Methyl isobutal ketone	-0.962
Trichloromonofluoromethane	-0.962
Chloropentane	-0.957
Camphene	-0.955
Bromohexane	-0.920
1,3 Cyclohexadiene	-0.863
Methyl methylethylbenzene	-0.858
Dichloromethane	-0.847
1,1,1-Trichlorethane	-0.845
1,1,2-Trichlorethene	-0.845
1,2-Dichloroethane	-0.844
Indane	-0.825
1-Ethyl,3-methyl cyclohexane	-0.822
Cyclohexadiene	-0.816
Tetramethylcyclohexane	-0.806
Trichlorofluoromethane	-0.802
1-Ethyl,4-methyl cyclohexane	-0.794
Ethane (ppmv)	-0.792
Methacrolein	-0.780

Table 4.6 Factor 2 high coefficients

	Factor 2
o-Xylene	0.904
Ethylbenzene	0.876
1,2,4 Trimethylbenzene	0.854
m&p Xylenes	0.818
1,3,5 Trimethylbenzene	0.810

and the lowest negative coefficients were all greater than – 0.5. For PCA Factor 3, no chemicals had coefficients > 0.8 in magnitude. The most strongly related chemicals were methyl ethyl disulphide (coefficient = 0.698), ethyl methylethyl disulfide (coefficient = 0.675) and dimethyl disulfide (coefficient = 0.539).

Plotting the coefficients of the original variables (chemical concentrations) of the PC Factor axes then allowed for visualization of the data. Plotting coefficients for Factors 1 and 2 (Figure 4.2) reveals that several chemicals with extreme values tightly grouped along the x-axis presenting strong relationships among concentrations of these chemicals (plotting close to -1.0 on the x-axis of Figure 4.2).

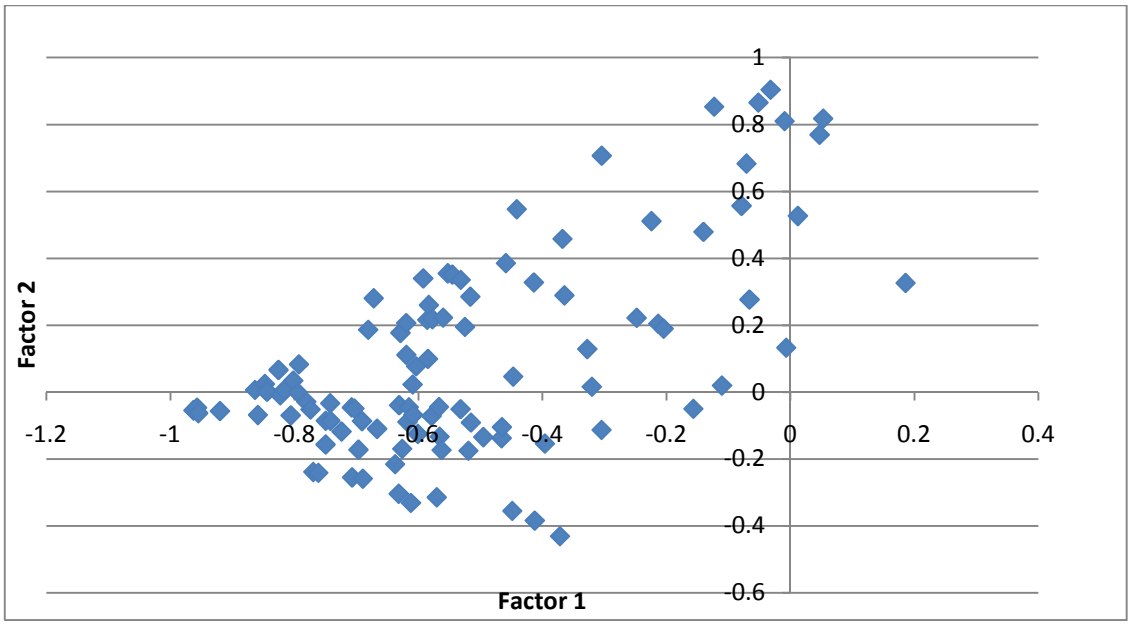


Figure 4.2 PCA Coefficients for chemicals factor 1 and 2

The chemicals with the strongest relationships indicated include: methyl isobutyl ketone (MIBK), trichloromonofluoromethane, chloropentane, camphene, and bromohexene. These chemicals were generally low in concentration, except for methyl isobutyl ketone, and were infrequently detected in ambient air monitoring and therefore contained numerous ND

observations. However, these chemicals are commonly used in drilling or fracking compounds as solvents and blowing agents (aerosol propellants).

Other chemicals with less extreme values on Factor 1, but also plotting with moderately to strong negative values included: 1,3 cyclohexadiene, methyl methylethyl cyclohexane, dichloromethane, 1,1,1-trichloroethane, indane, ethylmethyl cyclohexane, cyclohexadiene, tetramethyl cylopentane, methacrolein, trimethylhexene. Structurally, these chemicals are very similar. Both frequencies and concentrations of these chemicals were low. Many of these chemicals are related terpinenes (1,3 cyclohexadiene, methyl, methylethyl cyclohexane, tetramethyl cyclopentane (1,2 dihydrobenzene), and solvents (dichloromethane) and are present in coal tar (indane [hydrindonapthlene], trimethylhexene).

The extreme positive values identified along Factor 2 (the Y-axis of Figure 4.2) are chemicals with high frequency (that were consistently detected throughout ambient air monitoring). These high frequency chemicals had varying concentrations. Higher concentrations were seen in the presence of methane, indicating a possible source of natural gas production rather than background levels in ambient air. The extreme positive values include: m&p xylene (1,3 dimethylbenzene & 1,4 dimethylbenzene), toluene (methylbenzene), styrene (vinyl benzene), 1,3,5-trimethylbenzene, o-xylene (1,2 dimethylbenzene), ethylbenzene, dimethyl trisulfide, benzene, carbon disulfide, 1,2,4-trimethylbenzene, and C11 hydrocarbon (unspeciated). Many of these compounds are benzene compounds commonly extracted from crude oil and crude benzole from gas.

When plotting PCA coefficients of the chemical concentrations for Factors 1 and 3 (Figure 4.3), the same extreme values were present along the x-axis (Factor 1). Chemicals plotting near the intersection of Factors 1 and Factor 3 included many of the same compounds that plotted high on Factor 2 in Figure 4.3. These chemicals are high in frequency and concentration. Chemicals with extreme positive values for Factor 3, included: methyl ethyl disulfide, dimethyl disulfide, ethyl methyl ethyl disulfide. Therefore, this factor is strongly related

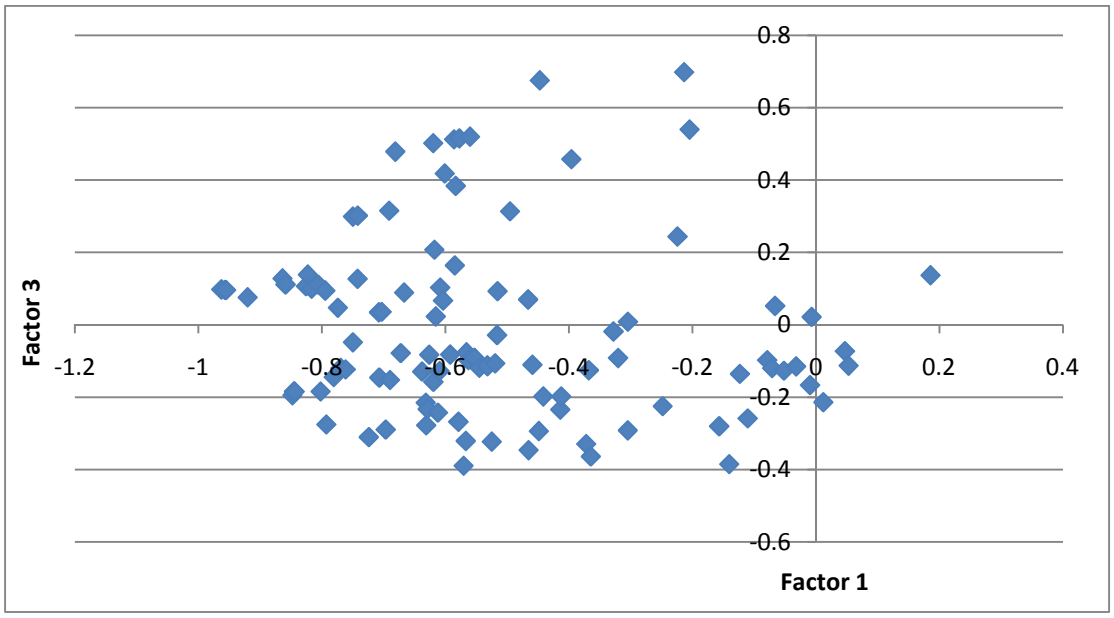


Figure 4.3 PCA coefficients for chemicals: Factor 1 and 3

to sulfide chemicals. The frequency with which these chemicals were detected was relatively high (approximately 40-50%) and they had both high and moderate concentrations.

4.1.3.2 PCA Analysis: Sample Site

Further PCA evaluation was performed analyzing the scores of sample sites for the first three PCA factors (Table 4.7). The position of samples on these plots, in relation to the corresponding positions of coefficients for chemicals, helps determine whether particular groups of chemicals can distinguish among sites, and to identify sample sites with similar and differing chemical composition in ambient air samples. Similarities and differences in chemical composition among sites can potentially be related to differences in equipment and operations at nearby gas wells.

In evaluating the graph of the sample sites for PCA Factor 1 and 2 (Figure 4.5), it initially appeared that there might have been an outlier, at the value (-25) along PCA Factor 1. In evaluating the two points directly next to the presumed 'outlier' (-18, -15) along Factor 1, it became apparent that the potential outlier might in fact convey important information. In

Table 4.7 PCA sample site scores

Site#	Factor 1	Factor 2	Factor 3
1	-6.848	4.464	1.0427
2	0.056	1.349	0.812
3	-0.980	-1.671	0.258
4	3.095	-2.227	4.900
5	-16.793	-0.287	-0.242
6	2.431	-1.336	1.778
7	3.138	-2.029	0.780
8	4.944	-2.475	0.642
9	4.160	-2.195	1.995
10	4.096	-2.001	0.237
11	-1.513	6.505	9.572
12	0.472	9.305	-3.427
13	0.378	9.968	-3.046
14	2.892	-1.068	1.037
15	-1.713	-3.653	-3.058
16	3.062	-2.032	-0.245
17	3.167	0.294	-0.590
18	5.747	-2.559	0.239
19	-15.116	0.043	-0.810
20	-4.203	-1.915	0.033
21	1.797	2.172	0.473
22	-1.907	-6.266	-4.934
23	-3.928	-1.747	0.301
24	-0.548	-0.978	-0.071
25	-1.341	4.658	-1.621
26	0.926	-4.485	-3.872
27	3.034	-1.376	1.184
28	-0.274	-0.286	-0.835
29	3.371	-1.341	-0.220
30	-0.237	-0.952	0.925
31	-0.175	2.114	-0.124
32	1.095	0.670	-0.480
33	0.066	1.534	-0.054

Table 4.7 – continued

Site#	Factor 1	Factor 2	Factor 3
34	0.041	2.711	1.581
35	2.091	1.991	-1.541
36	2.374	1.275	1.264
37	21.115	3.008	-6.690
38	-3.271	-0.280	-0.806
39	0.576	-0.329	-0.610
40	-23.312	-0.260	-4.041
41	1.472	4.962	-0.764
42	2.589	0.068	0.799
43	1.586	-2.156	0.009
44	1.732	-2.162	0.452
45	-0.520	-1.444	5.899
46	1.441	0.629	0.265
47	-0.119	-2.288	0.627
48	1.433	-2.981	0.281
49	-4.042	-1.225	-0.131
50	2.4650	-1.715	0.827

examining the original data and records of air sampling events, two of these three observations represented likely are releases of natural gas to the atmosphere at nearby well sites. For the third observation, numerous simlutaneous operations occurred nearby, some of which could release natural gas.

The strong value (-25) on Factor 1 was obtained when there was a nearby uncontrolled well, commonly called a ‘blown’ well, indicating well pressure insufficient to contain gas within the well, and that methane and associated chemicals were likely being released into the atmosphere. No tanks, compressors or separators were identified near or adjacent to the sampling location.

The observation with a value (-18) on PCA Factor 1 (Figure 4.4) corresponds to an air sampling event that captured the process of venting at a nearby, newly drilled natural gas well.

This common process used releases pressure prior to placement of the well head. No tanks, compressors or separators were present at the natural gas pad site; however, during the air sampling event a 4-hour episode of flaring was captured.

The observation with value (-15) on PCA Factor 1 corresponds to an air sampling event when nearby sites had numerous operations occurring simultaneously in the region including drilling, fracking and compression. It is possible, given the numerous natural gas pad sites that venting, flaring, or fracking could have occurred during the 24-hour air sampling event, but no field record indicated a visual confirmation. Given the similarity in the processes occuring for samples plotting at strong negative values on the PCA Factor 1 it can be determined that the most extreme of these observations is not actually an outlier; rather it is an extreme value with interpretable relationships to other extreme negative values for PCA Factor 1.

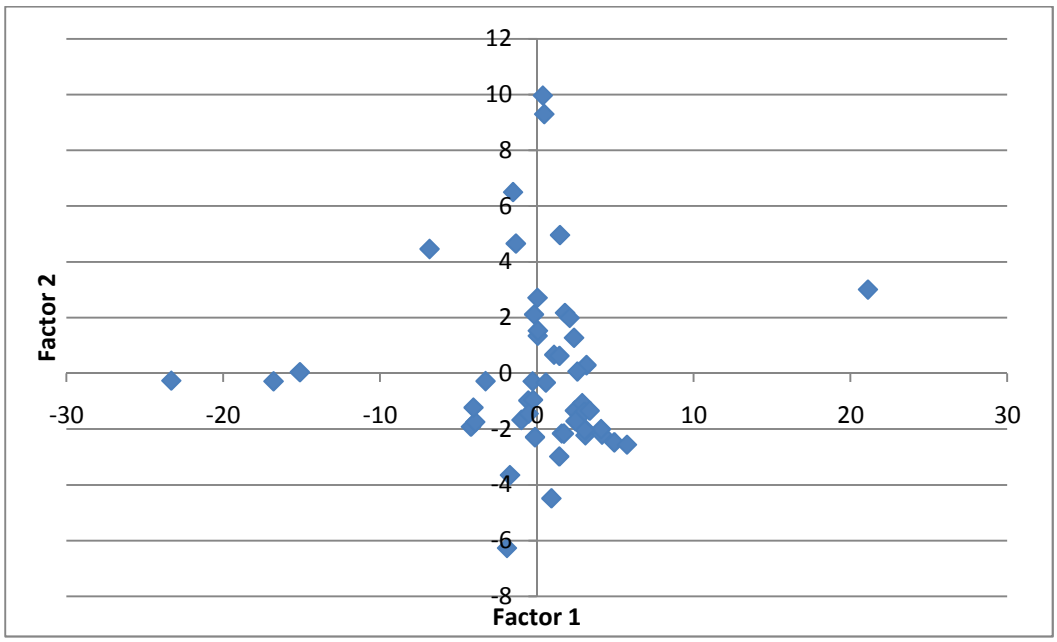


Figure 4.4 PCA sample site scores: Factor 1 to 2

A single strong positive value was present along the PCA Factor 1 (+22). In evaluating the chemical concentrations of this sampling event, high concentrations of C10, C11 and C12

hydrocarbons were present along with sulfur compounds. This sampling event occurred in a region where heavy drilling and fracking operations were occurring. Given the presence of only one high positive value on PCA Factor 1, it is not easy to reach an interpretation of this value.

Extreme positive values on PCA Factor 2, include three observations (+10, +9, +7) for which air sampling occurred on the same date and in a similar area, although not the same sample site. The sampling sites associated with the extreme (positive) values on Factor 2 were related to natural gas compression processes at nearby sites with less influence from processes associated with natural gas well drilling. All of the sample sites were in Denton County and lie within the Core Area of the Barnett Shale. These three observations were characterized by high concentrations of benzene and other chemicals (ethylbenzene, toluene, 1,3,5-trimethylbenzene, m&p-xylene, o-xylene, trimethylbenzene).

Samples with strong negative values on PCA Factor 2 were located (-6, -4.5, –3) were located in different counties but had processes at nearby locations that appeared to be consistent. All of these sites were associated with tanks and or tank batteries holding natural gas liquids (produced water, condensate etc.) and injection of produced water into 'injection wells'. There were other processes at the natural gas pad sites near the sampling site, but the predominant activities were related to holding or disposing of produced water, natural gas liquids and condensate from natural gas production.

The strongest positive value of Factor 3 was at +10 (Figure 4.5.). Extreme values were also seen at values +6 and +5 on PCA Factor 3. These sample sites were near to gas well sites that had simliar processes occurring during the sampling event (with compressors and separators present). Strong negative values on PCA Factor 3 were from sampling sites where nearby natural gas had compressors, for four out of five instances.

The graph below, Figure 4.6, the sample sites where natural gas wells were the predominant process were identified by a green symbol. A black diamond indicated natural gas wells were not the predominant process at that location. As several different processes were

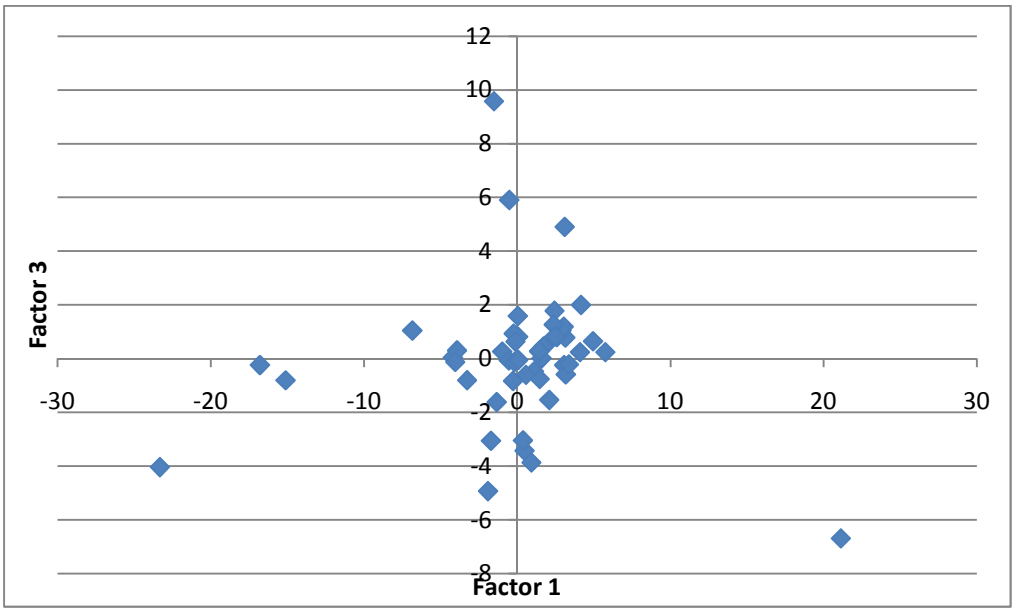


Figure 4.5 Factor by sample site: Factor 1 to 3

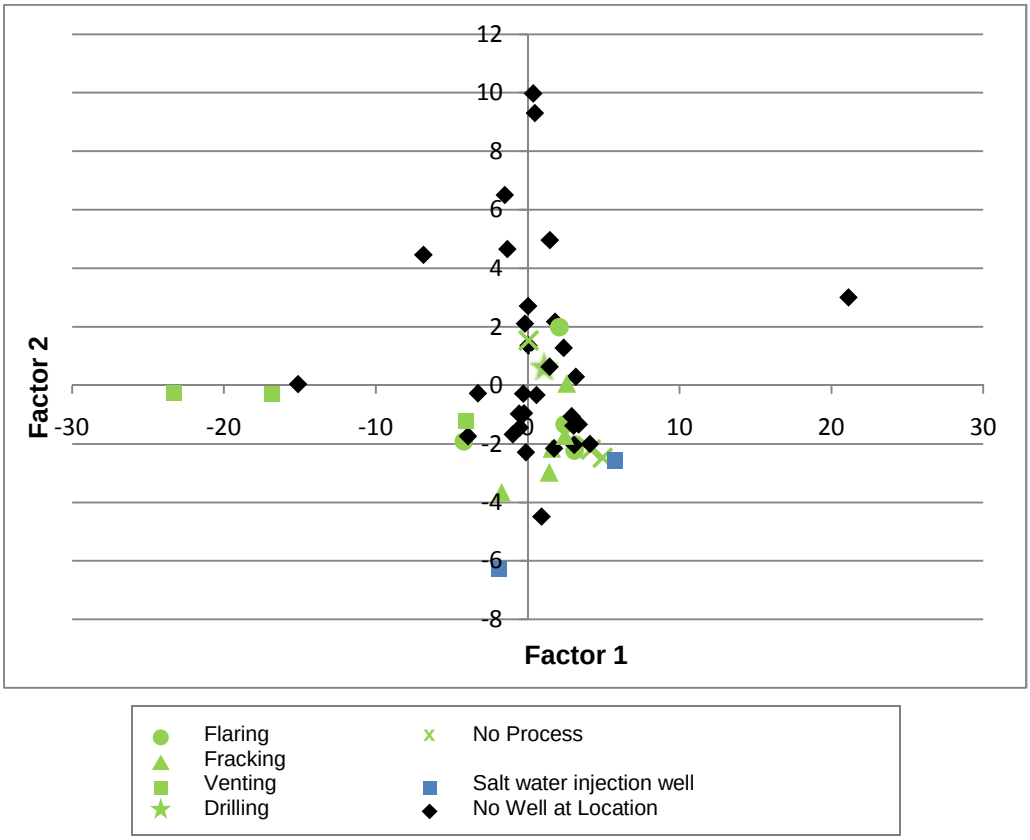


Figure 4.6 Sample site locations with wells present

captured during air sampling different green symbols were used to identify the specific processes occurring during the time air sampling occurred. A green circle indicates flaring occurred during some part of the air sampling. A green triangle indicates fracking was occurring. A green square indicates venting was identified. A green star indicates drilling was in process. A green cross indicates normal operations of production. Blue squares indicate the presence of a salt water injection well. Strong negative values along the X-axis were associated with venting.

Sample sites where natural gas compression was the primary process occurring at the time of air sampling events are presented in Figure 4.7, and identified with a yellow circle symbol. The sites most commonly associated with compression had strong positive values along Factor 2.

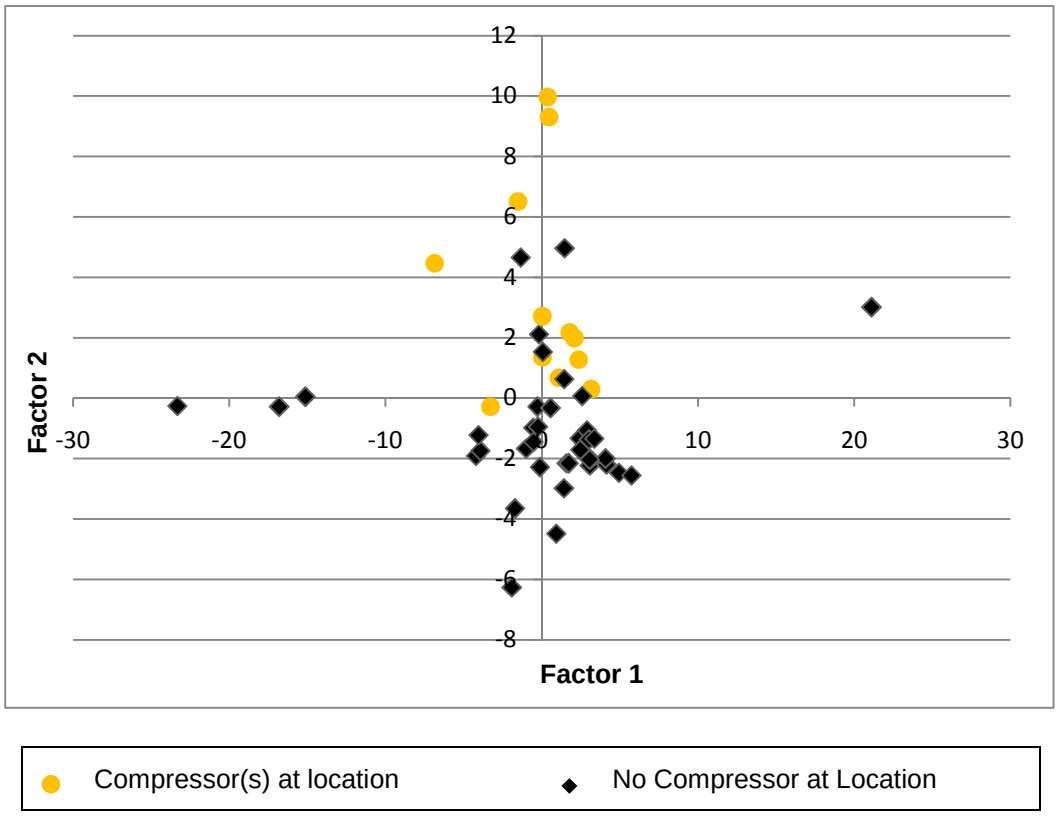


Figure 4.7 Sample site locations with compression predominating

Sample sites with the predominant activity of holding or disposing of natural gas liquids are indicated in Figure 4.8, where sites with tanks are identified with a blue circle symbol. Light gas liquids (LGL) and natural gas liquids (NGL) are often collected in tanks at the natural gas pad site or at a centralized collection facility, commonly called a tank farm, where trucks then collect the LGL, or NGL for further processing into petroleum products (solvents, paint thinners). The liquid contents in tanks may be salt water, condensate, or any manner of liquids being produced from natural gas mining. Salt water injection wells were also identified in this category as a blue circle, as they are facilities where the liquids are injected into a well several thousand feet below the earth's surface. The predominant area of the graph where these processes were seen was present as negative values on Factor 2.

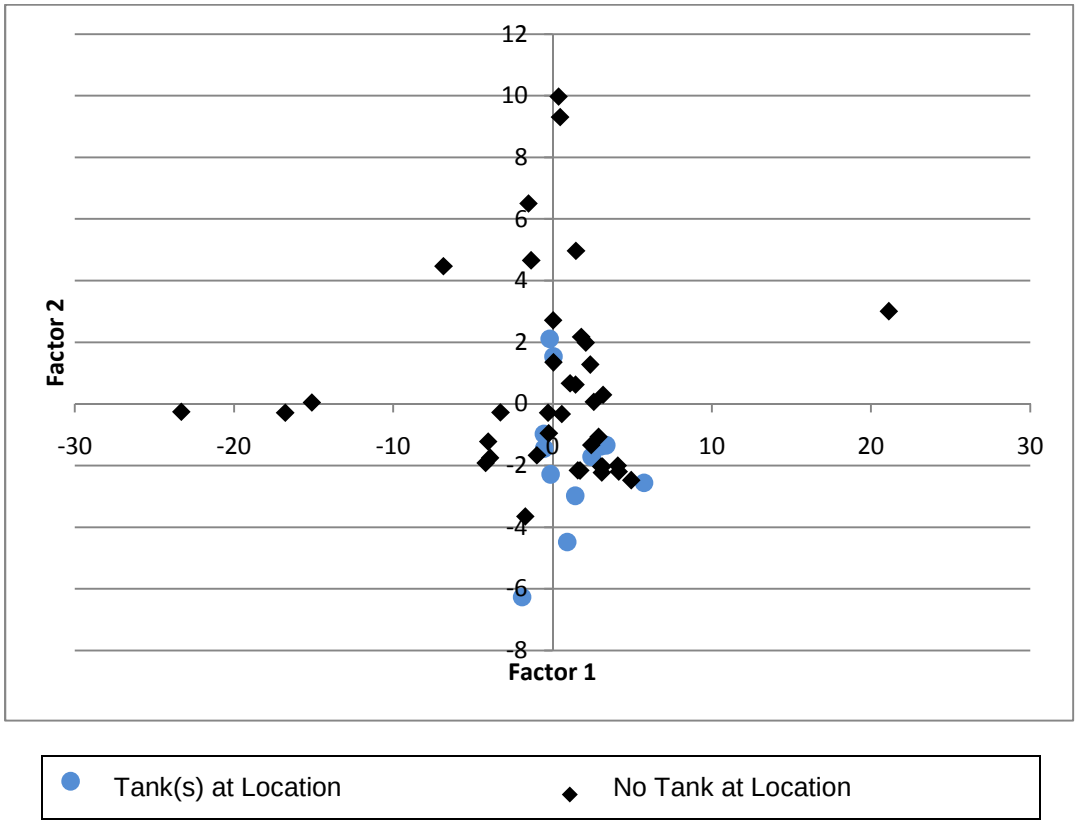


Figure 4.8 Sample site locations with tanks present

In comparing the chemical constituents graphed in relation to the sample site locations in Figures 4.2 and 4.3, specific chemical constituents appeared as strong negative values along Factor 1 and strong positive and negative values along Factor 2 and Factor 3. Overlaying the graph containing the chemical constituents with the graph containing a summary of equipment processes gave a visual summary of the underlying correlations. When comparing all the graphs developed; whether Factor 1 to Factor 2, or Factor 1 to Factor 3, the association between chemical constituents and equipment (or processes) was apparent.

In examining the strong values for Factor 1 associated with sites having natural gas wells in the process of drilling, fracking, flaring or venting nearby, the predominant chemicals associated with Factor 1 included: ethene, hexane, methane, acetone, chloroform, butane, propane, trichloromonofluoromethane, chloropentane, methyl isobutal, methyl,methylethylcyclopentane, tetramethylcyclopentane, bromohexene and trimethylhexene. The sample site with the strongest negative value for Factor 1 was associated with a blown well. Other sites with venting and flaring tended to plot negatively on Factor 1. The chemicals seen above would be consistent with natural gas product (methane, ethene, hexane, butane, propane, chloroform) and chemicals known to be used in hydraulic fracturing operations (acetone, methyl isobutyl ketone, methylene chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,2,-dichloroethane).

In examining strong values for Factor 2 associated with sites having nearby compression operations, the predominant chemicals included: xylene (1,2-dimethylbenzene), ethylbenzene, 1,2,3-trimethylbenzene, m&p xylenes (1,3 dimethylbenzene & 1,4 dimethylbenzene), 1,3,5-trimethylbenzene, toluene (methylbenzene), benzene and trimethylbenzene. These products are all benzene related products and are commonly seen in natural gas and in the combustion of natural gas. Compression engines are fueled by unrefined natural gas, more commonly called bypass natural gas. This is an unrefined fuel (natural gas) piped directly from the wellhead to the compressor. Unrefined fuel has numerous impurities in

it, which may produce more airborne pollutants. Benzene is a common contaminant in natural gas. Therefore, it is expected that benzene chemicals would be seen as emissions from combustion of unrefined natural gas.

The strong negative values seen along Factor 2 were associated with locations that collected LGL and NGL in tanks or injected salt water (common products in tanks) into injection wells. The primary chemical components related to this equipment and hence process included pentane, isohexane, and isobutene. These chemicals are one of the primary components in industrial chemicals including solvents, and paint thinners derived from LGL and NGL.

4.1.3.3 Statistical Significance of Correlation Patterns Among Chemical Concentrations and Site Characteristics

The PCA analysis summarized above provides several suggestions that multivariate signatures of nearby gas well operations might be present in patterns of chemical concentrations found in ambient air samples. As a more rigorous test of this notion, an Analysis of Variance (ANOVA) F-test was performed to test the null hypothesis that sample site scores for PCA Factor 1 and Factor 2 are independent of the particular phases of operation taking place at nearby gas wells. Based on the equipment observed at the nearest gas well to each sampling site, these wells were classified for five processes: (1) flaring vs. not flaring; (2) fracking vs. not fracking; (3) wells present vs. absent; (4) compressors present vs. absent; and (5) tanks or tank batteries present vs. absent.

The first ANOVA tested for differences in flaring (Table 4.8). We accept the null hypothesis for Factor 1, p-value >0.05; and we accept the null hypothesis for Factor 2, p-value >0.05.

The second ANOVA tested for differences in relation to fracking (Table 4.9). We accept the null hypothesis for Factor 1, >0.05; and we accept the null hypothesis for Factor 2, p-value >0.05.

Table 4.8 Factor 1 and factor 2 in relation to flaring

		Factor 1	Factor 1	Factor 1	Factor 1	Factor 2	Factor 2	Factor 2	Factor 2
	df	SS	MS	*F*	*P*	SS	MS	*F*	*p*
Intercept	1	6.4964	6.49635	0.611344	0.438203	1.0945	1.094503	0.117486	0.733306
Flaring	1	1.9341	1.93412	0.182012	0.671597	4.2079	4.207934	0.451688	0.504825
Error	47	499.4378	10.62634			437.8533	9.316027		
Total	48	501.3719				442.0612			

Table 4.9 Factor 1 and factor 2 in relation to fracking

		Factor 1	Factor 1	Factor 1	Factor 1	Factor 2	Factor 2	Factor 2	Factor 2
	df	SS	MS	*F*	*P*	SS	MS	*F*	*p*
Intercept	1	6.3144	6.31439	0.594121	0.444688	0.4711	0.471084	0.050461	0.823236
Frack	1	1.8502	1.8502	0.174086	0.678406	3.2908	3.290787	0.352501	0.555548
Error	47	499.5217	10.62812			438.7704	9.335541		
Total	48	501.3719				442.0612			

The third ANOVA tested for differences in relation to wells (Table 4.10). We accept the null hypothesis for Factor 1, with a p-value >0.05; and we accept the null hypothesis for Factor 2, p-value >0.05.

The fourth ANOVA tested for differences in relation to compressors (Table 4.11). We accept the null hypothesis for Factor 1, p-value >0.05; and we reject the null hypothesis for Factor 2, p-value >0.05. This further substantiates the suggestion previously discussed. There is a significant difference in Factor 2 in relation to compression. Operation of compressors is identified by a signature or fingerprint of chemicals in the air mass known to be products of combustion and which contribute to differences among sites along Factor 2 of the PCA.

The fifth ANOVA tested for differences in relation to tanks (Table 4.12). We accept the null hypothesis for Factor 1, p-value >0.05; and we accept the null hypothesis for Factor 2, p-value >0.05.

These ANOVA results identify compression processes as those producing the strongest signature in multivariate patterns of correlated chemical concentrations. Ambient air sampling sites near gas well sites with compressors present tends to have high concentrations of characteristic suites of chemicals likely to be produced by combustion of natural gas in compressor engines. The signatures for other processes of gas well operations suggested in the PCA did not provide statistically significant differences between sampling sites for scores on PCA Factors 1 and 2. However, these negative results do not imply that signatures of chemical concentrations for these other operations could not ultimately be identified through further research. To be conservative, only the first two PCA factors were tested in the ANOVAs, and additional axes might also contribute to useful signatures. Moreover, the identification of different well operations at nearby sites was not unambiguous. A definitive study of the chemical signatures in ambient air samples associated with different gas well operations would require records from well operators and a sampling design that ensured adequate representation of different well operations while accounting for distance of sampling sites from

Table 4.10 Factor 1 and factor 2 in relation to wells

		Factor 1	Factor 1	Factor 1	Factor 1	Factor 2	Factor 2	Factor 2	Factor 2
	Df	SS	MS	*F*	*P*	SS	MS	*F*	*p*
Intercept	1	3.7051	3.70512	0.347507	0.558351	0.3635	0.363524	0.039269	0.843772
Wells	1	0.2573	0.25734	0.024136	0.877205	6.9643	6.964273	0.752294	0.390158
Error	47	501.1146	10.66201			435.0969	9.257382		
Total	48	501.3719				442.0612			

Table 4.11 Factor 1 and factor 2 in relation to compressors

		Factor 1	Factor 1	Factor 1	Factor 1	Factor 2	Factor 2	Factor 2	Factor 2
	Df	SS	MS	*F*	*P*	SS	MS	*F*	*p*
Intercept	1	4.198	4.19797	0.40821	0.525981	0.0545	0.05447	0.006402	0.936565
Comp	1	18.032	18.03197	1.75343	0.19185	42.2057	42.20567	4.960958	0.030752
Error	47	483.3399	10.28383			399.8555	8.50756		
Total	48	501.3719				442.0612			

Table 4.12 Factor 1 and factor 2 in relation to tanks present

		Factor1	Factor1	Factor1	Factor1	Factor2	Factor2	Factor2	Factor2
	df	SS	MS	*F*	*p*	SS	MS	*F*	*p*
Intercept	1	4.255	4.25496	0.409259	0.525452	0	0	0	1
Tanks	1	12.7248	12.72477	1.223918	0.274224	27.184	27.18396	3.079576	0.085798
Error	47	488.6471	10.39675			414.8772	8.82718		
Total	48	501.3719				442.0612			

gas wells. The present results strongly suggest that such a study could identify signatures of gas well emissions based on concentrations of chemicals present in nearby ambient air.

4.1.3.4 PCA Analysis of Chemical Constituents With Nondetects Removed

Many chemicals identified in ambient air samples were found high in concentration but low in frequency (i.e. the data contained numerous ND). To explore the influence of data with very low frequency, a PCA was performed with data eliminating chemicals detected only once. In total, sixty-four (64) chemicals were included in the refined data. For this reduced data set, the first three PCA Factors again expressed almost half (45%) of the variance while the first ten express three quarters (75%) of the variance (Table 4.13).

Table 4.13 Eigenvalues with (0,1) nondetects removed

	Eigenvalue	% Total variance	Cumulative eigenvalue	Cumulative %
1	15.259	23.844	15.259	23.844
2	9.040	14.126	24.300	37.969
3	4.541	7.096	28.842	45.065
4	3.753	5.865	32.595	50.930
5	3.662	5.721	36.257	56.651
6	3.264	5.100	39.521	61.752
7	2.522	3.941	42.043	65.692
8	2.380	3.719	44.423	69.411
9	2.039	3.186	46.462	72.597
10	1.776	2.775	48.238	75.372

Chemicals that contribute strongly to PCA Factor 1, with coefficients >0.6, all had negative coefficients (Table 4.14). There is little overlap with the list of chemicals that had high coefficients for Factor 1 when all data were included (Table 4.5), because so many of the latter

had only one detected observation. The only compound found on both lists is trichlorofluoromethane.

Table 4.14 Chemicals associated with factor 1

	Factor 1
Trichlorofluoromethane	-0.782
Trimethylpentane,2,2,4	-0.767
Ethylmethyl cyclohexane	-0.754
3-Methylhexane	-0.749
Dichlorotetrafluoroethane	-0.747
Ethylmethylcyclohexane	-0.729
Methylhexane	-0.716
Methyl cyclopentane	-0.699
Methyl cyclohexane	-0.694
2-Methylbutane	-0.679
C8 Hydrocarbon	-0.670
Hexane	-0.663
C9 Hydrocarbon	-0.632
C5 Hydrocarbon	-0.632
Methane (ppmv)	-0.624
2,3-Dimethylpentane	-0.613
Dichlorodifluoromethane	-0.612

Chemicals with high coefficients for PCA Factor 2 in reduced data set included those with high values in the analysis for the full data set (previously seen as strong positive coefficients). For the reduced data set, chemicals with high (negative) coefficients for PCA

Factor 2 included xylene and ethylbenzene with the strongest values, and m&p xylene, toluene, 1,3,5 trimethylbenzene 1,2,4 trimethylbenzene and benzene also strongly associated. Positive coefficients for PCA Factor 2 for the full data set became negative coefficients for this axis for the reduced data set. This change aside, those chemicals present in both analyses plotted in similar positions for a graph of Factor 1 vs. Factor 2 coefficients (Figure 4.9). Likewise, those chemicals present in both analyses plotted in similar positions for a graph of Factor 1 vs. Factor 3 coefficients (Figure 4.10).

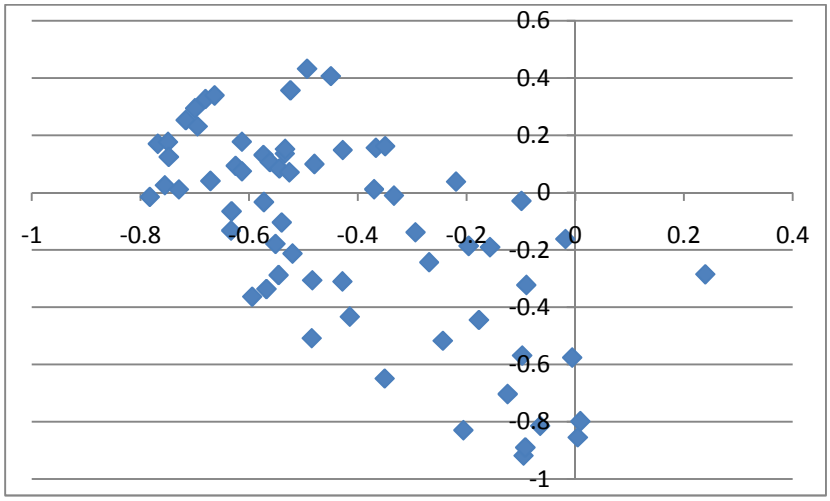


Figure 4.9 PCA Coefficients for chemicals factor 1 and 2, reduced data set

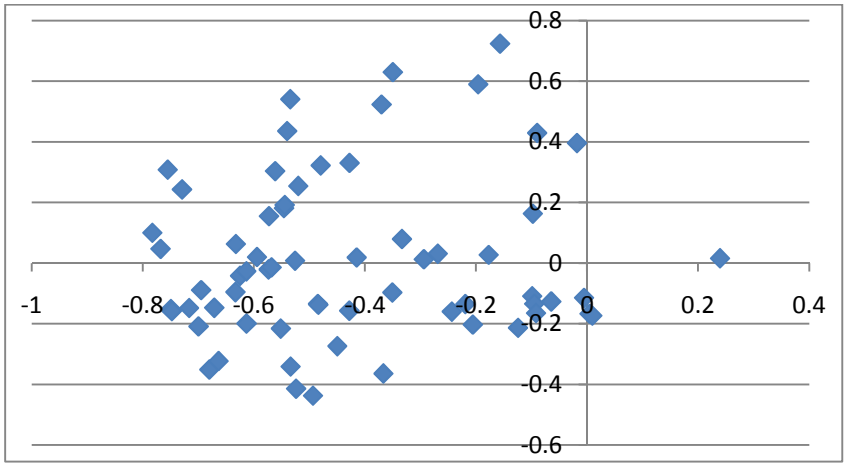


Figure 4.10 PCA Coefficients for chemicals factor 1 and 3, reduced data set

4.1.3.5 PCA Analysis of Sample Site Scores With Non-Detects Removed

Sample site scores calculated for the reduced data set plotted very similarly for Factor 1 and 2 (Figure 4.11), to the patterns seen for the full data set (Figure 4.5), except for the reversal of direction of Factor 2.

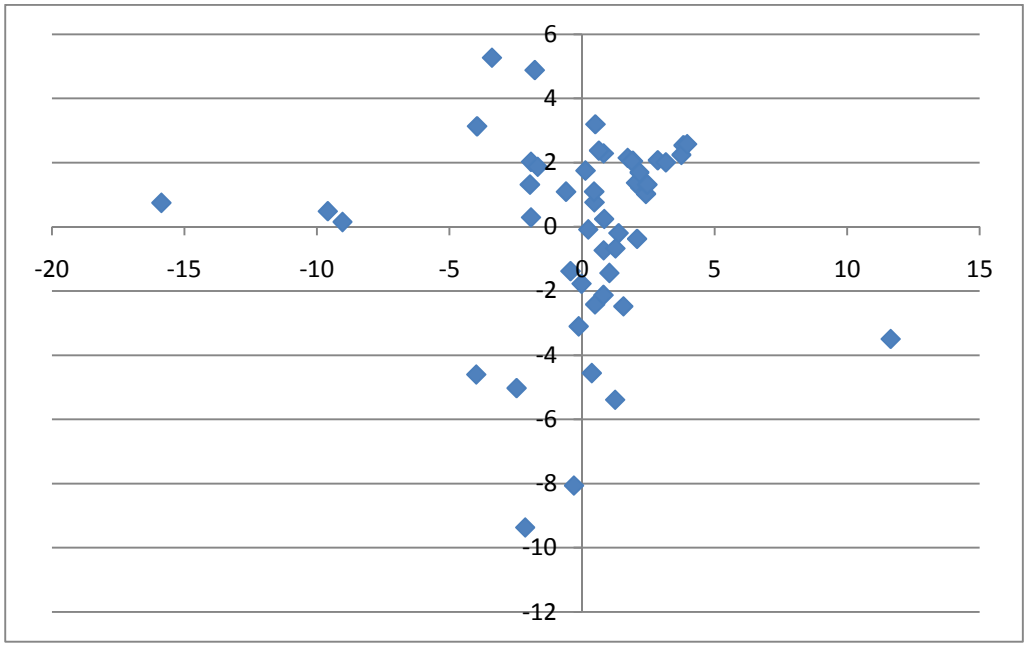


Figure 4.11 PCA Analysis of sample site scores with non-detects removed: Factor 1 to 2

Very similar results for the reduced data set compared to the full data set were seen when plotting sample site scores for Factors 1 and 3 (Figure 4.12). Overall, sample site scores for the PCA from the reduced data set display similar patterns as the sample scores for the PCA from the full data set. This suggests that the analyses of the full data are not unduly distorted by those data involving chemicals detected only once. Moreover, the similarity of the results suggests that chemicals occurring at low frequency might nevertheless provide useful information about the presence of natural gas emissions in ambient air, provided that those rare occurrences are highly correlated, as is the case here.

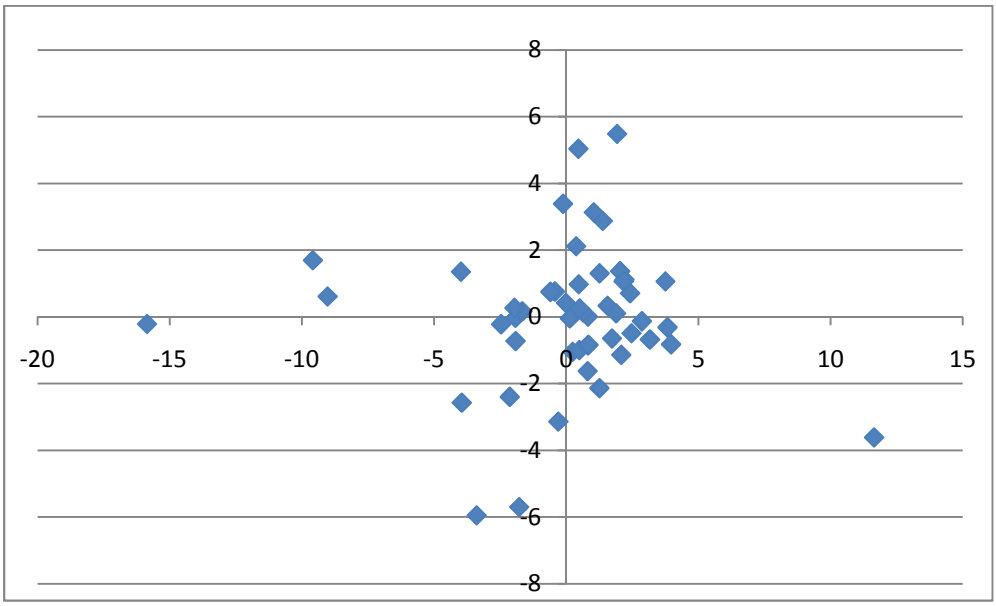


Figure 4.12 PCA analysis of sample site scores with nondetects removed: Factor 1 to 3

CHAPTER 5

DISCUSSION

5.1 Conclusions

Atmospheric concentrations of volatile organic compounds from natural gas mining and production in the Barnett Shale Geologic Formation, which lies beneath the DFW Metropolitan area, were measured through passive air sampling from 2008-2010. Air sampling occurred for 50 sampling events at 39 sites in and around the DFW area. Samples were taken throughout the year representing varying meteorological conditions, and in several counties, including Parker, Tarrant, Denton, Johnson, Wise and Somerville counties. Currently, six (6) of the nine (9) DFW counties are major producers of natural gas with Johnson, Tarrant, Denton and Parker counties identified as four of the top five producers of natural gas in the Barnett Shale (Armendariz, 2009).

Air sampling confirmed the presence of methane and 104 chemicals likely to be related to natural gas present in the atmosphere in and around sampled sites in the DFW Metroplex. Many of the chemical constituents were chemicals associated with the raw product of natural gas, while other chemical constituents were identified to be solvents, propellants and products of combustion from processes related to drilling and production of natural gas (drilling, fracking, flaring, combustion and processing). Many chemicals identified in air samples in this study are identified by the U.S EPA as Hazardous Air Pollutants (HAPs), including known and suspected carcinogens, neurotoxins, developmental toxins, and endocrine disruptors.

Methane is considered a compound with low reactivity in terms of its ability to form ozone; however, other volatile organic compounds found in association with it, such as xylenes and toluene, are significant contributors to ozone formation. Methane itself may also be more of a contributor to local ozone than previously thought. For example, the chlorination of methane

produces methyl chloride, a HAP and greenhouse gas (GHG) which also contributes to local ozone formation (International Programme on Chemical Safety, 2000). West (2005) found that control of methane concentrations was a viable method of ozone management.

5.1.1 Presence of Emissions from Operational Phases

A Principal Components Analysis identified several multivariate patterns of concentrations that potentially provide signatures of emissions from different phases of operation at natural gas sites. The second Factor from the PCA proved most informative. Extreme positive values were strongly and statistically associated with the presence of compressors at sample sites. Extreme negative values along Factor 2 were strongly associated to the presence of tanks that hold or store LGL, NGL, and produced water or salt water at sample sites.

Although, Factor 1 was not significantly related to classifications of equipment present at nearby sites, it did appear related to natural gas wells undergoing operations that resulted in heavy emissions related to venting or flaring. Many of the chemicals associated with such operations were observed at low frequency, but high concentrations. Emissions that are sporadic are inherently difficult to quantify and interpret. Nevertheless, there is at least preliminary evidence from this study that high volume releases of natural gas from blown wells, venting and perhaps flaring operations emit a characteristic suite of chemicals. Because such emissions are sporadic, further study will require ambient air monitoring for at least the 24 hours used in this study, and certainly longer than the much shorter sampling periods that regulatory agencies have been using.

5.2 Significance

5.2.1 Hazardous Air Pollutants Identified

The 1990 Clean Air Act (CAA; Public Law 101-549) authorized and empowered the U.S. EPA to regulate Hazardous Air Pollutants, (HAPs). Many HAPs have been confirmed through scientific studies, to be known or suspected carcinogens. The EPA has developed a list of 189 HAPs (hydrogen sulfide was deleted, so there are now 188) that have been determined

to be chemicals that present a threat to human health or the environment. The complete list of HAPs is provided in Appendix H.

Many of the compounds present in this study and likely to be emanating from processes related to natural gas mining and production were identified as HAPs and therefore regulated under the directive of the CAA. In this study, approximately 22 out of 104 (21%) chemicals identified through sampling are listed as HAPs according to the U.S. EPA.

5.2.2 Health Effects of HAPS

Health effects of HAPs have been determined primarily through occupational studies. Occupational studies typically rely on assessing adverse health effects of an average sized male worker exposed to industrial chemicals for an 8-hour period of exposure. Studies that identify potential health effects of industrial chemicals on children are lacking. Some chemicals identified in this study as strongly correlated to one another specifically benzene derivatives, toluene, ethylbenzene and xylenes (BTEX) and compounds of sulfur, are among those identified with PCA Factor 2 and the presence of compressors. These chemicals are capable of causing bone marrow damage, leucopenia, thrombocytopenia, pancytopenia and associated with Acute Myeloid Leukemia (AML); and chemicals toxic to the Central Nervous System (CNS) causing CNS depression, neurobehavioral changes, tremors, headaches, drowsiness, nystagmus and difficulty sleeping. These chemicals also have reproductive and developmental effects, including CNS dysfunction, attention deficits and craniofacial and limb abnormalities. Brain cancers, kidney cancers, irritation of the respiratory system, eye inflammation and skin irritation, headaches, nausea, vomiting and diarrhea are symptoms associated with exposure to chemical constituents related to mining and production of natural gas. For specific chemical symptoms see Appendix J, “Chemical Health Effects from Exposure to Chemical Compounds Associated with Natural Gas Mining and Production.”

Many compounds found in this study had statistically significant correlation between methane and benzene derivatives. Concern arises in that benzene itself, was identified as present in 38 of 50 sites sampled (76%). Correlation of exposure to benzene and resultant

induced blood diseases date back to 1897, with the first report of benzene causing leukemia published in 1928. The American Petroleum Institute published a toxicological review of benzene in 1948 identifying that benzene causes leukemia and that the only 'safe' level of exposure to benzene is zero parts per million (ppm). (http://www.atsdr.cdc.gov/tfacts3.html).

Many benzene derivatives have been classified as human carcinogens by the U.S. Department of Health and Human Services, the U.S EPA and the International Agency for Research on Cancer (IARC). Short-term effects of benzene on health can be varied but include drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion and unconsciousness. According to the ATSDR ToxFAQs, "the major effect of benzene from long term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Death due to acute benzene exposure has been attributed to asphyxiation, respiratory arrest, CNS depression or cardiac dysrhythmia."

State guidance for chemical exposure levels, called Effects Screening Levels (ESLs), currently identify benzene levels for short term exposure at 54 ppbv, which represents a 116% increase over the 2003 ESL levels of 25 ppbv. Recently developed Air Monitoring Comparison Values (AMCV) by TCEQ identified guidance levels for benzene at 180 ppbv a 620% increase from 2003. According to TCEQ, AMCV's are defined as "a collective term and refers to all odor-, vegetative-, and health based values used in review air monitoring data. Similar to ESLs, AMCVs are chemical specific air concentration set to protect human health and welfare" (http://www.tceq.texas.gov/toxicology/AirToxics.html#amcv). The guidance levels identified by the state contradict current medical data for adverse health effects from exposure to benzene (Collegium Ramazzini, 2004).

5.2.3 Identification of Methane, a Greenhouse Gas

According to the U.S. Climate Change Science Program methane has a half life in the atmosphere of nine (9) to fifteen (15) years and is a significant greenhouse gas (U.S. Climate

Change Science Program, 2006). The Interstate Natural Gas Association of America (INGAA) identifies methane and carbon dioxide emissions as the “chief greenhouse gases related to natural gas transmission and storage” with methane being a potent greenhouse gas with a global warming potency 21 times more effective in trapping heat in the atmosphere than carbon dioxide (CO_2) on a 100-year time horizon. The INGAA has concluded that “fugitive emissions from the natural gas industry emitted 20.6% of all U.S methane emissions” (INGAA, 2010).

According to the research presented within this report, methane was present in concentrations above laboratory detection limits in forty nine (49) out of fifty (50) of the sampled events. Laboratory results of sample sites identified 24- hour levels of methane ranging from a 1.9 parts per million by volume (ppmv) to 457 ppmv. Most of the areas investigated had atmospheric methane concentrations considerably higher than urban background concentrations (estimated at 1.8-2.0 ppmv). TCEQ has not established regulatory guidance for methane and considers it a ‘simple asphyxiant’ despites its noted toxic health effects (oxygen deprivation, asphyxia, increased breathing and pulse rate, muscular incoordination, abnormal fatigue, disturbed respiration, nausea, vomiting; Canadian Centre for Occupational Medicine, 2006).

The assumption should not be made that an arithmetic scale can be used to properly evaluate the degree of health complaint/impairment associated with exposure to methane nor simultaneous multiple chemical exposures. Current guidelines do not address the potential for the additive or synergistic actions of simultaneous exposure to multiple chemicals from natural gas production or the additional potential for human health impact from simultaneous exposure. The strong correlations of concentrations for several chemical constituents found in this study suggest that exposure to multiple chemicals is a likely consequence of emissions from natural gas operations. Nor do current guidelines provide health protective levels for determining appropriate exposure to children as medical data and studies evaluating adverse health effects of many of these industrial chemicals on pediatric populations is not available.

5.3 Recommendations

5.3.1 Atmospheric Sampling for Methane and Associated Chemicals

This study validates the importance and significance of sampling for methane and other chemical components found in this study to be associated with methane currently not tested for in relation to natural gas production facilities. Failure to properly analyze samples for methane, given it is the primary component of natural gas mining and production and a significant greenhouse gas, risks missing emissions most likely to result from sporadic but high intensity incidents such as venting or blown wells. The results from this study suggest the utility of measuring atmospheric concentrations of methane and its relationship to other chemicals, many of which are known to have deleterious effects on human health. The recommendation is therefore made, based on the results of this study, that future atmospheric studies near natural gas mining and processing sites include an evaluation of atmospheric methane and associated gases analyzed in this study.

A suite of associated gases was confirmed through statistical analysis to be present in the presence of compression including 1,2,4-trimethylbenzene, o-xylene, ethylbenzene, 1,3,5 trimethylbenzene, m- and p-xylene, toluene (methyl benzene), benzene, trimethylbenzene, carbon disulfide, styrene C11 and C13 hydrocarbons. Many of these chemicals are derivatives of benzene and are individually known to have harmful effects on human health even at low levels. Present together as a chemical suite, likely from incomplete combustion of raw natural gas, a more comprehensive approach to addressing the potential cumulative effect of simultaneous multiple chemical exposures, rather than identification of individual chemical guidance levels is warranted.

Recommendations for future study includes sampling for methane and the related suite of chemical compounds found in this study; making natural gas production information available, conducting on-site stack sampling, and conducting off-site sampling in populated areas. This would provide the ability to analyze stack emissions at the source related to

production, and the impact of meteorological factors through atmospheric dispersions of emissions in populated areas.

5.3.2 Use of U.S. EPA Approved Target List for Sample Analysis

The target list of compounds currently used in the analysis of ambient air sampling for emissions from natural gas operations by state investigators is not consistent with U.S EPA Compendium Method TO-14A target list found in Table 1 of the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/010b), nor U.S. EPA Compendium Method TO-15 target list found in Table 1 of the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/010b).

It was found that TCEQ's list included only 29 out of 40 (75%) approved chemicals from the TO-14A list, and only 32 out of 91 approved chemicals (35%) from the TO-15 chemical list. More than 65% of the chemicals evaluated by TCEQ were not consistent with TO-15 approved chemical list. The comparison is provided in Appendix I. The recommendation is made that state agency laboratory analyses comply with U.S EPA target lists for analysis of toxic organic compounds.

5.3.3 Use of Dispersion Modeling to Develop Risk Management Plans for Natural Gas Drilling and Production Facilities

To the author's knowledge, few municipalities in the DFW area have implemented the use of atmospheric dispersion modeling to identify the extent to which a potential incident or accident may expose human populations to natural gas compounds from urban drilling. The 1990 Clean Air Act Amendments, Section 112R under Title III (40 CFR 60 or 59 FR 4993) dated January 31, 1994, requires the preparation of risk management plans for facilities "processing or storing Hazardous Air Pollutants." This guidance defines the procedures firms must use to "define a potential accident requiring a plan, the procedure used to model this release and the procedures for dealing with the accidental release, such as notifications of nearby residents and their evacuation." (U.S. EPA, 1990). Any natural gas facility which has tanks present at a facility

where natural gas is being mined, produced, and compressed or transported stores Hazardous Air Pollutants and may need to comply with CAA requirements.

5.3.4 Use of Dispersion Modeling to Develop Safe Setback Distances Between Natural Gas Drilling/Production Facilities and Critical Receptors, Such as Schools.

Most municipal setback designations for distances between natural gas drilling and production facilities and other critical receptors, such as schools, were not established based on scientific research or atmospheric dispersion modeling. Municipal setbacks were developed after the historic New London, Texas, school house explosion in 1937, when natural gas leaked from pipes under the school and a spark from a sander exploded the facility, killing more than 300 people, most of them children. The regulatory result of this incident was legislation requiring gas companies to add an odorant to their product so people can determine when natural gas is leaking (McDonald, 2008). In response to this accident, many municipalities implemented a 200- foot setback for pipelines and facilities from buildings in order to define what was believed to be a safe distance. Historical documents do not indicate that the designated setback was based on scientific merit or study.

As extensive urban drilling began in the Barnett Shale in the last few years, cities reviewed their ordinances and setbacks related to natural gas facilities. Some municipalities boldly increased setbacks to 1,000 feet from the pad site to the corner of an inhabited building without a variance request. If a variance to the setback is requested and approved, the distance can be reduced in some cases to 200 feet, depending on the municipality. According to personal correspondence with local policy makers and legal counsel for municipalities, the 1,000-foot setback was implemented after concern was raised by residents that the 200-foot setback was not ample for protection of noise and vibration impact from natural gas facilities. No scientific studies providing support for the 1,000-foot setback being health protective of emissions could be provided or referenced.

Given that gas wells, tanks and compression operations have been statistically correlated to a suite of chemicals with potential health effects, greater caution is warranted in

siting of facilities until improved monitoring and more definitive understanding of the proper placement of the facilities from human populations can be supported by unbiased scientific studies.

Future placement of natural gas mining and production facilities within urban areas at a scientifically credible setback distance safe from human population centers including residences, day care centers, schools, hospitals, and care centers for the elderly is strongly warranted and supported by the results of this study. In addition, no process related to natural gas mining or production should be permitted without first performing atmospheric dispersion modeling of the potential emissions emanating from these processes, thus allowing for a more thorough investigation and assessment of the potential impact to residential communities and sensitive populations.

5.3.5 Electrification of Compressor Engines and Stations

In the previous chapter, the ANOVA test found a statistically significant relationship between compressors and a signature of chemicals associated with Factor 2 of the PCA, including m-, p- and o-xylenes, ethylbenzene, and trimethylbenzenes. Given this finding, it is recommended that municipalities require electrification of all compressor engines and compressor stations.

Use of electric motors to drive natural gas compressors is not a new technological application; numerous compressors driven by electric motors are operational throughout Texas (Armendariz, 2009). It would be a win-win for natural gas companies, in that the life cycle costs of electric motors are only a fraction of those for conventional unrefined by-pass natural gas powered equipment (Oliver, 1999). According to Occidental Oil and Gas Corporation (2006), converting gas-fired wellhead internal combustion engines to electric motor drives would save $23,400/year/unit.

In addition, electric motors are more efficient than natural-gas-powered internal combustion engines. According to the Electric Power Research Institute, “it is more efficient to send natural gas to a combined-cycle power plant to generate electricity transmitted back to the

pipeline compressor station than to burn the natural gas directly in gas-fired compressor engines" (Valenti, 1996).

5.4 Study Limitations

Limitations to this study are the lack of geologic specific information regarding the characteristics of the geologic formation and subsurface chemical composition which is often considered proprietary information. The operational schedules identifying maintenance down times and start up, which are large emission contributors, were not available. This information is critical to properly characterize emissions on an annualized basis. Specific information regarding the type of equipment present (make, model and horsepower) at natural gas pad sites and operational records including production volume was not readily available. The small sample size and inability to design a truly random sampling due to funding and property access issues is virtually inevitable in large scale monitoring projects such as this study.

5.5 Future Research

Information obtained from this study is geologically specific to the Barnett Shale, and no assumptions are made by the author regarding emissions in other areas where natural gas mining and production is occurring. Future research could include comparison of varying technical processes (drilling, hydraulic fracturing, venting, flaring) and air emissions identified in the Barnett Shale to other geologic formations.

This study revealed a significant association between specific equipment and suite of chemicals known to have adverse human health aspects. On-site (stack) sampling coupled with off-site sampling and production information would provide additional input for developing more precise atmospheric dispersion models which then would allow for scientifically supported identification of appropriate setbacks for facility siting from populated areas to minimize the potential for adverse health effects of human populations exposed to emissions from "urban drilling."

Further research is needed to comprehend the impact to sensitive populations, including pediatric and geriatric populations, of industrial chemicals in "urban drilling" previously

known more in the context of occupational exposures. Additional research into the potential for additive and synergistic effect on humans from atmospheric interaction of identified chemicals constituents in this study is needed along with recommendations for health protective chemical exposure guidelines.

APPENDIX A
COMPENDIUM METHODS T0-14A APPROVED
CHEMICAL TARGET LIST EPA/625/R-96/010b

TABLE 1. COMPENDIUM METHOD TO-14A VOC TCL DATA SHEET

COMPOUND (SYNONYM)	FORMULA	MOLECULAR WEIGHT	BOILING POINT (°C)	MELTING POINT (°C)	CAS NO.
Freon 12 (Dichlorodifluoromethane)	Cl_2CF_2	120.91	-29.8	-158.0	75-71-8
Methyl chloride (Chloromethane)	CH_3Cl	50.49	-24.2	-97.1	74-87-3
Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane)	$ClCF_2CClF_2$	170.93	4.1	-94.0	76-14-2
Vinyl chloride (Chloroethylene)	CH_2=CHCl	62.50	-13.4	-1538.0	75-01-4
Methyl bromide (Bromomethane)	CH_3Br	94.94	3.6	-93.6	74-83-9
Ethyl chloride (Chloroethane)	CH_3CH_2Cl	64.52	12.3	-136.4	75-00-3
Freon 11 (Trichlorofluoromethane)	CCl_3F	137.38	23.7	-111.0	75-69-4
Vinylidene chloride (1,1-Dichloroethene)	$C_2H_2Cl_2$	96.95	31.7	-122.5	75-35-4
Dichloromethane (Methylene chloride)	CH_2Cl_2	84.94	39.8	-95.1	75-09-2
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	CF_2ClCCl_2F	187.38	47.7	-36.4	76-13-1
1,1-Dichloroethane (Ethylidene chloride)	CH_3CHCl_2	98.96	57.3	-97.0	74-34-3
cis-1,2-Dichloroethylene	CHCl=CHCl	96.94	60.3	-80.5	156-59-2
Chloroform (Trichloromethane)	$CHCl_3$	119.38	61.7	-63.5	67-66-3
1,2-Dichloroethane (Ethylene dichloride)	$ClCH_2CH_2Cl$	98.96	83.5	-35.3	107-06-2
Methyl chloroform (1,1,1-Trichloroethane)	CH_3CCl_3	133.41	74.1	-30.4	71-55-6
Benzene (Cyclohexatriene)	C_6H_6	78.12	80.1	5.5	71-43-2
Carbon tetrachloride (Tetrachloromethane)	CCl_4	153.82	76.5	-23.0	56-23-5
1,2-Dichloropropane (Propylene dichloride)	$CH_3CHClCH_2Cl$	112.99	96.4	-100.4	78-87-5
Trichloroethylene (Trichloroethene)	$ClCH=CCl_2$	131.29	87	-73.0	79-01-6
cis-1,3-Dichloropropene (cis-1,3-dichloropropylene)	CH_3CCl=CHCl	110.97	104.3	---	542-75-6
trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	$ClCH_2CH$=CHCl	110.97	112.0	---	542-75-6
1,1,2-Trichloroethane (Vinyl trichloride)	$CH_2ClCHCl_2$	133.41	113.8	-36.5	79-00-5
Toluene (Methyl benzene)	$C_6H_5CH_3$	92.15	110.6	-95.0	108-88-3
1,2-Dibromoethane (Ethylene dibromide)	$BrCH_2CH_2Br$	187.88	131.3	9.8	106-93-4
Tetrachloroethylene (Perchloroethylene)	$Cl_2C=CCl_2$	165.83	121.1	-19.0	127-18-4
Chlorobenzene (Phenyl chloride)	C_6H_5Cl	112.56	132.0	-45.6	108-90-7
Ethylbenzene	$C_6H_5C_2H_5$	106.17	136.2	-95.0	100-41-4
m-Xylene (1,3-Dimethylbenzene)	$1,3-(CH_3)_2C_6H_4$	106.17	139.1	-47.9	108-38-3
p-Xylene (,14-Dimethylxylene)	$1,4-(CH_3)_2C_6H_4$	106.17	138.3	13.3	106-42-3
Styrene (Vinyl benzene)	$C_6H_5CH=CH_2$	104.16	145.2	-30.6	100-42-5
1,1,2,2-Tetrachloroethane	$CHCl_2CHCl_2$	167.85	146.2	-36.0	79-34-5
o-Xylene (1,2-Dimethylbenzene)	$1,2-(CH_3)_2C_6H_4$	106.17	144.4	-25.2	95-47-6
1,3,5-Trimethylbenzene (Mesitylene)	$1,3,5-(CH_3)_3C_6H_6$	120.20	164.7	-44.7	108-67-8
1,2,4-Trimethylbenzene (Pseudocumene)	$1,2,4-(CH_3)_3C_6H_6$	120.20	169.3	-43.8	95-63-6
m-Dichlorobenzene (1,3-Dichlorobenzene)	$1,3-Cl_2C_6H_4$	147.01	173.0	-24.7	541-73-1
Benzyl chloride (α-Chlorotoluene)	$C_6H_5CH_2Cl$	126.59	179.3	-39.0	100-44-7
o-Dichlorobenzene (1,2-dichlorobenzene)	$1,2-Cl_2C_6H_4$	147.01	180.5	-17.0	95-50-1
p-Dichlorobenzene (1,4-dichlorobenzene)	$1,4-Cl_2C_6H_4$	147.01	174.0	53.1	106-46-7
1,2,4-Trichlorobenzene	$1,2,4-Cl_3C_6H_3$	181.45	213.5	17.0	120-82-1
Hexachlorobutadiene (1,1,2,3,4,4-Hexachloro-1,3-butadiene)	C_4Cl_6	260.8	186 (sublimes)	-21.0	87-68-3

APPENDIX B
METEOROLOGICAL SUMMARY AIR MONITORING LOCAITONS
IN THE BARNETT SHALE QUALITY CONTROLLED
LOCAL CLIMATOLOGICAL DATA

SITE ID	#	DATE	COUNTY	STATION AIPORT	STATION ID	VISIBILITY (MPH)	TEMP LOW ℉	TEMP HIGH ℉	TEMP AVG ℉	WIND SPEED LOW (MPH)	WIND SPEED HIGH (MPH)	WIND SPEED AVG (MPH)	WIND DIR	WIND GUSTS (MPH)	PRECIP TOTAL (IN)	REL HUMID AVG %	SKY CONDITIONS
101	1	7/29/2009	Parker	Meacham	13961	10	72	89	81	0	13	6.6	ESE,N,NW	18	0.07	68.8	clear w /scattered show ers
102	2	4/18/2009	Parker	Meacham	13961	2.5-10	61	72	63	0	11	4.2	ESE,N,NW	3.0-8	0.01	90	ovc, scattered show ers
103	3	4/18/2009	Parker	Meacham	13961	2.5-10	61	72	63	0	11	4.2	SSE,W,SW	3.0-8	0.01	90	ovc, scattered show ers
116	4	5/26/2009	Tarrant	Meacham	13961	6.0-10	68	94	78	5	22	9.2	SSE,W,SW	17-30	0.09	66.5	ovc, scattered show ers
117	5	5/26/2009	Tarrant	Meacham	13961	6.0-10	68	94	78	5	22	9.2	SSE,W,SW	17-30	0.09	66.5	ovc, scattered show ers
118	6	5/26/2009	Tarrant	Meacham	13961	6.0-10	68	94	78	0	22	9.2	SSE,W,SW	17-30	0.09	66.5	ovc, scattered show ers
119	7	6/28/2009	Tarrant	Meacham	13961	10.0	80	101	91	0	10	6.2	SSE,N,NE	0	0	46.4	clear
120	8	6/28/2009	Tarrant	Meacham	13961	10.0	80	101	91	0	10	6.2	SSE,N,NE	0	0	46.4	clear
121	9	6/28/2009	Tarrant	Meacham	13961	10.0	80	101	91	0	10	6.2	SSE,N,NE	0	0	46.4	clear
122	10	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
123	11	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
124	12	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
125	13	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
126	14	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
127	15	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
128	16	8/17/2009	Denton	DentonMun	3991	10.0	77	99	89	6	14	9.3	ESE, SSE	20	0	53.3	clear
129	17	12/13/2009	Denton	DentonMun	3991	0.25-7.0	46	67	51	6	13	9.0	S,SE	0	0	86.0	overcast, clear
130	18	3/2/2010	Johnson	DentonMun	3991	10.0	35	52	41	3	15	9.9	NW,WNW	21	0	71	clear
131	19	1/22/2010	Tarrant	DFW	3927	10.0	46	75	63	5	24	13	SE	23-32	0	55	clear, bkn250, overcast
133	20	2/5/2010	Denton	DentonMun	3991	5.0-10.0	37	57	70	0	14	11.1	NW	17-23	0	82.3	clear
134	21	2/18/2010	Denton	DentonMun	3991	10	28	62	45	0	15	8.9	N,S	23	0	62	clear
136	22	1/12/2010	Johnson	Mineral w ells	93985	10	25	57	41	0	9	5	N,S	0-5	0	80	clear
137	23	2/5/2010	Denton	DentonMun	3991	5.0-10.0	38	57	47	0	14	7.4	NNW, W	17-23	0	86.6	overcast, sct,bkn, clear
138	24	12/14/2009	Parker	Meacham	13961	6.0-10.0	35	70	59	5	17	11.5	SSW,N	21-23	0	75	clear
140	25	12/14/2009	Parker	Meacham	13961	6.0-10.0	35	70	59	5	17	11.5	SSW,N	21-23	0	75	clear

SITE ID	#	DATE	COUNTY	STATION AIPORT	STATION ID	VISIBILITY (MPH)	TEMP LOW ℉	TEMP HIGH ℉	TEMP AVG ℉	WIND SPEED LOW (MPH)	WIND SPEED HIGH (MPH)	WIND SPEED AVG (MPH)	WIND DIR	WIND GUSTS (MPH)	PRECIP TOTAL (IN)	REL HUMID AVG %	SKY CONDITIONS
141	26	1/11/2010	Wise	DFW	3927	10	26	54	40	0	15	7	N,S	0-8	0	40	few scattered showers
142	27	3/11/2010	Wise	DentonMun	3991	10	37	58	44	0	13	5.2	NNW,WNW	0	0	65.1	clear
147	28	5/2/2010	Parker	Cleburne	53981	10	57	82	70	0	17	8.5	N,S	20	0	50.5	clear
148	29	3/5/2010	Parker	Mid-way	53966	10	46	67	51.3	5	20	15	SSE	20	0	68	clear
149	30	5/7/2010	Somervil	Cleburne	53981	10	66	79	72.5	8	17	12.5	S,N	20	0	75	clear
150	31	5/27/2010	Johnson	Granbury Mun	53977	10	64	93	78.5	0	7	4	N,S	0	0	57	clear
151	32	6/17/2010	Johnson	Spinks	3985	10	76	97	86.5	8	17	12.5	S	16-24	0	45	clear
152	33	6/16/2010	Denton	DentonMun	3991	10	76	96	86	3	16	9.5	S	17-25	0	55	clear
153	34	5/17/2010	Johnson	Cleburne	53981	3.0-10.0	63	88	71	0	14	7	N,S	20-44	0.18	87.9	clear, scatter showers
154	35	7/15/2010	Denton	DentonMun	53981	10	76	96	86	3	14	8.8	S,SW	18	0	66	clear
155	36	7/15/2010	Denton	DentonMun	53981	10	76	96	86	3	14	8.8	S,SW	18	0	66	clear
156	37	8/4/2010	Denton	DentonMun	3991	10	73	92	82.5	9	21	15	S	21-26	0	70	scattered showers
157	38	8/15/2010	Parker	GranburyMun	53977	10	81	104	92.5	0	20	10	N,S	25-32	0.05	50	clear, scatter showers
158	39	8/3/2010	Tarrant	GranburyMun	53977	10	77	103	90	3	11	6.5	N,S	16-22	0	41	clear
159	40	8/14/2010	Parker	GranburyMun	53977	10	83	104	93.5	3	10	7	SSE,SSW	20	0	32	clear
160	41	8/13/2010	Tarrant	GranburyMun	53977	10	79	103	91	6	15	10.5	S,ESE	16-22	0	30	clear
161	42	9/11/2010	Tarrant	GranburyMun	53977	10	78	96	87	0	11	5.5	N,S	0	0	60	clear
162	43	9/24/2010	Denton	DentonMun	3991	10	77	96	87	0	11	5	N,S	0	0	59	clear
163	44	10/15/2010	Denton	DentonMun	3991	10	46	85	65.5	0	9	5	N,S	0-5	0	45	clear
164	45	10/2/2010	Johnson	FWSpinks	3985	5.0-10.0	53	89	52	0	11	5	N	0	0	74	ovc, scatter showers,
165	46	7/15/2010	Denton	DentonMun	3991	10	76	95	85	3	14	8.5	S,SSW	18-21	0	69	clear
166	47	11/26/2010	Johnson	FWSpinks	3985	10	30	52	41	0	9	4.8	NNW	0	0	60.2	clear,
167	48	12/14/2010	Wise	DentonMun	53981	10	34	65	49.2	6	18	9.7	SSE,S	23	0	51	clear
169	49	12/14/2010	Denton	DFW	3985	10	35	68	51	7	18	12.5	ESE,S	21-26	0	40	few scattered showers,clear
168	50	12/31/2010	Denton	DFW	3985	10	57	67	62	10	26	18	NNW,S	24-36	0	55	few scattered showers,clear
				Summary		2.5 0 10.0	26	104	65	0	26	13		3.0-44	0.074	60.3	

APPENDIX C
AIR SAMPLING LOCATIONS AND LABORATORY RESULTS, 2008–2010

Air sampling locations and laboratory results: 2009 data

Date	County	CAN	UNITS	Methane (ppmv)	Benzene	Chloroform	Chloro-methane (Methyl Chloride)	Dichloro-difluoromethane (F12)	Dichloro-tetrafluoro-ethane (F114)	1,2-Dichloro-ethane (EDC)	Dichloromethane (Methylene chloride)	Ethylbenzene	Hexachloro-butadiene	Styrene (monomer)	1,1,2,2-Tetrachloro-ethane
		CAS	#→	74828	71432	67663	74873	75718	76142	107062	75092	100414	87683	100425	79345
4/18/2009	Parker	288	ppbv	3.4	3.11	*0.31*	*0.31*	0.393	*0.31*	*0.31*	*0.31*	1.84	0.818	0.293	*0.31*
4/18/2009	Parker	999	ppbv	3.2	0.6	*0.35*	*0.35*	0.431	*0.35*	*0.35*	*0.35*	*0.35*	*0.88*	*0.35*	*0.35*
5/26/2009	Tarrant	62039	ppbv	2.8	0.833	2.58	*0.25*	0.306	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*
5/26/2009	Tarrant	1021	ppbv	3.2	*0.89*	2.23	*0.89*	*0.89*	*0.89*	*0.89*	*0.89*	*0.89*	*2.22*	*0.89*	*0.89*
5/26/2009	Tarrant	1043	ppbv	3.2	0.465	1.26	*0.28*	0.326	*0.28*	*0.28*	*0.28*	0.532	0.7	0.313	*0.28*
6/28/2009	Tarrant	312	ppbv	2.2	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	0.447	*0.28*	*0.28*	*0.28*
6/28/2009	Tarrant	60183	ppbv	2.2	*0.25*	*0.25*	*0.25*	0.272	*0.25*	*0.25*	*0.25*	*0.25*	*0.62*	*0.25*	*0.25*
6/28/2009	Tarrant	9904	ppbv	2.2	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*
7/29/2009	Parker	99015	ppbv	2	32.5	*0.46*	*0.46*	*0.46*	*0.46*	*0.46*	*0.46*	11.6	*1.16*	0.59	*0.46*
8/17/2009	Denton	2519	ppbv	2.8	0.69	*0.26*	0.26	0.494	*0.26*	*0.26*	*0.26*	0.276	*0.65*	*0.26*	*0.26*
8/17/2009	Denton	314	ppbv	2.5	10.7	*0.28*	*0.28*	0.4	*0.28*	*0.28*	*0.28*	5.5	*0.71*	0.39	*0.28*
8/17/2009	Denton	2471	ppbv	2.1	12.3	*0.26*	1.53	0.59	*0.26*	*0.26*	0.287	13.8	*0.65*	0.91	*0.26*
8/17/2009	Denton	145	ppbv	2.6	77.7	*0.26*	0.679	0.54	*0.26*	*0.26*	*0.26*	21.5	*0.65*	1.28	*0.26*
8/17/2009	Denton	1043	ppbv	2	1.03	*0.28*	0.55	*0.28*	*0.28*	*0.28*	*0.28*	0.373	*0.69*	*0.28*	*0.28*
8/17/2009	Denton	2517	ppbv	5.9	0.599	*0.27*	0.645	0.418	*0.27*	*0.27*	*0.27*	0.518	*0.68*	*0.27*	*0.27*
8/17/2009	Denton	2514	ppbv	2.1	0.336	*0.26*	0.636	0.721	*0.26*	*0.26*	*0.26*	*0.26*	0.66	*0.26*	*0.26*
12/13/2009	Denton	2471	ppbv	5.8	1.63	*0.27*	0.59	0.4	*0.27*	*0.27*	*0.27*	0.72	0.67	*0.27*	*0.27*
12/14/2009	Parker	2468	ppbv	2.3	0.886	*0.32*	0.603	0.404	*0.32*	0.367	*0.32*	*0.32*	*0.8*	*0.32*	*0.32*
12/14/2009	Parker	336	ppbv	2.7	9.76	*0.32*	0.649	0.431	*0.32*	*0.32*	*0.32*	6.52	0.8	0.455	*0.32*

Date	County	CAN	UNITS	Tetrachloro-ethene (PCE)	Toluene	1,1,1-Trichloro-ethane (TCA)	1,1,2-Trichloro-ethane	1,3,5 Trimethyl-benzene	1,2,4 Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloro-ethene (TCE)	Trichloro-fluoromethane (F-11)	m&p Xylene	0-Xylene	Carbon disulfide**
		CAS	#→	127184	108883	71556	79005	108678	95636	120821	79016	75694	1330207	95476	75150
4/18/2009	Parker	288	ppbv	*0.31*	6.05	*0.31*	*0.31*	0.84	2.36	0.736	*0.31*	*0.31*	7.37	3.03	*1.54*
4/18/2009	Parker	999	ppbv	*0.35*	0.88	*0.35*	*0.35*	*0.35*	*0.35*	0.702	*0.35*	*0.35*	0.551	*0.35*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*0.25*	1.13	*0.25*	*0.25*	*0.25*	*0.35*	0.432	*0.25*	*0.25*	0.617	0.396	14.7
5/26/2009	Tarrant	1021	ppbv	*0.89*	*0.89*	*0.89*	*0.89*	*0.89*	*0.89*	*2.22*	*0.89*	*0.89*	*0.89*	*0.89*	15.1
5/26/2009	Tarrant	1043	ppbv	*0.28*	2.6	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	1.56	0.788	5.86
6/28/2009	Tarrant	312	ppbv	*0.28*	2.2	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	1.18	0.365	*1.38*
6/28/2009	Tarrant	60183	ppbv	*0.25*	0.706	*0.25*	*0.25*	*0.25*	*0.25*	*0.62*	*0.25*	*0.25*	*0.25*	*0.25*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*0.25*	0.557	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	0.281	*0.25*	9.53
7/29/2009	Parker	99015	ppbv	*0.46*	79.8	*0.46*	*0.46*	2.57	11.6	*1.16*	*0.46*	*0.46*	47.1	16.3	34.3
8/17/2009	Denton	2519	ppbv	*0.26*	3.1	*0.26*	*0.26*	*0.26*	*0.26*	*0.65*	*0.26*	*0.26*	0.821	0.437	*1.29*
8/17/2009	Denton	314	ppbv	0.82	33.7	*0.28*	*0.28*	3.71	19.2	0.48	*0.28*	*0.28*	23.1	10.5	*1.42*
8/17/2009	Denton	2471	ppbv	*0.26*	61.7	*0.26*	*0.26*	9.95	60.4	*0.65*	*0.26*	0.33	46.2	16.4	103
8/17/2009	Denton	145	ppbv	*0.26*	139	*0.26*	*0.26*	9.82	47.1	*0.65*	*0.26*	*0.26*	84.5	39.4	97.6
8/17/2009	Denton	1043	ppbv	*0.28*	3.09	*0.28*	*0.28*	*0.28*	*0.28*	*0.69*	0.402	*0.28*	0.826	0.475	7.33
8/17/2009	Denton	2517	ppbv	*0.27*	0.734	*0.27*	*0.27*	0.671	1.98	*0.68*	*0.27*	0.276	1.89	0.989	*1.36*
8/17/2009	Denton	2514	ppbv	*0.26*	0.384	*0.26*	*0.26*	*0.26*	0.503	0.66	*0.26*	0.302	0.263	*0.26*	*1.31*
12/13/2009	Denton	2471	ppbv	*0.27*	4.16	*0.27*	*0.27*	3.67	1.05	*0.67*	*0.27*	*0.27*	3.12	1.34	21
12/14/2009	Parker	2468	ppbv	2.43	0.955	*0.32*	*0.32*	0.537	*0.32*	*0.8*	60.9	*0.32*	0.684	0.353	18.8
12/14/2009	Parker	336	ppbv	*0.32*	23.4	*0.32*	*0.32*	*0.32*	3.69	13.5	1.56	*0.32*	25.3	13.8	9.56

Date	County	CAN	UNITS	Carbonyl sulfide**	Dimethyl disulfide	Methyl ethyl disulphide	Ethylmethyl benzene	Methyl propyl disulfide	Diethyl disulfide C4H10S2	Ethyl, methylethyl disulfide	Dimethyl trisulfide	Ethyl n-propyl disulfide	Trimethyl benzene	Undecane	1-Methyl propenyl-benzene
		CAS	#→	463-58-1	624920	20333395	611143	2179604	110816	53966362	3658808	30453317	95636	1120214	2082613
4/18/2009	Parker	288	ppbv	15.5	66	43.7	13.4	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	9.3	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	50.3	80	*1.24*	41.6	29.1	8.7	8.82	7.75	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	4.75	*4.43*	*4.43*	*4.43*	*4.43*	4.43	4.43	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	17.8	14.7	*1.39*	8.35	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	8.26	11.9	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
7/29/2009	Parker	99015	ppbv	2.52	54	42.6	42.8	*2.32*	*2.32*	*2.32*	46.3	*2.32*	*2.32*	*2.32*	*2.32*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	200	145	24.5	*1.42*	*1.42*	46.5	*1.42*	*1.42*	67	72	51
8/17/2009	Denton	2471	ppbv	36.7	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	366	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	29.5	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	203	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	4.25	19.5	10.4	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	52.5	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*
12/14/2009	Parker	2468	ppbv	12.8	1.12	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	1.88	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	17.5	38.3	12.8	*1.59*	*1.59*	*1.59*	*1.59*	42.8	*1.59*	46.4	*1.59*	*1.59*

Date	County	CAN	UNITS	Dodecane	1-Methyl-1H-Indene	2-Methyl propenyl benzene	Propyl benzene	Diethyl benzene	Methyl-methylethyl benzene, methyl-Cumene	Tetramethyl benzene	Napthalene/ TrimethylBicyclo 2.2.1 heptane	Methyl pyridine	Diemethyl pyridine/ Aldrich	Ethyl pyridine	2-Methylbutane
		CAS	#→	112403	767599	768490	103651	25340174	19876	110189	91203	109068	108485	100710	78784
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	29	79	95.9	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	*1.3*	23.5	93.4	84.7	22.7	30.3	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	34.1	*1.3*	*1.3*	*1.3*	210	47.2	69.4	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	146
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	36.4	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*

Date	County	CAN	UNITS	Pentane	2,4-Dimethyl-pentane	Methyl cyclopentane	2-Methylhexane	2,3-Dimethyl-pentane	3-Methyl-hexane	Methyl cyclohexane	Trimethyl-pentane,2,2,4	C3 Hydrocarbon	C4 Hydrocarbon	C5 Hydrocarbon	C6 Hydrocarbon
		CAS	#→	109660	108087	963772	591764	565593	589344	108872	540841				
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	18.6	65	26.4
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	12.1	294
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	51.4	*1.3*	*1.3*	13
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	67.6	184
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	47	50	22	21	98	18	38	17	*1.36*	76.7	*1.36*	161
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	8.77	13
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	6.26	11.8
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	2	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	22.9	18.9

Date	County	CAN	UNITS	C7 Hydrocarbon	C8 Hydrocarbon	C9 Hydrocarbon	C10 Hydrocarbon	C11 Hydrocarbon	C12 hydrocarbon	C13 Hydrocarbon	Acetone	Propane / ppmv	Butane / ppmv	ethane / ppmv	Isobutane
		CAS	#→								76641	74986	106978	74840	75285
4/18/2009	Parker	288	ppbv	17.8	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.5*	*1.5*	*1.5*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.8*	*1.8*	*1.8*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.2*	*1.2*	*1.2*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	191	*4.43*	*4.43*	*4.43*	*4.43*	*4.2*	*4.2*	*4.2*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	4.36	*1.39*	*1.39*	*1.39*	18.4	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	73.3	3.57	*1.38*	*1.38*	*1.38*	15.4	*1.38*	*1.38*	*1.4*	*1.4*	*1.4*	*1.38*
6/28/2009	Tarrant	60183	ppbv	38.6	*1.23*	*1.23*	*1.23*	*1.23*	33.1	*1.23*	*1.23*	*1.2*	*1.2*	*1.2*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	34.9	*1.34*	*1.34*	*1.3*	*1.4*	*1.3*	*1.34*
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.0*	*2.0*	*2.0*	*2.32*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.3*	*1.3*	*1.3*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	395	231	*1.42*	*1.3*	*1.3*	*1.3*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	53.6	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	45.6	*1.3*	*1.3*	61.4	95.7		*2.6*	*2.6*	*2.6*	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.4*	*1.4*	*1.4*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.6*	*1.6*	*1.6*	*1.36*
8/17/2009	Denton	2514	ppbv	80.8	7.4	*1.31*	*1.31*	*1.31*	*1.31*	8.8	*1.31*	*1.3*	*1.3*	*1.3*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	12.1	*1.33*	*1.33*	*1.3*	*1.3*	*1.3*	6.75
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	15.6	*1.59*	*1.59*	*1.6*	*1.6*	*1.6*	3.69
12/14/2009	Parker	336	ppbv	18.9	77.3	*1.59*	*1.59*	45.2	*1.59*	*1.59*	*1.59*	*1.6*	*1.6*	*1.6*	*1.59*

Date	County	CAN	UNITS	Camphene	Cyclo-hexadiene	Propynyl benzene	Diethyl trisulfide	Methyl butene	Dimethyl-cyclopropane	Dimethyl-butane/ neoheptane	Methyl-pentane/ Isohexane	Hexane	Limonene	Dimethyl-pentatnone	Bromohexene
		CAS	#→	79925	592574	103651	226666	513359	2511957	75832	107835	110543	138863		No CAS
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*

Date	County	CAN	UNITS	Ethylmethylcyclohexane	Trimethyl hexene	Dimethyl-octane	1-R-alpha-pinene/2,6,6 Trimethyl Bicyclo[3.1.1] hetp-2-ene/2-Pinene	methyl isobutal ketone	Indane	2,2-dimethyl-hexane	Thieno[3,2b] thiophene	Methacrolein	1,4 Dichloro-benzene	methyl-hexane	Trichloro-monofluoro-methane
		CAS	#→	3728550	4316658	1072168	7785708	108101	496117	590738	251412	78853	106467	591764	75694
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*0.31*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*0.35*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*0.28*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*0.28*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*0.25*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*0.25*	*1.34*	*1.34*
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	15.2	*2.32*	*2.32*	*2.32*	*0.46*	*2.32*	*2.32*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*0.26*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*0.28*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*0.26*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*0.26*	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*0.28*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	168	*1.36*	*1.36*	*0.27*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*0.27*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*0.27*	*1.33*	*1.33*
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*0.32*	*1.59*	*1.59*

Date	County	CAN	UNITS	Difluorochloro-methane	tetramethyl cyclopentane	Ethylmethyl cyclohexane	methyl methylethyl cyclohexane	chloropentane	1,3 Cyclohexadiene	Methyl n-butyl disulfide	Propyl n-butyl disulfide	Dipropyl disulfide
		CAS	#→	75456	137631	4926787	6069983	543599	592574	60779240	72437640	629196
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*

Air sampling locations and laboratory results: 2009 data

Date	County	CAN	UNITS	Methane (ppmv)	Benzene	Chloroform	Chloro-methane (Methyl Chloride)	Dichloro-difluoromethane (F12)	Dichloro-tetrafluoro-ethane (F114)	1,2-Dichloro-ethane (EDC)	Dichloromethane (Methylene chloride)	Ethylbenzene
		CAS	#→	74828	71432	67663	74873	75718	76142	107062	75092	100414
1/11/2010	Wise	62417	ppbv	3	2.56	*0.3*	*0.3*	0.63	0.665	*0.3*	*0.3*	*0.3*
1/12/2010	Johnson	312	ppbv	2.9	6.58	*0.3*	*0.3*	0.6	0.631	*0.3*	*0.3*	*0.3*
1/22/2010	Tarrant	2519	ppbv	*3.9*	1.77	*0.8*	1.3	*0.8*	*0.8*	*0.8*	*0.8*	*0.8*
2/5/2010	Denton	2877	ppbv	2.9	*0.4*	*0.4*	0.645	0.49	*0.4*	*0.4*	*0.4*	*0.4*
2/5/2010	Denton	16	ppbv	2.9	*0.4*	*0.4*	0.514	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*
2/18/2010	Denton	17	ppbv	1.9	55.4	*0.3*	*0.3*	0.48	0.68	*0.3*	*0.3*	3.18
3/2/2010	Johnson	2879	ppbv	2.4	*0.2*	*0.2*	0.72	0.49	*0.2*	*0.2*	*0.2*	*0.2*
3/5/2010	Parker	145	ppbv	2.2	0.52	*0.3*	0.49	0.43	*0.3*	*0.3*	*0.3*	*0.3*
3/11/2010	Wise	2874	ppbv	2.4	1.21	*0.3*	0.55	0.42	*0.3*	*0.3*	*0.3*	*0.3*
5/2/2010	Parker	2519	ppbv	2.7	1.76	*0.3*	0.69	0.56	*0.3*	*0.3*	*0.3*	1.94
5/7/2010	Parker	60183	ppbv	2	*0.3*	*0.3*	5.33	0.34	*0.3*	*0.3*	*0.3*	1.14
5/17/2010	Johnson	288	ppbv	3.4	12.8	*0.3*	0.78	0.41	*0.3*	*0.3*	*0.3*	5.1
5/27/2010	Johnson	62417	ppbv	3.1	81.7	*0.3*	0.836	0.456	*0.3*	*0.3*	*0.3*	10.6
6/16/2010	Denton	336	ppbv	2.6	1	*0.3*	0.714	0.491	*0.3*	*0.3*	*0.3*	1.84
6/17/2010	Johnson	99015	ppbv	2.2	*0.3*	*0.3*	0.54	0.38	*0.3*	*0.3*	*0.3*	0.88
7/15/2010	Denton	2513	ppbv	3.3	0.87	*0.3*	0.62	0.41	*0.3*	*0.3*	*0.3*	4.17
7/15/2010	Denton	2512	ppbv	3.6	2.26	*0.3*	0.57	0.4	*0.3*	*0.3*	*0.3*	0.67
7/15/2010	Denton	62212	ppbv	2.4	0.34	*0.3*	0.71	0.45	*0.3*	*0.3*	*0.3*	0.56
8/3/2010	Tarrant	607	ppbv	2.5	*0.3*	*0.3*	0.73	0.47	*0.3*	*0.3*	*0.3*	0.48
8/4/2010	Denton	9904	ppbv	2.7	2.27	*0.3*	0.65	0.33	*0.3*	*0.3*	*0.3*	3.93
8/13/2010	Tarrant	62213	ppbv	2.5	592	*0.3*	0.45	*0.3*	*0.3*	*0.3*	*0.3*	113
8/14/2010	Parker	2512	ppbv	457	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*
8/15/2010	Parker	6007	ppbv	2.3	1.23	1.26	*0.4*	0.485	*0.4*	*0.4*	*0.4*	0.622
9/11/2010	Tarrant	62212	ppbv	2.6	0.473	*0.3*	0.802	0.454	*0.3*	*0.3*	*0.3*	*0.3*
9/24/2010	Denton	62207	ppbv	2	0.99	*0.3*	*0.3*	1.13	*0.3*	*0.3*	*0.3*	*0.3*
10/2/2010	Johnson	314	ppbv	2.3	0.76	*0.3*	0.59	0.4	*0.3*	*0.3*	*0.3*	0.68
10/15/2010	Denton	607	ppbv	3.7	*0.3*	*0.3*	0.64	0.45	*0.3*	*0.3*	*0.3*	*0.3*
11/26/2010	Johnson	4043	ppbv	3.4	0.38	*0.3*	0.88	0.63	*0.3*	*0.3*	*0.3*	*0.3*
12/14/2010	Wise	314	ppbv	3.2	0.31	*0.3*	0.62	0.45	*0.3*	*0.3*	*0.3*	*0.3*
12/14/2010	Denton	2516	ppbv	7.3	1.04	*0.4*	*0.4*	0.56	*0.4*	*0.4*	*0.4*	*0.4*
12/31/2010	Denton	50205	ppbv	2.9	0.51	*0.3*	0.75	0.53	*0.3*	*0.3*	*0.3*	*0.3*

Date	County	CAN	UNITS	Hexachloro-butadiene	Styrene (monomer)	1,1,2,2-Tetrachloro-ethane	Tetrachloro-ethene (PCE)	Toluene	1,1,1-Trichloro-ethane (TCA)	1,1,2-Trichloro-ethane	1,3,5 Trimethyl-benzene	1,2,4 Trimethyl-benzene	1,2,4-Trichloro-benzene
		CAS	#→	87683	100425	79345	127184	108883	71556	79005	108678	95636	120821
1/11/2010	Wise	62417	ppbv	*0.7*	*0.3*	*0.3*	*0.3*	1.73	*0.3*	*0.3*	*0.3*	*0.3*	*0.7*
1/12/2010	Johnson	312	ppbv	*0.6*	*0.3*	*0.3*	*0.3*	5.95	*0.3*	*0.3*	*0.3*	*0.3*	*0.6*
1/22/2010	Tarrant	2519	ppbv	*1.9*	*0.8*	*0.8*	*0.8*	5.74	*0.8*	*0.8*	*0.8*	*0.8*	*1.9*
2/5/2010	Denton	2877	ppbv	*1.1*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*1.1*
2/5/2010	Denton	16	ppbv	*1.1*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*1.1*
2/18/2010	Denton	17	ppbv	*0.6*	10.8	*0.3*	*0.3*	26.9	*0.3*	*0.3*	1.26	*0.3*	*0.6*
3/2/2010	Johnson	2879	ppbv	*1.2*	*0.2*	*0.2*	*0.2*	0.48	*0.2*	*0.2*	*0.2*	*0.2*	*1.2*
3/5/2010	Parker	145	ppbv	0.7	0.31	*0.3*	*0.3*	1.69	*0.3*	*0.3*	*0.3*	0.7	1.3
3/11/2010	Wise	2874	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	6.57	*0.3*	*0.3*	*0.3*	*0.3*	0.3
5/2/2010	Parker	2519	ppbv	0.4	1	*0.3*	*0.3*	17.8	*0.3*	*0.3*	0.67	0.45	0.4
5/7/2010	Parker	60183	ppbv	*0.3*	0.32	*0.3*	*0.3*	7.59	*0.3*	*0.3*	0.66	0.34	*0.5*
5/17/2010	Johnson	288	ppbv	*0.3*	7.22	*0.3*	*0.3*	19.9	*0.3*	*0.3*	2.68	0.86	*0.5*
5/27/2010	Johnson	62417	ppbv	0.424	0.814	*0.3*	*0.3*	167	*0.3*	*0.3*	0.39	1	*0.5*
6/16/2010	Denton	336	ppbv	*0.9*	2.98	*0.3*	*0.3*	5.3	*0.3*	*0.3*	2.54	1.09	*1.9*
6/17/2010	Johnson	99015	ppbv	*0.9*	1.52	*0.3*	*0.3*	1.83	*0.3*	*0.3*	2.7	1.68	*1.7*
7/15/2010	Denton	2513	ppbv	*0.7*	3.58	*0.3*	*0.3*	25.9	*0.3*	*0.3*	1.37	1.18	*0.8*
7/15/2010	Denton	2512	ppbv	*0.7*	0.46	*0.3*	*0.3*	3.93	*0.3*	*0.3*	2.09	0.58	*0.8*
7/15/2010	Denton	62212	ppbv	*0.7*	*0.3*	2.06	*0.3*	2.5	*0.3*	*0.3*	1.11	0.53	*0.8*
8/3/2010	Tarrant	607	ppbv	*0.8*	1.67	*0.3*	*0.3*	2.03	*0.3*	*0.3*	1.3	*0.3*	*1.9*
8/4/2010	Denton	9904	ppbv	*0.7*	4.96	*0.3*	*0.3*	10.8	*0.3*	*0.3*	5.3	2.3	*1.4*
8/13/2010	Tarrant	62213	ppbv	*0.8*	43.4	*0.3*	*0.3*	276	*0.3*	*0.3*	5.25	1.54	*1.5*
8/14/2010	Parker	2512	ppbv	*2.6*	*1.0*	*1.0*	*1.0*	1.39	*1.0*	*1.0*	*1.0*	*1.0*	*5.2*
8/15/2010	Parker	6007	ppbv	*0.9*	0.988	*0.4*	*0.4*	3.45	*0.4*	*0.4*	1.35	2.2	*0.4*
9/11/2010	Tarrant	62212	ppbv	*0.7*	0.611	*0.3*	*0.3*	0.961	*0.3*	*0.3*	0.647	*0.3*	0.738
9/24/2010	Denton	62207	ppbv	*0.3*	0.34	*0.3*	*0.3*	2.33	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
10/2/2010	Johnson	314	ppbv	*0.3*	0.78	*0.3*	0.31	4.26	*0.3*	*0.3*	0.64	0.31	*0.4*
10/15/2010	Denton	607	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	2.44	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
11/26/2010	Johnson	4043	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	0.46	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
12/14/2010	Wise	314	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	0.44	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
12/14/2010	Denton	2516	ppbv	*0.4*	*0.4*	*0.4*	*0.4*	0.56	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*
12/31/2010	Denton	50205	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	0.61	*0.3*	*0.3*	0.37	*0.3*	*0.3*

Date	County	CAN	UNITS	Trichloro-ethene (TCE)	Trichloro-fluoromethane (F-11)	m&p Xylene	0-Xylene	Carbon disulfide**	Carbonyl sulfide**	Dimethyl disulfide	Methyl ethyl disulphide	Ethylmethyl benzene	Methyl propyl disulfide	Diethyl disulfide C4H10S2
		CAS	#→	79016	75694	1330207	95476	75150	463-58-1	624920	20333395	611143	2179604	110816
1/11/2010	Wise	62417	ppbv	*0.3*	*0.3*	0.56	*0.3*	0.7	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*0.3*	0.258	1.85	0.46	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/22/2010	Tarrant	2519	ppbv	*0.8*	*0.8*	1.57	*0.8*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*0.4*	*0.4*	*0.4*	*0.4*	1.1	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*0.4*	*0.4*	*0.4*	*0.4*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*0.3*	*0.3*	11.4	1.73	15.4	*1.3*	6.5	11.3	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*0.2*	*0.2*	0.34	*0.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*0.3*	*0.3*	1.2	0.41	3	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*0.3*	*0.3*	1.79	*0.3*	*1.3*	*1.3*	27.4	2	*1.3*	*1.3*	12
5/2/2010	Parker	2519	ppbv	*0.3*	*0.3*	7.08	1.91	1.3	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*0.3*	*0.3*	3.25	0.96	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*0.3*	*0.3*	14.5	3.78	44	*1.5*	59.4	38.6	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*0.3*	*0.3*	221	1.49	30.5	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*0.3*	*0.3*	8.52	3.12	*1.6*	*1.6*	14.4	4.1	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	*0.3*	*0.3*	4.73	1.74	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*0.3*	*0.3*	11.7	3.89	11.2	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*0.3*	*0.3*	2.41	1.03	6.7	*1.3*	31.8	21.2	*1.3*	*1.3*	4.65
7/15/2010	Denton	62212	ppbv	*0.3*	*0.3*	3.09	1.22	11.6	*1.4*	12.3	4.72	*1.4*	*1.4*	*1.4*
8/3/2010	Tarrant	607	ppbv	*0.3*	*0.3*	3.1	1.08	3.74	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*0.3*	*0.3*	21.7	6.13	6.66	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/13/2010	Tarrant	62213	ppbv	*0.3*	*0.3*	206	15.9	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	*1.0*	*1.0*	*1.0*	*1.0*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*
8/15/2010	Parker	6007	ppbv	*0.4*	*0.4*	2.62	0.99	7.03	*1.8*	3.61	*1.8*	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	*0.3*	*0.3*	0.937	0.417	20.4	15.2	17.7	10	*1.3*	*1.3*	2.12
9/24/2010	Denton	62207	ppbv	*0.3*	0.56	*0.3*	*0.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	*0.3*	*0.3*	3.3	1.28	*1.4*	*1.4*	9.3	39.2	*1.4*	*1.4*	32.7
10/15/2010	Denton	607	ppbv	*0.3*	*0.3*	1.06	0.43	8.9	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*0.3*	*0.3*	0.38	*0.3*	4.1	*1.4*	*1.4*	4.8	*1.4*	*1.4*	3
12/14/2010	Denton	2516	ppbv	*0.4*	*0.4*	1.27	0.43	30.5	2.1	4.77	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*0.3*	*0.3*	0.47	0.25	6.8	*1.4*	4.4	6	*1.4*	*1.4*	1.27

Date	County	CAN	UNITS	Ethyl, methylethyl disulfide	Dimethyl trisulfide	Ethyl n-propyl disulfide	Trimethyl benzene	Undecane	1-Methyl propenyl-benzene	Dodecane	1-Methyl-1H-Indene	2-Methyl propenyl benzene	Propyl benzene	Diethyl benzene
		CAS	#→	53966362	3658808	30453317	95636	1120214	2082613	112403	767599	768490	103651	25340174
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	11.9	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*1.3*	8.93	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*1.5*	74.5	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*1.6*	26.4	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	38.7	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
7/15/2010	Denton	62212	ppbv	*1.4*	23.9	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
8/3/2010	Tarrant	607	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*0.3*	8.82	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*
8/15/2010	Parker	6007	ppbv	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	*1.3*	37.4	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	46.7	*1.4*	25.2	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	5.6	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.4*	6.75	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

Date	County	CAN	UNITS	Methyl-methylethyl benzene, methyl-Cumene	Tetramethyl benzene	Napthalene/ TrimethylBicyclo 2.2.1 heptane	Methyl pyridine	Diemethyl pyridine/ Aldrich	Ethyl pyridine	2-Methylbutane	Pentane	2,4-Dimethyl-pentane	Methyl cyclopentane
		CAS	#→	19876	110189	91203	109068	108485	100710	78784	109660	108087	963772
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	64	42	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	336	198	*1.3*	18.6
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	*1.3*	10.2	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
7/15/2010	Denton	62212	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
8/3/2010	Tarrant	607	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	3620	*5.2*	*5.2*	*5.2*
8/15/2010	Parker	6007	ppbv	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	152	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	*1.3*	*1.3*	6.17	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	14.6	22.8	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

Date	County	CAN	UNITS	2-Methylhexane	2,3-Dimethyl-pentane	3-Methyl-hexane	Methyl cyclohexane	Trimethyl-pentane,2,2,4	C3 Hydrocarbon	C4 Hydrocarbon	C5 Hydrocarbon	C6 Hydrocarbon
		CAS	#→	591764	565593	589344	108872	540841				
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	3.8	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	25	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	46	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	16.4	*2.1*	7.27	3.32
2/5/2010	Denton	16	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	13.5	*2.1*	5.32	2.75
2/18/2010	Denton	17	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	20.3	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	9.08	6.48
3/11/2010	Wise	2874	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	13.8	*1.3*	23.2	9.28
5/2/2010	Parker	2519	ppbv	35.3	*1.3*	35.3	*1.3*	*1.3*	26.8	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	32.3	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	16.4
7/15/2010	Denton	2512	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	26.9	*1.3*
7/15/2010	Denton	62212	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	4.53	10.8
8/3/2010	Tarrant	607	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	3.74	1.91	1.86
8/4/2010	Denton	9904	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	19	*0.3*	*0.3*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	2300	*5.2*	*5.2*	*5.2*	*5.2*	6780	40
8/15/2010	Parker	6007	ppbv	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	64	18.4
9/11/2010	Tarrant	62212	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	4	6
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	1.5	3.7	*1.4*
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	18.4	*1.7*	5.1	2.8
12/14/2010	Wise	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	37.4	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	137	17.9	16.2
12/31/2010	Denton	50205	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	18	*1.4*	1.4	*1.4*

Date	County	CAN	UNITS	C7 Hydrocarbon	C8 Hydrocarbon	C9 Hydrocarbon	C10 Hydrocarbon	C11 Hydrocarbon	C12 hydrocarbon	C13 Hydrocarbon	Acetone	Propane / ppmv	Butane / ppmv
		CAS	#→								76641	74986	106978
1/11/2010	Wise	62417	ppbv	*1.3*	1.53	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	62.9	69
1/12/2010	Johnson	312	ppbv	*1.3*	43.2	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/22/2010	Tarrant	2519	ppbv	98.9	192	19	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	10.7	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*2.1*	*2.1*	2.59	*2.1*	*2.1*	6.39	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	23.4	11.7	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	3.3	*1.2*	4.8	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	1.0	1.0
3/11/2010	Wise	2874	ppbv	3.94	*1.3*	*1.3*	*1.3*	*1.3*	14.6	*1.3*	*1.3*	*1.0*	*1.0*
5/2/2010	Parker	2519	ppbv	10	*1.3*	20.8	35.6	*1.3*	27.3	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	10.5	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.3*	*1.3*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*1.6*	3.7	*1.6*	13.1	6.9	15.2	*1.6*	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	*1.5*	22.5	7.82	45.4	*1.5*	24.7	28.9	*1.5*	*1.4*	*1.4*
7/15/2010	Denton	2513	ppbv	*1.4*	104	60.9	26.9	*1.4*	15	8.09	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	17.3	12.4	*1.3*	*1.3*	*1.3*
7/15/2010	Denton	62212	ppbv	*1.4*	*1.4*	*1.4*	11	*1.4*	163	23.9	*1.4*	*1.3*	*1.3*
8/3/2010	Tarrant	607	ppbv	*1.6*	5.67	*1.6*	88.6	*1.6*	20.9	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*0.3*	*0.3*	*0.3*	67.1	13	55.2	*0.3*	*0.3*	*1.4*	*1.4*
8/13/2010	Tarrant	62213	ppbv	18.5	*1.5*	*1.5*	*1.5*	*1.5*	45.7	52.4	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	2390	1420	761	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	9.4	2.2
8/15/2010	Parker	6007	ppbv	*1.8*	26	*1.8*	*1.8*	*1.8*	43.9	*1.8*	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	20.3	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	7.6	6	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	3	20.7	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	21.2	5.2	*1.4*	23.7	*1.4*	47.4	*1.4*	*1.4*	*1.3*	*1.3*
12/14/2010	Denton	2516	ppbv	2.05	*2.1*	*2.1*	5	*2.1*	3.13	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	2.12	*1.4*	*1.4*	*1.3*	*1.3*

Date	County	CAN	UNITS	ethane / ppmv	Isobutane	Camphene	Cyclo-hexadiene	Propynyl benzene	Diethyl trisulfide	Methyl butene	Dimethyl-cyclopropane	Dimethyl-butane/ neoheptane	Methyl-pentane/ Isohexane	Hexane	Limonene
		CAS	#→	74840	75285	79925	592574	103651	226666	513359	2511957	75832	107835	110543	138863
1/11/2010	Wise	62417	ppbv	*1.3*	34	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	26.4	8.6	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	29	*1.3*	*1.3*	*1.3*	*1.3*	16	29	15	199	35	*1.3*
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	6.74	2.85	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*2.1*	5.19	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	*1.3*	*1.3*	7.1	7.2	6.2	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	1.0	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*1.0*	5.82	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*1.3*	*1.5*	*1.5*	*1.5*	*1.5*	8.23	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	3.3	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	8.1
6/17/2010	Johnson	99015	ppbv	*1.4*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*0.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	7.32	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
7/15/2010	Denton	62212	ppbv	*1.3*	5.92	*1.4*	*1.4*	*1.4*	3.38	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
8/3/2010	Tarrant	607	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*1.4*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	34.6	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*
8/15/2010	Parker	6007	ppbv	*1.8*	12.9	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	4.8	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	12.9
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	8.2
10/15/2010	Denton	607	ppbv	*1.4*	6	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*1.3*	16.6	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

Date	County	CAN	UNITS	Dimethyl-pentatnone	Bromohexene	Ethylmethylcyclohexane	Trimethyl hexene	Dimethyl-octane	pinene/2,6,6 Trimethyl Bicyclo[3.1.1] hetp-2-ene/2-Pinene	methyl isobutal ketone	Indane	2,2-dimethyl-hexane	Thieno[3,2b] thiophene	Methacrolein
		CAS	#→		No CAS	3728550	4316658	1072168	7785708	108101	496117	590738	251412	78853
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	42.8	3.66	6.1	11.9	20.4	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	*1.5*	*1.5*	5.68	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	56.5	*1.5*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	40.3	*1.3*
7/15/2010	Denton	62212	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	23.8	*1.4*
8/3/2010	Tarrant	607	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	17.7	*0.3*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	1710
8/15/2010	Parker	6007	ppbv	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	29	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	33.4	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	8.7	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	5.33	*1.4*

Date	County	CAN	UNITS	1,4 Dichloro-benzene	methyl-hexane	Trichloro-monofluoro-methane	Difluoro-chloro-methane	tetramethyl cyclopentane	Ethylmethyl cyclohexane	methyl methylethyl cyclo-hexane	chloropentane	1,3 Cyclo-hexadiene	Methyl n-butyl disulfide	Propyl n-butyl disulfide	Dipropyl disulfide
		CAS	#→	106467	591764	75694	75456	137631	4926787	6069983	543599	592574	60779240	72437640	629196
1/11/2010	Wise	62417	ppbv	*0.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*0.3*	25	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/22/2010	Tarrant	2519	ppbv	*0.8*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*0.4*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/5/2010	Denton	16	ppbv	*0.4*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*0.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/2/2010	Johnson	2879	ppbv	*0.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
3/5/2010	Parker	145	ppbv	*0.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*0.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	*0.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	45	9.24	4.33	6.17	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/17/2010	Johnson	288	ppbv	0.384	*1.5*	*1.5*	*1.5*	*1.5*	5.68	*1.5*	*1.5*	5.8	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*0.3*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	2.1	*1.7*	*1.7*	*1.7*	*1.7*
6/16/2010	Denton	336	ppbv	*0.3*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
6/17/2010	Johnson	99015	ppbv	0.94	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*0.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*0.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
7/15/2010	Denton	62212	ppbv	0.43	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
8/3/2010	Tarrant	607	ppbv	*0.3*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/4/2010	Denton	9904	ppbv	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/13/2010	Tarrant	62213	ppbv	*0.3*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
8/14/2010	Parker	2512	ppbv	*1.0*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*
8/15/2010	Parker	6007	ppbv	*0.4*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*	*1.8*
9/11/2010	Tarrant	62212	ppbv	0.738	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*0.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	0.4	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	15.5	14.6	23.1
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
11/26/2010	Johnson	4043	ppbv	*0.3*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*0.4*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*0.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

APPENDIX D
EQUIPMENT

COUNTY	SITE	IDENTIFIER	# TIMES SAMPLED	EQUIPMENT 200 Foot Zones of Influence				EQUIPMENT 2000 Foot Zone of Influence				EQUIPMENT 5280 Foot Zone of Influence			
				#wells	#tanks	#comp	#sep	#wells	#tanks	#comp	#sep	#wells	#tanks	#comp	#sep
PARKER	A	101	1	0	0	0	0	4	6	9	1	10	12	9	2
PARKER	B	102	1	0	0	0	0	4	6	9	1	10	12	9	2
PARKER	C	103	1	0	0	0	0	0	0	9	1	10	12	9	2
PARKER	D	138,147	2	0	0	0	0	0	0	0	0	8	6	2	1
PARKER	E	140	1	0	0	0	0	0	0	0	0	8	6	2	1
PARKER	F	148	1	0	0	0	0	0	0	0	0	8	6	2	1
PARKER	G	157	1	0	0	0	0	0	0	0	0	2	4	1	2
PARKER	H	159	1	1	0	0	0	0	0	0	0	0	0	0	0
			9	W	T	C	S	W	T	C	S	W	T	C	S
TARRANT	A	116,121	2	0	0	0	0	0	0	0	0	2	2	0	0
TARRANT	B	117,119	2	0	0	0	0	0	0	0	0	2	2	0	0
TARRANT	C	118,120	2	0	0	0	0	0	0	0	0	2	2	0	0
TARRANT	D	131	1	1	0	0	0	4	10	3	2	16	30	8	6
TARRANT	E	158	1	1	0	0	0	0	0	0	0	2	4	1	1
TARRANT	F	160	1	1	0	0	0	0	0	0	0	1	2	1	1
TARRANT	G	161	1	1	0	0	0	3	2	1	1	3	2	1	1
			10	W	T	C	S	W	T	C	S	W	T	C	S
JOHNSON	A	130	1	0	0	4	2	1	4	4	2	1	4	4	2
JOHNSON	B	136	1	0	0	4	2	1	4	4	2	1	4	4	2
JOHNSON	C	150	1	0	0	0	0	1	2	0	0	8	14	4	2
JOHNSON	D	151, 164	2	0	0	0	0	1	2	0	0	8	14	4	2
JOHNSON	E	153	1	2	12	2	2	2	12	2	2	5	12	2	2
JOHNSON	F	166	1	1	2	0	0	1	2	0	0	1	2	0	0
			7	W	T	C	S	W	T	C	S	W	T	C	S

COUNTY	SITE	IDENTIFIER	# TIMES SAMPLED	EQUIPMENT 200 Foot Zones of Influence				EQUIPMENT 2000 Foot Zone of Influence				EQUIPMENT 5280 Foot Zone of Influence			
				#wells	#tanks	#comp	#sep	#wells	#tanks	#comp	#sep	#wells	#tanks	#comp	#sep
DENTON	A	122	1	0	0	0	0	4	4	9	6	4	4	9	6
DENTON	B	123	1	0	0	0	0	4	4	9	6	4	4	9	6
DENTON	C	124,154	2	0	0	0	0	0	0	0	0	3	4	9	6
DENTON	D	125,155,129	3	0	0	0	0	2	2	6	1	4	4	9	6
DENTON	E	126	1	0	0	0	0	2	2	6	1	4	4	9	6
DENTON	F	127	1	0	0	0	0	2	2	4	6	4	4	9	6
DENTON	G	128	1	0	1	1	1	2	4	5	6	4	4	9	6
DENTON	H	133	1	0	0	0	0	2	0	0	0	2	0	0	0
DENTON	I	134	1	0	0	0	0	2	0	0	0	2	0	0	0
DENTON	J	137	1	0	0	0	0	0	0	0	0	5	6	4	2
DENTON	K	152	1	4	4	1	1	6	6	1	1	24	24	4	6
DENTON	L	156,162	2	0	0	0	0	2	0	0	0	6	6	0	1
DENTON	M	163,169,168	3	0	0	0	0	2	0	0	0	22	14	5	8
DENTON	N	165	1	2	2	0	0	6	6	1	1	12	12	12	4
			20	W	T	C	S	W	T	C	S	W	T	C	S
SOMERVIL	A	149	1	0	0	0	0	0	0	0	0	4	6	2	0
			1	W	T	C	S	W	T	C	S	W	T	C	S
WISE	A	141	1	2	4	0	0	2	4	0	0	4	8	2	0
WISE	B	142	1	0	0	0	0	0	0	0	0	4	8	2	0
WISE	C	169	1	2	4	0	0	2	4	0	0	4	8	2	0
			3												

APPENDIX E
PCA ANALYSIS CORRELATION LOG DATA

Correlation matrix, logged data with all cases: Part 1

	Methane (ppmv)	Benzene	Chloroform	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	1,2-Dichloro-ethane (EDC)	Dichloro-methane (Methylene chloride)	Ethyl-benzene	Hexachloro-butadiene	Styrene (monomer)	1,1,2,2-Tetrachloroethane
Methane (ppmv)	1	-0.04	0.29	0.15	0.38	0.47	0.58	0.58	-0.02	0.36	0.02	0.4
Benzene	-0.04	1	-0.03	-0.07	0.01	0.23	0.06	0.08	0.84	0.1	0.6	-0.03
Chloroform	0.29	-0.03	1	-0.04	0.21	0.47	0.6	0.6	-0.06	0.31	0.01	0.41
Chloromethane (Methyl Chloride)	0.15	-0.07	-0.04	1	0.24	0.08	0.27	0.28	0.19	0.12	0.12	0.25
Dichlorodifluoromethane (F12)	0.38	0.01	0.21	0.24	1	0.57	0.55	0.56	-0.1	0.33	-0.03	0.41
Dichlorotetrafluoroethane (F114)	0.47	0.23	0.47	0.08	0.57	1	0.83	0.83	0.06	0.54	0.2	0.59
1,2-Dichloroethane (EDC)	0.58	0.06	0.6	0.27	0.55	0.83	1	1	0.09	0.62	0.14	0.72
Dichloromethane (Methylene chloride)	0.58	0.08	0.6	0.28	0.56	0.83	1	1	0.11	0.62	0.15	0.72
Ethylbenzene	-0.02	0.84	-0.06	0.19	-0.1	0.06	0.09	0.11	1	0.17	0.72	0.04
Hexachlorobutadiene	0.36	0.1	0.31	0.12	0.33	0.54	0.62	0.62	0.17	1	0.18	0.48
Styrene (monomer)	0.02	0.6	0.01	0.12	-0.03	0.2	0.14	0.15	0.72	0.18	1	0.05
1,1,2,2-Tetrachloroethane	0.4	-0.03	0.41	0.25	0.41	0.59	0.72	0.72	0.04	0.48	0.05	1
Tetrachloroethene (PCE)	0.35	0.09	0.37	0.14	0.32	0.53	0.71	0.66	0.07	0.48	0.03	0.47
Toluene	-0.14	0.85	-0.12	0.11	-0.12	0.03	-0.05	-0.03	0.89	0.01	0.59	-0.05
1,1,1-Trichloroethane (TCA)	0.58	0.07	0.6	0.27	0.55	0.83	1	1	0.09	0.61	0.15	0.73
1,1,2-Trichloroethane	0.58	0.07	0.6	0.27	0.55	0.83	1	1	0.09	0.61	0.15	0.73
1,3,5 Trimethylbenzene	0.05	0.5	-0.03	0.26	-0.03	0.06	0.12	0.15	0.72	0.29	0.66	0.14
1,2,4 Trimethylbenzene	0.04	0.52	0.04	0.16	0.05	0.02	0.13	0.16	0.71	0.32	0.27	0.08
1,2,4-Trichlorobenzene	0.33	0.19	0.14	0.26	0.21	0.37	0.46	0.46	0.33	0.75	0.3	0.36
Trichloroethene (TCE)	0.15	0.04	0.17	0.13	0.13	0.27	0.41	0.35	-0.01	0.3	-0.03	0.24
Trichlorofluoromethane (F-11)	0.53	0.06	0.56	0.26	0.68	0.76	0.94	0.95	0.09	0.55	0.13	0.68
m&p Xylene	-0.08	0.81	-0.11	0.17	-0.17	-0.02	-0.03	-0.01	0.93	0.09	0.65	0
0-Xylene	-0.02	0.7	-0.03	0.17	-0.11	0.02	0.07	0.09	0.92	0.24	0.61	0.08
Carbon disulfide**	0.07	0.31	0.23	0.19	-0.02	0.07	0.16	0.17	0.32	-0.01	0.2	0.19
Carbonyl sulfide**	0.13	0.13	0.09	0.21	0.18	0.16	0.29	0.3	0.16	0.34	-0.1	0.16
Dimethyl disulfide	0.05	0.21	0.22	-0.16	-0.18	-0.03	0.03	0.04	0.16	0	-0.06	0.1

	Tetrachloroethene (PCE)	Toluene	1,1,1-Trichloroethane (TCA)	1,1,2-Trichloroethane	1,3,5 Trimethylbenzene	1,2,4 Trimethylbenzene	1,2,4-Trichlorobenzene	Trichloroethene (TCE)	Trichlorofluoromethane (F-11)	m&p Xylene	0-Xylene	Carbon disulfide**
Methane (ppmv)	0.35	-0.14	0.58	0.58	0.05	0.04	0.33	0.15	0.53	-0.08	-0.02	0.07
Benzene	0.09	0.85	0.07	0.07	0.5	0.52	0.19	0.04	0.06	0.81	0.7	0.31
Chloroform	0.37	-0.12	0.6	0.6	-0.03	0.04	0.14	0.17	0.56	-0.11	-0.03	0.23
Chloromethane (Methyl Chloride)	0.14	0.11	0.27	0.27	0.26	0.16	0.26	0.13	0.26	0.17	0.17	0.19
Dichlorodifluoromethane (F12)	0.32	-0.12	0.55	0.55	-0.03	0.05	0.21	0.13	0.68	-0.17	-0.11	-0.02
Dichlorotetrafluoroethane (F114)	0.53	0.03	0.83	0.83	0.06	0.02	0.37	0.27	0.76	-0.02	0.02	0.07
1,2-Dichloroethane (EDC)	0.71	-0.05	1	1	0.12	0.13	0.46	0.41	0.94	-0.03	0.07	0.16
Dichloromethane (Methylene chloride)	0.66	-0.03	1	1	0.15	0.16	0.46	0.35	0.95	-0.01	0.09	0.17
Ethylbenzene	0.07	0.89	0.09	0.09	0.72	0.71	0.33	-0.01	0.09	0.93	0.92	0.32
Hexachlorobutadiene	0.48	0.01	0.61	0.61	0.29	0.32	0.75	0.3	0.55	0.09	0.24	-0.01
Styrene (monomer)	0.03	0.59	0.15	0.15	0.66	0.27	0.3	-0.03	0.13	0.65	0.61	0.2
1,1,2,2-Tetrachloroethane	0.47	-0.05	0.73	0.73	0.14	0.08	0.36	0.24	0.68	0	0.08	0.19
Tetrachloroethene (PCE)	1	-0.03	0.66	0.66	0.15	0.18	0.3	0.82	0.62	-0.01	0.08	0.17
Toluene	-0.03	1	-0.04	-0.04	0.59	0.59	0.15	-0.07	-0.04	0.93	0.82	0.28
1,1,1-Trichloroethane (TCA)	0.66	-0.04	1	1	0.13	0.14	0.46	0.35	0.95	-0.02	0.08	0.15
1,1,2-Trichloroethane	0.66	-0.04	1	1	0.13	0.14	0.46	0.35	0.95	-0.02	0.08	0.15
1,3,5 Trimethylbenzene	0.15	0.59	0.13	0.13	1	0.73	0.28	-0.03	0.13	0.7	0.8	0.34
1,2,4 Trimethylbenzene	0.18	0.59	0.14	0.14	0.73	1	0.33	0.02	0.17	0.68	0.83	0.33
1,2,4-Trichlorobenzene	0.3	0.15	0.46	0.46	0.28	0.33	1	0.33	0.4	0.27	0.42	0.04
Trichloroethene (TCE)	0.82	-0.07	0.35	0.35	-0.03	0.02	0.33	1	0.32	-0.05	0	0.24
Trichlorofluoromethane (F-11)	0.62	-0.04	0.95	0.95	0.13	0.17	0.4	0.32	1	-0.05	0.07	0.15
m&p Xylene	-0.01	0.93	-0.02	-0.02	0.7	0.68	0.27	-0.05	-0.05	1	0.9	0.35
0-Xylene	0.08	0.82	0.08	0.08	0.8	0.83	0.42	0	0.07	0.9	1	0.32
Carbon disulfide**	0.17	0.28	0.15	0.15	0.34	0.33	0.04	0.24	0.15	0.35	0.32	1
Carbonyl sulfide**	0.36	0.06	0.27	0.27	0.08	0.34	0.34	0.47	0.3	0.09	0.2	0.34
Dimethyl disulfide	0.07	0.17	0.04	0.04	0.12	0.29	0.03	-0.04	0	0.2	0.3	0.19

	Carbonyl sulfide**	Dimethyl disulfide	Methyl ethyl disulphide	Ethylmethyl benzene	Methyl propyl disulfide	Diethyl disulfide C4H10S2	Ethyl, methylethyl-disulfide	Dimethyl trisulfide	Ethyl n-propyl disulfide	Trimethyl benzene	Undecane	1-Methyl propenylbenzene
Methane (ppmv)	0.13	0.05	0.01	0.19	0.28	0.19	0.17	0.05	0.27	0.09	0.25	0.27
Benzene	0.13	0.21	0.23	0.27	-0.06	-0.06	0.04	0.26	-0.04	0.3	0.15	0.15
Chloroform	0.09	0.22	0.29	0.23	0.83	0.48	0.32	0.14	0.51	0.06	0.22	0.24
Chloromethane (Methyl Chloride)	0.21	-0.16	-0.21	-0.07	-0.1	0.01	-0.06	0.14	0.06	0.2	-0.02	-0.01
Dichlorodifluoromethane (F12)	0.18	-0.18	-0.18	0.19	0.1	0.08	0.1	0.02	0.2	0.22	0.24	0.26
Dichlorotetrafluoroethane (F114)	0.16	-0.03	0.03	0.33	0.25	0.17	0.16	0.15	0.32	0.09	0.3	0.32
1,2-Dichloroethane (EDC)	0.29	0.03	0.06	0.44	0.35	0.28	0.26	0.18	0.43	0.17	0.4	0.43
Dichloromethane (Methylene chloride)	0.3	0.04	0.06	0.44	0.35	0.28	0.26	0.18	0.44	0.2	0.4	0.43
Ethylbenzene	0.16	0.16	0.17	0.28	-0.12	-0.16	0.03	0.25	-0.07	0.41	0.16	0.16
Hexachlorobutadiene	0.34	0	-0.06	0.37	0.12	-0.09	0.01	0.1	0.08	0.22	0.31	0.33
Styrene (monomer)	-0.1	-0.06	-0.02	-0.09	-0.15	-0.13	-0.1	0.29	-0.06	-0.02	-0.08	-0.08
1,1,2,2-Tetrachloroethane	0.16	0.1	0.07	0.3	0.23	0.17	0.16	0.31	0.3	0.09	0.28	0.3
Tetrachloroethene (PCE)	0.36	0.07	0.13	0.46	0.22	0.16	0.37	0.06	0.29	0.26	0.56	0.57
Toluene	0.06	0.17	0.17	0.22	-0.15	-0.1	0.01	0.22	-0.1	0.32	0.1	0.09
1,1,1-Trichloroethane (TCA)	0.27	0.04	0.07	0.45	0.35	0.28	0.26	0.19	0.44	0.17	0.4	0.43
1,1,2-Trichloroethane	0.27	0.04	0.07	0.45	0.35	0.28	0.26	0.19	0.44	0.17	0.4	0.43
1,3,5 Trimethylbenzene	0.08	0.12	0.1	0.2	-0.21	-0.16	0.02	0.29	-0.12	0.32	0.16	0.15
1,2,4 Trimethylbenzene	0.34	0.29	0.2	0.48	-0.08	-0.15	0.16	0.16	-0.08	0.7	0.36	0.35
1,2,4-Trichlorobenzene	0.34	0.03	-0.03	0.17	0.05	-0.04	-0.04	0.33	0.09	0.29	0.12	0.13
Trichloroethene (TCE)	0.47	-0.04	-0.01	0.13	0.11	0.06	0.06	0.1	0.14	0.14	0.13	0.14
Trichlorofluoromethane (F-11)	0.3	0	0.02	0.41	0.32	0.25	0.23	0.14	0.41	0.23	0.37	0.4
m&p Xylene	0.09	0.2	0.16	0.22	-0.17	-0.14	0	0.27	-0.11	0.33	0.09	0.08
0-Xylene	0.2	0.3	0.27	0.35	-0.12	-0.15	0.09	0.33	-0.06	0.49	0.2	0.19
Carbon disulfide**	0.34	0.19	0.25	0.06	0.18	0.02	-0.07	0.43	0.03	0.27	-0.06	-0.05
Carbonyl sulfide**	1	0.21	0.2	0.32	0.15	0.09	0.07	0.12	0.18	0.6	0.18	0.2
Dimethyl disulfide	0.21	1	0.86	0.51	0.34	0.38	0.4	0.54	0.27	0.25	0.41	0.41

	Dodecane	1-Methyl-1H-Indene	2-Methyl propenyl benzene	Propyl benzene	Diethyl benzene	Methyl-methylethyl benzene, methyl-Cumene	Tetramethyl benzene	Napthalene/ Trimethyl Bicyclo 2.2.1 heptane	Methyl pyridine	Diemethyl pyridine/ Aldrich	Ethyl pyridine	2-Methyl-butane
Methane (ppmv)	0.3	0.24	0.24	0.29	0.21	0.21	0.21	0.24	0.49	0.49	0.49	0.64
Benzene	0.14	0.15	0.16	0.15	0.17	0.17	0.22	0.13	0.01	0.01	0.01	0.02
Chloroform	0.28	0.22	0.21	0.28	0.19	0.2	0.2	0.19	0.49	0.49	0.49	0.3
Chloromethane (Methyl Chloride)	0.01	-0.03	-0.03	0.35	0.35	0.35	0.3	0.35	0.21	0.21	0.21	0
Dichlorodifluoromethane (F12)	0.29	0.23	0.22	0.44	0.38	0.38	0.33	0.35	0.5	0.5	0.5	0.41
Dichlorotetrafluoroethane (F114)	0.37	0.29	0.28	0.36	0.25	0.26	0.27	0.26	0.63	0.63	0.63	0.59
1,2-Dichloroethane (EDC)	0.49	0.39	0.38	0.48	0.35	0.35	0.37	0.37	0.79	0.79	0.79	0.45
Dichloromethane (Methylene chloride)	0.49	0.39	0.38	0.52	0.39	0.4	0.4	0.4	0.79	0.79	0.79	0.46
Ethylbenzene	0.15	0.16	0.17	0.22	0.26	0.25	0.31	0.15	0	0	0	-0.13
Hexachlorobutadiene	0.36	0.3	0.3	0.35	0.28	0.28	0.32	0.32	0.49	0.49	0.49	0.33
Styrene (monomer)	-0.08	-0.08	-0.08	0	0.02	0.02	-0.02	-0.01	-0.05	-0.05	-0.05	-0.08
1,1,2,2-Tetrachloroethane	0.34	0.27	0.26	0.33	0.24	0.24	0.25	0.24	0.57	0.57	0.57	0.3
Tetrachloroethene (PCE)	0.59	0.56	0.55	0.32	0.22	0.23	0.23	0.23	0.55	0.55	0.55	0.27
Toluene	0.08	0.11	0.11	0.11	0.16	0.16	0.2	0.08	-0.11	-0.11	-0.11	-0.15
1,1,1-Trichloroethane (TCA)	0.49	0.39	0.38	0.48	0.35	0.36	0.38	0.37	0.79	0.79	0.79	0.46
1,1,2-Trichloroethane	0.49	0.39	0.38	0.48	0.35	0.36	0.38	0.37	0.79	0.79	0.79	0.46
1,3,5 Trimethylbenzene	0.13	0.16	0.16	0.23	0.29	0.29	0.11	0.29	-0.08	-0.08	-0.08	-0.07
1,2,4 Trimethylbenzene	0.33	0.36	0.37	0.44	0.5	0.49	0.47	0.36	0.04	0.04	0.04	0.04
1,2,4-Trichlorobenzene	0.16	0.12	0.11	0.21	0.16	0.16	0.51	0.18	0.32	0.32	0.32	0.17
Trichloroethene (TCE)	0.17	0.13	0.12	0.17	0.11	0.12	0.29	0.11	0.3	0.3	0.3	0.11
Trichlorofluoromethane (F-11)	0.46	0.37	0.35	0.54	0.42	0.43	0.41	0.42	0.75	0.75	0.75	0.39
m&p Xylene	0.06	0.09	0.1	0.1	0.15	0.15	0.21	0.08	-0.12	-0.12	-0.12	-0.15
0-Xylene	0.17	0.2	0.21	0.21	0.26	0.25	0.36	0.16	-0.06	-0.06	-0.06	-0.12
Carbon disulfide**	-0.04	-0.06	-0.06	0.34	0.37	0.37	0.32	0.39	0.09	0.09	0.09	-0.14
Carbonyl sulfide**	0.23	0.18	0.17	0.64	0.63	0.63	0.72	0.64	0.41	0.41	0.41	0.06
Dimethyl disulfide	0.4	0.41	0.41	0.04	-0.01	0	0.16	0.15	0.18	0.18	0.18	0.02

	Pentane	2,4-Dimethylpentane	Methyl cyclopentane	2-Methyl-hexane	2,3-Dimethylpentane	3-Methyl-hexane	Methyl cyclohexane	Trimethyl-pentane,2,2,4	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon
Methane (ppmv)	0.22	0.4	0.36	0.32	0.37	0.81	0.4	0.45	0.08	0.34	0.68	0.33
Benzene	0.04	-0.05	0.04	-0.02	-0.05	0.02	-0.03	-0.04	0.23	-0.01	-0.02	0.11
Chloroform	0.06	0.24	0.22	0.2	0.2	0.28	0.24	0.31	0.04	0.11	0.33	0.14
Chloromethane (Methyl Chloride)	-0.07	0.17	0.06	0.18	0.15	0.15	0.13	0.19	0.28	0.04	0.13	0.1
Dichlorodifluoromethane (F12)	0.31	0.28	0.35	0.32	0.24	0.46	0.32	0.35	0.33	0.12	0.43	0.31
Dichlorotetrafluoroethane (F114)	0.47	0.31	0.48	0.27	0.26	0.55	0.4	0.41	0.23	0.19	0.46	0.19
1,2-Dichloroethane (EDC)	0.19	0.42	0.4	0.37	0.36	0.57	0.43	0.53	0.21	0.29	0.63	0.33
Dichloromethane (Methylene chloride)	0.19	0.42	0.4	0.37	0.36	0.57	0.43	0.53	0.23	0.29	0.64	0.34
Ethylbenzene	-0.19	-0.04	-0.1	0.03	-0.05	-0.01	-0.07	-0.04	0.18	0.04	-0.06	0.17
Hexachlorobutadiene	0.12	0.32	0.3	0.21	0.29	0.36	0.33	0.38	-0.01	0.18	0.37	0.31
Styrene (monomer)	-0.2	-0.12	-0.15	-0.04	-0.12	-0.01	-0.14	-0.11	0.07	0.03	-0.13	-0.13
1,1,2,2-Tetrachloroethane	0.11	0.29	0.27	0.25	0.25	0.4	0.29	0.37	0.11	0.18	0.49	0.33
Tetrachloroethene (PCE)	0.09	0.27	0.25	0.23	0.23	0.36	0.27	0.35	0.08	0.15	0.37	0.14
Toluene	-0.16	-0.18	-0.12	-0.04	-0.18	-0.05	-0.19	-0.18	0.16	-0.14	-0.13	0.09
1,1,1-Trichloroethane (TCA)	0.2	0.42	0.4	0.37	0.36	0.57	0.43	0.53	0.21	0.29	0.64	0.33
1,1,2-Trichloroethane	0.2	0.42	0.4	0.37	0.36	0.57	0.43	0.53	0.21	0.29	0.64	0.33
1,3,5 Trimethylbenzene	-0.21	-0.05	-0.12	-0.05	-0.05	-0.03	-0.08	-0.06	0.01	0.11	-0.03	0.15
1,2,4 Trimethylbenzene	-0.07	0.13	0.05	0.06	0.13	0.03	0.1	0.12	0.11	0.18	0.12	0.48
1,2,4-Trichlorobenzene	0.02	0.19	0.16	0.1	0.16	0.29	0.19	0.23	-0.1	0.14	0.33	0.25
Trichloroethene (TCE)	0.03	0.14	0.12	0.11	0.12	0.17	0.14	0.19	0.01	0.05	0.22	0.09
Trichlorofluoromethane (F-11)	0.13	0.4	0.34	0.35	0.34	0.52	0.41	0.51	0.23	0.26	0.62	0.38
m&p Xylene	-0.17	-0.09	-0.1	-0.01	-0.08	-0.06	-0.12	-0.1	0.13	0.06	-0.12	0.15
0-Xylene	-0.19	-0.03	-0.08	0.02	-0.03	-0.01	-0.07	-0.04	0.03	0.1	-0.02	0.28
Carbon disulfide**	-0.23	-0.06	-0.11	-0.12	-0.07	-0.1	-0.1	-0.03	0.16	0.07	0.05	0.2
Carbonyl sulfide**	0	0.19	0.16	0.14	0.16	0.15	0.18	0.26	0.24	0.04	0.28	0.31
Dimethyl disulfide	0	0.3	0.18	0.15	0.3	0.05	0.27	0.3	-0.07	0.14	0.18	0.32

	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Acetone	Propane / ppmv	Butane / ppmv	ethane / ppmv	Isobutane
Methane (ppmv)	0.55	0.55	0.68	0.06	0.15	-0.09	0.05	0.38	0.42	0.13	0.86	0.19
Benzene	0.01	-0.01	-0.05	-0.2	0.25	-0.01	0.31	-0.08	0.06	0.07	0	-0.04
Chloroform	0.19	0.35	0.3	0.18	0.11	-0.05	0	0.32	0.27	0.19	0.48	0.19
Chloromethane (Methyl Chloride)	0.07	0.15	0.2	0.22	0.34	-0.07	-0.06	0.18	0.03	-0.03	0.27	-0.04
Dichlorodifluoromethane (F12)	0.27	0.4	0.5	0.26	0.21	-0.34	0.04	0.36	0.43	0.33	0.5	0.32
Dichlorotetrafluoroethane (F114)	0.35	0.54	0.49	0.2	0.17	-0.12	0.13	0.42	0.67	0.56	0.69	0.51
1,2-Dichloroethane (EDC)	0.49	0.58	0.63	0.33	0.27	-0.07	0.13	0.55	0.5	0.34	0.86	0.32
Dichloromethane (Methylene chloride)	0.49	0.59	0.63	0.33	0.31	-0.08	0.13	0.55	0.5	0.34	0.86	0.31
Ethylbenzene	0.06	0.06	0.09	0.08	0.44	0.17	0.37	-0.08	-0.04	-0.05	0.07	-0.27
Hexachlorobutadiene	0.3	0.47	0.39	0.3	0.32	0.06	0.26	0.22	0.39	0.29	0.59	0.16
Styrene (monomer)	0	0.11	0.16	0.32	0.22	0.28	0.31	-0.1	-0.01	-0.03	0.11	-0.24
1,1,2,2-Tetrachloroethane	0.32	0.39	0.44	0.35	0.17	0.16	0.3	0.38	0.34	0.22	0.6	0.34
Tetrachloroethene (PCE)	0.28	0.34	0.39	0.15	0.15	0.15	0.26	0.36	0.32	0.21	0.57	0.24
Toluene	-0.05	0.03	0.03	-0.07	0.29	0.13	0.28	-0.1	-0.11	-0.09	-0.1	-0.19
1,1,1-Trichloroethane (TCA)	0.5	0.59	0.63	0.34	0.28	-0.07	0.13	0.55	0.51	0.35	0.86	0.32
1,1,2-Trichloroethane	0.5	0.59	0.63	0.34	0.28	-0.07	0.13	0.55	0.51	0.35	0.86	0.32
1,3,5 Trimethylbenzene	-0.12	0.01	0.06	0.26	0.39	0.39	0.39	-0.14	-0.05	-0.07	0.09	-0.18
1,2,4 Trimethylbenzene	0.01	0.13	0.06	0.04	0.61	0.09	0.31	-0.04	-0.01	-0.03	0.11	-0.15
1,2,4-Trichlorobenzene	0.32	0.5	0.32	0.33	0.58	-0.04	0.16	0.11	0.28	0.17	0.49	-0.03
Trichloroethene (TCE)	0.16	0.23	0.18	0.03	0.21	0.01	-0.02	0.19	0.17	0.12	0.31	0.16
Trichlorofluoromethane (F-11)	0.48	0.53	0.65	0.34	0.32	-0.13	0.12	0.52	0.47	0.32	0.82	0.24
m&p Xylene	-0.09	0.02	-0.02	0.06	0.38	0.19	0.3	-0.14	-0.13	-0.12	-0.06	-0.25
0-Xylene	-0.02	0.11	0.06	0.15	0.55	0.21	0.35	-0.11	-0.08	-0.09	0.05	-0.27
Carbon disulfide**	-0.2	-0.01	-0.01	-0.01	0.34	-0.02	-0.06	0.13	-0.12	-0.14	0.09	-0.09
Carbonyl sulfide**	0.23	0.22	0.16	-0.16	0.48	-0.26	-0.05	0.25	0.1	0.06	0.26	0.04
Dimethyl disulfide	-0.02	-0.02	-0.07	-0.29	-0.01	0.02	0.24	0.05	-0.1	-0.11	0.01	-0.12

	Camphene	Cyclohexadiene	Propynylbenzene	Diethyltrisulfide	Methylbutene	Dimethylcyclopropane	Dimethylbutane/neoheptane	Methylpentane/Isohexane	Hexane	Limonene	Dimethyl-pentatnone	Bromo-hexene
Methane (ppmv)	0.48	0.38	0.33	0.29	0.36	0.32	0.37	0.2	0.29	0.24	0.29	0.46
Benzene	0	0.18	0.18	0.17	0.1	0.11	0.1	0.14	0.13	-0.04	0.03	0.02
Chloroform	0.48	0.4	0.37	0.23	0.34	0.29	0.34	0.15	0.24	0.25	0.27	0.45
Chloromethane (Methyl Chloride)	0.22	0.1	0.08	0.19	0.05	0.02	0.06	-0.11	-0.05	0.09	0.18	0.23
Dichlorodifluoromethane (F12)	0.49	0.45	0.42	0.31	0.47	0.44	0.47	0.39	0.46	0.54	0.39	0.51
Dichlorotetrafluoroethane (F114)	0.62	0.71	0.65	0.46	0.66	0.63	0.66	0.63	0.7	0.35	0.36	0.58
1,2-Dichloroethane (EDC)	0.79	0.67	0.61	0.47	0.57	0.51	0.58	0.3	0.44	0.47	0.47	0.74
Dichloromethane (Methylene chloride)	0.79	0.67	0.61	0.47	0.58	0.51	0.58	0.3	0.44	0.47	0.47	0.74
Ethylbenzene	-0.01	0.07	-0.01	0.09	-0.08	-0.09	-0.08	-0.14	-0.13	-0.04	0.07	0.03
Hexachlorobutadiene	0.49	0.42	0.36	0.29	0.36	0.32	0.37	0.22	0.3	0.17	0.21	0.42
Styrene (monomer)	-0.06	0.16	0.04	0.25	-0.1	-0.11	-0.1	-0.14	-0.14	0.02	0.02	-0.03
1,1,2,2-Tetrachloroethane	0.57	0.48	0.44	0.46	0.4	0.36	0.41	0.2	0.3	0.32	0.33	0.53
Tetrachloroethene (PCE)	0.54	0.45	0.42	0.28	0.38	0.34	0.39	0.18	0.28	0.3	0.31	0.5
Toluene	-0.13	0	-0.08	0.03	-0.05	-0.04	-0.05	-0.04	-0.06	-0.07	0.05	-0.06
1,1,1-Trichloroethane (TCA)	0.79	0.67	0.61	0.47	0.58	0.51	0.58	0.3	0.44	0.48	0.47	0.74
1,1,2-Trichloroethane	0.79	0.67	0.61	0.47	0.58	0.51	0.58	0.3	0.44	0.48	0.47	0.74
1,3,5 Trimethylbenzene	-0.09	-0.02	-0.06	0.18	-0.14	-0.15	-0.14	-0.19	-0.19	-0.05	-0.05	-0.08
1,2,4 Trimethylbenzene	0.03	-0.02	-0.05	-0.04	-0.04	-0.05	-0.04	-0.11	-0.09	-0.05	-0.02	0.02
1,2,4-Trichlorobenzene	0.32	0.26	0.22	0.22	0.22	0.19	0.22	0.11	0.16	0.14	0.11	0.26
Trichloroethene (TCE)	0.3	0.24	0.23	0.13	0.2	0.18	0.2	0.08	0.14	0.15	0.16	0.27
Trichlorofluoromethane (F-11)	0.75	0.63	0.58	0.43	0.49	0.43	0.5	0.22	0.36	0.6	0.44	0.7
m&p Xylene	-0.14	-0.03	-0.09	0.04	-0.11	-0.1	-0.11	-0.13	-0.14	-0.12	0	-0.08
0-Xylene	-0.07	-0.01	-0.08	0.06	-0.1	-0.11	-0.1	-0.16	-0.16	-0.04	0.03	-0.03
Carbon disulfide**	0.07	0.16	0.1	0.32	-0.03	-0.05	-0.03	-0.18	-0.14	-0.12	-0.06	0.04
Carbonyl sulfide**	0.4	0.31	0.3	0.27	0.25	0.22	0.26	0.08	0.16	0.19	0.19	0.36
Dimethyl disulfide	0.16	0.17	0.2	0.41	0.05	0.03	0.05	-0.08	-0.03	0.13	0.02	0.12

	Ethylmethyl-cyclohexane	Trimethyl-hexene	Dimethylo ctane	1-R-alpha-pinene/ 2,6,6Trimethyl-Bicyclo[3.1.1] hetp-2-ene/2-Pinene	methyl isobutal ketone	Indane	2,2-dimethyl-hexane	Thieno[3,2b] thiophene	Metha-crolein	1,4 Dichlorobe nzene	methyl-hexane	Trichloro-monofluoro-methane
Methane (ppmv)	0.4	0.37	0.34	0.29	0.49	0.33	0.35	0.15	0.9	0.2	0.33	0.49
Benzene	0.1	0.02	0.02	0	0.01	0.15	-0.06	0.04	-0.02	-0.19	0.11	0.01
Chloroform	0.36	0.36	0.32	0.56	0.49	0.41	0.18	0.04	0.39	0.54	0.3	0.49
Chloromethane (Methyl Chloride)	0.24	0.21	0.2	0.09	0.21	0.14	0.14	0.25	0.2	0.37	0.03	0.21
Dichlorodifluoromethane (F12)	0.44	0.46	0.43	0.36	0.5	0.39	0.22	0.05	0.46	0.2	0.44	0.5
Dichlorotetrafluoroethane (F114)	0.47	0.47	0.42	0.48	0.63	0.55	0.23	0.1	0.59	0.4	0.64	0.63
1,2-Dichloroethane (EDC)	0.62	0.61	0.55	0.61	0.79	0.7	0.32	0.21	0.72	0.56	0.53	0.79
Dichloromethane (Methylene chloride)	0.62	0.61	0.55	0.61	0.79	0.7	0.32	0.21	0.72	0.54	0.53	0.79
Ethylbenzene	0.11	0.05	0.06	-0.03	0	0.14	-0.05	0.09	0.01	-0.12	-0.09	0
Hexachlorobutadiene	0.27	0.31	0.27	0.4	0.49	0.46	0.26	0.07	0.47	0.16	0.33	0.49
Styrene (monomer)	0.12	0	0.01	0.01	-0.05	-0.04	-0.12	0.25	0.03	-0.03	-0.11	-0.05
1,1,2,2-Tetrachloroethane	0.43	0.43	0.38	0.43	0.57	0.5	0.22	0.39	0.52	0.41	0.37	0.57
Tetrachloroethene (PCE)	0.41	0.41	0.36	0.41	0.55	0.47	0.2	0.09	0.48	0.54	0.35	0.55
Toluene	0.04	0	0.03	-0.08	-0.11	0.06	-0.18	0.02	-0.1	-0.21	-0.04	-0.11
1,1,1-Trichloroethane (TCA)	0.62	0.61	0.55	0.61	0.79	0.7	0.32	0.21	0.72	0.54	0.53	0.79
1,1,2-Trichloroethane	0.62	0.61	0.55	0.61	0.79	0.7	0.32	0.21	0.72	0.54	0.53	0.79
1,3,5 Trimethylbenzene	0.01	-0.07	-0.06	0.01	-0.08	0.04	-0.04	0.32	0.01	-0.02	-0.15	-0.08
1,2,4 Trimethylbenzene	0.02	0	-0.01	0.13	0.04	0.21	0.14	0.01	0.05	-0.08	-0.05	0.04
1,2,4-Trichlorobenzene	0.18	0.18	0.15	0.14	0.32	0.29	0.15	0.12	0.4	0.15	0.2	0.32
Trichloroethene (TCE)	0.21	0.22	0.19	0.21	0.3	0.25	0.1	0.01	0.24	0.45	0.18	0.3
Trichlorofluoromethane (F-11)	0.58	0.58	0.52	0.58	0.75	0.66	0.31	0.18	0.69	0.49	0.44	0.75
m&p Xylene	0.01	-0.04	-0.02	-0.08	-0.12	0.04	-0.08	0.1	-0.1	-0.17	-0.1	-0.12
0-Xylene	0.05	0.01	0.02	-0.04	-0.06	0.13	-0.03	0.14	-0.02	-0.11	-0.11	-0.06
Carbon disulfide**	0.12	-0.02	-0.04	0.1	0.09	0.2	-0.08	0.33	0.05	0.23	-0.04	0.09
Carbonyl sulfide**	0.28	0.27	0.24	0.26	0.41	0.33	0.14	0	0.26	0.22	0.23	0.41
Dimethyl disulfide	0.19	0.06	0.04	0.11	0.18	0.26	0.3	0.26	0.08	-0.03	0.03	0.18

	Difluoro-chloro-methane	tetramethyl-cyclopentane	Ethylmethyl cyclohexane	methyl methylethyl cyclohexane	chloro-pentane	1,3 Cyclo-hexadiene	Methyl n-butyl disulfide	Propyl butyl disulfide	n-Dipropyl-disulfide
Methane (ppmv)	0.24	0.36	0.4	0.4	0.49	0.45	0.34	0.34	0.31
Benzene	-0.09	-0.06	0.05	-0.05	0.04	0.09	-0.03	-0.02	-0.03
Chloroform	0.27	0.38	0.38	0.41	0.48	0.42	0.34	0.34	0.31
Chloromethane (Methyl Chloride)	0.6	0.51	0.42	0.46	0.22	0.23	0.18	0.18	0.17
Dichlorodifluoromethane (F12)	0.21	0.34	0.36	0.38	0.5	0.43	0.34	0.34	0.31
Dichlorotetrafluoroethane (F114)	0.35	0.5	0.5	0.54	0.62	0.54	0.44	0.45	0.41
1,2-Dichloroethane (EDC)	0.47	0.64	0.65	0.69	0.78	0.69	0.58	0.59	0.53
Dichloromethane (Methylene chloride)	0.47	0.64	0.65	0.69	0.78	0.69	0.58	0.59	0.53
Ethylbenzene	0.02	0.01	0.09	0.01	0.02	0.08	-0.02	-0.02	-0.02
Hexachlorobutadiene	0.16	0.3	0.27	0.34	0.47	0.35	0.24	0.25	0.21
Styrene (monomer)	-0.1	-0.09	0.06	-0.09	-0.05	0.09	-0.02	-0.02	-0.01
1,1,2,2-Tetrachloroethane	0.33	0.45	0.46	0.49	0.56	0.49	0.41	0.41	0.37
Tetrachloroethene (PCE)	0.31	0.43	0.43	0.46	0.54	0.47	0.39	0.4	0.36
Toluene	-0.02	-0.06	-0.01	-0.07	-0.09	-0.03	-0.07	-0.07	-0.07
1,1,1-Trichloroethane (TCA)	0.47	0.64	0.65	0.69	0.78	0.69	0.58	0.59	0.54
1,1,2-Trichloroethane	0.47	0.64	0.65	0.69	0.78	0.69	0.58	0.59	0.54
1,3,5 Trimethylbenzene	-0.05	-0.07	0.01	-0.07	-0.08	0.02	-0.07	-0.07	-0.06
1,2,4 Trimethylbenzene	-0.04	-0.01	0.02	0	0.04	0.05	-0.03	-0.03	-0.04
1,2,4-Trichlorobenzene	0.14	0.23	0.22	0.25	0.31	0.25	0.17	0.17	0.14
Trichloroethene (TCE)	0.16	0.23	0.23	0.25	0.3	0.25	0.2	0.21	0.19
Trichlorofluoromethane (F-11)	0.44	0.61	0.61	0.65	0.74	0.66	0.55	0.55	0.5
m&p Xylene	-0.05	-0.09	-0.03	-0.1	-0.09	-0.04	-0.07	-0.08	-0.07
0-Xylene	-0.04	-0.05	0.02	-0.05	-0.05	0.02	-0.02	-0.02	-0.02
Carbon disulfide**	-0.04	0.01	0.15	0.02	0.11	0.2	-0.02	-0.02	-0.03
Carbonyl sulfide**	0.21	0.31	0.31	0.34	0.4	0.34	0.27	0.27	0.24
Dimethyl disulfide	0.03	0.09	0.22	0.11	0.17	0.27	0.18	0.18	0.18

Correlation matrix, logged data with all cases: Part 2

	Methane (ppmv)	Benzene	Chloroform	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	1,2-Dichloro-ethane (EDC)	Dichloro-methane (Methylene chloride)	Ethyl-benzene	Hexachloro-butadiene	Styrene (monomer)	1,1,2,2-Tetrachloroethane
Methyl ethyl disulphide	0.01	0.23	0.29	-0.21	-0.18	0.03	0.06	0.06	0.17	-0.06	-0.02	0.07
Ethylmethyl benzene	0.19	0.27	0.23	-0.07	0.19	0.33	0.44	0.44	0.28	0.37	-0.09	0.3
Methyl propyl disulfide	0.28	-0.06	0.83	-0.1	0.1	0.25	0.35	0.35	-0.12	0.12	-0.15	0.23
Diethyl disulfide C4H10S2	0.19	-0.06	0.48	0.01	0.08	0.17	0.28	0.28	-0.16	-0.09	-0.13	0.17
Ethyl, methylethyl disulfide	0.17	0.04	0.32	-0.06	0.1	0.16	0.26	0.26	0.03	0.01	-0.1	0.16
Dimethyl trisulfide	0.05	0.26	0.14	0.14	0.02	0.15	0.18	0.18	0.25	0.1	0.29	0.31
Ethyl n-propyl disulfide	0.27	-0.04	0.51	0.06	0.2	0.32	0.43	0.44	-0.07	0.08	-0.06	0.3
Trimethyl benzene	0.09	0.3	0.06	0.2	0.22	0.09	0.17	0.2	0.41	0.22	-0.02	0.09
Undecane	0.25	0.15	0.22	-0.02	0.24	0.3	0.4	0.4	0.16	0.31	-0.08	0.28
1-Methyl propenylbenzene	0.27	0.15	0.24	-0.01	0.26	0.32	0.43	0.43	0.16	0.33	-0.08	0.3
Dodecane	0.3	0.14	0.28	0.01	0.29	0.37	0.49	0.49	0.15	0.36	-0.08	0.34
1-Methyl-1H-Indene	0.24	0.15	0.22	-0.03	0.23	0.29	0.39	0.39	0.16	0.3	-0.08	0.27
2-Methyl propenyl benzene	0.24	0.16	0.21	-0.03	0.22	0.28	0.38	0.38	0.17	0.3	-0.08	0.26
Propyl benzene	0.29	0.15	0.28	0.35	0.44	0.36	0.48	0.52	0.22	0.35	0	0.33
Diethyl benzene	0.21	0.17	0.19	0.35	0.38	0.25	0.35	0.39	0.26	0.28	0.02	0.24
Methyl-methylethyl benzene, methyl-Cumene	0.21	0.17	0.2	0.35	0.38	0.26	0.35	0.4	0.25	0.28	0.02	0.24
Tetramethyl benzene	0.21	0.22	0.2	0.3	0.33	0.27	0.37	0.4	0.31	0.32	-0.02	0.25
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.24	0.13	0.19	0.35	0.35	0.26	0.37	0.4	0.15	0.32	-0.01	0.24
Methyl pyridine	0.49	0.01	0.49	0.21	0.5	0.63	0.79	0.79	0	0.49	-0.05	0.57
Diemethyl pyridine/Aldrich	0.49	0.01	0.49	0.21	0.5	0.63	0.79	0.79	0	0.49	-0.05	0.57
Ethyl pyridine	0.49	0.01	0.49	0.21	0.5	0.63	0.79	0.79	0	0.49	-0.05	0.57
2-Methylbutane	0.64	0.02	0.3	0	0.41	0.59	0.45	0.46	-0.13	0.33	-0.08	0.3
Pentane	0.22	0.04	0.06	-0.07	0.31	0.47	0.19	0.19	-0.19	0.12	-0.2	0.11
2,4-Dimethylpentane	0.4	-0.05	0.24	0.17	0.28	0.31	0.42	0.42	-0.04	0.32	-0.12	0.29
Methyl cyclopentane	0.36	0.04	0.22	0.06	0.35	0.48	0.4	0.4	-0.1	0.3	-0.15	0.27
2-Methylhexane	0.32	-0.02	0.2	0.18	0.32	0.27	0.37	0.37	0.03	0.21	-0.04	0.25

	Tetrachloroethene (PCE)	Toluene	1,1,1-Trichloroethane (TCA)	1,1,2-Trichloroethane	1,3,5 Trimethylbenzene	1,2,4 Trimethylbenzene	1,2,4-Trichlorobenzene	Trichloroethene (TCE)	Trichlorofluoromethane (F-11)	m&p Xylene	0-Xylene	Carbon disulfide**
Methyl ethyl disulphide	0.13	0.17	0.07	0.07	0.1	0.2	-0.03	-0.01	0.02	0.16	0.27	0.25
Ethylmethyl benzene	0.46	0.22	0.45	0.45	0.2	0.48	0.17	0.13	0.41	0.22	0.35	0.06
Methyl propyl disulfide	0.22	-0.15	0.35	0.35	-0.21	-0.08	0.05	0.11	0.32	-0.17	-0.12	0.18
Diethyl disulfide C4H10S2	0.16	-0.1	0.28	0.28	-0.16	-0.15	-0.04	0.06	0.25	-0.14	-0.15	0.02
Ethyl, methylethyl disulfide	0.37	0.01	0.26	0.26	0.02	0.16	-0.04	0.06	0.23	0	0.09	-0.07
Dimethyl trisulfide	0.06	0.22	0.19	0.19	0.29	0.16	0.33	0.1	0.14	0.27	0.33	0.43
Ethyl n-propyl disulfide	0.29	-0.1	0.44	0.44	-0.12	-0.08	0.09	0.14	0.41	-0.11	-0.06	0.03
Trimethyl benzene	0.26	0.32	0.17	0.17	0.32	0.7	0.29	0.14	0.23	0.33	0.49	0.27
Undecane	0.56	0.1	0.4	0.4	0.16	0.36	0.12	0.13	0.37	0.09	0.2	-0.06
1-Methyl propenylbenzene	0.57	0.09	0.43	0.43	0.15	0.35	0.13	0.14	0.4	0.08	0.19	-0.05
Dodecane	0.59	0.08	0.49	0.49	0.13	0.33	0.16	0.17	0.46	0.06	0.17	-0.04
1-Methyl-1H-Indene	0.56	0.11	0.39	0.39	0.16	0.36	0.12	0.13	0.37	0.09	0.2	-0.06
2-Methyl propenyl benzene	0.55	0.11	0.38	0.38	0.16	0.37	0.11	0.12	0.35	0.1	0.21	-0.06
Propyl benzene	0.32	0.11	0.48	0.48	0.23	0.44	0.21	0.17	0.54	0.1	0.21	0.34
Diethyl benzene	0.22	0.16	0.35	0.35	0.29	0.5	0.16	0.11	0.42	0.15	0.26	0.37
Methyl-methylethyl benzene, methyl-Cumene	0.23	0.16	0.36	0.36	0.29	0.49	0.16	0.12	0.43	0.15	0.25	0.37
Tetramethyl benzene	0.23	0.2	0.38	0.38	0.11	0.47	0.51	0.29	0.41	0.21	0.36	0.32
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.23	0.08	0.37	0.37	0.29	0.36	0.18	0.11	0.42	0.08	0.16	0.39
Methyl pyridine	0.55	-0.11	0.79	0.79	-0.08	0.04	0.32	0.3	0.75	-0.12	-0.06	0.09
Diemethyl pyridine/Aldrich	0.55	-0.11	0.79	0.79	-0.08	0.04	0.32	0.3	0.75	-0.12	-0.06	0.09
Ethyl pyridine	0.55	-0.11	0.79	0.79	-0.08	0.04	0.32	0.3	0.75	-0.12	-0.06	0.09
2-Methylbutane	0.27	-0.15	0.46	0.46	-0.07	0.04	0.17	0.11	0.39	-0.15	-0.12	-0.14
Pentane	0.09	-0.16	0.2	0.2	-0.21	-0.07	0.02	0.03	0.13	-0.17	-0.19	-0.23
2,4-Dimethylpentane	0.27	-0.18	0.42	0.42	-0.05	0.13	0.19	0.14	0.4	-0.09	-0.03	-0.06
Methyl cyclopentane	0.25	-0.12	0.4	0.4	-0.12	0.05	0.16	0.12	0.34	-0.1	-0.08	-0.11
2-Methylhexane	0.23	-0.04	0.37	0.37	-0.05	0.06	0.1	0.11	0.35	-0.01	0.02	-0.12

	Carbonyl sulfide**	Dimethyl disulfide	Methyl ethyl disulphide	Ethylmethyl benzene	Methyl propyl disulfide	Diethyl disulfide C4H10S2	Ethyl, methylethyl-disulfide	Dimethyl trisulfide	Ethyl n-propyl disulfide	Trimethyl benzene	Undecane	1-Methyl propenylbenzene
Methyl ethyl disulphide	0.2	0.86	1	0.56	0.44	0.48	0.61	0.46	0.45	0.25	0.45	0.44
Ethylmethyl benzene	0.32	0.51	0.56	1	0.27	0.17	0.5	0.11	0.31	0.39	0.73	0.74
Methyl propyl disulfide	0.15	0.34	0.44	0.27	1	0.6	0.42	0.08	0.62	0.11	0.27	0.29
Diethyl disulfide C4H10S2	0.09	0.38	0.48	0.17	0.6	1	0.66	0.18	0.85	0.04	0.18	0.2
Ethyl, methylethyl disulfide	0.07	0.4	0.61	0.5	0.42	0.66	1	-0.07	0.76	0.36	0.7	0.7
Dimethyl trisulfide	0.12	0.54	0.46	0.11	0.08	0.18	-0.07	1	0.02	0.03	-0.05	-0.05
Ethyl n-propyl disulfide	0.18	0.27	0.45	0.31	0.62	0.85	0.76	0.02	1	0.14	0.31	0.33
Trimethyl benzene	0.6	0.25	0.25	0.39	0.11	0.04	0.36	0.03	0.14	1	0.56	0.55
Undecane	0.18	0.41	0.45	0.73	0.27	0.18	0.7	-0.05	0.31	0.56	1	1
1-Methyl propenylbenzene	0.2	0.41	0.44	0.74	0.29	0.2	0.7	-0.05	0.33	0.55	1	1
Dodecane	0.23	0.4	0.44	0.75	0.33	0.23	0.7	-0.04	0.37	0.55	0.99	1
1-Methyl-1H-Indene	0.18	0.41	0.45	0.73	0.26	0.18	0.7	-0.06	0.3	0.56	1	1
2-Methyl propenyl benzene	0.17	0.41	0.45	0.73	0.25	0.17	0.7	-0.06	0.29	0.56	1	1
Propyl benzene	0.64	0.04	0.06	0.36	0.33	0.22	0.24	-0.05	0.37	0.72	0.35	0.38
Diethyl benzene	0.63	-0.01	0.02	0.26	0.24	0.16	0.17	-0.07	0.28	0.76	0.26	0.28
Methyl-methylethyl benzene, methyl-Cumene	0.63	0	0.02	0.27	0.24	0.16	0.17	-0.07	0.28	0.76	0.27	0.29
Tetramethyl benzene	0.72	0.16	0.13	0.27	0.25	0.15	0.17	0.16	0.28	0.82	0.27	0.29
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.64	0.15	0.17	0.25	0.22	0.27	0.14	0.19	0.26	0.6	0.25	0.27
Methyl pyridine	0.41	0.18	0.2	0.57	0.52	0.39	0.4	0.04	0.59	0.3	0.56	0.59
Diemethyl pyridine/Aldrich	0.41	0.18	0.2	0.57	0.52	0.39	0.4	0.04	0.59	0.3	0.56	0.59
Ethyl pyridine	0.41	0.18	0.2	0.57	0.52	0.39	0.4	0.04	0.59	0.3	0.56	0.59
2-Methylbutane	0.06	0.02	-0.08	0.16	0.19	0.12	0.15	-0.11	0.21	0.06	0.21	0.22
Pentane	0	0	-0.09	0.1	0.08	0.06	0.12	-0.18	0.1	0.01	0.11	0.12
2,4-Dimethylpentane	0.19	0.3	0.04	0.31	0.28	0.19	0.2	-0.06	0.32	0.15	0.31	0.33
Methyl cyclopentane	0.16	0.18	-0.01	0.28	0.25	0.16	0.17	-0.1	0.29	0.12	0.28	0.3
2-Methylhexane	0.14	0.15	-0.02	0.25	0.23	0.14	0.15	-0.1	0.26	0.1	0.25	0.27

	Dodecane	1-Methyl-1H-Indene	2-Methyl propenyl benzene	Propyl benzene	Diethyl benzene	Methyl-methylethyl benzene, methyl-Cumene	Tetramethyl benzene	Napthalene/ Trimethyl Bicyclo 2.2.1 heptane	Methyl pyridine	Diemethyl pyridine/ Aldrich	Ethyl pyridine	2-Methyl-butane
Methyl ethyl disulphide	0.44	0.45	0.45	0.06	0.02	0.02	0.13	0.17	0.2	0.2	0.2	-0.08
Ethylmethyl benzene	0.75	0.73	0.73	0.36	0.26	0.27	0.27	0.25	0.57	0.57	0.57	0.16
Methyl propyl disulfide	0.33	0.26	0.25	0.33	0.24	0.24	0.25	0.22	0.52	0.52	0.52	0.19
Diethyl disulfide C4H10S2	0.23	0.18	0.17	0.22	0.16	0.16	0.15	0.27	0.39	0.39	0.39	0.12
Ethyl, methylethyl disulfide	0.7	0.7	0.7	0.24	0.17	0.17	0.17	0.14	0.4	0.4	0.4	0.15
Dimethyl trisulfide	-0.04	-0.06	-0.06	-0.05	-0.07	-0.07	0.16	0.19	0.04	0.04	0.04	-0.11
Ethyl n-propyl disulfide	0.37	0.3	0.29	0.37	0.28	0.28	0.28	0.26	0.59	0.59	0.59	0.21
Trimethyl benzene	0.55	0.56	0.56	0.72	0.76	0.76	0.82	0.6	0.3	0.3	0.3	0.06
Undecane	0.99	1	1	0.35	0.26	0.27	0.27	0.25	0.56	0.56	0.56	0.21
1-Methyl propenylbenzene	1	1	1	0.38	0.28	0.29	0.29	0.27	0.59	0.59	0.59	0.22
Dodecane	1	0.99	0.99	0.42	0.32	0.32	0.33	0.31	0.66	0.66	0.66	0.25
1-Methyl-1H-Indene	0.99	1	1	0.35	0.26	0.26	0.27	0.25	0.55	0.55	0.55	0.2
2-Methyl propenyl benzene	0.99	1	1	0.34	0.25	0.25	0.26	0.24	0.53	0.53	0.53	0.19
Propyl benzene	0.42	0.35	0.34	1	0.98	0.98	0.77	0.83	0.66	0.66	0.66	0.26
Diethyl benzene	0.32	0.26	0.25	0.98	1	1	0.75	0.83	0.5	0.5	0.5	0.19
Methyl-methylethyl benzene, methyl-Cumene	0.32	0.26	0.25	0.98	1	1	0.76	0.83	0.51	0.51	0.51	0.19
Tetramethyl benzene	0.33	0.27	0.26	0.77	0.75	0.76	1	0.63	0.53	0.53	0.53	0.18
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.31	0.25	0.24	0.83	0.83	0.83	0.63	1	0.51	0.51	0.51	0.17
Methyl pyridine	0.66	0.55	0.53	0.66	0.5	0.51	0.53	0.51	1	1	1	0.43
Diemethyl pyridine/Aldrich	0.66	0.55	0.53	0.66	0.5	0.51	0.53	0.51	1	1	1	0.43
Ethyl pyridine	0.66	0.55	0.53	0.66	0.5	0.51	0.53	0.51	1	1	1	0.43
2-Methylbutane	0.25	0.2	0.19	0.26	0.19	0.19	0.18	0.17	0.43	0.43	0.43	1
Pentane	0.14	0.11	0.1	0.14	0.09	0.09	0.09	0.06	0.26	0.26	0.26	0.76
2,4-Dimethylpentane	0.37	0.3	0.29	0.37	0.28	0.28	0.29	0.27	0.58	0.58	0.58	0.54
Methyl cyclopentane	0.34	0.27	0.26	0.34	0.25	0.25	0.26	0.23	0.54	0.54	0.54	0.71
2-Methylhexane	0.31	0.25	0.24	0.31	0.22	0.23	0.23	0.21	0.5	0.5	0.5	0.39

	Pentane	2,4-Dimethylpentane	Methyl cyclopentane	2-Methyl-hexane	2,3-Dimethylpentane	3-Methyl-hexane	Methyl cyclohexane	Trimethyl-pentane,2,2,4	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon
Methyl ethyl disulphide	-0.09	0.04	-0.01	-0.02	0.02	-0.02	0.02	0.08	-0.07	-0.09	0.15	0.07
Ethylmethyl benzene	0.1	0.31	0.28	0.25	0.27	0.25	0.31	0.39	0.1	0.14	0.41	0.5
Methyl propyl disulfide	0.08	0.28	0.25	0.23	0.25	0.27	0.28	0.36	0.1	-0.03	0.26	0.13
Diethyl disulfide C4H10S2	0.06	0.19	0.16	0.14	0.16	0.18	0.18	0.25	0.13	-0.1	0.33	0.09
Ethyl, methylethyl disulfide	0.12	0.2	0.17	0.15	0.17	0.18	0.2	0.26	0.02	-0.07	0.2	0.03
Dimethyl trisulfide	-0.18	-0.06	-0.1	-0.1	-0.06	-0.04	-0.08	-0.04	-0.02	-0.03	0.15	0.12
Ethyl n-propyl disulfide	0.1	0.32	0.29	0.26	0.28	0.31	0.32	0.41	0.13	-0.02	0.3	0.16
Trimethyl benzene	0.01	0.15	0.12	0.1	0.12	0.13	0.14	0.19	0.34	-0.07	0.17	0.28
Undecane	0.11	0.31	0.28	0.25	0.27	0.29	0.31	0.39	0.14	0	0.28	0.16
1-Methyl propenylbenzene	0.12	0.33	0.3	0.27	0.29	0.31	0.33	0.41	0.15	0	0.31	0.18
Dodecane	0.14	0.37	0.34	0.31	0.32	0.35	0.37	0.46	0.18	0.01	0.35	0.21
1-Methyl-1H-Indene	0.11	0.3	0.27	0.25	0.26	0.29	0.3	0.38	0.13	0	0.28	0.16
2-Methyl propenyl benzene	0.1	0.29	0.26	0.24	0.25	0.27	0.29	0.37	0.13	0	0.26	0.15
Propyl benzene	0.14	0.37	0.34	0.31	0.32	0.36	0.37	0.47	0.54	0.01	0.36	0.4
Diethyl benzene	0.09	0.28	0.25	0.22	0.24	0.27	0.27	0.35	0.53	-0.02	0.26	0.35
Methyl-methylethyl benzene, methyl-Cumene	0.09	0.28	0.25	0.23	0.24	0.27	0.28	0.35	0.53	-0.01	0.26	0.36
Tetramethyl benzene	0.09	0.29	0.26	0.23	0.25	0.26	0.28	0.36	0.38	-0.02	0.38	0.43
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.06	0.27	0.23	0.21	0.23	0.26	0.26	0.34	0.41	-0.05	0.34	0.26
Methyl pyridine	0.26	0.58	0.54	0.5	0.51	0.56	0.59	0.72	0.34	0.08	0.61	0.42
Diemethyl pyridine/Aldrich	0.26	0.58	0.54	0.5	0.51	0.56	0.59	0.72	0.34	0.08	0.61	0.42
Ethyl pyridine	0.26	0.58	0.54	0.5	0.51	0.56	0.59	0.72	0.34	0.08	0.61	0.42
2-Methylbutane	0.76	0.54	0.71	0.39	0.53	0.76	0.61	0.56	0	0.22	0.52	0.36
Pentane	1	0.5	0.78	0.34	0.51	0.47	0.59	0.49	-0.03	0.17	0.15	0.19
2,4-Dimethylpentane	0.5	1	0.8	0.73	1	0.55	0.97	0.98	0.15	0.47	0.3	0.59
Methyl cyclopentane	0.78	0.8	1	0.59	0.79	0.66	0.78	0.81	0.11	0.33	0.26	0.44
2-Methylhexane	0.34	0.73	0.59	1	0.72	0.67	0.71	0.74	0.36	0.29	0.23	0.39

	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Acetone	Propane / ppmv	Butane / ppmv	ethane / ppmv	Isobutane
Methyl ethyl disulphide	0.01	-0.01	-0.03	-0.26	-0.07	0.03	0.28	0.07	-0.08	-0.1	0.03	-0.13
Ethylmethyl benzene	0.27	0.21	0.27	-0.05	0	0	0.39	0.38	0.18	0.12	0.36	0.13
Methyl propyl disulfide	0.22	0.29	0.3	-0.06	-0.05	-0.2	0.06	0.35	0.17	0.09	0.36	0.12
Diethyl disulfide C4H10S2	0.18	0.15	0.19	-0.1	-0.11	-0.18	0.03	0.24	0.06	0	0.22	0.17
Ethyl, methylethyl disulfide	0.17	0.17	0.2	-0.04	-0.09	0.05	0.37	0.25	0.09	0.03	0.25	0.13
Dimethyl trisulfide	-0.05	0.02	-0.06	0.02	0.28	0.08	0.05	-0.04	-0.04	-0.07	0.08	-0.12
Ethyl n-propyl disulfide	0.25	0.29	0.34	-0.05	-0.04	-0.3	0.08	0.4	0.2	0.12	0.41	0.15
Trimethyl benzene	0.16	0.24	0.13	-0.11	0.65	-0.04	0.29	0.19	0.07	0.03	0.19	0
Undecane	0.24	0.28	0.32	-0.02	-0.02	0.22	0.62	0.38	0.19	0.11	0.37	0.16
1-Methyl propenylbenzene	0.26	0.3	0.34	-0.02	-0.01	0.2	0.61	0.4	0.2	0.12	0.4	0.17
Dodecane	0.3	0.34	0.39	-0.01	-0.01	0.16	0.6	0.45	0.23	0.14	0.45	0.2
1-Methyl-1H-Indene	0.24	0.27	0.31	-0.02	-0.02	0.22	0.62	0.37	0.18	0.11	0.37	0.15
2-Methyl propenyl benzene	0.22	0.26	0.3	-0.03	-0.02	0.23	0.62	0.36	0.17	0.1	0.35	0.14
Propyl benzene	0.31	0.35	0.39	-0.01	0.48	-0.26	0.12	0.45	0.24	0.15	0.47	0.2
Diethyl benzene	0.22	0.25	0.29	-0.04	0.54	-0.24	0.07	0.34	0.17	0.1	0.35	0.13
Methyl-methylethyl benzene, methyl-Cumene	0.22	0.26	0.3	-0.03	0.53	-0.24	0.07	0.34	0.18	0.11	0.36	0.13
Tetramethyl benzene	0.35	0.46	0.29	-0.05	0.72	-0.28	0.06	0.35	0.18	0.11	0.37	0.12
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.19	0.23	0.28	-0.09	0.37	-0.14	0.16	0.33	0.16	0.08	0.35	0.09
Methyl pyridine	0.52	0.58	0.62	0.08	0.05	-0.2	0.25	0.7	0.41	0.27	0.73	0.38
Diemethyl pyridine/Aldrich	0.52	0.58	0.62	0.08	0.05	-0.2	0.25	0.7	0.41	0.27	0.73	0.38
Ethyl pyridine	0.52	0.58	0.62	0.08	0.05	-0.2	0.25	0.7	0.41	0.27	0.73	0.38
2-Methylbutane	0.37	0.59	0.44	-0.04	0.01	-0.13	-0.01	0.27	0.53	0.36	0.59	0.62
Pentane	0.13	0.32	0.11	-0.04	-0.11	-0.24	-0.06	0.15	0.45	0.45	0.18	0.68
2,4-Dimethylpentane	0.26	0.3	0.34	-0.02	-0.02	-0.24	0.09	0.39	0.24	0.16	0.45	0.17
Methyl cyclopentane	0.22	0.45	0.31	-0.06	-0.05	-0.3	0.06	0.36	0.2	0.13	0.41	0.42
2-Methylhexane	0.32	0.23	0.5	0.18	-0.06	-0.1	0.04	0.33	0.18	0.11	0.37	0.1

	Camphene	Cyclohexadiene	Propynyl benzene	Diethyl trisulfide	Methyl butene	Dimethylcyclopropane	Dimethylbutane/neoheptane	Methylpentane/Isohexane	Hexane	Limonene	Dimethyl-pentatnone	Bromo-hexene
Methyl ethyl disulphide	0.19	0.24	0.26	0.42	0.08	0.05	0.08	-0.05	-0.01	0.19	0.04	0.15
Ethylmethyl benzene	0.56	0.47	0.43	0.29	0.39	0.34	0.4	0.17	0.28	0.32	0.31	0.52
Methyl propyl disulfide	0.52	0.43	0.39	0.27	0.36	0.31	0.36	0.15	0.25	0.3	0.28	0.48
Diethyl disulfide C4H10S2	0.39	0.3	0.29	0.28	0.25	0.21	0.25	0.08	0.16	0.44	0.19	0.35
Ethyl, methylethyl disulfide	0.4	0.32	0.3	0.17	0.26	0.22	0.26	0.09	0.17	0.47	0.2	0.36
Dimethyl trisulfide	0.03	0.12	0.15	0.58	-0.04	-0.05	-0.04	-0.12	-0.1	0.04	-0.06	0
Ethyl n-propyl disulfide	0.59	0.48	0.45	0.31	0.41	0.36	0.41	0.18	0.29	0.64	0.33	0.54
Trimethyl benzene	0.3	0.23	0.22	0.11	0.19	0.16	0.19	0.06	0.12	0.14	0.15	0.27
Undecane	0.55	0.46	0.42	0.3	0.39	0.34	0.39	0.18	0.28	0.33	0.31	0.51
1-Methyl propenylbenzene	0.59	0.49	0.45	0.33	0.41	0.36	0.42	0.19	0.3	0.35	0.33	0.55
Dodecane	0.65	0.55	0.5	0.37	0.46	0.41	0.47	0.22	0.34	0.4	0.37	0.61
1-Methyl-1H-Indene	0.54	0.45	0.41	0.3	0.38	0.33	0.38	0.17	0.28	0.32	0.31	0.5
2-Methyl propenyl benzene	0.52	0.43	0.4	0.28	0.37	0.32	0.37	0.17	0.26	0.31	0.29	0.49
Propyl benzene	0.66	0.55	0.5	0.37	0.46	0.41	0.47	0.22	0.34	0.4	0.37	0.61
Diethyl benzene	0.5	0.41	0.38	0.27	0.35	0.3	0.35	0.16	0.25	0.29	0.28	0.46
Methyl-methylethyl benzene, methyl-Cumene	0.51	0.42	0.38	0.27	0.35	0.31	0.36	0.16	0.25	0.3	0.28	0.47
Tetramethyl benzene	0.52	0.43	0.4	0.27	0.36	0.31	0.37	0.16	0.26	0.3	0.29	0.48
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.5	0.41	0.38	0.55	0.34	0.29	0.34	0.14	0.23	0.28	0.27	0.46
Methyl pyridine	0.99	0.84	0.75	0.61	0.72	0.63	0.73	0.36	0.54	0.64	0.59	0.93
Diemethyl pyridine/Aldrich	0.99	0.84	0.75	0.61	0.72	0.63	0.73	0.36	0.54	0.64	0.59	0.93
Ethyl pyridine	0.99	0.84	0.75	0.61	0.72	0.63	0.73	0.36	0.54	0.64	0.59	0.93
2-Methylbutane	0.42	0.34	0.33	0.18	0.62	0.61	0.62	0.65	0.68	0.22	0.22	0.39
Pentane	0.26	0.2	0.19	0.07	0.63	0.65	0.62	0.81	0.78	0.11	0.12	0.23
2,4-Dimethylpentane	0.58	0.48	0.44	0.32	0.4	0.35	0.41	0.19	0.29	0.35	0.33	0.54
Methyl cyclopentane	0.54	0.44	0.41	0.28	0.79	0.79	0.79	0.65	0.7	0.31	0.29	0.5
2-Methylhexane	0.49	0.4	0.37	0.25	0.34	0.29	0.34	0.14	0.24	0.28	0.83	0.7

	Ethylmethyl-cyclohexane	Trimethyl-hexene	Dimethyloctane	1-R-alpha-pinene/ 2,6,6Trimethyl-Bicyclo[3.1.1] hetp-2-ene/2-Pinene	methyl isobutal ketone	Indane	2,2-dimethyl-hexane	Thieno[3,2b] thiophene	Metha-crolein	1,4 Dichlorobenzene	methyl-hexane	Trichloro-monofluoro-methane
Methyl ethyl disulphide	0.22	0.09	0.07	0.09	0.2	0.3	0.01	0.29	0.1	0.1	0.06	0.2
Ethylmethyl benzene	0.43	0.42	0.37	0.39	0.57	0.75	0.24	-0.08	0.36	0.16	0.35	0.57
Methyl propyl disulfide	0.39	0.38	0.34	0.37	0.52	0.44	0.22	-0.13	0.39	0.42	0.32	0.52
Diethyl disulfide C4H10S2	0.27	0.27	0.23	0.26	0.39	0.32	0.14	0.12	0.29	0.37	0.22	0.39
Ethyl, methylethyl disulfide	0.28	0.28	0.24	0.27	0.4	0.33	0.15	0	0.29	0.3	0.23	0.4
Dimethyl trisulfide	0.14	-0.04	-0.05	-0.02	0.04	0.2	-0.07	0.67	0.06	0.11	-0.05	0.04
Ethyl n-propyl disulfide	0.45	0.44	0.39	0.42	0.59	0.5	0.25	0.06	0.43	0.39	0.37	0.59
Trimethyl benzene	0.21	0.21	0.18	0.2	0.3	0.24	0.11	-0.14	0.21	0.01	0.17	0.3
Undecane	0.43	0.41	0.37	0.39	0.56	0.47	0.24	-0.09	0.4	0.18	0.35	0.56
1-Methyl propenylbenzene	0.46	0.44	0.39	0.42	0.59	0.5	0.26	-0.09	0.42	0.2	0.37	0.59
Dodecane	0.51	0.49	0.44	0.47	0.66	0.56	0.29	-0.09	0.47	0.24	0.42	0.66
1-Methyl-1H-Indene	0.42	0.4	0.36	0.38	0.55	0.46	0.24	-0.09	0.39	0.18	0.34	0.55
2-Methyl propenyl benzene	0.4	0.39	0.35	0.37	0.53	0.44	0.23	-0.09	0.38	0.17	0.33	0.53
Propyl benzene	0.51	0.49	0.44	0.47	0.66	0.56	0.29	-0.1	0.48	0.24	0.42	0.66
Diethyl benzene	0.38	0.37	0.33	0.35	0.5	0.42	0.22	-0.1	0.37	0.16	0.31	0.5
Methyl-methylethyl benzene, methyl-Cumene	0.39	0.38	0.33	0.36	0.51	0.43	0.22	-0.1	0.37	0.16	0.32	0.51
Tetramethyl benzene	0.4	0.39	0.34	0.37	0.53	0.44	0.22	-0.11	0.37	0.15	0.33	0.53
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.37	0.36	0.32	0.35	0.51	0.42	0.2	0.23	0.37	0.2	0.3	0.51
Methyl pyridine	0.79	0.76	0.68	0.72	1	0.85	0.46	-0.05	0.72	0.45	0.65	1
Diemethyl pyridine/Aldrich	0.79	0.76	0.68	0.72	1	0.85	0.46	-0.05	0.72	0.45	0.65	1
Ethyl pyridine	0.79	0.76	0.68	0.72	1	0.85	0.46	-0.05	0.72	0.45	0.65	1
2-Methylbutane	0.31	0.31	0.27	0.53	0.43	0.33	0.52	-0.07	0.64	0.17	0.61	0.43
Pentane	0.17	0.17	0.15	0.17	0.26	0.21	0.5	-0.17	0.19	0.13	0.65	0.26
2,4-Dimethylpentane	0.45	0.43	0.38	0.41	0.58	0.49	0.99	-0.09	0.42	0.2	0.37	0.58
Methyl cyclopentane	0.41	0.39	0.35	0.38	0.54	0.45	0.78	-0.13	0.39	0.17	0.79	0.54
2-Methylhexane	0.69	0.81	0.82	0.34	0.5	0.41	0.71	-0.13	0.36	0.15	0.3	0.5

	Difluoro-chloro-methane	tetramethyl-cyclopentane	Ethylmethyl cyclohexane	methyl methylethyl cyclohexane	chloro-pentane	1,3 Cyclo-hexadiene	Methyl n-butyl disulfide	Propyl n-butyl disulfide	Dipropyl-disulfide
Methyl ethyl disulphide	0.05	0.12	0.25	0.14	0.19	0.3	0.33	0.33	0.33
Ethylmethyl benzene	0.33	0.46	0.46	0.49	0.57	0.5	0.4	0.41	0.37
Methyl propyl disulfide	0.31	0.42	0.43	0.45	0.52	0.46	0.37	0.38	0.34
Diethyl disulfide C4H10S2	0.21	0.3	0.3	0.33	0.39	0.33	0.66	0.66	0.67
Ethyl, methylethyl disulfide	0.22	0.31	0.31	0.34	0.4	0.34	0.68	0.68	0.69
Dimethyl trisulfide	-0.04	-0.02	0.16	-0.01	0.03	0.2	-0.03	-0.03	-0.04
Ethyl n-propyl disulfide	0.35	0.48	0.49	0.52	0.59	0.52	0.89	0.89	0.9
Trimethyl benzene	0.16	0.23	0.23	0.25	0.3	0.25	0.2	0.2	0.18
Undecane	0.33	0.45	0.46	0.49	0.55	0.49	0.4	0.41	0.37
1-Methyl propenylbenzene	0.36	0.48	0.49	0.52	0.59	0.52	0.43	0.43	0.39
Dodecane	0.4	0.54	0.55	0.58	0.66	0.58	0.48	0.48	0.44
1-Methyl-1H-Indene	0.33	0.44	0.45	0.48	0.54	0.48	0.39	0.4	0.36
2-Methyl propenyl benzene	0.32	0.43	0.44	0.46	0.53	0.47	0.38	0.38	0.35
Propyl benzene	0.4	0.54	0.55	0.58	0.66	0.59	0.48	0.49	0.44
Diethyl benzene	0.3	0.41	0.41	0.44	0.5	0.44	0.36	0.36	0.33
Methyl-methylethyl benzene, methyl-Cumene	0.3	0.42	0.42	0.45	0.51	0.45	0.37	0.37	0.34
Tetramethyl benzene	0.31	0.43	0.43	0.46	0.53	0.46	0.37	0.38	0.34
Napthalene/TrimethylBicyclo 2.2.1 heptane	0.29	0.4	0.41	0.43	0.5	0.44	0.35	0.36	0.32
Methyl pyridine	0.62	0.83	0.85	0.89	1	0.9	0.74	0.75	0.69
Diemethyl pyridine/Aldrich	0.62	0.83	0.85	0.89	1	0.9	0.74	0.75	0.69
Ethyl pyridine	0.62	0.83	0.85	0.89	1	0.9	0.74	0.75	0.69
2-Methylbutane	0.23	0.33	0.33	0.36	0.43	0.37	0.29	0.3	0.27
Pentane	0.13	0.2	0.19	0.21	0.26	0.22	0.17	0.17	0.15
2,4-Dimethylpentane	0.35	0.47	0.48	0.51	0.58	0.51	0.42	0.42	0.39
Methyl cyclopentane	0.32	0.44	0.44	0.47	0.54	0.47	0.38	0.39	0.35
2-Methylhexane	0.29	0.4	0.4	0.43	0.49	0.43	0.35	0.35	0.32

Correlation matrix, logged data with all cases: Part 3

	Methane (ppmv)	Benzene	Chloroform	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	1,2-Dichloro-ethane (EDC)	Dichloro-methane (Methylene chloride)	Ethyl-benzene	Hexachloro-butadiene	Styrene (monomer)	1,1,2,2-Tetrachloroethane
2,3-Dimethylpentane	0.37	-0.05	0.2	0.15	0.24	0.26	0.36	0.36	-0.05	0.29	-0.12	0.25
3-Methylhexane	0.81	0.02	0.28	0.15	0.46	0.55	0.57	0.57	-0.01	0.36	-0.01	0.4
Methyl cyclohexane	0.4	-0.03	0.24	0.13	0.32	0.4	0.43	0.43	-0.07	0.33	-0.14	0.29
Trimethylpentane,2,2,4	0.45	-0.04	0.31	0.19	0.35	0.41	0.53	0.53	-0.04	0.38	-0.11	0.37
C3 Hydrocarbon	0.08	0.23	0.04	0.28	0.33	0.23	0.21	0.23	0.18	-0.01	0.07	0.11
C4 Hydrocarbon	0.34	-0.01	0.11	0.04	0.12	0.19	0.29	0.29	0.04	0.18	0.03	0.18
C5 Hydrocarbon	0.68	-0.02	0.33	0.13	0.43	0.46	0.63	0.64	-0.06	0.37	-0.13	0.49
C6 Hydrocarbon	0.33	0.11	0.14	0.1	0.31	0.19	0.33	0.34	0.17	0.31	-0.13	0.33
C7 Hydrocarbon	0.55	0.01	0.19	0.07	0.27	0.35	0.49	0.49	0.06	0.3	0	0.32
C8 Hydrocarbon	0.55	-0.01	0.35	0.15	0.4	0.54	0.58	0.59	0.06	0.47	0.11	0.39
C9 Hydrocarbon	0.68	-0.05	0.3	0.2	0.5	0.49	0.63	0.63	0.09	0.39	0.16	0.44
C10 Hydrocarbon	0.06	-0.2	0.18	0.22	0.26	0.2	0.33	0.33	0.08	0.3	0.32	0.35
C11 Hydrocarbon	0.15	0.25	0.11	0.34	0.21	0.17	0.27	0.31	0.44	0.32	0.22	0.17
C12 hydrocarbon	-0.09	-0.01	-0.05	-0.07	-0.34	-0.12	-0.07	-0.08	0.17	0.06	0.28	0.16
C13 Hydrocarbon	0.05	0.31	0	-0.06	0.04	0.13	0.13	0.13	0.37	0.26	0.31	0.3
Acetone	0.38	-0.08	0.32	0.18	0.36	0.42	0.55	0.55	-0.08	0.22	-0.1	0.38
Propane / ppmv	0.42	0.06	0.27	0.03	0.43	0.67	0.5	0.5	-0.04	0.39	-0.01	0.34
Butane / ppmv	0.13	0.07	0.19	-0.03	0.33	0.56	0.34	0.34	-0.05	0.29	-0.03	0.22
ethane / ppmv	0.86	0	0.48	0.27	0.5	0.69	0.86	0.86	0.07	0.59	0.11	0.6
Isobutane	0.19	-0.04	0.19	-0.04	0.32	0.51	0.32	0.31	-0.27	0.16	-0.24	0.34
Camphene	0.48	0	0.48	0.22	0.49	0.62	0.79	0.79	-0.01	0.49	-0.06	0.57
Cyclohexadiene	0.38	0.18	0.4	0.1	0.45	0.71	0.67	0.67	0.07	0.42	0.16	0.48
Propynyl benzene	0.33	0.18	0.37	0.08	0.42	0.65	0.61	0.61	-0.01	0.36	0.04	0.44
Diethyl trisulfide	0.29	0.17	0.23	0.19	0.31	0.46	0.47	0.47	0.09	0.29	0.25	0.46
Methyl butene	0.36	0.1	0.34	0.05	0.47	0.66	0.57	0.58	-0.08	0.36	-0.1	0.4
Dimethylcyclopropane	0.32	0.11	0.29	0.02	0.44	0.63	0.51	0.51	-0.09	0.32	-0.11	0.36

	Tetrachloroethene (PCE)	Toluene	1,1,1-Trichloroethane (TCA)	1,1,2-Trichloroethane	1,3,5 Trimethylbenzene	1,2,4 Trimethylbenzene	1,2,4-Trichlorobenzene	Trichloroethene (TCE)	Trichlorofluoromethane (F-11)	m&p Xylene	0-Xylene	Carbon disulfide**
2,3-Dimethylpentane	0.23	-0.18	0.36	0.36	-0.05	0.13	0.16	0.12	0.34	-0.08	-0.03	-0.07
3-Methylhexane	0.36	-0.05	0.57	0.57	-0.03	0.03	0.29	0.17	0.52	-0.06	-0.01	-0.1
Methyl cyclohexane	0.27	-0.19	0.43	0.43	-0.08	0.1	0.19	0.14	0.41	-0.12	-0.07	-0.1
Trimethylpentane,2,2,4	0.35	-0.18	0.53	0.53	-0.06	0.12	0.23	0.19	0.51	-0.1	-0.04	-0.03
C3 Hydrocarbon	0.08	0.16	0.21	0.21	0.01	0.11	-0.1	0.01	0.23	0.13	0.03	0.16
C4 Hydrocarbon	0.15	-0.14	0.29	0.29	0.11	0.18	0.14	0.05	0.26	0.06	0.1	0.07
C5 Hydrocarbon	0.37	-0.13	0.64	0.64	-0.03	0.12	0.33	0.22	0.62	-0.12	-0.02	0.05
C6 Hydrocarbon	0.14	0.09	0.33	0.33	0.15	0.48	0.25	0.09	0.38	0.15	0.28	0.2
C7 Hydrocarbon	0.28	-0.05	0.5	0.5	-0.12	0.01	0.32	0.16	0.48	-0.09	-0.02	-0.2
C8 Hydrocarbon	0.34	0.03	0.59	0.59	0.01	0.13	0.5	0.23	0.53	0.02	0.11	-0.01
C9 Hydrocarbon	0.39	0.03	0.63	0.63	0.06	0.06	0.32	0.18	0.65	-0.02	0.06	-0.01
C10 Hydrocarbon	0.15	-0.07	0.34	0.34	0.26	0.04	0.33	0.03	0.34	0.06	0.15	-0.01
C11 Hydrocarbon	0.15	0.29	0.28	0.28	0.39	0.61	0.58	0.21	0.32	0.38	0.55	0.34
C12 hydrocarbon	0.15	0.13	-0.07	-0.07	0.39	0.09	-0.04	0.01	-0.13	0.19	0.21	-0.02
C13 Hydrocarbon	0.26	0.28	0.13	0.13	0.39	0.31	0.16	-0.02	0.12	0.3	0.35	-0.06
Acetone	0.36	-0.1	0.55	0.55	-0.14	-0.04	0.11	0.19	0.52	-0.14	-0.11	0.13
Propane / ppmv	0.32	-0.11	0.51	0.51	-0.05	-0.01	0.28	0.17	0.47	-0.13	-0.08	-0.12
Butane / ppmv	0.21	-0.09	0.35	0.35	-0.07	-0.03	0.17	0.12	0.32	-0.12	-0.09	-0.14
ethane / ppmv	0.57	-0.1	0.86	0.86	0.09	0.11	0.49	0.31	0.82	-0.06	0.05	0.09
Isobutane	0.24	-0.19	0.32	0.32	-0.18	-0.15	-0.03	0.16	0.24	-0.25	-0.27	-0.09
Camphene	0.54	-0.13	0.79	0.79	-0.09	0.03	0.32	0.3	0.75	-0.14	-0.07	0.07
Cyclohexadiene	0.45	0	0.67	0.67	-0.02	-0.02	0.26	0.24	0.63	-0.03	-0.01	0.16
Propynyl benzene	0.42	-0.08	0.61	0.61	-0.06	-0.05	0.22	0.23	0.58	-0.09	-0.08	0.1
Diethyl trisulfide	0.28	0.03	0.47	0.47	0.18	-0.04	0.22	0.13	0.43	0.04	0.06	0.32
Methyl butene	0.38	-0.05	0.58	0.58	-0.14	-0.04	0.22	0.2	0.49	-0.11	-0.1	-0.03
Dimethylcyclopropane	0.34	-0.04	0.51	0.51	-0.15	-0.05	0.19	0.18	0.43	-0.1	-0.11	-0.05

	Carbonyl sulfide**	Dimethyl disulfide	Methyl ethyl disulphide	Ethylmethyl benzene	Methyl propyl disulfide	Diethyl disulfide C4H10S2	Ethyl, methylethyl-disulfide	Dimethyl trisulfide	Ethyl n-propyl disulfide	Trimethyl benzene	Undecane	1-Methyl propenylb enzene
2,3-Dimethylpentane	0.16	0.3	0.02	0.27	0.25	0.16	0.17	-0.06	0.28	0.12	0.27	0.29
3-Methylhexane	0.15	0.05	-0.02	0.25	0.27	0.18	0.18	-0.04	0.31	0.13	0.29	0.31
Methyl cyclohexane	0.18	0.27	0.02	0.31	0.28	0.18	0.2	-0.08	0.32	0.14	0.31	0.33
Trimethylpentane,2,2,4	0.26	0.3	0.08	0.39	0.36	0.25	0.26	-0.04	0.41	0.19	0.39	0.41
C3 Hydrocarbon	0.24	-0.07	-0.07	0.1	0.1	0.13	0.02	-0.02	0.13	0.34	0.14	0.15
C4 Hydrocarbon	0.04	0.14	-0.09	0.14	-0.03	-0.1	-0.07	-0.03	-0.02	-0.07	0	0
C5 Hydrocarbon	0.28	0.18	0.15	0.41	0.26	0.33	0.2	0.15	0.3	0.17	0.28	0.31
C6 Hydrocarbon	0.31	0.32	0.07	0.5	0.13	0.09	0.03	0.12	0.16	0.28	0.16	0.18
C7 Hydrocarbon	0.23	-0.02	0.01	0.27	0.22	0.18	0.17	-0.05	0.25	0.16	0.24	0.26
C8 Hydrocarbon	0.22	-0.02	-0.01	0.21	0.29	0.15	0.17	0.02	0.29	0.24	0.28	0.3
C9 Hydrocarbon	0.16	-0.07	-0.03	0.27	0.3	0.19	0.2	-0.06	0.34	0.13	0.32	0.34
C10 Hydrocarbon	-0.16	-0.29	-0.26	-0.05	-0.06	-0.1	-0.04	0.02	-0.05	-0.11	-0.02	-0.02
C11 Hydrocarbon	0.48	-0.01	-0.07	0	-0.05	-0.11	-0.09	0.28	-0.04	0.65	-0.02	-0.01
C12 hydrocarbon	-0.26	0.02	0.03	0	-0.2	-0.18	0.05	0.08	-0.3	-0.04	0.22	0.2
C13 Hydrocarbon	-0.05	0.24	0.28	0.39	0.06	0.03	0.37	0.05	0.08	0.29	0.62	0.61
Acetone	0.25	0.05	0.07	0.38	0.35	0.24	0.25	-0.04	0.4	0.19	0.38	0.4
Propane / ppmv	0.1	-0.1	-0.08	0.18	0.17	0.06	0.09	-0.04	0.2	0.07	0.19	0.2
Butane / ppmv	0.06	-0.11	-0.1	0.12	0.09	0	0.03	-0.07	0.12	0.03	0.11	0.12
ethane / ppmv	0.26	0.01	0.03	0.36	0.36	0.22	0.25	0.08	0.41	0.19	0.37	0.4
Isobutane	0.04	-0.12	-0.13	0.13	0.12	0.17	0.13	-0.12	0.15	0	0.16	0.17
Camphene	0.4	0.16	0.19	0.56	0.52	0.39	0.4	0.03	0.59	0.3	0.55	0.59
Cyclohexadiene	0.31	0.17	0.24	0.47	0.43	0.3	0.32	0.12	0.48	0.23	0.46	0.49
Propynyl benzene	0.3	0.2	0.26	0.43	0.39	0.29	0.3	0.15	0.45	0.22	0.42	0.45
Diethyl trisulfide	0.27	0.41	0.42	0.29	0.27	0.28	0.17	0.58	0.31	0.11	0.3	0.33
Methyl butene	0.25	0.05	0.08	0.39	0.36	0.25	0.26	-0.04	0.41	0.19	0.39	0.41
Dimethylcyclopropane	0.22	0.03	0.05	0.34	0.31	0.21	0.22	-0.05	0.36	0.16	0.34	0.36

	Dodecane	1-Methyl-1H-Indene	2-Methyl propenyl benzene	Propyl benzene	Diethyl benzene	Methyl-methylethyl benzene, methyl-Cumene	Tetramethyl benzene	Napthalene/ Trimethyl Bicyclo 2.2.1 heptane	Methyl pyridine	Diemethyl pyridine/ Aldrich	Ethyl pyridine	2-Methyl-butane
2,3-Dimethylpentane	0.32	0.26	0.25	0.32	0.24	0.24	0.25	0.23	0.51	0.51	0.51	0.53
3-Methylhexane	0.35	0.29	0.27	0.36	0.27	0.27	0.26	0.26	0.56	0.56	0.56	0.76
Methyl cyclohexane	0.37	0.3	0.29	0.37	0.27	0.28	0.28	0.26	0.59	0.59	0.59	0.61
Trimethylpentane,2,2,4	0.46	0.38	0.37	0.47	0.35	0.35	0.36	0.34	0.72	0.72	0.72	0.56
C3 Hydrocarbon	0.18	0.13	0.13	0.54	0.53	0.53	0.38	0.41	0.34	0.34	0.34	0
C4 Hydrocarbon	0.01	0	0	0.01	-0.02	-0.01	-0.02	-0.05	0.08	0.08	0.08	0.22
C5 Hydrocarbon	0.35	0.28	0.26	0.36	0.26	0.26	0.38	0.34	0.61	0.61	0.61	0.52
C6 Hydrocarbon	0.21	0.16	0.15	0.4	0.35	0.36	0.43	0.26	0.42	0.42	0.42	0.36
C7 Hydrocarbon	0.3	0.24	0.22	0.31	0.22	0.22	0.35	0.19	0.52	0.52	0.52	0.37
C8 Hydrocarbon	0.34	0.27	0.26	0.35	0.25	0.26	0.46	0.23	0.58	0.58	0.58	0.59
C9 Hydrocarbon	0.39	0.31	0.3	0.39	0.29	0.3	0.29	0.28	0.62	0.62	0.62	0.44
C10 Hydrocarbon	-0.01	-0.02	-0.03	-0.01	-0.04	-0.03	-0.05	-0.09	0.08	0.08	0.08	-0.04
C11 Hydrocarbon	-0.01	-0.02	-0.02	0.48	0.54	0.53	0.72	0.37	0.05	0.05	0.05	0.01
C12 hydrocarbon	0.16	0.22	0.23	-0.26	-0.24	-0.24	-0.28	-0.14	-0.2	-0.2	-0.2	-0.13
C13 Hydrocarbon	0.6	0.62	0.62	0.12	0.07	0.07	0.06	0.16	0.25	0.25	0.25	-0.01
Acetone	0.45	0.37	0.36	0.45	0.34	0.34	0.35	0.33	0.7	0.7	0.7	0.27
Propane / ppmv	0.23	0.18	0.17	0.24	0.17	0.18	0.18	0.16	0.41	0.41	0.41	0.53
Butane / ppmv	0.14	0.11	0.1	0.15	0.1	0.11	0.11	0.08	0.27	0.27	0.27	0.36
ethane / ppmv	0.45	0.37	0.35	0.47	0.35	0.36	0.37	0.35	0.73	0.73	0.73	0.59
Isobutane	0.2	0.15	0.14	0.2	0.13	0.13	0.12	0.09	0.38	0.38	0.38	0.62
Camphene	0.65	0.54	0.52	0.66	0.5	0.51	0.52	0.5	0.99	0.99	0.99	0.42
Cyclohexadiene	0.55	0.45	0.43	0.55	0.41	0.42	0.43	0.41	0.84	0.84	0.84	0.34
Propynyl benzene	0.5	0.41	0.4	0.5	0.38	0.38	0.4	0.38	0.75	0.75	0.75	0.33
Diethyl trisulfide	0.37	0.3	0.28	0.37	0.27	0.27	0.27	0.55	0.61	0.61	0.61	0.18
Methyl butene	0.46	0.38	0.37	0.46	0.35	0.35	0.36	0.34	0.72	0.72	0.72	0.62
Dimethylcyclopropane	0.41	0.33	0.32	0.41	0.3	0.31	0.31	0.29	0.63	0.63	0.63	0.61

	Pentane	2,4-Dimethylpentane	Methyl cyclopentane	2-Methyl-hexane	2,3-Dimethylpentane	3-Methyl-hexane	Methyl cyclohexane	Trimethyl-pentane,2,2,4	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon
2,3-Dimethylpentane	0.51	1	0.79	0.72	1	0.52	0.96	0.96	0.12	0.49	0.26	0.58
3-Methylhexane	0.47	0.55	0.66	0.67	0.52	1	0.54	0.59	0.23	0.22	0.54	0.35
Methyl cyclohexane	0.59	0.97	0.78	0.71	0.96	0.54	1	0.96	0.13	0.44	0.3	0.55
Trimethylpentane,2,2,4	0.49	0.98	0.81	0.74	0.96	0.59	0.96	1	0.2	0.42	0.4	0.59
C3 Hydrocarbon	-0.03	0.15	0.11	0.36	0.12	0.23	0.13	0.2	1	-0.12	0.12	0.1
C4 Hydrocarbon	0.17	0.47	0.33	0.29	0.49	0.22	0.44	0.42	-0.12	1	0.22	0.41
C5 Hydrocarbon	0.15	0.3	0.26	0.23	0.26	0.54	0.3	0.4	0.12	0.22	1	0.55
C6 Hydrocarbon	0.19	0.59	0.44	0.39	0.58	0.35	0.55	0.59	0.1	0.41	0.55	1
C7 Hydrocarbon	0.13	0.26	0.22	0.32	0.22	0.56	0.25	0.34	0.09	0.06	0.65	0.27
C8 Hydrocarbon	0.32	0.3	0.45	0.23	0.25	0.59	0.29	0.38	0.01	0.02	0.6	0.34
C9 Hydrocarbon	0.11	0.34	0.31	0.5	0.29	0.74	0.34	0.43	0.23	0.05	0.54	0.33
C10 Hydrocarbon	-0.04	-0.02	-0.06	0.18	-0.03	0.1	-0.04	0	-0.02	0.23	0	-0.06
C11 Hydrocarbon	-0.11	-0.02	-0.05	-0.06	-0.03	0.06	-0.03	-0.01	0.19	0.17	0.16	0.21
C12 hydrocarbon	-0.24	-0.24	-0.3	-0.1	-0.24	-0.12	-0.28	-0.25	-0.17	-0.12	-0.07	-0.24
C13 Hydrocarbon	-0.06	0.09	0.06	0.04	0.07	0.06	0.08	0.14	0	-0.14	0.11	0.06
Acetone	0.15	0.39	0.36	0.33	0.35	0.38	0.4	0.49	0.19	0.02	0.44	0.23
Propane / ppmv	0.45	0.24	0.2	0.18	0.21	0.34	0.45	0.3	0.04	0.15	0.28	0.11
Butane / ppmv	0.45	0.16	0.13	0.11	0.14	0.09	0.39	0.2	0.01	0.11	0.07	0.02
ethane / ppmv	0.18	0.45	0.41	0.37	0.4	0.77	0.45	0.55	0.18	0.3	0.68	0.33
Isobutane	0.68	0.17	0.42	0.1	0.14	0.28	0.28	0.23	0.09	-0.13	0.38	0.15
Camphene	0.26	0.58	0.54	0.49	0.51	0.55	0.58	0.72	0.36	0.08	0.61	0.41
Cyclohexadiene	0.2	0.48	0.44	0.4	0.42	0.46	0.48	0.6	0.45	0.03	0.48	0.31
Propynyl benzene	0.19	0.44	0.41	0.37	0.39	0.43	0.44	0.54	0.43	0.05	0.46	0.2
Diethyl trisulfide	0.07	0.32	0.28	0.25	0.27	0.29	0.31	0.41	0.22	-0.07	0.38	0.14
Methyl butene	0.63	0.4	0.79	0.34	0.35	0.63	0.41	0.51	0.2	0.01	0.4	0.24
Dimethylcyclopropane	0.65	0.35	0.79	0.29	0.31	0.6	0.35	0.44	0.17	0	0.34	0.2

	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Acetone	Propane / ppmv	Butane / ppmv	ethane / ppmv	Isobutane
2,3-Dimethylpentane	0.22	0.25	0.29	-0.03	-0.03	-0.24	0.07	0.35	0.21	0.14	0.4	0.14
3-Methylhexane	0.56	0.59	0.74	0.1	0.06	-0.12	0.06	0.38	0.34	0.09	0.77	0.28
Methyl cyclohexane	0.25	0.29	0.34	-0.04	-0.03	-0.28	0.08	0.4	0.45	0.39	0.45	0.28
Trimethylpentane,2,2,4	0.34	0.38	0.43	0	-0.01	-0.25	0.14	0.49	0.3	0.2	0.55	0.23
C3 Hydrocarbon	0.09	0.01	0.23	-0.02	0.19	-0.17	0	0.19	0.04	0.01	0.18	0.09
C4 Hydrocarbon	0.06	0.02	0.05	0.23	0.17	-0.12	-0.14	0.02	0.15	0.11	0.3	-0.13
C5 Hydrocarbon	0.65	0.6	0.54	0	0.16	-0.07	0.11	0.44	0.28	0.07	0.68	0.38
C6 Hydrocarbon	0.27	0.34	0.33	-0.06	0.21	-0.24	0.06	0.23	0.11	0.02	0.33	0.15
C7 Hydrocarbon	1	0.6	0.56	0	0.14	0.01	0.16	0.32	0.26	0.06	0.62	0.13
C8 Hydrocarbon	0.6	1	0.73	0.2	0.26	-0.03	0.2	0.37	0.31	0.13	0.65	0.32
C9 Hydrocarbon	0.56	0.73	1	0.33	0.07	-0.01	0.23	0.41	0.34	0.12	0.74	0.13
C10 Hydrocarbon	0	0.2	0.33	1	0.19	0.31	0.06	0	0.09	0.07	0.23	-0.02
C11 Hydrocarbon	0.14	0.26	0.07	0.19	1	-0.11	-0.15	0	0.12	0.06	0.29	-0.14
C12 hydrocarbon	0.01	-0.03	-0.01	0.31	-0.11	1	0.45	-0.25	-0.19	-0.2	-0.08	-0.04
C13 Hydrocarbon	0.16	0.2	0.23	0.06	-0.15	0.45	1	0.2	0	-0.04	0.11	0.01
Acetone	0.32	0.37	0.41	0	0	-0.25	0.2	1	0.26	0.17	0.5	0.38
Propane / ppmv	0.26	0.31	0.34	0.09	0.12	-0.19	0	0.26	1	0.95	0.51	0.5
Butane / ppmv	0.06	0.13	0.12	0.07	0.06	-0.2	-0.04	0.17	0.95	1	0.25	0.49
ethane / ppmv	0.62	0.65	0.74	0.23	0.29	-0.08	0.11	0.5	0.51	0.25	1	0.2
Isobutane	0.13	0.32	0.13	-0.02	-0.14	-0.04	0.01	0.38	0.5	0.49	0.2	1
Camphene	0.5	0.56	0.61	0.1	0.05	-0.21	0.24	0.7	0.4	0.27	0.72	0.39
Cyclohexadiene	0.41	0.46	0.51	0.02	0.01	-0.1	0.32	0.58	0.32	0.21	0.61	0.28
Propynyl benzene	0.39	0.26	0.27	-0.08	0.03	-0.13	0.22	0.53	0.3	0.2	0.55	0.28
Diethyl trisulfide	0.21	0.26	0.32	-0.03	-0.04	0.02	0.33	0.39	0.17	0.09	0.39	0.15
Methyl butene	0.34	0.61	0.43	0	-0.01	-0.26	0.13	0.49	0.27	0.17	0.51	0.57
Dimethylcyclopropane	0.29	0.58	0.38	-0.02	-0.02	-0.25	0.11	0.43	0.23	0.14	0.45	0.57

	Camphene	Cyclohexadiene	Propynyl benzene	Diethyl trisulfide	Methyl butene	Dimethylcyclopropane	Dimethylbutane/neoheptane	Methylpentane/Isohexane	Hexane	Limonene	Dimethyl-pentatnone	Bromo-hexene
2,3-Dimethylpentane	0.51	0.42	0.39	0.27	0.35	0.31	0.36	0.16	0.25	0.3	0.28	0.47
3-Methylhexane	0.55	0.46	0.43	0.29	0.63	0.6	0.63	0.45	0.53	0.32	0.62	0.66
Methyl cyclohexane	0.58	0.48	0.44	0.31	0.41	0.35	0.41	0.31	0.4	0.34	0.33	0.54
Trimethylpentane,2,2,4	0.72	0.6	0.54	0.41	0.51	0.44	0.51	0.24	0.37	0.44	0.41	0.67
C3 Hydrocarbon	0.36	0.45	0.43	0.22	0.2	0.17	0.2	0.04	0.11	0.13	0.47	0.44
C4 Hydrocarbon	0.08	0.03	0.05	-0.07	0.01	0	0.01	-0.05	-0.03	-0.02	-0.01	0.05
C5 Hydrocarbon	0.61	0.48	0.46	0.38	0.4	0.34	0.41	0.15	0.27	0.34	0.31	0.55
C6 Hydrocarbon	0.41	0.31	0.2	0.14	0.24	0.2	0.25	0.05	0.14	0.24	0.18	0.36
C7 Hydrocarbon	0.5	0.41	0.39	0.21	0.34	0.29	0.34	0.13	0.23	0.25	0.41	0.53
C8 Hydrocarbon	0.56	0.46	0.26	0.26	0.61	0.58	0.61	0.42	0.51	0.32	0.3	0.52
C9 Hydrocarbon	0.61	0.51	0.27	0.32	0.43	0.38	0.44	0.2	0.31	0.46	0.62	0.69
C10 Hydrocarbon	0.1	0.02	-0.08	-0.03	0	-0.02	0	-0.09	-0.06	0.12	0.27	0.17
C11 Hydrocarbon	0.05	0.01	0.03	-0.04	-0.01	-0.02	-0.01	-0.07	-0.05	0.07	-0.03	0.02
C12 hydrocarbon	-0.21	-0.1	-0.13	0.02	-0.26	-0.25	-0.26	-0.29	-0.3	-0.24	-0.01	-0.14
C13 Hydrocarbon	0.24	0.32	0.22	0.33	0.13	0.11	0.14	0.01	0.06	0.08	0.09	0.21
Acetone	0.7	0.58	0.53	0.39	0.49	0.43	0.5	0.23	0.36	0.42	0.4	0.65
Propane / ppmv	0.4	0.32	0.3	0.17	0.27	0.23	0.27	0.53	0.55	0.22	0.21	0.37
Butane / ppmv	0.27	0.21	0.2	0.09	0.17	0.14	0.17	0.51	0.5	0.14	0.13	0.24
ethane / ppmv	0.72	0.61	0.55	0.39	0.51	0.45	0.52	0.25	0.38	0.45	0.42	0.68
Isobutane	0.39	0.28	0.28	0.15	0.57	0.57	0.57	0.7	0.71	0.15	0.17	0.33
Camphene	1	0.83	0.75	0.6	0.71	0.63	0.72	0.36	0.54	0.63	0.58	0.93
Cyclohexadiene	0.83	1	0.9	0.7	0.59	0.52	0.6	0.29	0.44	0.52	0.48	0.78
Propynyl benzene	0.75	0.9	1	0.65	0.54	0.48	0.55	0.27	0.41	0.48	0.44	0.7
Diethyl trisulfide	0.6	0.7	0.65	1	0.4	0.35	0.41	0.16	0.28	0.4	0.32	0.55
Methyl butene	0.71	0.59	0.54	0.4	1	0.99	1	0.82	0.9	0.44	0.41	0.66
Dimethylcyclopropane	0.63	0.52	0.48	0.35	0.99	1	0.99	0.85	0.91	0.38	0.36	0.59

	Ethylmethyl-cyclohexane	Trimethyl-hexene	Dimethyloctane	1-R-alpha-pinene/ 2,6,6Trimethyl-Bicyclo[3.1.1] hetp-2-ene/2-Pinene	methyl isobutal ketone	Indane	2,2-dimethyl-hexane	Thieno[3,2b] thiophene	Metha-crolein	1,4 Dichlorobenzene	methyl-hexane	Trichloro-monofluoro-methane
2,3-Dimethylpentane	0.39	0.38	0.33	0.36	0.51	0.43	1	-0.09	0.37	0.16	0.32	0.51
3-Methylhexane	0.6	0.66	0.65	0.37	0.56	0.44	0.5	-0.02	0.83	0.19	0.61	0.56
Methyl cyclohexane	0.45	0.43	0.38	0.41	0.59	0.49	0.95	-0.11	0.43	0.19	0.37	0.59
Trimethylpentane,2,2,4	0.56	0.54	0.48	0.51	0.72	0.61	0.95	-0.09	0.52	0.27	0.46	0.72
C3 Hydrocarbon	0.4	0.47	0.47	0.2	0.34	0.26	0.1	-0.14	0.2	-0.05	0.17	0.34
C4 Hydrocarbon	0.01	0.02	0.01	0.04	0.08	0.07	0.5	0.08	0.13	0.04	0	0.08
C5 Hydrocarbon	0.43	0.43	0.38	0.59	0.61	0.53	0.23	0.08	0.73	0.24	0.36	0.61
C6 Hydrocarbon	0.26	0.27	0.23	0.41	0.42	0.57	0.57	-0.12	0.35	-0.04	0.21	0.42
C7 Hydrocarbon	0.45	0.48	0.45	0.32	0.52	0.38	0.19	-0.09	0.66	0.16	0.3	0.52
C8 Hydrocarbon	0.41	0.41	0.36	0.53	0.58	0.43	0.22	-0.07	0.65	0.22	0.59	0.58
C9 Hydrocarbon	0.62	0.68	0.65	0.41	0.62	0.48	0.26	-0.02	0.78	0.25	0.39	0.62
C10 Hydrocarbon	0.16	0.24	0.25	0.02	0.08	0.05	-0.04	0.11	0.07	0.33	-0.01	0.08
C11 Hydrocarbon	-0.01	0	-0.01	0.03	0.05	0.06	-0.03	0.07	0.15	0.04	-0.02	0.05
C12 hydrocarbon	-0.15	-0.07	-0.04	-0.01	-0.2	-0.2	-0.23	0.14	-0.09	0.02	-0.25	-0.2
C13 Hydrocarbon	0.14	0.15	0.12	0.14	0.25	0.19	0.06	0.06	0.16	0.08	0.11	0.25
Acetone	0.54	0.52	0.47	0.5	0.7	0.59	0.31	-0.09	0.5	0.52	0.45	0.7
Propane / ppmv	0.28	0.29	0.25	0.29	0.41	0.33	0.19	0	0.45	0.2	0.24	0.41
Butane / ppmv	0.18	0.18	0.16	0.2	0.27	0.23	0.13	-0.04	0.15	0.14	0.15	0.27
ethane / ppmv	0.55	0.55	0.49	0.52	0.73	0.59	0.37	0.14	0.94	0.4	0.47	0.73
Isobutane	0.24	0.24	0.21	0.45	0.38	0.29	0.12	-0.14	0.24	0.28	0.57	0.38
Camphene	0.79	0.76	0.68	0.72	0.99	0.84	0.46	-0.05	0.71	0.44	0.65	0.99
Cyclohexadiene	0.66	0.63	0.56	0.6	0.84	0.71	0.38	-0.09	0.61	0.35	0.54	0.84
Propynyl benzene	0.6	0.57	0.51	0.55	0.75	0.64	0.35	-0.05	0.55	0.34	0.49	0.75
Diethyl trisulfide	0.62	0.43	0.38	0.41	0.61	0.5	0.24	0.51	0.43	0.27	0.36	0.61
Methyl butene	0.56	0.54	0.48	0.51	0.72	0.61	0.32	-0.1	0.52	0.29	1	0.72
Dimethylcyclopropane	0.49	0.47	0.42	0.45	0.63	0.54	0.28	-0.1	0.46	0.25	1	0.63

	Difluoro-chloro-methane	tetramethyl-cyclopentane	Ethylmethyl cyclohexane	methyl methylethyl cyclohexane	chloro-pentane	1,3 Cyclo-hexadiene	Methyl n-butyl disulfide	Propyl n-butyl disulfide	Dipropyl-disulfide
2,3-Dimethylpentane	0.31	0.42	0.42	0.45	0.51	0.45	0.37	0.37	0.34
3-Methylhexane	0.33	0.45	0.45	0.49	0.56	0.49	0.4	0.41	0.37
Methyl cyclohexane	0.35	0.48	0.48	0.51	0.59	0.52	0.42	0.43	0.39
Trimethylpentane,2,2,4	0.44	0.59	0.6	0.63	0.72	0.64	0.52	0.53	0.48
C3 Hydrocarbon	0.16	0.25	0.24	0.27	0.36	0.28	0.21	0.21	0.19
C4 Hydrocarbon	0.01	0.04	0.03	0.05	0.08	0.05	0.02	0.02	0.01
C5 Hydrocarbon	0.32	0.47	0.46	0.51	0.6	0.51	0.41	0.41	0.37
C6 Hydrocarbon	0.19	0.3	0.29	0.33	0.41	0.33	0.25	0.26	0.23
C7 Hydrocarbon	0.27	0.39	0.39	0.43	0.51	0.43	0.35	0.35	0.31
C8 Hydrocarbon	0.31	0.45	0.44	0.48	0.57	0.49	0.39	0.4	0.36
C9 Hydrocarbon	0.36	0.5	0.5	0.53	0.62	0.54	0.44	0.45	0.4
C10 Hydrocarbon	-0.01	0.03	0.01	0.04	0.08	0.04	0	0.01	0
C11 Hydrocarbon	0	0.02	0.01	0.03	0.05	0.03	0	0	-0.01
C12 hydrocarbon	-0.09	-0.14	-0.21	-0.15	-0.21	-0.24	-0.25	-0.25	-0.25
C13 Hydrocarbon	0.11	0.17	0.17	0.19	0.24	0.2	0.14	0.15	0.13
Acetone	0.42	0.57	0.58	0.61	0.7	0.62	0.51	0.52	0.47
Propane / ppmv	0.23	0.32	0.31	0.35	0.4	0.34	0.28	0.29	0.26
Butane / ppmv	0.15	0.22	0.2	0.23	0.27	0.22	0.18	0.18	0.17
ethane / ppmv	0.44	0.6	0.59	0.64	0.73	0.63	0.53	0.54	0.49
Isobutane	0.18	0.28	0.27	0.3	0.37	0.31	0.24	0.24	0.21
Camphene	0.62	0.83	0.84	0.88	0.99	0.89	0.74	0.74	0.68
Cyclohexadiene	0.51	0.69	0.71	0.74	0.84	0.75	0.61	0.62	0.57
Propynyl benzene	0.47	0.63	0.64	0.67	0.75	0.68	0.56	0.56	0.52
Diethyl trisulfide	0.35	0.48	0.66	0.52	0.6	0.72	0.42	0.43	0.38
Methyl butene	0.44	0.59	0.6	0.63	0.71	0.64	0.52	0.53	0.48
Dimethylcyclopropane	0.38	0.52	0.53	0.56	0.63	0.56	0.46	0.46	0.42

Correlation matrix, logged data with all cases: Part 4

	Methane (ppmv)	Benzene	Chloroform	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	1,2-Dichloro-ethane (EDC)	Dichloro-methane (Methylene chloride)	Ethyl-benzene	Hexachloro-butadiene	Styrene (monomer)	1,1,2,2-Tetrachloroethane
Dimethylbutane/neoheptane	0.37	0.1	0.34	0.06	0.47	0.66	0.58	0.58	-0.08	0.37	-0.1	0.41
Methylpentane/Isohexane	0.2	0.14	0.15	-0.11	0.39	0.63	0.3	0.3	-0.14	0.22	-0.14	0.2
Hexane	0.29	0.13	0.24	-0.05	0.46	0.7	0.44	0.44	-0.13	0.3	-0.14	0.3
Limonene	0.24	-0.04	0.25	0.09	0.54	0.35	0.47	0.47	-0.04	0.17	0.02	0.32
Dimethylpentatnone	0.29	0.03	0.27	0.18	0.39	0.36	0.47	0.47	0.07	0.21	0.02	0.33
Bromohexene	0.46	0.02	0.45	0.23	0.51	0.58	0.74	0.74	0.03	0.42	-0.03	0.53
Ethylmethylcyclohexane	0.4	0.1	0.36	0.24	0.44	0.47	0.62	0.62	0.11	0.27	0.12	0.43
Trimethylhexene	0.37	0.02	0.36	0.21	0.46	0.47	0.61	0.61	0.05	0.31	0	0.43
Dimethyloctane	0.34	0.02	0.32	0.2	0.43	0.42	0.55	0.55	0.06	0.27	0.01	0.38
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.29	0	0.56	0.09	0.36	0.48	0.61	0.61	-0.03	0.4	0.01	0.43
methyl isobutal ketone	0.49	0.01	0.49	0.21	0.5	0.63	0.79	0.79	0	0.49	-0.05	0.57
Indane	0.33	0.15	0.41	0.14	0.39	0.55	0.7	0.7	0.14	0.46	-0.04	0.5
2,2-dimethylhexane	0.35	-0.06	0.18	0.14	0.22	0.23	0.32	0.32	-0.05	0.26	-0.12	0.22
Thieno[3,2b] thiophene	0.15	0.04	0.04	0.25	0.05	0.1	0.21	0.21	0.09	0.07	0.25	0.39
Methacrolein	0.9	-0.02	0.39	0.2	0.46	0.59	0.72	0.72	0.01	0.47	0.03	0.52
1,4 Dichlorobenzene	0.2	-0.19	0.54	0.37	0.2	0.4	0.56	0.54	-0.12	0.16	-0.03	0.41
methylhexane	0.33	0.11	0.3	0.03	0.44	0.64	0.53	0.53	-0.09	0.33	-0.11	0.37
Trichloromonofluoromethane	0.49	0.01	0.49	0.21	0.5	0.63	0.79	0.79	0	0.49	-0.05	0.57
Difluorochloromethane	0.24	-0.09	0.27	0.6	0.21	0.35	0.47	0.47	0.02	0.16	-0.1	0.33
tetramethyl cyclopentane	0.36	-0.06	0.38	0.51	0.34	0.5	0.64	0.64	0.01	0.3	-0.09	0.45
Ethylmethyl cyclohexane	0.4	0.05	0.38	0.42	0.36	0.5	0.65	0.65	0.09	0.27	0.06	0.46
methyl methylethyl cyclohexane	0.4	-0.05	0.41	0.46	0.38	0.54	0.69	0.69	0.01	0.34	-0.09	0.49
chloropentane	0.49	0.04	0.48	0.22	0.5	0.62	0.78	0.78	0.02	0.47	-0.05	0.56
1,3 Cyclohexadiene	0.45	0.09	0.42	0.23	0.43	0.54	0.69	0.69	0.08	0.35	0.09	0.49
Methyl n-butyl disulfide	0.34	-0.03	0.34	0.18	0.34	0.44	0.58	0.58	-0.02	0.24	-0.02	0.41
Propyl n-butyl disulfide	0.34	-0.02	0.34	0.18	0.34	0.45	0.59	0.59	-0.02	0.25	-0.02	0.41
Dipropyl disulfide	0.31	-0.03	0.31	0.17	0.31	0.41	0.53	0.53	-0.02	0.21	-0.01	0.37

	Tetrachloroethene (PCE)	Toluene	1,1,1-Trichloroethane (TCA)	1,1,2-Trichloroethane	1,3,5 Trimethylbenzene	1,2,4 Trimethylbenzene	1,2,4-Trichlorobenzene	Trichloroethene (TCE)	Trichlorofluoromethane (F-11)	m&p Xylene	0-Xylene	Carbon disulfide**
Dimethylbutane/neoheptane	0.39	-0.05	0.58	0.58	-0.14	-0.04	0.22	0.2	0.5	-0.11	-0.1	-0.03
Methylpentane/Isohexane	0.18	-0.04	0.3	0.3	-0.19	-0.11	0.11	0.08	0.22	-0.13	-0.16	-0.18
Hexane	0.28	-0.06	0.44	0.44	-0.19	-0.09	0.16	0.14	0.36	-0.14	-0.16	-0.14
Limonene	0.3	-0.07	0.48	0.48	-0.05	-0.05	0.14	0.15	0.6	-0.12	-0.04	-0.12
Dimethylpentatnone	0.31	0.05	0.47	0.47	-0.05	-0.02	0.11	0.16	0.44	0	0.03	-0.06
Bromohexene	0.5	-0.06	0.74	0.74	-0.08	0.02	0.26	0.27	0.7	-0.08	-0.03	0.04
Ethylmethylcyclohexane	0.41	0.04	0.62	0.62	0.01	0.02	0.18	0.21	0.58	0.01	0.05	0.12
Trimethylhexene	0.41	0	0.61	0.61	-0.07	0	0.18	0.22	0.58	-0.04	0.01	-0.02
Dimethyloctane	0.36	0.03	0.55	0.55	-0.06	-0.01	0.15	0.19	0.52	-0.02	0.02	-0.04
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.41	-0.08	0.61	0.61	0.01	0.13	0.14	0.21	0.58	-0.08	-0.04	0.1
methyl isobutal ketone	0.55	-0.11	0.79	0.79	-0.08	0.04	0.32	0.3	0.75	-0.12	-0.06	0.09
Indane	0.47	0.06	0.7	0.7	0.04	0.21	0.29	0.25	0.66	0.04	0.13	0.2
2,2-dimethylhexane	0.2	-0.18	0.32	0.32	-0.04	0.14	0.15	0.1	0.31	-0.08	-0.03	-0.08
Thieno[3,2b] thiophene	0.09	0.02	0.21	0.21	0.32	0.01	0.12	0.01	0.18	0.1	0.14	0.33
Methacrolein	0.48	-0.1	0.72	0.72	0.01	0.05	0.4	0.24	0.69	-0.1	-0.02	0.05
1,4 Dichlorobenzene	0.54	-0.21	0.54	0.54	-0.02	-0.08	0.15	0.45	0.49	-0.17	-0.11	0.23
methylhexane	0.35	-0.04	0.53	0.53	-0.15	-0.05	0.2	0.18	0.44	-0.1	-0.11	-0.04
Trichloromonofluoromethane	0.55	-0.11	0.79	0.79	-0.08	0.04	0.32	0.3	0.75	-0.12	-0.06	0.09
Difluorochloromethane	0.31	-0.02	0.47	0.47	-0.05	-0.04	0.14	0.16	0.44	-0.05	-0.04	-0.04
tetramethyl cyclopentane	0.43	-0.06	0.64	0.64	-0.07	-0.01	0.23	0.23	0.61	-0.09	-0.05	0.01
Ethylmethyl cyclohexane	0.43	-0.01	0.65	0.65	0.01	0.02	0.22	0.23	0.61	-0.03	0.02	0.15
methyl methylethyl cyclohexane	0.46	-0.07	0.69	0.69	-0.07	0	0.25	0.25	0.65	-0.1	-0.05	0.02
chloropentane	0.54	-0.09	0.78	0.78	-0.08	0.04	0.31	0.3	0.74	-0.09	-0.05	0.11
1,3 Cyclohexadiene	0.47	-0.03	0.69	0.69	0.02	0.05	0.25	0.25	0.66	-0.04	0.02	0.2
Methyl n-butyl disulfide	0.39	-0.07	0.58	0.58	-0.07	-0.03	0.17	0.2	0.55	-0.07	-0.02	-0.02
Propyl n-butyl disulfide	0.4	-0.07	0.59	0.59	-0.07	-0.03	0.17	0.21	0.55	-0.08	-0.02	-0.02
Dipropyl disulfide	0.36	-0.07	0.54	0.54	-0.06	-0.04	0.14	0.19	0.5	-0.07	-0.02	-0.03

	Carbonyl sulfide**	Dimethyl disulfide	Methyl ethyl disulphide	Ethylmethyl benzene	Methyl propyl disulfide	Diethyl disulfide C4H10S2	Ethyl, methylethyl-disulfide	Dimethyl trisulfide	Ethyl n-propyl disulfide	Trimethyl benzene	Undecane	1-Methyl propenylbenzene
Dimethylbutane/neoheptane	0.26	0.05	0.08	0.4	0.36	0.25	0.26	-0.04	0.41	0.19	0.39	0.42
Methylpentane/Isohexane	0.08	-0.08	-0.05	0.17	0.15	0.08	0.09	-0.12	0.18	0.06	0.18	0.19
Hexane	0.16	-0.03	-0.01	0.28	0.25	0.16	0.17	-0.1	0.29	0.12	0.28	0.3
Limonene	0.19	0.13	0.19	0.32	0.3	0.44	0.47	0.04	0.64	0.14	0.33	0.35
Dimethylpentatnone	0.19	0.02	0.04	0.31	0.28	0.19	0.2	-0.06	0.33	0.15	0.31	0.33
Bromohexene	0.36	0.12	0.15	0.52	0.48	0.35	0.36	0	0.54	0.27	0.51	0.55
Ethylmethylcyclohexane	0.28	0.19	0.22	0.43	0.39	0.27	0.28	0.14	0.45	0.21	0.43	0.46
Trimethylhexene	0.27	0.06	0.09	0.42	0.38	0.27	0.28	-0.04	0.44	0.21	0.41	0.44
Dimethyloctane	0.24	0.04	0.07	0.37	0.34	0.23	0.24	-0.05	0.39	0.18	0.37	0.39
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.26	0.11	0.09	0.39	0.37	0.26	0.27	-0.02	0.42	0.2	0.39	0.42
methyl isobutal ketone	0.41	0.18	0.2	0.57	0.52	0.39	0.4	0.04	0.59	0.3	0.56	0.59
Indane	0.33	0.26	0.3	0.75	0.44	0.32	0.33	0.2	0.5	0.24	0.47	0.5
2,2-dimethylhexane	0.14	0.3	0.01	0.24	0.22	0.14	0.15	-0.07	0.25	0.11	0.24	0.26
Thieno[3,2b] thiophene	0	0.26	0.29	-0.08	-0.13	0.12	0	0.67	0.06	-0.14	-0.09	-0.09
Methacrolein	0.26	0.08	0.1	0.36	0.39	0.29	0.29	0.06	0.43	0.21	0.4	0.42
1,4 Dichlorobenzene	0.22	-0.03	0.1	0.16	0.42	0.37	0.3	0.11	0.39	0.01	0.18	0.2
methylhexane	0.23	0.03	0.06	0.35	0.32	0.22	0.23	-0.05	0.37	0.17	0.35	0.37
Trichloromonofluoromethane	0.41	0.18	0.2	0.57	0.52	0.39	0.4	0.04	0.59	0.3	0.56	0.59
Difluorochloromethane	0.21	0.03	0.05	0.33	0.31	0.21	0.22	-0.04	0.35	0.16	0.33	0.36
tetramethyl cyclopentane	0.31	0.09	0.12	0.46	0.42	0.3	0.31	-0.02	0.48	0.23	0.45	0.48
Ethylmethyl cyclohexane	0.31	0.22	0.25	0.46	0.43	0.3	0.31	0.16	0.49	0.23	0.46	0.49
methyl methylethyl cyclohexane	0.34	0.11	0.14	0.49	0.45	0.33	0.34	-0.01	0.52	0.25	0.49	0.52
chloropentane	0.4	0.17	0.19	0.57	0.52	0.39	0.4	0.03	0.59	0.3	0.55	0.59
1,3 Cyclohexadiene	0.34	0.27	0.3	0.5	0.46	0.33	0.34	0.2	0.52	0.25	0.49	0.52
Methyl n-butyl disulfide	0.27	0.18	0.33	0.4	0.37	0.66	0.68	-0.03	0.89	0.2	0.4	0.43
Propyl n-butyl disulfide	0.27	0.18	0.33	0.41	0.38	0.66	0.68	-0.03	0.89	0.2	0.41	0.43
Dipropyl disulfide	0.24	0.18	0.33	0.37	0.34	0.67	0.69	-0.04	0.9	0.18	0.37	0.39

	Dodecane	1-Methyl-1H-Indene	2-Methyl propenyl benzene	Propyl benzene	Diethyl benzene	Methyl-methylethyl benzene, methyl-Cumene	Tetramethyl benzene	Napthalene/ Trimethyl Bicyclo 2.2.1 heptane	Methyl pyridine	Diemethyl pyridine/ Aldrich	Ethyl pyridine	2-Methyl-butane
Dimethylbutane/neoheptane	0.47	0.38	0.37	0.47	0.35	0.36	0.37	0.34	0.73	0.73	0.73	0.62
Methylpentane/Isohexane	0.22	0.17	0.17	0.22	0.16	0.16	0.16	0.14	0.36	0.36	0.36	0.65
Hexane	0.34	0.28	0.26	0.34	0.25	0.25	0.26	0.23	0.54	0.54	0.54	0.68
Limonene	0.4	0.32	0.31	0.4	0.29	0.3	0.3	0.28	0.64	0.64	0.64	0.22
Dimethylpentatnone	0.37	0.31	0.29	0.37	0.28	0.28	0.29	0.27	0.59	0.59	0.59	0.22
Bromohexene	0.61	0.5	0.49	0.61	0.46	0.47	0.48	0.46	0.93	0.93	0.93	0.39
Ethylmethylcyclohexane	0.51	0.42	0.4	0.51	0.38	0.39	0.4	0.37	0.79	0.79	0.79	0.31
Trimethylhexene	0.49	0.4	0.39	0.49	0.37	0.38	0.39	0.36	0.76	0.76	0.76	0.31
Dimethyloctane	0.44	0.36	0.35	0.44	0.33	0.33	0.34	0.32	0.68	0.68	0.68	0.27
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.47	0.38	0.37	0.47	0.35	0.36	0.37	0.35	0.72	0.72	0.72	0.53
methyl isobutal ketone	0.66	0.55	0.53	0.66	0.5	0.51	0.53	0.51	1	1	1	0.43
Indane	0.56	0.46	0.44	0.56	0.42	0.43	0.44	0.42	0.85	0.85	0.85	0.33
2,2-dimethylhexane	0.29	0.24	0.23	0.29	0.22	0.22	0.22	0.2	0.46	0.46	0.46	0.52
Thieno[3,2b] thiophene	-0.09	-0.09	-0.09	-0.1	-0.1	-0.1	-0.11	0.23	-0.05	-0.05	-0.05	-0.07
Methacrolein	0.47	0.39	0.38	0.48	0.37	0.37	0.37	0.37	0.72	0.72	0.72	0.64
1,4 Dichlorobenzene	0.24	0.18	0.17	0.24	0.16	0.16	0.15	0.2	0.45	0.45	0.45	0.17
methylhexane	0.42	0.34	0.33	0.42	0.31	0.32	0.33	0.3	0.65	0.65	0.65	0.61
Trichloromonofluoromethane	0.66	0.55	0.53	0.66	0.5	0.51	0.53	0.51	1	1	1	0.43
Difluorochloromethane	0.4	0.33	0.32	0.4	0.3	0.3	0.31	0.29	0.62	0.62	0.62	0.23
tetramethyl cyclopentane	0.54	0.44	0.43	0.54	0.41	0.42	0.43	0.4	0.83	0.83	0.83	0.33
Ethylmethyl cyclohexane	0.55	0.45	0.44	0.55	0.41	0.42	0.43	0.41	0.85	0.85	0.85	0.33
methyl methylethyl cyclohexane	0.58	0.48	0.46	0.58	0.44	0.45	0.46	0.43	0.89	0.89	0.89	0.36
chloropentane	0.66	0.54	0.53	0.66	0.5	0.51	0.53	0.5	1	1	1	0.43
1,3 Cyclohexadiene	0.58	0.48	0.47	0.59	0.44	0.45	0.46	0.44	0.9	0.9	0.9	0.37
Methyl n-butyl disulfide	0.48	0.39	0.38	0.48	0.36	0.37	0.37	0.35	0.74	0.74	0.74	0.29
Propyl n-butyl disulfide	0.48	0.4	0.38	0.49	0.36	0.37	0.38	0.36	0.75	0.75	0.75	0.3
Dipropyl disulfide	0.44	0.36	0.35	0.44	0.33	0.34	0.34	0.32	0.69	0.69	0.69	0.27

	Pentane	2,4-Dimethylpentane	Methyl cyclopentane	2-Methyl-hexane	2,3-Dimethylpentane	3-Methyl-hexane	Methyl cyclohexane	Trimethyl-pentane,2,2,4	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon
Dimethylbutane/neoheptane	0.62	0.41	0.79	0.34	0.36	0.63	0.41	0.51	0.2	0.01	0.41	0.25
Methylpentane/Isohexane	0.81	0.19	0.65	0.14	0.16	0.45	0.31	0.24	0.04	-0.05	0.15	0.05
Hexane	0.78	0.29	0.7	0.24	0.25	0.53	0.4	0.37	0.11	-0.03	0.27	0.14
Limonene	0.11	0.35	0.31	0.28	0.3	0.32	0.34	0.44	0.13	-0.02	0.34	0.24
Dimethylpentatnone	0.12	0.33	0.29	0.83	0.28	0.62	0.33	0.41	0.47	-0.01	0.31	0.18
Bromohexene	0.23	0.54	0.5	0.7	0.47	0.66	0.54	0.67	0.44	0.05	0.55	0.36
Ethylmethylcyclohexane	0.17	0.45	0.41	0.69	0.39	0.6	0.45	0.56	0.4	0.01	0.43	0.26
Trimethylhexene	0.17	0.43	0.39	0.81	0.38	0.66	0.43	0.54	0.47	0.02	0.43	0.27
Dimethyloctane	0.15	0.38	0.35	0.82	0.33	0.65	0.38	0.48	0.47	0.01	0.38	0.23
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.17	0.41	0.38	0.34	0.36	0.37	0.41	0.51	0.2	0.04	0.59	0.41
methyl isobutal ketone	0.26	0.58	0.54	0.5	0.51	0.56	0.59	0.72	0.34	0.08	0.61	0.42
Indane	0.21	0.49	0.45	0.41	0.43	0.44	0.49	0.61	0.26	0.07	0.53	0.57
2,2-dimethylhexane	0.5	0.99	0.78	0.71	1	0.5	0.95	0.95	0.1	0.5	0.23	0.57
Thieno[3,2b] thiophene	-0.17	-0.09	-0.13	-0.13	-0.09	-0.02	-0.11	-0.09	-0.14	0.08	0.08	-0.12
Methacrolein	0.19	0.42	0.39	0.36	0.37	0.83	0.43	0.52	0.2	0.13	0.73	0.35
1,4 Dichlorobenzene	0.13	0.2	0.17	0.15	0.16	0.19	0.19	0.27	-0.05	0.04	0.24	-0.04
methylhexane	0.65	0.37	0.79	0.3	0.32	0.61	0.37	0.46	0.17	0	0.36	0.21
Trichloromonofluoromethane	0.26	0.58	0.54	0.5	0.51	0.56	0.59	0.72	0.34	0.08	0.61	0.42
Difluorochloromethane	0.13	0.35	0.32	0.29	0.31	0.33	0.35	0.44	0.16	0.01	0.32	0.19
tetramethyl cyclopentane	0.2	0.47	0.44	0.4	0.42	0.45	0.48	0.59	0.25	0.04	0.47	0.3
Ethylmethyl cyclohexane	0.19	0.48	0.44	0.4	0.42	0.45	0.48	0.6	0.24	0.03	0.46	0.29
methyl methylethyl cyclohexane	0.21	0.51	0.47	0.43	0.45	0.49	0.51	0.63	0.27	0.05	0.51	0.33
chloropentane	0.26	0.58	0.54	0.49	0.51	0.56	0.59	0.72	0.36	0.08	0.6	0.41
1,3 Cyclohexadiene	0.22	0.51	0.47	0.43	0.45	0.49	0.52	0.64	0.28	0.05	0.51	0.33
Methyl n-butyl disulfide	0.17	0.42	0.38	0.35	0.37	0.4	0.42	0.52	0.21	0.02	0.41	0.25
Propyl n-butyl disulfide	0.17	0.42	0.39	0.35	0.37	0.41	0.43	0.53	0.21	0.02	0.41	0.26
Dipropyl disulfide	0.15	0.39	0.35	0.32	0.34	0.37	0.39	0.48	0.19	0.01	0.37	0.23

	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Acetone	Propane / ppmv	Butane / ppmv	ethane / ppmv	Isobutane
Dimethylbutane/neoheptane	0.34	0.61	0.44	0	-0.01	-0.26	0.14	0.5	0.27	0.17	0.52	0.57
Methylpentane/Isohexane	0.13	0.42	0.2	-0.09	-0.07	-0.29	0.01	0.23	0.53	0.51	0.25	0.7
Hexane	0.23	0.51	0.31	-0.06	-0.05	-0.3	0.06	0.36	0.55	0.5	0.38	0.71
Limonene	0.25	0.32	0.46	0.12	0.07	-0.24	0.08	0.42	0.22	0.14	0.45	0.15
Dimethylpentatnone	0.41	0.3	0.62	0.27	-0.03	-0.01	0.09	0.4	0.21	0.13	0.42	0.17
Bromohexene	0.53	0.52	0.69	0.17	0.02	-0.14	0.21	0.65	0.37	0.24	0.68	0.33
Ethylmethylcyclohexane	0.45	0.41	0.62	0.16	-0.01	-0.15	0.14	0.54	0.28	0.18	0.55	0.24
Trimethylhexene	0.48	0.41	0.68	0.24	0	-0.07	0.15	0.52	0.29	0.18	0.55	0.24
Dimethyloctane	0.45	0.36	0.65	0.25	-0.01	-0.04	0.12	0.47	0.25	0.16	0.49	0.21
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.32	0.53	0.41	0.02	0.03	-0.01	0.14	0.5	0.29	0.2	0.52	0.45
methyl isobutal ketone	0.52	0.58	0.62	0.08	0.05	-0.2	0.25	0.7	0.41	0.27	0.73	0.38
Indane	0.38	0.43	0.48	0.05	0.06	-0.2	0.19	0.59	0.33	0.23	0.59	0.29
2,2-dimethylhexane	0.19	0.22	0.26	-0.04	-0.03	-0.23	0.06	0.31	0.19	0.13	0.37	0.12
Thieno[3,2b] thiophene	-0.09	-0.07	-0.02	0.11	0.07	0.14	0.06	-0.09	0	-0.04	0.14	-0.14
Methacrolein	0.66	0.65	0.78	0.07	0.15	-0.09	0.16	0.5	0.45	0.15	0.94	0.24
1,4 Dichlorobenzene	0.16	0.22	0.25	0.33	0.04	0.02	0.08	0.52	0.2	0.14	0.4	0.28
methylhexane	0.3	0.59	0.39	-0.01	-0.02	-0.25	0.11	0.45	0.24	0.15	0.47	0.57
Trichloromonofluoromethane	0.52	0.58	0.62	0.08	0.05	-0.2	0.25	0.7	0.41	0.27	0.73	0.38
Difluorochloromethane	0.27	0.31	0.36	-0.01	0	-0.09	0.11	0.42	0.23	0.15	0.44	0.18
tetramethyl cyclopentane	0.39	0.45	0.5	0.03	0.02	-0.14	0.17	0.57	0.32	0.22	0.6	0.28
Ethylmethyl cyclohexane	0.39	0.44	0.5	0.01	0.01	-0.21	0.17	0.58	0.31	0.2	0.59	0.27
methyl methylethyl cyclohexane	0.43	0.48	0.53	0.04	0.03	-0.15	0.19	0.61	0.35	0.23	0.64	0.3
chloropentane	0.51	0.57	0.62	0.08	0.05	-0.21	0.24	0.7	0.4	0.27	0.73	0.37
1,3 Cyclohexadiene	0.43	0.49	0.54	0.04	0.03	-0.24	0.2	0.62	0.34	0.22	0.63	0.31
Methyl n-butyl disulfide	0.35	0.39	0.44	0	0	-0.25	0.14	0.51	0.28	0.18	0.53	0.24
Propyl n-butyl disulfide	0.35	0.4	0.45	0.01	0	-0.25	0.15	0.52	0.29	0.18	0.54	0.24
Dipropyl disulfide	0.31	0.36	0.4	0	-0.01	-0.25	0.13	0.47	0.26	0.17	0.49	0.21

	Camphene	Cyclohexadiene	Propynyl benzene	Diethyl trisulfide	Methyl butene	Dimethylcyclopropane	Dimethylbutane/neoheptane	Methylpentane/Isohexane	Hexane	Limonene	Dimethyl-pentatnone	Bromo-hexene
Dimethylbutane/neoheptane	0.72	0.6	0.55	0.41	1	0.99	1	0.81	0.89	0.44	0.41	0.67
Methylpentane/Isohexane	0.36	0.29	0.27	0.16	0.82	0.85	0.81	1	0.98	0.19	0.19	0.33
Hexane	0.54	0.44	0.41	0.28	0.9	0.91	0.89	0.98	1	0.31	0.3	0.5
Limonene	0.63	0.52	0.48	0.4	0.44	0.38	0.44	0.19	0.31	1	0.35	0.58
Dimethylpentatnone	0.58	0.48	0.44	0.32	0.41	0.36	0.41	0.19	0.3	0.35	1	0.84
Bromohexene	0.93	0.78	0.7	0.55	0.66	0.59	0.67	0.33	0.5	0.58	0.84	1
Ethylmethylcyclohexane	0.79	0.66	0.6	0.62	0.56	0.49	0.56	0.26	0.41	0.48	0.84	0.91
Trimethylhexene	0.76	0.63	0.57	0.43	0.54	0.47	0.54	0.26	0.4	0.46	0.97	0.94
Dimethyloctane	0.68	0.56	0.51	0.38	0.48	0.42	0.48	0.22	0.35	0.41	0.99	0.9
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.72	0.6	0.55	0.41	0.51	0.45	0.52	0.25	0.38	0.44	0.41	0.67
methyl isobutal ketone	0.99	0.84	0.75	0.61	0.72	0.63	0.73	0.36	0.54	0.64	0.59	0.93
Indane	0.84	0.71	0.64	0.5	0.61	0.54	0.62	0.3	0.46	0.53	0.49	0.79
2,2-dimethylhexane	0.46	0.38	0.35	0.24	0.32	0.28	0.32	0.14	0.23	0.27	0.26	0.43
Thieno[3,2b] thiophene	-0.05	-0.09	-0.05	0.51	-0.1	-0.1	-0.1	-0.13	-0.13	-0.01	-0.1	-0.08
Methacrolein	0.71	0.61	0.55	0.43	0.52	0.46	0.53	0.27	0.4	0.45	0.43	0.68
1,4 Dichlorobenzene	0.44	0.35	0.34	0.27	0.29	0.25	0.29	0.1	0.19	0.22	0.22	0.4
methylhexane	0.65	0.54	0.49	0.36	1	1	0.99	0.84	0.9	0.39	0.37	0.6
Trichloromonofluoromethane	0.99	0.84	0.75	0.61	0.72	0.63	0.73	0.36	0.54	0.64	0.59	0.93
Difluorochloromethane	0.62	0.51	0.47	0.35	0.44	0.38	0.44	0.2	0.32	0.37	0.35	0.58
tetramethyl cyclopentane	0.83	0.69	0.63	0.48	0.59	0.52	0.6	0.29	0.44	0.51	0.48	0.77
Ethylmethyl cyclohexane	0.84	0.71	0.64	0.66	0.6	0.53	0.61	0.29	0.44	0.52	0.49	0.79
methyl methylethyl cyclohexane	0.88	0.74	0.67	0.52	0.63	0.56	0.64	0.31	0.47	0.55	0.51	0.82
chloropentane	0.99	0.84	0.75	0.6	0.71	0.63	0.72	0.36	0.54	0.63	0.58	0.93
1,3 Cyclohexadiene	0.89	0.75	0.68	0.72	0.64	0.56	0.64	0.31	0.48	0.56	0.52	0.83
Methyl n-butyl disulfide	0.74	0.61	0.56	0.42	0.52	0.46	0.53	0.25	0.38	0.74	0.42	0.69
Propyl n-butyl disulfide	0.74	0.62	0.56	0.43	0.53	0.46	0.53	0.25	0.39	0.75	0.43	0.69
Dipropyl disulfide	0.68	0.57	0.52	0.38	0.48	0.42	0.49	0.23	0.35	0.73	0.39	0.63

	Ethylmethyl-cyclohexane	Trimethyl-hexene	Dimethyloctane	1-R-alpha-pinene/ 2,6,6Trimethyl-Bicyclo[3.1.1] hetp-2-ene/2-Pinene	methyl isobutal ketone	Indane	2,2-dimethyl-hexane	Thieno[3,2b] thiophene	Metha-crolein	1,4 Dichlorobenzene	methyl-hexane	Trichloro-monofluoro-methane
Dimethylbutane/neoheptane	0.56	0.54	0.48	0.52	0.73	0.62	0.32	-0.1	0.53	0.29	0.99	0.73
Methylpentane/Isohexane	0.26	0.26	0.22	0.25	0.36	0.3	0.14	-0.13	0.27	0.1	0.84	0.36
Hexane	0.41	0.4	0.35	0.38	0.54	0.46	0.23	-0.13	0.4	0.19	0.9	0.54
Limonene	0.48	0.46	0.41	0.44	0.64	0.53	0.27	-0.01	0.45	0.22	0.39	0.64
Dimethylpentatnone	0.84	0.97	0.99	0.41	0.59	0.49	0.26	-0.1	0.43	0.22	0.37	0.59
Bromohexene	0.91	0.94	0.9	0.67	0.93	0.79	0.43	-0.08	0.68	0.4	0.6	0.93
Ethylmethylcyclohexane	1	0.9	0.88	0.56	0.79	0.67	0.35	0.11	0.57	0.33	0.5	0.79
Trimethylhexene	0.9	1	0.99	0.54	0.76	0.65	0.34	-0.09	0.55	0.31	0.49	0.76
Dimethyloctane	0.88	0.99	1	0.48	0.68	0.58	0.3	-0.1	0.5	0.27	0.43	0.68
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.56	0.54	0.48	1	0.72	0.6	0.32	-0.06	0.5	0.3	0.46	0.72
methyl isobutal ketone	0.79	0.76	0.68	0.72	1	0.85	0.46	-0.05	0.72	0.45	0.65	1
Indane	0.67	0.65	0.58	0.6	0.85	1	0.39	-0.04	0.58	0.36	0.55	0.85
2,2-dimethylhexane	0.35	0.34	0.3	0.32	0.46	0.39	1	-0.09	0.34	0.14	0.29	0.46
Thieno[3,2b] thiophene	0.11	-0.09	-0.1	-0.06	-0.05	-0.04	-0.09	1	0.07	0.14	-0.1	-0.05
Methacrolein	0.57	0.55	0.5	0.5	0.72	0.58	0.34	0.07	1	0.32	0.48	0.72
1,4 Dichlorobenzene	0.33	0.31	0.27	0.3	0.45	0.36	0.14	0.14	0.32	1	0.26	0.45
methylhexane	0.5	0.49	0.43	0.46	0.65	0.55	0.29	-0.1	0.48	0.26	1	0.65
Trichloromonofluoromethane	0.79	0.76	0.68	0.72	1	0.85	0.46	-0.05	0.72	0.45	0.65	1
Difluorochloromethane	0.48	0.46	0.41	0.44	0.62	0.52	0.28	-0.08	0.44	0.51	0.4	0.62
tetramethyl cyclopentane	0.65	0.63	0.56	0.59	0.83	0.7	0.38	-0.08	0.59	0.53	0.54	0.83
Ethylmethyl cyclohexane	0.83	0.64	0.57	0.6	0.85	0.72	0.38	0.13	0.6	0.47	0.54	0.85
methyl methylethyl cyclohexane	0.7	0.67	0.6	0.63	0.89	0.75	0.4	-0.07	0.64	0.53	0.57	0.89
chloropentane	0.79	0.76	0.68	0.72	1	0.85	0.46	-0.05	0.72	0.44	0.65	1
1,3 Cyclohexadiene	0.89	0.68	0.6	0.64	0.9	0.76	0.41	0.16	0.64	0.39	0.58	0.9
Methyl n-butyl disulfide	0.58	0.55	0.49	0.53	0.74	0.63	0.33	0.09	0.53	0.33	0.47	0.74
Propyl n-butyl disulfide	0.58	0.56	0.5	0.53	0.75	0.63	0.34	0.09	0.54	0.34	0.48	0.75
Dipropyl disulfide	0.53	0.51	0.46	0.49	0.69	0.58	0.3	0.11	0.49	0.31	0.44	0.69

	Difluoro-chloro-methane	tetramethyl-cyclopentane	Ethylmethyl cyclohexane	methyl methylethyl cyclohexane	chloro-pentane	1,3 Cyclo-hexadiene	Methyl n-butyl disulfide	Propyl n-butyl disulfide	Dipropyl-disulfide
Dimethylbutane/neoheptane	0.44	0.6	0.61	0.64	0.72	0.64	0.53	0.53	0.49
Methylpentane/Isohexane	0.2	0.29	0.29	0.31	0.36	0.31	0.25	0.25	0.23
Hexane	0.32	0.44	0.44	0.47	0.54	0.48	0.38	0.39	0.35
Limonene	0.37	0.51	0.52	0.55	0.63	0.56	0.74	0.75	0.73
Dimethylpentatnone	0.35	0.48	0.49	0.51	0.58	0.52	0.42	0.43	0.39
Bromohexene	0.58	0.77	0.79	0.82	0.93	0.83	0.69	0.69	0.63
Ethylmethylcyclohexane	0.48	0.65	0.83	0.7	0.79	0.89	0.58	0.58	0.53
Trimethylhexene	0.46	0.63	0.64	0.67	0.76	0.68	0.55	0.56	0.51
Dimethyloctane	0.41	0.56	0.57	0.6	0.68	0.6	0.49	0.5	0.46
1-R-alpha-pinene/2,6,6TrimethylBicyclo[3.1.1]hetp-2-ene/2-Pinene	0.44	0.59	0.6	0.63	0.72	0.64	0.53	0.53	0.49
methyl isobutal ketone	0.62	0.83	0.85	0.89	1	0.9	0.74	0.75	0.69
Indane	0.52	0.7	0.72	0.75	0.85	0.76	0.63	0.63	0.58
2,2-dimethylhexane	0.28	0.38	0.38	0.4	0.46	0.41	0.33	0.34	0.3
Thieno[3,2b] thiophene	-0.08	-0.08	0.13	-0.07	-0.05	0.16	0.09	0.09	0.11
Methacrolein	0.44	0.59	0.6	0.64	0.72	0.64	0.53	0.54	0.49
1,4 Dichlorobenzene	0.51	0.53	0.47	0.53	0.44	0.39	0.33	0.34	0.31
methylhexane	0.4	0.54	0.54	0.57	0.65	0.58	0.47	0.48	0.44
Trichloromonofluoromethane	0.62	0.83	0.85	0.89	1	0.9	0.74	0.75	0.69
Difluorochloromethane	1	0.95	0.78	0.91	0.62	0.55	0.45	0.46	0.42
tetramethyl cyclopentane	0.95	1	0.89	0.99	0.83	0.74	0.61	0.62	0.56
Ethylmethyl cyclohexane	0.78	0.89	1	0.9	0.85	0.94	0.62	0.63	0.57
methyl methylethyl cyclohexane	0.91	0.99	0.9	1	0.88	0.79	0.65	0.66	0.6
chloropentane	0.62	0.83	0.85	0.88	1	0.89	0.74	0.75	0.68
1,3 Cyclohexadiene	0.55	0.74	0.94	0.79	0.89	1	0.66	0.67	0.61
Methyl n-butyl disulfide	0.45	0.61	0.62	0.65	0.74	0.66	1	1	1
Propyl n-butyl disulfide	0.46	0.62	0.63	0.66	0.75	0.67	1	1	1
Dipropyl disulfide	0.42	0.56	0.57	0.6	0.68	0.61	1	1	1

APPENDIX F
AIR SAMPLING LOCATIONS AND LABORATORY RESULTS, 2008–2010
DATABASE WITH NON-DETECTS REMOVED

Date	County	CAN	UNITS	Methane (ppmv)	Benzene	Chloroform	Chloromethane (Methyl Chloride)	Dichlorodifluoromethane (F12)	Dichlorotetrafluoroethane (F114)	Ethylbenzene	Hexachlorobutadiene
		CAS	#→	74828	71432	67663	74873	75718	76142	100414	87683
7/29/2009	Parker	99015	ppbv	2	32.5	*0.46*	*0.46*	*0.46*	*0.46*	11.6	*1.16*
4/18/2009	Parker	288	ppbv	3.4	3.11	*0.31*	*0.31*	0.393	*0.31*	1.84	0.818
4/18/2009	Parker	999	ppbv	3.2	0.6	*0.35*	*0.35*	0.431	*0.35*	*0.35*	*0.88*
5/26/2009	Tarrant	62039	ppbv	2.8	0.833	2.58	*0.25*	0.306	*0.25*	*0.25*	*0.25*
5/26/2009	Tarrant	1021	ppbv	3.2	*0.89*	2.23	*0.89*	*0.89*	*0.89*	*0.89*	*2.22*
5/26/2009	Tarrant	1043	ppbv	3.2	0.465	1.26	*0.28*	0.326	*0.28*	0.532	0.7
6/28/2009	Tarrant	312	ppbv	2.2	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*	0.447	*0.28*
6/28/2009	Tarrant	60183	ppbv	2.2	*0.25*	*0.25*	*0.25*	0.272	*0.25*	*0.25*	*0.62*
6/28/2009	Tarrant	9904	ppbv	2.2	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*
8/17/2009	Denton	2519	ppbv	2.8	0.69	*0.26*	0.26	0.494	*0.26*	0.276	*0.65*
8/17/2009	Denton	314	ppbv	2.5	10.7	*0.28*	*0.28*	0.4	*0.28*	5.5	*0.71*
8/17/2009	Denton	2471	ppbv	2.1	12.3	*0.26*	1.53	0.59	*0.26*	13.8	*0.65*
8/17/2009	Denton	145	ppbv	2.6	77.7	*0.26*	0.679	0.54	*0.26*	21.5	*0.65*
8/17/2009	Denton	1043	ppbv	2	1.03	*0.28*	0.55	*0.28*	*0.28*	0.373	*0.69*
8/17/2009	Denton	2517	ppbv	5.9	0.599	*0.27*	0.645	0.418	*0.27*	0.518	*0.68*
8/17/2009	Denton	2514	ppbv	2.1	0.336	*0.26*	0.636	0.721	*0.26*	*0.26*	0.66
12/13/2009	Denton	2471	ppbv	5.8	1.63	*0.27*	0.59	0.4	*0.27*	0.72	0.67
3/2/2010	Johnson	2879	ppbv	2.4	*0.2*	*0.2*	0.72	0.49	*0.2*	*0.2*	*1.2*
1/22/2010	Tarrant	2519	ppbv	*3.9*	1.77	*0.8*	1.3	*0.8*	*0.8*	*0.8*	*1.9*
2/5/2010	Denton	2877	ppbv	2.9	*0.4*	*0.4*	0.645	0.49	*0.4*	*0.4*	*1.1*
2/18/2010	Denton	17	ppbv	1.9	55.4	*0.3*	*0.3*	0.48	0.68	3.18	*0.6*
1/12/2010	Johnson	312	ppbv	2.9	6.58	*0.3*	*0.3*	0.6	0.631	*0.3*	*0.6*
2/5/2010	Denton	16	ppbv	2.9	*0.4*	*0.4*	0.514	*0.4*	*0.4*	*0.4*	*1.1*

Date	County	CAN	UNITS	Methane (ppmv)	Benzene	Chloro-form	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	Ethyl-benzene	Hexachloro-butadiene
		CAS	#→	74828	71432	67663	74873	75718	76142	100414	87683
7/29/2009	Parker	99015	ppbv	2	*32.5*	*0.46*	0.46	*0.46*	*0.46*	*11.6*	*1.16*
4/18/2009	Parker	288	ppbv	3.4	*3.11*	*0.31*	0.31	*0.393*	*0.31*	*1.84*	*0.818*
4/18/2009	Parker	999	ppbv	3.2	*0.6*	*0.35*	0.35	*0.431*	*0.35*	*0.35*	*0.88*
5/26/2009	Tarrant	62039	ppbv	2.8	*0.833*	*2.58*	0.25	*0.306*	*0.25*	*0.25*	*0.25*
5/26/2009	Tarrant	1021	ppbv	3.2	*0.89*	*2.23*	0.89	*0.89*	*0.89*	*0.89*	*2.22*
5/26/2009	Tarrant	1043	ppbv	3.2	*0.465*	*1.26*	0.28	*0.326*	*0.28*	*0.532*	*0.7*
6/28/2009	Tarrant	312	ppbv	2.2	*0.28*	*0.28*	0.28	*0.28*	*0.28*	*0.447*	*0.28*
6/28/2009	Tarrant	60183	ppbv	2.2	*0.25*	*0.25*	0.25	*0.272*	*0.25*	*0.25*	*0.62*
6/28/2009	Tarrant	9904	ppbv	2.2	*0.25*	*0.25*	0.25	*0.25*	*0.25*	*0.25*	*0.25*
8/17/2009	Denton	2519	ppbv	2.8	*0.69*	*0.26*	0.26	*0.494*	*0.26*	*0.276*	*0.65*
8/17/2009	Denton	314	ppbv	2.5	*10.7*	*0.28*	0.28	*0.4*	*0.28*	*5.5*	*0.71*
8/17/2009	Denton	2471	ppbv	2.1	*12.3*	*0.26*	1.53	*0.59*	*0.26*	*13.8*	*0.65*
8/17/2009	Denton	145	ppbv	2.6	*77.7*	*0.26*	0.679	*0.54*	*0.26*	*21.5*	*0.65*
8/17/2009	Denton	1043	ppbv	2	*1.03*	*0.28*	0.55	*0.28*	*0.28*	*0.373*	*0.69*
8/17/2009	Denton	2517	ppbv	5.9	*0.599*	*0.27*	0.645	*0.418*	*0.27*	*0.518*	*0.68*
8/17/2009	Denton	2514	ppbv	2.1	*0.336*	*0.26*	0.636	*0.721*	*0.26*	*0.26*	*0.66*
12/13/2009	Denton	2471	ppbv	5.8	*1.63*	*0.27*	0.59	*0.4*	*0.27*	*0.72*	*0.67*
3/2/2010	Johnson	2879	ppbv	2.4	*0.2*	*0.2*	0.72	*0.49*	*0.2*	*0.2*	*1.2*
1/22/2010	Tarrant	2519	ppbv	3.9	*1.77*	*0.8*	1.3	*0.8*	*0.8*	*0.8*	*1.9*
2/5/2010	Denton	2877	ppbv	2.9	*0.4*	*0.4*	0.645	*0.49*	*0.4*	*0.4*	*1.1*
2/18/2010	Denton	17	ppbv	1.9	*55.4*	*0.3*	0.3	*0.48*	*0.68*	*3.18*	*0.6*
1/12/2010	Johnson	312	ppbv	2.9	*6.58*	*0.3*	0.3	*0.6*	*0.631*	*0.3*	*0.6*
2/5/2010	Denton	16	ppbv	2.9	*0.4*	*0.4*	0.514	*0.4*	*0.4*	*0.4*	*1.1*

Date	County	CAN	UNITS	Styrene (monomer)	Tetrachloro-ethene (PCE)	Toluene	1,3,5 Trimethyl-benzene	1,2,4 Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloro-ethene (TCE)	Trichloro-fluoro-methane (F-11)
		CAS	#→	100425	127184	108883	108678	95636	120821	79016	75694
7/29/2009	Parker	99015	ppbv	0.59	*0.46*	79.8	2.57	11.6	*1.16*	*0.46*	*0.46*
4/18/2009	Parker	288	ppbv	0.293	*0.31*	6.05	0.84	2.36	0.736	*0.31*	*0.31*
4/18/2009	Parker	999	ppbv	*0.35*	*0.35*	0.88	*0.35*	*0.35*	0.702	*0.35*	*0.35*
5/26/2009	Tarrant	62039	ppbv	*0.25*	*0.25*	1.13	*0.25*	*0.35*	0.432	*0.25*	*0.25*
5/26/2009	Tarrant	1021	ppbv	*0.89*	*0.89*	*0.89*	*0.89*	*0.89*	*2.22*	*0.89*	*0.89*
5/26/2009	Tarrant	1043	ppbv	0.313	*0.28*	2.6	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*
6/28/2009	Tarrant	312	ppbv	*0.28*	*0.28*	2.2	*0.28*	*0.28*	*0.28*	*0.28*	*0.28*
6/28/2009	Tarrant	60183	ppbv	*0.25*	*0.25*	0.706	*0.25*	*0.25*	*0.62*	*0.25*	*0.25*
6/28/2009	Tarrant	9904	ppbv	*0.25*	*0.25*	0.557	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*
8/17/2009	Denton	2519	ppbv	*0.26*	*0.26*	3.1	*0.26*	*0.26*	*0.65*	*0.26*	*0.26*
8/17/2009	Denton	314	ppbv	0.39	0.82	33.7	3.71	19.2	0.48	*0.28*	*0.28*
8/17/2009	Denton	2471	ppbv	0.91	*0.26*	61.7	9.95	60.4	*0.65*	*0.26*	0.33
8/17/2009	Denton	145	ppbv	1.28	*0.26*	139	9.82	47.1	*0.65*	*0.26*	*0.26*
8/17/2009	Denton	1043	ppbv	*0.28*	*0.28*	3.09	*0.28*	*0.28*	*0.69*	0.402	*0.28*
8/17/2009	Denton	2517	ppbv	*0.27*	*0.27*	0.734	0.671	1.98	*0.68*	*0.27*	0.276
8/17/2009	Denton	2514	ppbv	*0.26*	*0.26*	0.384	*0.26*	0.503	0.66	*0.26*	0.302
12/13/2009	Denton	2471	ppbv	*0.27*	*0.27*	4.16	3.67	1.05	*0.67*	*0.27*	*0.27*
3/2/2010	Johnson	2879	ppbv	*0.2*	*0.2*	0.48	*0.2*	*0.2*	*1.2*	*0.2*	*0.2*
1/22/2010	Tarrant	2519	ppbv	*0.8*	*0.8*	5.74	*0.8*	*0.8*	*1.9*	*0.8*	*0.8*
2/5/2010	Denton	2877	ppbv	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*1.1*	*0.4*	*0.4*
2/18/2010	Denton	17	ppbv	10.8	*0.3*	26.9	1.26	*0.3*	*0.6*	*0.3*	*0.3*
1/12/2010	Johnson	312	ppbv	*0.3*	*0.3*	5.95	*0.3*	*0.3*	*0.6*	*0.3*	0.258
2/5/2010	Denton	16	ppbv	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*1.1*	*0.4*	*0.4*

Date	County	CAN	UNITS	m&p Xylene	0-Xylene	Carbon disulfide**	Carbonyl sulfide**	Dimethyl disulfide	Methyl-ethyl-disulphide	Ethyl-methyl - benzene	Diethyl disulfide C4H10S2
		CAS	#→	1330207	95476	75150	463-58-1	624920	20333395	611143	110816
7/29/2009	Parker	99015	ppbv	*47.1*	*16.3*	*34.3*	*2.52*	*54*	*42.6*	*42.8*	*2.32*
4/18/2009	Parker	288	ppbv	*7.37*	*3.03*	*1.54*	*15.5*	*66*	*43.7*	*13.4*	*1.54*
4/18/2009	Parker	999	ppbv	*0.551*	*0.35*	*1.75*	*9.3*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*0.617*	*0.396*	*14.7*	*1.24*	*50.3*	*80*	*1.24*	*29.1*
5/26/2009	Tarrant	1021	ppbv	*0.89*	*0.89*	*15.1*	*4.43*	*4.43*	*4.75*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.56*	*0.788*	*5.86*	*1.39*	*17.8*	*14.7*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.18*	*0.365*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*0.25*	*0.25*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*0.281*	*0.25*	*9.53*	*1.34*	*8.26*	*11.9*	*1.34*	*1.34*
8/17/2009	Denton	2519	ppbv	*0.821*	*0.437*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*23.1*	*10.5*	*1.42*	*1.42*	*200*	*145*	*24.5*	*1.42*
8/17/2009	Denton	2471	ppbv	*46.2*	*16.4*	*103*	*36.7*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*84.5*	*39.4*	*97.6*	*29.5*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	*0.826*	*0.475*	*7.33*	*4.25*	*19.5*	*10.4*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.89*	*0.989*	*1.36*	*1.36*	*52.5*	*1.36*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*0.263*	*0.26*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*3.12*	*1.34*	*21*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*
3/2/2010	Johnson	2879	ppbv	*0.34*	*0.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
1/22/2010	Tarrant	2519	ppbv	*1.57*	*0.8*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*0.4*	*0.4*	*1.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*11.4*	*1.73*	*15.4*	*1.3*	*6.5*	*11.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.85*	*0.46*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
2/5/2010	Denton	16	ppbv	*0.4*	*0.4*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*

Date	County	CAN	UNITS	Ethyl-methyl-ethyl disulfide	Dimethyl trisulfide	Trimethyl benzene	Napthalene/ Trimethyl-Bicyclo 2.2.1 heptane	2-Methyl-butane	Pentane	3-Methyl-hexane	2,2,4-Trimethyl-pentane
		CAS	#→	53966362	3658808	95636	91203	78784	109660	589344	540841
7/29/2009	Parker	99015	ppbv	*2.32*	46.3	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	8.7	8.82	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	4.43	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	46.5	*1.42*	67	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	*1.3*	*1.3*	366	30.3	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	203	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	146	47	18	17
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*	*1.33*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	11.9	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	336	198	25	*1.3*
2/5/2010	Denton	16	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*

Date	County	CAN	UNITS	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon
		CAS	#→								
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	12.1	294	*2.32*	*2.32*	*2.32*	*2.32*
4/18/2009	Parker	288	ppbv	*1.54*	18.6	65	26.4	17.8	*1.54*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	191
5/26/2009	Tarrant	1043	ppbv	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	4.36	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	73.3	3.57	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	*1.23*	*1.23*	*1.23*	38.6	*1.23*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	51.4	*1.3*	*1.3*	13	*1.3*	*1.3*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	*1.3*	67.6	184	*1.3*	*1.3*	45.6	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	76.7	*1.36*	161	*1.36*	*1.36*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	8.77	13	80.8	7.4	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	*1.33*	6.26	11.8	*1.33*	*1.33*	*1.33*	*1.33*
3/2/2010	Johnson	2879	ppbv	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	3.3
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	46	*3.9*	98.9	192	19	*3.9*
2/5/2010	Denton	2877	ppbv	16.4	*2.1*	7.27	3.32	*2.1*	*2.1*	*2.1*	10.7
2/18/2010	Denton	17	ppbv	20.3	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	43.2	*1.3*	*1.3*
2/5/2010	Denton	16	ppbv	13.5	*2.1*	5.32	2.75	*2.1*	*2.1*	2.59	*2.1*

Date	County	CAN	UNITS	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Iso-butane	Diethyl trisul-fide	Limo-nene	Thieno [3,2b] thio-phene	1,4 Di-chloro-benzene	methyl-hexane	Difluoro-chloro-methane
		CAS	#→				75285	226666	138863	251412	106467	591764	75456
7/29/2009	Parker	99015	ppbv	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*2.32*	*0.46*	*2.32*	*2.32*
4/18/2009	Parker	288	ppbv	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*1.54*	*0.31*	*1.54*	*1.54*
4/18/2009	Parker	999	ppbv	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*1.75*	*0.35*	*1.75*	*1.75*
5/26/2009	Tarrant	62039	ppbv	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*	*1.24*
5/26/2009	Tarrant	1021	ppbv	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*	*4.43*
5/26/2009	Tarrant	1043	ppbv	*1.39*	18.4	*1.39*	*1.39*	*1.39*	*1.39*	*1.39*	*0.28*	*1.39*	*1.39*
6/28/2009	Tarrant	312	ppbv	*1.38*	15.4	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*0.28*	*1.38*	*1.38*
6/28/2009	Tarrant	60183	ppbv	*1.23*	33.1	*1.23*	*1.23*	*1.23*	*1.23*	*1.23*	*0.25*	*1.23*	*1.23*
6/28/2009	Tarrant	9904	ppbv	*1.34*	34.9	*1.34*	*1.34*	*1.34*	*1.34*	*1.34*	*0.25*	*1.34*	*1.34*
8/17/2009	Denton	2519	ppbv	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*1.29*	*0.26*	*1.29*	*1.29*
8/17/2009	Denton	314	ppbv	*1.42*	395	231	*1.42*	*1.42*	*1.42*	*1.42*	*0.28*	*1.42*	*1.42*
8/17/2009	Denton	2471	ppbv	53.6	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*0.26*	*1.3*	*1.3*
8/17/2009	Denton	145	ppbv	*1.3*	61.4	95.7	*1.3*	*1.3*	*1.3*	*1.3*	*0.26*	*1.3*	*1.3*
8/17/2009	Denton	1043	ppbv	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*1.38*	*0.28*	*1.38*	*1.38*
8/17/2009	Denton	2517	ppbv	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*	*0.27*	*1.36*	*1.36*
8/17/2009	Denton	2514	ppbv	*1.31*	*1.31*	8.8	*1.31*	*1.31*	*1.31*	*1.31*	*0.27*	*1.31*	*1.31*
12/13/2009	Denton	2471	ppbv	*1.33*	12.1	*1.33*	6.75	*1.33*	*1.33*	*1.33*	*0.27*	*1.33*	*1.33*
3/2/2010	Johnson	2879	ppbv	*1.2*	4.8	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*0.2*	*1.2*	*1.2*
1/22/2010	Tarrant	2519	ppbv	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*3.9*	*0.8*	*3.9*	*3.9*
2/5/2010	Denton	2877	ppbv	*2.1*	*2.1*	*2.1*	6.74	*2.1*	*2.1*	*2.1*	*0.4*	*2.1*	*2.1*
2/18/2010	Denton	17	ppbv	*1.3*	23.4	11.7	*1.3*	6.2	*1.3*	*1.3*	*0.3*	*1.3*	*1.3*
1/12/2010	Johnson	312	ppbv	*1.3*	*1.3*	*1.3*	29	*1.3*	*1.3*	*1.3*	*0.3*	25	*1.3*
2/5/2010	Denton	16	ppbv	*2.1*	6.39	*2.1*	5.19	*2.1*	*2.1*	*2.1*	*0.4*	*2.1*	*2.1*

Date	County	CAN	UNITS	Methane (ppmv)	Benzene	Chloro-form	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	Ethyl-benzene	Hexa-chloro-butadiene
		CAS	#→	74828	71432	67663	74873	75718	76142	100414	87683
12/14/2009	Parker	2468	ppbv	2.3	0.886	*0.32*	0.603	0.404	*0.32*	*0.32*	*0.8*
12/14/2009	Parker	336	ppbv	2.7	9.76	*0.32*	0.649	0.431	*0.32*	6.52	0.8
1/11/2010	Wise	62417	ppbv	3	2.56	*0.3*	*0.3*	0.63	0.665	*0.3*	*0.7*
3/11/2010	Wise	2874	ppbv	2.4	1.21	*0.3*	0.55	0.42	*0.3*	*0.3*	*0.3*
5/2/2010	Parker	2519	ppbv	2.7	1.76	*0.3*	0.69	0.56	*0.3*	1.94	0.4
3/5/2010	Parker	145	ppbv	2.2	0.52	*0.3*	0.49	0.43	*0.3*	*0.3*	0.7
5/7/2010	Parker	60183	ppbv	2	*0.3*	*0.3*	5.33	0.34	*0.3*	1.14	*0.3*
5/27/2010	Johnson	62417	ppbv	3.1	81.7	*0.3*	0.836	0.456	*0.3*	10.6	0.424
6/17/2010	Johnson	99015	ppbv	2.2	*0.3*	*0.3*	0.54	0.38	*0.3*	0.88	*0.9*
6/16/2010	Denton	336	ppbv	2.6	1	*0.3*	0.714	0.491	*0.3*	1.84	*0.9*
5/17/2010	Johnson	288	ppbv	3.4	12.8	*0.3*	0.78	0.41	*0.3*	5.1	*0.3*
7/15/2010	Denton	2513	ppbv	3.3	0.87	*0.3*	0.62	0.41	*0.3*	4.17	*0.7*
7/15/2010	Denton	2512	ppbv	3.6	2.26	*0.3*	0.57	0.4	*0.3*	0.67	*0.7*
8/4/2010	Denton	9904	ppbv	2.7	2.27	*0.3*	0.65	0.33	*0.3*	3.93	*0.7*
8/15/2010	Parker	6007	ppbv	2.3	1.23	1.26	*0.4*	0.485	*0.4*	0.622	*0.9*
8/3/2010	Tarrant	607	ppbv	2.5	*0.3*	*0.3*	0.73	0.47	*0.3*	0.48	*0.8*
8/14/2010	Parker	2512	ppbv	457	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	*2.6*
8/13/2010	Tarrant	62213	ppbv	2.5	592	*0.3*	0.45	*0.3*	*0.3*	113	*0.8*
9/11/2010	Tarrant	62212	ppbv	2.6	0.473	*0.3*	0.802	0.454	*0.3*	*0.3*	*0.7*
9/24/2010	Denton	62207	ppbv	2	0.99	*0.3*	*0.3*	1.13	*0.3*	*0.3*	*0.3*
10/15/2010	Denton	607	ppbv	3.7	*0.3*	*0.3*	0.64	0.45	*0.3*	*0.3*	*0.3*
10/2/2010	Johnson	314	ppbv	2.3	0.76	*0.3*	0.59	0.4	*0.3*	0.68	*0.3*
7/15/2010	Denton	62212	ppbv	2.4	0.34	*0.3*	0.71	0.45	*0.3*	0.56	*0.7*

Date	County	CAN	UNITS	Styrene (monomer)	Tetrachloro-ethene (PCE)	Toluene	1,3,5 Trimethyl-benzene	1,2,4 Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloro-ethene (TCE)	Trichloro-fluoro-methane (F-11)
		CAS	#→	100425	127184	108883	108678	95636	120821	79016	75694
12/14/2009	Parker	2468	ppbv	*0.32*	2.43	0.955	0.537	*0.32*	*0.8*	60.9	*0.32*
12/14/2009	Parker	336	ppbv	0.455	*0.32*	23.4	*0.32*	3.69	13.5	1.56	*0.32*
1/11/2010	Wise	62417	ppbv	*0.3*	*0.3*	1.73	*0.3*	*0.3*	*0.7*	*0.3*	*0.3*
3/11/2010	Wise	2874	ppbv	*0.3*	*0.3*	6.57	*0.3*	*0.3*	0.3	*0.3*	*0.3*
5/2/2010	Parker	2519	ppbv	1	*0.3*	17.8	0.67	0.45	0.4	*0.3*	*0.3*
3/5/2010	Parker	145	ppbv	0.31	*0.3*	1.69	*0.3*	0.7	1.3	*0.3*	*0.3*
5/7/2010	Parker	60183	ppbv	0.32	*0.3*	7.59	0.66	0.34	*0.5*	*0.3*	*0.3*
5/27/2010	Johnson	62417	ppbv	0.814	*0.3*	167	0.39	1	*0.5*	*0.3*	*0.3*
6/17/2010	Johnson	99015	ppbv	1.52	*0.3*	1.83	2.7	1.68	*1.7*	*0.3*	*0.3*
6/16/2010	Denton	336	ppbv	2.98	*0.3*	5.3	2.54	1.09	*1.9*	*0.3*	*0.3*
5/17/2010	Johnson	288	ppbv	7.22	*0.3*	19.9	2.68	0.86	*0.5*	*0.3*	*0.3*
7/15/2010	Denton	2513	ppbv	3.58	*0.3*	25.9	1.37	1.18	*0.8*	*0.3*	*0.3*
7/15/2010	Denton	2512	ppbv	0.46	*0.3*	3.93	2.09	0.58	*0.8*	*0.3*	*0.3*
8/4/2010	Denton	9904	ppbv	4.96	*0.3*	10.8	5.3	2.3	*1.4*	*0.3*	*0.3*
8/15/2010	Parker	6007	ppbv	0.988	*0.4*	3.45	1.35	2.2	*0.4*	*0.4*	*0.4*
8/3/2010	Tarrant	607	ppbv	1.67	*0.3*	2.03	1.3	*0.3*	*1.9*	*0.3*	*0.3*
8/14/2010	Parker	2512	ppbv	*1.0*	*1.0*	1.39	*1.0*	*1.0*	*5.2*	*1.0*	*1.0*
8/13/2010	Tarrant	62213	ppbv	43.4	*0.3*	276	5.25	1.54	*1.5*	*0.3*	*0.3*
9/11/2010	Tarrant	62212	ppbv	0.611	*0.3*	0.961	0.647	*0.3*	0.738	*0.3*	*0.3*
9/24/2010	Denton	62207	ppbv	0.34	*0.3*	2.33	*0.3*	*0.3*	*0.3*	*0.3*	0.56
10/15/2010	Denton	607	ppbv	*0.3*	*0.3*	2.44	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
10/2/2010	Johnson	314	ppbv	0.78	0.31	4.26	0.64	0.31	*0.4*	*0.3*	*0.3*
7/15/2010	Denton	62212	ppbv	*0.3*	*0.3*	2.5	1.11	0.53	*0.8*	*0.3*	*0.3*

Date	County	CAN	UNITS	m&p Xylene	0-Xylene	Carbon disulfide **	Carbonyl sulfide**	Dimethyl disulfide	Methyl-ethyl-disulphide	Ethyl-methyl - benzene	Diethyl disulfide C4H10S2
		CAS	#→	1330207	95476	75150	463-58-1	624920	20333395	611143	110816
12/14/2009	Parker	2468	ppbv	0.684	0.353	18.8	12.8	1.12	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	25.3	13.8	9.56	17.5	38.3	12.8	*1.59*	*1.59*
1/11/2010	Wise	62417	ppbv	0.56	*0.3*	0.7	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	1.79	*0.3*	*1.3*	*1.3*	27.4	2	*1.3*	12
5/2/2010	Parker	2519	ppbv	7.08	1.91	1.3	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
3/5/2010	Parker	145	ppbv	1.2	0.41	3	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	3.25	0.96	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	221	1.49	30.5	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/17/2010	Johnson	99015	ppbv	4.73	1.74	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
6/16/2010	Denton	336	ppbv	8.52	3.12	*1.6*	*1.6*	14.4	4.1	*1.6*	*1.6*
5/17/2010	Johnson	288	ppbv	14.5	3.78	44	*1.5*	59.4	38.6	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	11.7	3.89	11.2	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	2.41	1.03	6.7	*1.3*	31.8	21.2	*1.3*	4.65
8/4/2010	Denton	9904	ppbv	21.7	6.13	6.66	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/15/2010	Parker	6007	ppbv	2.62	0.99	7.03	*1.8*	3.61	*1.8*	*1.8*	*1.8*
8/3/2010	Tarrant	607	ppbv	3.1	1.08	3.74	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/14/2010	Parker	2512	ppbv	*1.0*	*1.0*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*
8/13/2010	Tarrant	62213	ppbv	206	15.9	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
9/11/2010	Tarrant	62212	ppbv	0.937	0.417	20.4	15.2	17.7	10	*1.3*	2.12
9/24/2010	Denton	62207	ppbv	*0.3*	*0.3*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	1.06	0.43	8.9	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	3.3	1.28	*1.4*	*1.4*	9.3	39.2	*1.4*	32.7
7/15/2010	Denton	62212	ppbv	3.09	1.22	11.6	*1.4*	12.3	4.72	*1.4*	*1.4*

Date	County	CAN	UNITS	Ethyl-methyl-ethyl disulfide	Dimethyl trisulfide	Trimethyl benzene	Napthalene/ Trimethyl- Bicyclo 2.2.1 heptane	2-Methyl-butane	Pentane	3-Methyl-hexane	2,2,4-Trimethyl-pentane
		CAS	#→	53966362	3658808	95636	91203	78784	109660	589344	540841
12/14/2009	Parker	2468	ppbv	*1.59*	1.88	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	42.8	46.4	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	64	42	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*1.3*	8.93	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	35.3	*1.3*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/17/2010	Johnson	99015	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
6/16/2010	Denton	336	ppbv	*1.6*	26.4	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
5/17/2010	Johnson	288	ppbv	*1.5*	74.5	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	38.7	*1.3*	10.2	*1.3*	*1.3*	*1.3*	*1.3*
8/4/2010	Denton	9904	ppbv	*0.3*	8.82	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/15/2010	Parker	6007	ppbv	*1.8*	*1.8*	*1.8*	*1.8*	152	*1.8*	*1.8*	*1.8*
8/3/2010	Tarrant	607	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	*5.2*	*5.2*	3620	*5.2*	2300	*5.2*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
9/11/2010	Tarrant	62212	ppbv	*1.3*	37.4	*1.3*	6.17	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	46.7	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	62212	ppbv	*1.4*	23.9	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

Date	County	CAN	UNITS	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon
		CAS	#→								
12/14/2009	Parker	2468	ppbv	*1.59*	*1.59*	2	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	*1.59*	*1.59*	22.9	18.9	18.9	77.3	*1.59*	*1.59*
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	1.53	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	13.8	*1.3*	23.2	9.28	3.94	*1.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	26.8	*1.3*	*1.3*	*1.3*	10	*1.3*	20.8	35.6
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	9.08	6.48	*1.3*	*1.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
5/27/2010	Johnson	62417	ppbv	32.3	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
6/17/2010	Johnson	99015	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	22.5	7.82	45.4
6/16/2010	Denton	336	ppbv	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	3.7	*1.6*	13.1
5/17/2010	Johnson	288	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	*1.4*	*1.4*	16.4	*1.4*	104	60.9	26.9
7/15/2010	Denton	2512	ppbv	*1.3*	*1.3*	26.9	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
8/4/2010	Denton	9904	ppbv	*0.3*	19	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	67.1
8/15/2010	Parker	6007	ppbv	*1.8*	*1.8*	64	18.4	*1.8*	26	*1.8*	*1.8*
8/3/2010	Tarrant	607	ppbv	*1.6*	3.74	1.91	1.86	*1.6*	5.67	*1.6*	88.6
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	6780	40	2390	1420	761	*5.2*
8/13/2010	Tarrant	62213	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	18.5	*1.5*	*1.5*	*1.5*
9/11/2010	Tarrant	62212	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	4	6	*1.4*	*1.4*	7.6	6
10/15/2010	Denton	607	ppbv	*1.4*	1.5	3.7	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
7/15/2010	Denton	62212	ppbv	*1.4*	*1.4*	4.53	10.8	*1.4*	*1.4*	*1.4*	11

Date	County	CAN	UNITS	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Iso-butane	Diethyl trisulfide	Limo-nene	Thieno [3,2b] thio-phene	1,4 Dichloro-benzene	methyl-hexane	Difluoro-chloro-methane
		CAS	#→				75285	226666	138863	251412	106467	591764	75456
12/14/2009	Parker	2468	ppbv	*1.59*	15.6	*1.59*	3.69	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*
12/14/2009	Parker	336	ppbv	45.2	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*1.59*	*0.32*	*1.59*	*1.59*
1/11/2010	Wise	62417	ppbv	*1.3*	*1.3*	*1.3*	34	*1.3*	*1.3*	*1.3*	*0.3*	*1.3*	*1.3*
3/11/2010	Wise	2874	ppbv	*1.3*	14.6	*1.3*	5.82	*1.3*	*1.3*	*1.3*	*0.3*	*1.3*	*1.3*
5/2/2010	Parker	2519	ppbv	*1.3*	27.3	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*0.3*	*1.3*	*1.3*
3/5/2010	Parker	145	ppbv	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*1.3*	*0.3*	*1.3*	*1.3*
5/7/2010	Parker	60183	ppbv	*1.5*	10.5	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	45
5/27/2010	Johnson	62417	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*0.3*	*1.7*	*1.7*
6/17/2010	Johnson	99015	ppbv	*1.5*	24.7	28.9	*1.5*	*1.5*	*1.5*	*1.5*	0.94	*1.5*	*1.5*
6/16/2010	Denton	336	ppbv	6.9	15.2	*1.6*	*1.6*	3.3	8.1	*1.6*	*0.3*	*1.6*	*1.6*
5/17/2010	Johnson	288	ppbv	*1.5*	*1.5*	*1.5*	*1.5*	8.23	*1.5*	56.5	0.384	*1.5*	*1.5*
7/15/2010	Denton	2513	ppbv	*1.4*	15	8.09	*1.4*	*1.4*	*1.4*	*1.4*	*0.3*	*1.4*	*1.4*
7/15/2010	Denton	2512	ppbv	*1.3*	17.3	12.4	*1.3*	7.32	*1.3*	40.3	*0.3*	*1.3*	*1.3*
8/4/2010	Denton	9904	ppbv	13	55.2	*0.3*	*0.3*	*0.3*	*0.3*	17.7	*0.3*	*0.3*	*0.3*
8/15/2010	Parker	6007	ppbv	*1.8*	43.9	*1.8*	12.9	*1.8*	*1.8*	*1.8*	*0.4*	*1.8*	*1.8*
8/3/2010	Tarrant	607	ppbv	*1.6*	20.9	*1.6*	*1.6*	*1.6*	*1.6*	*1.6*	*0.3*	*1.6*	*1.6*
8/14/2010	Parker	2512	ppbv	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*5.2*	*1.0*	*5.2*	*5.2*
8/13/2010	Tarrant	62213	ppbv	*1.5*	45.7	52.4	*1.5*	*1.5*	*1.5*	*1.5*	*0.3*	*1.5*	*1.5*
9/11/2010	Tarrant	62212	ppbv	*1.3*	20.3	*1.3*	*1.3*	4.8	*1.3*	33.4	0.738	*1.3*	*1.3*
9/24/2010	Denton	62207	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	12.9	*1.4*	*0.3*	*1.4*	*1.4*
10/15/2010	Denton	607	ppbv	*1.4*	*1.4*	3	6	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
10/2/2010	Johnson	314	ppbv	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	8.2	8.7	0.4	*1.4*	*1.4*
7/15/2010	Denton	62212	ppbv	*1.4*	163	23.9	5.92	3.38	*1.4*	23.8	0.43	*1.4*	*1.4*

Date	County	CAN	UNITS	Methane (ppmv)	Benzene	Chloro-form	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	Ethyl-benzene	Hexachloro-butadiene
		CAS	#→	74828	71432	67663	74873	75718	76142	100414	87683
11/26/2010	Johnson	4043	ppbv	3.4	0.38	*0.3*	0.88	0.63	*0.3*	*0.3*	*0.3*
12/14/2010	Wise	314	ppbv	3.2	0.31	*0.3*	0.62	0.45	*0.3*	*0.3*	*0.3*
12/14/2010	Denton	2516	ppbv	7.3	1.04	*0.4*	*0.4*	0.56	*0.4*	*0.4*	*0.4*
12/31/2010	Denton	50205	ppbv	2.9	0.51	*0.3*	0.75	0.53	*0.3*	*0.3*	*0.3*

Date	County	CAN	UNITS	Styrene (monomer)	Tetrachloro-ethene (PCE)	Toluene	1,3,5 Trimethyl-benzene	1,2,4 Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloro-ethene (TCE)	Trichloro-fluoro-methane (F-11)
		CAS	#→	100425	127184	108883	108678	95636	120821	79016	75694
11/26/2010	Johnson	4043	ppbv	*0.3*	*0.3*	0.46	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
12/14/2010	Wise	314	ppbv	*0.3*	*0.3*	0.44	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
12/14/2010	Denton	2516	ppbv	*0.4*	*0.4*	0.56	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*
12/31/2010	Denton	50205	ppbv	*0.3*	*0.3*	0.61	0.37	*0.3*	*0.3*	*0.3*	*0.3*

Date	County	CAN	UNITS	m&p Xylene	0-Xylene	Carbon disulfide**	Carbonyl sulfide**	Dimethyl disulfide	Methyl-ethyl-disulphide	Ethyl-methyl - benzene	Diethyl disulfide C4H10S2
		CAS	#→	1330207	95476	75150	463-58-1	624920	20333395	611143	110816
11/26/2010	Johnson	4043	ppbv	*0.3*	*0.3*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	0.38	*0.3*	4.1	*1.4*	*1.4*	4.8	*1.4*	3
12/14/2010	Denton	2516	ppbv	1.27	0.43	30.5	2.1	4.77	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	0.47	0.25	6.8	*1.4*	4.4	6	*1.4*	1.27

Date	County	CAN	UNITS	Ethyl-methyl-ethyl disulfide	Dimethyl trisulfide	Trimethyl benzene	Napthalene/ Trimethyl-Bicyclo 2.2.1 heptane	2-Methyl-butane	Pentane	3-Methyl-hexane	2,2,4-Trimethyl-pentane
		CAS	#→	53966362	3658808	95636	91203	78784	109660	589344	540841
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	5.6	*1.4*	*1.4*	*1.4*	14.6	22.8	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.4*	6.75	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

Date	County	CAN	UNITS	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon	C7 Hydro-carbon	C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon
		CAS	#→								
11/26/2010	Johnson	4043	ppbv	18.4	*1.7*	5.1	2.8	*1.7*	*1.7*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*1.4*	*1.4*	37.4	*1.4*	21.2	5.2	*1.4*	23.7
12/14/2010	Denton	2516	ppbv	*2.1*	137	17.9	16.2	2.05	*2.1*	*2.1*	5
12/31/2010	Denton	50205	ppbv	18	*1.4*	1.4	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*

Date	County	CAN	UNITS	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Iso-butane	Diethyl-trisulfide	Limo-nene	Thieno [3,2b] thio-phene	1,4 Di-chloro-benzene	methyl-hexane	Difluoro-chloro-methane
		CAS	#→				75285	226666	138863	251412	106467	591764	75456
11/26/2010	Johnson	4043	ppbv	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*0.3*	*1.7*	*1.7*
12/14/2010	Wise	314	ppbv	*1.4*	47.4	*1.4*	16.6	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
12/14/2010	Denton	2516	ppbv	*2.1*	3.13	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*0.4*	*2.1*	*2.1*
12/31/2010	Denton	50205	ppbv	*1.4*	2.12	*1.4*	*1.4*	*1.4*	*1.4*	5.33	*0.3*	*1.4*	*1.4*

APPENDIX G
CORRELATION DATA NON-DETECTS REMOVED

		Methane (ppmv)	Benzene	Chloro-form	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	Ethyl-benzene	Hexachloro-butadiene	Styrene (monomer)
1	Methane (ppmv)	1	-0.05	0.12	0.01	0.13	0.12	-0.1	0.03	-0.12
2	Benzene	-0.05	1	-0.05	-0.04	0.05	0.22	0.86	0.12	0.6
3	Chloroform	0.12	-0.05	1	-0.1	0.12	0.41	-0.09	0.23	-0.01
4	Chloromethane (Methyl Chloride)	0.01	-0.04	-0.1	1	0.2	0	0.2	0.07	0.12
5	Dichlorodifluoromethane (F12)	0.13	0.05	0.12	0.2	1	0.48	-0.08	0.23	-0.05
6	Dichlorotetrafluoroethane (F114)	0.12	0.22	0.41	0	0.48	1	0.02	0.44	0.18
7	Ethylbenzene	-0.1	0.86	-0.09	0.2	-0.08	0.02	1	0.18	0.71
8	Hexachlorobutadiene	0.03	0.12	0.23	0.07	0.23	0.44	0.18	1	0.16
9	Styrene (monomer)	-0.12	0.6	-0.01	0.12	-0.05	0.18	0.71	0.16	1
10	Tetrachloroethene (PCE)	0.04	0.07	0.3	0.08	0.21	0.45	0.03	0.39	0
11	Toluene	-0.18	0.86	-0.12	0.13	-0.07	0.03	0.9	0.05	0.6
12	1,3,5 Trimethylbenzene	-0.01	0.56	-0.08	0.26	-0.02	0	0.75	0.28	0.65
13	1,2,4 Trimethylbenzene	-0.04	0.59	-0.02	0.16	0.07	-0.05	0.74	0.3	0.29
14	1,2,4-Trichlorobenzene	-0.04	0.2	0.04	0.22	0.09	0.25	0.32	0.71	0.29
15	Trichloroethene (TCE)	-0.04	0.02	0.14	0.1	0.06	0.22	-0.03	0.26	-0.05
16	Trichlorofluoromethane (F-11)	0.12	0.05	0.51	0.2	0.6	0.69	0.05	0.44	0.1
17	m&p Xylene	-0.06	0.83	-0.11	0.2	-0.12	-0.02	0.94	0.13	0.65
18	0-Xylene	-0.08	0.73	-0.06	0.18	-0.07	-0.02	0.93	0.25	0.6
19	Carbon disulfide**	0.13	0.38	0.19	0.2	0	0.02	0.39	-0.01	0.22
20	Carbonyl sulfide**	-0.05	0.25	0.02	0.2	0.16	0.05	0.26	0.29	-0.07
21	Dimethyl disulfide	0.1	0.17	0.23	-0.17	-0.21	-0.03	0.12	-0.01	-0.07
22	Methyl ethyl disulphide	-0.06	0.18	0.29	-0.22	-0.22	0.03	0.12	-0.09	-0.03

		Tetra-chloro-ethene (PCE)	Toluene	1,3,5-Trimethyl-benzene	1,2,4 -Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloro-ethene (TCE)	Trichloro-fluoro-methane (F-11)	m&p Xylene	0-Xylene
1	Methane (ppmv)	0.04	-0.18	-0.01	-0.04	-0.04	-0.04	0.12	-0.06	-0.08
2	Benzene	0.07	0.86	0.56	0.59	0.2	0.02	0.05	0.83	0.73
3	Chloroform	0.3	-0.12	-0.08	-0.02	0.04	0.14	0.51	-0.11	-0.06
4	Chloromethane (Methyl Chloride)	0.08	0.13	0.26	0.16	0.22	0.1	0.2	0.2	0.18
5	Dichlorodifluoromethane (F12)	0.21	-0.07	-0.02	0.07	0.09	0.06	0.6	-0.12	-0.07
6	Dichlorotetrafluoroethane (F114)	0.45	0.03	0	-0.05	0.25	0.22	0.69	-0.02	-0.02
7	Ethylbenzene	0.03	0.9	0.75	0.74	0.32	-0.03	0.05	0.94	0.93
8	Hexachlorobutadiene	0.39	0.05	0.28	0.3	0.71	0.26	0.44	0.13	0.25
9	Styrene (monomer)	0	0.6	0.65	0.29	0.29	-0.05	0.1	0.65	0.6
10	Tetrachloroethene (PCE)	1	-0.03	0.1	0.11	0.19	0.83	0.54	-0.01	0.04
11	Toluene	-0.03	1	0.64	0.64	0.18	-0.07	-0.03	0.94	0.84
12	1,3,5 Trimethylbenzene	0.1	0.64	1	0.77	0.26	-0.05	0.07	0.74	0.83
13	1,2,4 Trimethylbenzene	0.11	0.64	0.77	1	0.29	-0.02	0.1	0.72	0.86
14	1,2,4-Trichlorobenzene	0.19	0.18	0.26	0.29	1	0.29	0.26	0.3	0.4
15	Trichloroethene (TCE)	0.83	-0.07	-0.05	-0.02	0.29	1	0.28	-0.05	-0.02
16	Trichlorofluoromethane (F-11)	0.54	-0.03	0.07	0.1	0.26	0.28	1	-0.05	0.03
17	m&p Xylene	-0.01	0.94	0.74	0.72	0.3	-0.05	-0.05	1	0.91
18	0-Xylene	0.04	0.84	0.83	0.86	0.4	-0.02	0.03	0.91	1
19	Carbon disulfide**	0.13	0.36	0.42	0.43	0.02	0.2	0.11	0.41	0.41
20	Carbonyl sulfide**	0.27	0.19	0.2	0.46	0.28	0.39	0.19	0.2	0.33
21	Dimethyl disulfide	0.08	0.13	0.07	0.2	0.03	-0.04	0	0.16	0.23
22	Methyl ethyl disulphide	0.13	0.13	0.05	0.13	-0.05	-0.01	0.02	0.12	0.21

		Carbon-disulfide**	Carbonyl sulfide**	Dimethyl-disulfide	Methyl-ethyl-disulphide	Ethyl-methyl-benzene	Diethyl disulfide C4H10S2	Ethyl, methyl-ethyl disulfide	Dimethyl-trisulfide	Ethyl n-propyl disulfide
1	Methane (ppmv)	0.13	-0.05	0.1	-0.06	0.01	0.04	0.01	-0.03	0.04
2	Benzene	0.38	0.25	0.17	0.18	0.25	-0.08	0.02	0.22	-0.06
3	Chloroform	0.19	0.02	0.23	0.29	0.19	0.45	0.29	0.13	0.47
4	Chloromethane (Methyl Chloride)	0.2	0.2	-0.17	-0.22	-0.11	-0.02	-0.09	0.13	0.02
5	Dichlorodifluoromethane (F12)	0	0.16	-0.21	-0.22	0.13	0	0.03	-0.01	0.11
6	Dichlorotetrafluoroethane (F114)	0.02	0.05	-0.03	0.03	0.28	0.1	0.1	0.15	0.23
7	Ethylbenzene	0.39	0.26	0.12	0.12	0.25	-0.18	0.01	0.21	-0.1
8	Hexachlorobutadiene	-0.01	0.29	-0.01	-0.09	0.33	-0.18	-0.06	0.08	-0.03
9	Styrene (monomer)	0.22	-0.07	-0.07	-0.03	-0.11	-0.15	-0.12	0.27	-0.09
10	Tetrachloroethene (PCE)	0.13	0.27	0.08	0.13	0.43	0.1	0.33	0.05	0.21
11	Toluene	0.36	0.19	0.13	0.13	0.21	-0.11	0	0.18	-0.1
12	1,3,5 Trimethylbenzene	0.42	0.2	0.07	0.05	0.16	-0.19	-0.01	0.24	-0.15
13	1,2,4 Trimethylbenzene	0.43	0.46	0.2	0.13	0.4	-0.17	0.11	0.1	-0.11
14	1,2,4-Trichlorobenzene	0.02	0.28	0.03	-0.05	0.1	-0.12	-0.11	0.33	-0.01
15	Trichloroethene (TCE)	0.2	0.39	-0.04	-0.01	0.1	0.03	0.03	0.09	0.1
16	Trichlorofluoromethane (F-11)	0.11	0.19	0	0.02	0.37	0.18	0.17	0.14	0.32
17	m&p Xylene	0.41	0.2	0.16	0.12	0.21	-0.15	0	0.24	-0.1
18	0-Xylene	0.41	0.33	0.23	0.21	0.3	-0.16	0.06	0.27	-0.08
19	Carbon disulfide**	1	0.43	0.14	0.2	0.03	-0.01	-0.09	0.37	0
20	Carbonyl sulfide**	0.43	1	0.14	0.13	0.25	0.03	0.02	0.07	0.11
21	Dimethyl disulfide	0.14	0.14	1	0.86	0.52	0.39	0.41	0.54	0.28
22	Methyl ethyl disulphide	0.2	0.13	0.86	1	0.56	0.48	0.61	0.46	0.46

		Trimethyl benzene	Diethyl ben-zene	Methyl-methyl-ethyl benzene, methyl-Cumene	Tetra-methyl-benzene	Napthalene/ Trimethyl Bicyclo 2.2.1 heptane	2-Methyl-butane	Pentane	Methyl-cyclo-pentane	2-Methyl-hexane
1	Methane (ppmv)	-0.09	-0.05	-0.03	0	0.05	0.24	0.3	0.37	0.31
2	Benzene	0.42	0.32	0.16	0.21	0.11	0.02	0.02	0.03	-0.03
3	Chloroform	-0.02	0.07	0.15	0.15	0.14	0.18	0.04	0.16	0.15
4	Chloromethane (Methyl Chloride)	0.19	0.31	0.32	0.27	0.32	-0.13	-0.09	0.02	0.15
5	Dichlorodifluoromethane (F12)	0.21	0.32	0.32	0.26	0.28	0.25	0.28	0.28	0.26
6	Dichlorotetrafluoroethane (F114)	-0.02	0.08	0.18	0.19	0.18	0.44	0.47	0.42	0.19
7	Ethylbenzene	0.5	0.38	0.23	0.28	0.13	-0.19	-0.2	-0.12	0.01
8	Hexachlorobutadiene	0.17	0.19	0.21	0.25	0.25	0.13	0.08	0.23	0.13
9	Styrene (monomer)	0.02	0.05	0	-0.04	-0.03	-0.16	-0.21	-0.18	-0.06
10	Tetrachloroethene (PCE)	0.15	0.08	0.16	0.17	0.16	0.07	0.06	0.18	0.17
11	Toluene	0.43	0.31	0.16	0.19	0.08	-0.14	-0.16	-0.12	-0.04
12	1,3,5 Trimethylbenzene	0.44	0.42	0.25	0.07	0.24	-0.15	-0.22	-0.15	-0.08
13	1,2,4 Trimethylbenzene	0.77	0.62	0.42	0.4	0.29	-0.01	-0.1	0.01	0.02
14	1,2,4-Trichlorobenzene	0.22	0.06	0.08	0.47	0.1	-0.07	-0.03	0.08	0.01
15	Trichloroethene (TCE)	0.08	0.03	0.08	0.26	0.07	0.01	0.01	0.09	0.08
16	Trichlorofluoromethane (F-11)	0.1	0.24	0.37	0.36	0.35	0.1	0.08	0.25	0.28
17	m&p Xylene	0.43	0.3	0.15	0.21	0.08	-0.14	-0.18	-0.09	-0.01
18	0-Xylene	0.59	0.41	0.22	0.32	0.13	-0.16	-0.2	-0.1	0
19	Carbon disulfide**	0.39	0.48	0.34	0.29	0.35	-0.2	-0.24	-0.13	-0.14
20	Carbonyl sulfide**	0.67	0.69	0.55	0.63	0.55	-0.06	-0.04	0.09	0.07
21	Dimethyl disulfide	0.15	-0.07	0	0.17	0.16	0.02	0.01	0.19	0.16
22	Methyl ethyl disulphide	0.15	-0.05	0.01	0.13	0.17	-0.13	-0.09	-0.01	-0.03

		2,3-Dimethyl-pentane	3-Methyl-hexane	Methyl-cyclo-hexane	2,2,4-Trimethyl-pentane	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon	C7 Hydro-carbon
1	Methane (ppmv)	0.44	0.27	0.44	0.42	-0.04	0.61	0.22	0.2	-0.04
2	Benzene	-0.06	0.04	-0.04	-0.05	0.2	-0.03	0.09	0.24	0
3	Chloroform	0.15	0.11	0.18	0.25	0.02	0.08	0.17	0.04	0.04
4	Chloromethane (Methyl Chloride)	0.12	0.04	0.09	0.14	0.26	0.01	0.06	0.08	-0.03
5	Dichlorodifluoromethane (F12)	0.17	0.3	0.25	0.25	0.3	0.07	0.29	0.25	0.06
6	Dichlorotetrafluoroethane (F114)	0.18	0.34	0.32	0.31	0.21	0.15	0.19	0.03	0.11
7	Ethylbenzene	-0.06	-0.05	-0.09	-0.06	0.15	0.01	0.02	0.28	0.03
8	Hexachlorobutadiene	0.22	0.11	0.26	0.29	-0.05	0.14	0.18	0.23	0.09
9	Styrene (monomer)	-0.14	-0.1	-0.16	-0.15	0.06	0.02	-0.19	-0.1	-0.05
10	Tetrachloroethene (PCE)	0.16	0.13	0.2	0.27	0.06	0.12	0.15	0.02	0.08
11	Toluene	-0.17	-0.01	-0.18	-0.17	0.13	-0.14	0.01	0.22	-0.03
12	1,3,5 Trimethylbenzene	-0.07	-0.13	-0.11	-0.1	-0.03	0.08	0.04	0.26	-0.21
13	1,2,4 Trimethylbenzene	0.09	-0.04	0.06	0.07	0.06	0.13	0.25	0.58	-0.05
14	1,2,4-Trichlorobenzene	0.09	-0.01	0.1	0.12	-0.14	0.1	0.11	0.15	0.14
15	Trichloroethene (TCE)	0.08	0.05	0.1	0.14	-0.01	0.04	0.11	0.02	0.08
16	Trichlorofluoromethane (F-11)	0.27	0.18	0.32	0.42	0.22	0.24	0.37	0.22	0.24
17	m&p Xylene	-0.08	-0.02	-0.12	-0.1	0.11	0.05	0.01	0.27	-0.08
18	0-Xylene	-0.05	-0.05	-0.09	-0.06	-0.01	0.07	0.1	0.4	-0.06
19	Carbon disulfide**	-0.09	-0.2	-0.12	-0.05	0.13	0.05	0.15	0.31	-0.27
20	Carbonyl sulfide**	0.1	0.03	0.12	0.18	0.18	-0.01	0.34	0.4	0.13
21	Dimethyl disulfide	0.31	0.07	0.28	0.32	-0.06	0.14	0.18	0.25	-0.03
22	Methyl ethyl disulphide	0.02	-0.08	0.01	0.07	-0.06	-0.09	0.12	0.02	-0.01

		C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Propane / ppmv	Butane / ppmv	Iso-butane
1	Methane (ppmv)	0.07	0.06	0.04	-0.04	-0.19	-0.1	0.16	0.16	0.19
2	Benzene	-0.03	0.12	-0.22	0.22	0.06	0.4	0.11	0.1	-0.06
3	Chloroform	0.26	0.1	0.18	0.07	-0.06	-0.06	0.17	0.17	0.17
4	Chloromethane (Methyl Chloride)	0.08	0.14	0.21	0.32	-0.05	-0.05	-0.02	-0.03	-0.07
5	Dichlorodifluoromethane (F12)	0.24	0.36	0.25	0.15	-0.33	0.04	0.34	0.34	0.28
6	Dichlorotetrafluoroethane (F114)	0.38	0.17	0.2	0.11	-0.14	0.04	0.58	0.58	0.52
7	Ethylbenzene	0.03	0.24	0.04	0.4	0.23	0.45	-0.01	-0.02	-0.28
8	Hexachlorobutadiene	0.34	0.18	0.3	0.28	0.08	0.23	0.29	0.28	0.11
9	Styrene (monomer)	0.09	0.19	0.31	0.2	0.3	0.32	-0.02	-0.03	-0.26
10	Tetrachloroethene (PCE)	0.18	0.14	0.15	0.1	0.14	0.18	0.2	0.19	0.22
11	Toluene	0.06	0.25	-0.09	0.27	0.18	0.38	-0.04	-0.05	-0.2
12	1,3,5 Trimethylbenzene	-0.05	0.2	0.21	0.33	0.43	0.48	-0.03	-0.03	-0.21
13	1,2,4 Trimethylbenzene	0.07	0.24	-0.01	0.51	0.17	0.44	0.02	0.02	-0.18
14	1,2,4-Trichlorobenzene	0.39	0.08	0.33	0.56	-0.04	0.12	0.16	0.15	-0.09
15	Trichloroethene (TCE)	0.17	0.05	0.03	0.19	0	-0.06	0.1	0.1	0.15
16	Trichlorofluoromethane (F-11)	0.33	0.35	0.37	0.27	-0.16	0.02	0.33	0.32	0.21
17	m&p Xylene	0.04	0.17	0.04	0.36	0.23	0.39	-0.07	-0.08	-0.25
18	0-Xylene	0.08	0.25	0.1	0.48	0.27	0.45	-0.04	-0.04	-0.29
19	Carbon disulfide**	-0.05	0.13	-0.04	0.3	0.05	0.08	-0.09	-0.1	-0.12
20	Carbonyl sulfide**	0.12	0.25	-0.2	0.4	-0.15	0.11	0.09	0.09	-0.02
21	Dimethyl disulfide	-0.03	-0.15	-0.27	-0.01	0	0.17	-0.13	-0.13	-0.12
22	Methyl ethyl disulphide	-0.04	-0.13	-0.25	-0.07	0.01	0.21	-0.12	-0.11	-0.12

		Diethyl trisul-fide	Methyl-pentane/ Iso-hexane	Hexane	Limo-nene	Ethyl-methyl-cyclo-hexane	Thieno [3,2b] thiophene	1,4 Dichloro-benzene	methyl-hexane	Difluoro-chloro-methane	Ethyl-methyl cyclo-hexane
1	Methane (ppmv)	0.11	0.11	0.14	-0.04	0.19	0.11	0.04	0.14	-0.03	0.14
2	Benzene	0.15	0.12	0.12	-0.05	0.09	0.01	-0.21	0.1	-0.1	0.04
3	Chloroform	0.18	0.11	0.19	0.2	0.29	0.02	0.52	0.24	0.21	0.31
4	Chloromethane (Methyl Chloride)	0.15	-0.15	-0.1	0.05	0.2	0.23	0.34	-0.02	0.58	0.39
5	Dichlorodifluoromethane (F12)	0.22	0.35	0.4	0.48	0.34	0	0.13	0.37	0.12	0.25
6	Dichlorotetrafluoroethane (F114)	0.4	0.63	0.68	0.26	0.38	0.06	0.36	0.59	0.27	0.4
7	Ethylbenzene	0.06	-0.16	-0.15	-0.06	0.09	0.05	-0.15	-0.11	0	0.06
8	Hexachlorobutadiene	0.21	0.17	0.23	0.08	0.15	0.02	0.09	0.25	0.06	0.15
9	Styrene (monomer)	0.23	-0.16	-0.16	0	0.09	0.23	-0.05	-0.14	-0.12	0.03
10	Tetrachloroethene (PCE)	0.21	0.13	0.21	0.23	0.33	0.05	0.52	0.27	0.24	0.35
11	Toluene	0.03	-0.04	-0.05	-0.06	0.05	0	-0.21	-0.03	-0.01	0
12	1,3,5 Trimethylbenzene	0.13	-0.21	-0.21	-0.08	-0.03	0.27	-0.06	-0.18	-0.08	-0.03
13	1,2,4 Trimethylbenzene	-0.08	-0.13	-0.12	-0.08	-0.03	-0.04	-0.13	-0.08	-0.07	-0.03
14	1,2,4-Trichlorobenzene	0.13	0.05	0.08	0.05	0.06	0.08	0.09	0.09	0.05	0.09
15	Trichloroethene (TCE)	0.09	0.06	0.1	0.11	0.17	-0.01	0.43	0.14	0.12	0.18
16	Trichlorofluoromethane (F-11)	0.36	0.16	0.28	0.56	0.5	0.14	0.47	0.35	0.37	0.53
17	m&p Xylene	0.04	-0.13	-0.14	-0.12	0.01	0.09	-0.18	-0.09	-0.05	-0.02
18	0-Xylene	0.03	-0.17	-0.17	-0.07	0.03	0.1	-0.14	-0.12	-0.05	-0.01
19	Carbon disulfide**	0.28	-0.19	-0.16	-0.14	0.09	0.29	0.18	-0.07	-0.06	0.12
20	Carbonyl sulfide**	0.19	0.03	0.09	0.12	0.2	-0.05	0.14	0.15	0.15	0.23
21	Dimethyl disulfide	0.43	-0.07	-0.03	0.14	0.2	0.27	-0.02	0.04	0.03	0.24
22	Methyl ethyl disulphide	0.43	-0.06	-0.01	0.19	0.22	0.29	0.1	0.05	0.05	0.26

		Methane (ppmv)	Benzene	Chloro-form	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	Ethyl-benzene	Hexa-chloro-buta-diene	Styrene (monomer)
23	Ethylmethyl benzene	0.01	0.25	0.19	-0.11	0.13	0.28	0.25	0.33	-0.11
24	Diethyl disulfide C4H10S2	0.04	-0.08	0.45	-0.02	0	0.1	-0.18	-0.18	-0.15
25	Ethyl, methylethyl disulfide	0.01	0.02	0.29	-0.09	0.03	0.1	0.01	-0.06	-0.12
26	Dimethyl trisulfide	-0.03	0.22	0.13	0.13	-0.01	0.15	0.21	0.08	0.27
27	Ethyl n-propyl disulfide	0.04	-0.06	0.47	0.02	0.11	0.23	-0.1	-0.03	-0.09
28	Trimethyl benzene	-0.09	0.42	-0.02	0.19	0.21	-0.02	0.5	0.17	0.02
29	Diethyl benzene	-0.05	0.32	0.07	0.31	0.32	0.08	0.38	0.19	0.05
30	Methyl-methylethyl benzene, methyl-Cumene	-0.03	0.16	0.15	0.32	0.32	0.18	0.23	0.21	0
31	Tetramethyl benzene	0	0.21	0.15	0.27	0.26	0.19	0.28	0.25	-0.04
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.05	0.11	0.14	0.32	0.28	0.18	0.13	0.25	-0.03
33	2-Methylbutane	0.24	0.02	0.18	-0.13	0.25	0.44	-0.19	0.13	-0.16
34	Pentane	0.3	0.02	0.04	-0.09	0.28	0.47	-0.2	0.08	-0.21
35	Methyl cyclopentane	0.37	0.03	0.16	0.02	0.28	0.42	-0.12	0.23	-0.18
36	2-Methylhexane	0.31	-0.03	0.15	0.15	0.26	0.19	0.01	0.13	-0.06
37	2,3-Dimethylpentane	0.44	-0.06	0.15	0.12	0.17	0.18	-0.06	0.22	-0.14
38	3-Methylhexane	0.27	0.04	0.11	0.04	0.3	0.34	-0.05	0.11	-0.1
39	Methyl cyclohexane	0.44	-0.04	0.18	0.09	0.25	0.32	-0.09	0.26	-0.16
40	Trimethylpentane,2,2,4	0.42	-0.05	0.25	0.14	0.25	0.31	-0.06	0.29	-0.15
41	C3 Hydrocarbon	-0.04	0.2	0.02	0.26	0.3	0.21	0.15	-0.05	0.06
42	C4 Hydrocarbon	0.61	-0.03	0.08	0.01	0.07	0.15	0.01	0.14	0.02
43	C5 Hydrocarbon	0.22	0.09	0.17	0.06	0.29	0.19	0.02	0.18	-0.19

		Tetra-chloro-ethene (PCE)	Toluene	1,3,5-Trimethyl-benzene	1,2,4 -Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloroethene (TCE)	Trichloro-fluoro-methane (F-11)	m&p Xylene	0-Xylene
23	Ethylmethyl benzene	0.43	0.21	0.16	0.4	0.1	0.1	0.37	0.21	0.3
24	Diethyl disulfide C4H10S2	0.1	-0.11	-0.19	-0.17	-0.12	0.03	0.18	-0.15	-0.16
25	Ethyl, methylethyl disulfide	0.33	0	-0.01	0.11	-0.11	0.03	0.17	0	0.06
26	Dimethyl trisulfide	0.05	0.18	0.24	0.1	0.33	0.09	0.14	0.24	0.27
27	Ethyl n-propyl disulfide	0.21	-0.1	-0.15	-0.11	-0.01	0.1	0.32	-0.1	-0.08
28	Trimethyl benzene	0.15	0.43	0.44	0.77	0.22	0.08	0.1	0.43	0.59
29	Diethyl benzene	0.08	0.31	0.42	0.62	0.06	0.03	0.24	0.3	0.41
30	Methyl-methylethyl benzene, methyl-Cumene	0.16	0.16	0.25	0.42	0.08	0.08	0.37	0.15	0.22
31	Tetramethyl benzene	0.17	0.19	0.07	0.4	0.47	0.26	0.36	0.21	0.32
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.16	0.08	0.24	0.29	0.1	0.07	0.35	0.08	0.13
33	2-Methylbutane	0.07	-0.14	-0.15	-0.01	-0.07	0.01	0.1	-0.14	-0.16
34	Pentane	0.06	-0.16	-0.22	-0.1	-0.03	0.01	0.08	-0.18	-0.2
35	Methyl cyclopentane	0.18	-0.12	-0.15	0.01	0.08	0.09	0.25	-0.09	-0.1
36	2-Methylhexane	0.17	-0.04	-0.08	0.02	0.01	0.08	0.28	-0.01	0
37	2,3-Dimethylpentane	0.16	-0.17	-0.07	0.09	0.09	0.08	0.27	-0.08	-0.05
38	3-Methylhexane	0.13	-0.01	-0.13	-0.04	-0.01	0.05	0.18	-0.02	-0.05
39	Methyl cyclohexane	0.2	-0.18	-0.11	0.06	0.1	0.1	0.32	-0.12	-0.09
40	Trimethylpentane,2,2,4	0.27	-0.17	-0.1	0.07	0.12	0.14	0.42	-0.1	-0.06
41	C3 Hydrocarbon	0.06	0.13	-0.03	0.06	-0.14	-0.01	0.22	0.11	-0.01
42	C4 Hydrocarbon	0.12	-0.14	0.08	0.13	0.1	0.04	0.24	0.05	0.07
43	C5 Hydrocarbon	0.15	0.01	0.04	0.25	0.11	0.11	0.37	0.01	0.1

		Carbon-disulfide**	Carbonyl sulfide**	Dimethyl-disulfide	Methyl-ethyl-disulphide	Ethyl-methyl-benzene	Diethyl disulfide C4H10S2	Ethyl, methyl-ethyl disulfide	Dimethyl-trisulfide	Ethyl n-propyl disulfide
23	Ethylmethyl benzene	0.03	0.25	0.52	0.56	1	0.14	0.48	0.11	0.27
24	Diethyl disulfide C4H10S2	-0.01	0.03	0.39	0.48	0.14	1	0.65	0.17	0.84
25	Ethyl, methylethyl disulfide	-0.09	0.02	0.41	0.61	0.48	0.65	1	-0.08	0.76
26	Dimethyl trisulfide	0.37	0.07	0.54	0.46	0.11	0.17	-0.08	1	0
27	Ethyl n-propyl disulfide	0	0.11	0.28	0.46	0.27	0.84	0.76	0	1
28	Trimethyl benzene	0.39	0.67	0.15	0.15	0.29	-0.02	0.26	-0.03	0.06
29	Diethyl benzene	0.48	0.69	-0.07	-0.05	0.16	0.06	0.08	-0.12	0.16
30	Methyl-methylethyl benzene, methyl-Cumene	0.34	0.55	0	0.01	0.23	0.12	0.14	-0.08	0.23
31	Tetramethyl benzene	0.29	0.63	0.17	0.13	0.23	0.12	0.13	0.16	0.24
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.35	0.55	0.16	0.17	0.22	0.23	0.11	0.19	0.21
33	2-Methylbutane	-0.2	-0.06	0.02	-0.13	0.06	0.01	0.06	-0.19	0.06
34	Pentane	-0.24	-0.04	0.01	-0.09	0.08	0.04	0.1	-0.18	0.08
35	Methyl cyclopentane	-0.13	0.09	0.19	-0.01	0.24	0.12	0.13	-0.11	0.24
36	2-Methylhexane	-0.14	0.07	0.16	-0.03	0.22	0.1	0.12	-0.11	0.21
37	2,3-Dimethylpentane	-0.09	0.1	0.31	0.02	0.24	0.13	0.14	-0.08	0.24
38	3-Methylhexane	-0.2	0.03	0.07	-0.08	0.16	0.05	0.07	-0.15	0.16
39	Methyl cyclohexane	-0.12	0.12	0.28	0.01	0.27	0.14	0.16	-0.09	0.27
40	Trimethylpentane,2,2,4	-0.05	0.18	0.32	0.07	0.35	0.21	0.22	-0.06	0.35
41	C3 Hydrocarbon	0.13	0.18	-0.06	-0.06	0.09	0.11	0.01	-0.01	0.11
42	C4 Hydrocarbon	0.05	-0.01	0.14	-0.09	0.12	-0.12	-0.09	-0.03	-0.06
43	C5 Hydrocarbon	0.15	0.34	0.18	0.12	0.34	0.24	0.08	0.1	0.13

		Tri-methyl benzene	Diethyl benzene	Methyl-methyl-ethyl benzene, methyl-Cumene	Tetra-methyl-benzene	Napthalene/TrimethylBicyclo 2.2.1 heptane	2-Methyl-butane	Pen-tane	Methyl-cyclo-pentane	2-Methyl-hexane
23	Ethylmethyl benzene	0.29	0.16	0.23	0.23	0.22	0.06	0.08	0.24	0.22
24	Diethyl disulfide C4H10S2	-0.02	0.06	0.12	0.12	0.23	0.01	0.04	0.12	0.1
25	Ethyl, methylethyl disulfide	0.26	0.08	0.14	0.13	0.11	0.06	0.1	0.13	0.12
26	Dimethyl trisulfide	-0.03	-0.12	-0.08	0.16	0.19	-0.19	-0.18	-0.11	-0.11
27	Ethyl n-propyl disulfide	0.06	0.16	0.23	0.24	0.21	0.06	0.08	0.24	0.21
28	Trimethyl benzene	1	0.82	0.62	0.68	0.48	-0.05	-0.04	0.05	0.04
29	Diethyl benzene	0.82	1	0.82	0.6	0.66	0.01	0.02	0.14	0.12
30	Methyl-methylethyl benzene, methyl-Cumene	0.62	0.82	1	0.74	0.82	0.06	0.07	0.21	0.18
31	Tetramethyl benzene	0.68	0.6	0.74	1	0.61	0.05	0.06	0.21	0.19
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.48	0.66	0.82	0.61	1	0.03	0.04	0.19	0.16
33	2-Methylbutane	-0.05	0.01	0.06	0.05	0.03	1	0.88	0.73	0.33
34	Pentane	-0.04	0.02	0.07	0.06	0.04	0.88	1	0.78	0.33
35	Methyl cyclopentane	0.05	0.14	0.21	0.21	0.19	0.73	0.78	1	0.56
36	2-Methylhexane	0.04	0.12	0.18	0.19	0.16	0.33	0.33	0.56	1
37	2,3-Dimethylpentane	0.06	0.14	0.2	0.21	0.19	0.5	0.49	0.78	0.71
38	3-Methylhexane	0	0.08	0.14	0.14	0.11	0.57	0.62	0.79	0.84
39	Methyl cyclohexane	0.07	0.16	0.23	0.24	0.21	0.58	0.59	0.76	0.69
40	Trimethylpentane,2,2,4	0.11	0.22	0.3	0.31	0.29	0.48	0.48	0.79	0.72
41	C3 Hydrocarbon	0.25	0.4	0.53	0.37	0.4	-0.06	-0.04	0.09	0.35
42	C4 Hydrocarbon	-0.11	-0.08	-0.04	-0.05	-0.08	0.18	0.16	0.31	0.27
43	C5 Hydrocarbon	0.26	0.29	0.12	0.28	0.22	0.16	0.06	0.1	0.08

		2,3-Dimethyl-pentane	3-Methyl-hexane	Methyl-cyclo-hexane	2,2,4-Trimethyl-pentane	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon	C7 Hydro-carbon
23	Ethylmethyl benzene	0.24	0.16	0.27	0.35	0.09	0.12	0.34	0.41	0.2
24	Diethyl disulfide C4H10S2	0.13	0.05	0.14	0.21	0.11	-0.12	0.24	0.02	0.09
25	Ethyl, methylethyl disulfide	0.14	0.07	0.16	0.22	0.01	-0.09	0.08	-0.04	0.09
26	Dimethyl trisulfide	-0.08	-0.15	-0.09	-0.06	-0.01	-0.03	0.1	0.06	-0.1
27	Ethyl n-propyl disulfide	0.24	0.16	0.27	0.35	0.11	-0.06	0.13	0.06	0.11
28	Trimethyl benzene	0.06	0	0.07	0.11	0.25	-0.11	0.26	0.41	0.05
29	Diethyl benzene	0.14	0.08	0.16	0.22	0.4	-0.08	0.29	0.45	0.04
30	Methyl-methylethyl benzene, methyl-Cumene	0.2	0.14	0.23	0.3	0.53	-0.04	0.12	0.27	0.1
31	Tetramethyl benzene	0.21	0.14	0.24	0.31	0.37	-0.05	0.28	0.34	0.27
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.19	0.11	0.21	0.29	0.4	-0.08	0.22	0.17	0.06
33	2-Methylbutane	0.5	0.57	0.58	0.48	-0.06	0.18	0.16	0.22	0.01
34	Pentane	0.49	0.62	0.59	0.48	-0.04	0.16	0.06	0.13	0.07
35	Methyl cyclopentane	0.78	0.79	0.76	0.79	0.09	0.31	0.1	0.35	0.09
36	2-Methylhexane	0.71	0.84	0.69	0.72	0.35	0.27	0.08	0.3	0.24
37	2,3-Dimethylpentane	1	0.57	0.96	0.97	0.1	0.48	0.12	0.49	0.1
38	3-Methylhexane	0.57	1	0.56	0.58	0.27	0.19	0.02	0.2	0.17
39	Methyl cyclohexane	0.96	0.56	1	0.96	0.12	0.42	0.14	0.46	0.12
40	Trimethylpentane,2,2,4	0.97	0.58	0.96	1	0.18	0.41	0.22	0.49	0.18
41	C3 Hydrocarbon	0.1	0.27	0.12	0.18	1	-0.13	0.05	0.04	0.04
42	C4 Hydrocarbon	0.48	0.19	0.42	0.41	-0.13	1	0.14	0.33	-0.02
43	C5 Hydrocarbon	0.12	0.02	0.14	0.22	0.05	0.14	1	0.58	0.37

		C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Propane / ppmv	Butane / ppmv	Iso-butane
23	Ethylmethyl benzene	0.13	0.14	-0.06	-0.04	-0.01	0.33	0.11	0.11	0.11
24	Diethyl disulfide C4H10S2	0.06	0.05	-0.11	-0.15	-0.19	-0.01	-0.02	-0.02	0.15
25	Ethyl, methylethyl disulfide	0.09	0.06	-0.05	-0.12	0.04	0.3	0.02	0.01	0.11
26	Dimethyl trisulfide	-0.01	-0.17	0.03	0.28	0.06	0	-0.08	-0.09	-0.12
27	Ethyl n-propyl disulfide	0.17	0.16	-0.06	-0.09	-0.31	0.02	0.1	0.1	0.12
28	Trimethyl benzene	0.13	0.29	-0.15	0.52	0.07	0.43	0.07	0.07	-0.05
29	Diethyl benzene	0.08	0.39	-0.09	0.4	-0.09	0.26	0.14	0.13	0.04
30	Methyl-methylethyl benzene, methyl-Cumene	0.15	0.14	-0.05	0.52	-0.25	0.03	0.09	0.09	0.11
31	Tetramethyl benzene	0.42	0.13	-0.06	0.71	-0.29	0.01	0.1	0.09	0.1
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.12	0.11	-0.1	0.35	-0.15	0.1	0.06	0.06	0.07
33	2-Methylbutane	0.37	-0.02	-0.09	-0.12	-0.16	-0.1	0.4	0.39	0.69
34	Pentane	0.31	0	-0.04	-0.13	-0.25	-0.09	0.43	0.43	0.68
35	Methyl cyclopentane	0.38	0.14	-0.07	-0.09	-0.31	0.01	0.11	0.11	0.4
36	2-Methylhexane	0.12	0.41	0.17	-0.1	-0.11	0	0.1	0.09	0.08
37	2,3-Dimethylpentane	0.15	0.14	-0.04	-0.07	-0.24	0.03	0.13	0.13	0.11
38	3-Methylhexane	0.28	0.33	0.1	-0.12	-0.18	-0.04	0.05	0.05	0.3
39	Methyl cyclohexane	0.18	0.16	-0.05	-0.08	-0.29	0.03	0.38	0.38	0.26
40	Trimethylpentane,2,2,4	0.25	0.23	-0.02	-0.06	-0.26	0.08	0.19	0.18	0.2
41	C3 Hydrocarbon	-0.05	0.16	-0.02	0.18	-0.18	-0.04	0	0	0.08
42	C4 Hydrocarbon	-0.06	-0.09	0.22	0.15	-0.13	-0.17	0.1	0.09	-0.14
43	C5 Hydrocarbon	0.31	0.27	-0.08	0.03	0	0.19	0.07	0.07	0.34

		Diethyl trisulfide	Methyl-pentane/ Isohexane	Hex-ane	Limo-nene	Ethyl-methyl-cyclo-hexane	Thieno [3,2b] thio-phene	1,4 Dichloro-benzene	methyl-hexane	Difluoro-chloro-methane	Ethyl-methyl cyclo-hexane
23	Ethylmethyl benzene	0.26	0.15	0.24	0.29	0.39	-0.11	0.13	0.32	0.3	0.43
24	Diethyl disulfide C4H10S2	0.25	0.05	0.12	0.42	0.23	0.11	0.35	0.18	0.17	0.26
25	Ethyl, methylethyl disulfide	0.13	0.07	0.13	0.44	0.24	-0.01	0.28	0.19	0.18	0.27
26	Dimethyl trisulfide	0.59	-0.12	-0.11	0.03	0.13	0.67	0.11	-0.07	-0.06	0.15
27	Ethyl n-propyl disulfide	0.26	0.14	0.24	0.62	0.39	0.03	0.36	0.31	0.3	0.43
28	Trimethyl benzene	0.03	0.01	0.05	0.07	0.12	-0.17	-0.06	0.09	0.09	0.14
29	Diethyl benzene	0.14	0.07	0.14	0.17	0.24	-0.15	0.04	0.19	0.19	0.27
30	Methyl-methylethyl benzene, methyl-Cumene	0.22	0.12	0.21	0.25	0.34	-0.13	0.12	0.27	0.26	0.37
31	Tetramethyl benzene	0.22	0.12	0.21	0.26	0.35	-0.14	0.11	0.28	0.27	0.38
32	Napthalene/TrimethylBicyclo 2.2.1 heptane	0.52	0.1	0.19	0.23	0.32	0.22	0.17	0.25	0.24	0.35
33	2-Methylbutane	0.03	0.7	0.69	0.07	0.12	-0.18	0.06	0.57	0.09	0.14
34	Pentane	0.04	0.81	0.79	0.08	0.14	-0.19	0.12	0.65	0.1	0.16
35	Methyl cyclopentane	0.23	0.63	0.68	0.26	0.35	-0.16	0.13	0.77	0.27	0.39
36	2-Methylhexane	0.2	0.11	0.19	0.23	0.67	-0.16	0.11	0.25	0.24	0.35
37	2,3-Dimethylpentane	0.23	0.13	0.21	0.25	0.34	-0.12	0.12	0.27	0.26	0.37
38	3-Methylhexane	0.13	0.53	0.56	0.17	0.56	-0.18	0.06	0.64	0.19	0.28
39	Methyl cyclohexane	0.26	0.27	0.36	0.29	0.39	-0.15	0.15	0.31	0.3	0.43
40	Trimethylpentane,2,2,4	0.35	0.2	0.32	0.38	0.5	-0.13	0.22	0.4	0.38	0.55
41	C3 Hydrocarbon	0.21	0.03	0.09	0.11	0.39	-0.15	-0.06	0.16	0.14	0.23
42	C4 Hydrocarbon	-0.1	-0.08	-0.06	-0.05	-0.03	0.07	0.02	-0.03	-0.02	-0.01
43	C5 Hydrocarbon	0.24	0.03	0.11	0.19	0.24	-0.03	0.1	0.19	0.17	0.27

		Methane (ppmv)	Benzene	Chloro-form	Chloro-methane (Methyl Chloride)	Dichloro-difluoro-methane (F12)	Dichloro-tetrafluoro-ethane (F114)	Ethyl-benzene	Hexachloro-butadiene	Styrene (monomer)
44	C6 Hydrocarbon	0.2	0.24	0.04	0.08	0.25	0.03	0.28	0.23	-0.1
45	C7 Hydrocarbon	-0.04	0	0.04	-0.03	0.06	0.11	0.03	0.09	-0.05
46	C8 Hydrocarbon	0.07	-0.03	0.26	0.08	0.24	0.38	0.03	0.34	0.09
47	C9 Hydrocarbon	0.06	0.12	0.1	0.14	0.36	0.17	0.24	0.18	0.19
48	C10 Hydrocarbon	0.04	-0.22	0.18	0.21	0.25	0.2	0.04	0.3	0.31
49	C11 Hydrocarbon	-0.04	0.22	0.07	0.32	0.15	0.11	0.4	0.28	0.2
50	C12 hydrocarbon	-0.19	0.06	-0.06	-0.05	-0.33	-0.14	0.23	0.08	0.3
51	C13 Hydrocarbon	-0.1	0.4	-0.06	-0.05	0.04	0.04	0.45	0.23	0.32
52	Propane / ppmv	0.16	0.11	0.17	-0.02	0.34	0.58	-0.01	0.29	-0.02
53	Butane / ppmv	0.16	0.1	0.17	-0.03	0.34	0.58	-0.02	0.28	-0.03
54	Isobutane	0.19	-0.06	0.17	-0.07	0.28	0.52	-0.28	0.11	-0.26
55	Diethyl trisulfide	0.11	0.15	0.18	0.15	0.22	0.4	0.06	0.21	0.23
56	Methylpentane/Isohexane	0.11	0.12	0.11	-0.15	0.35	0.63	-0.16	0.17	-0.16
57	Hexane	0.14	0.12	0.19	-0.1	0.4	0.68	-0.15	0.23	-0.16
58	Limonene	-0.04	-0.05	0.2	0.05	0.48	0.26	-0.06	0.08	0
59	Ethylmethylcyclohexane	0.19	0.09	0.29	0.2	0.34	0.38	0.09	0.15	0.09
60	Thieno[3,2b] thiophene	0.11	0.01	0.02	0.23	0	0.06	0.05	0.02	0.23
61	1,4 Dichlorobenzene	0.04	-0.21	0.52	0.34	0.13	0.36	-0.15	0.09	-0.05
62	methylhexane	0.14	0.1	0.24	-0.02	0.37	0.59	-0.11	0.25	-0.14
63	Difluorochloromethane	-0.03	-0.1	0.21	0.58	0.12	0.27	0	0.06	-0.12
64	Ethylmethyl cyclohexane	0.14	0.04	0.31	0.39	0.25	0.4	0.06	0.15	0.03

		Tetra-chloro-ethene (PCE)	Toluene	1,3,5-Trimethyl-benzene	1,2,4 -Trimethyl-benzene	1,2,4-Trichloro-benzene	Trichloroethene (TCE)	Trichloro-fluoro-methane (F-11)	m&p Xylene	0-Xylene
44	C6 Hydrocarbon	0.02	0.22	0.26	0.58	0.15	0.02	0.22	0.27	0.4
45	C7 Hydrocarbon	0.08	-0.03	-0.21	-0.05	0.14	0.08	0.24	-0.08	-0.06
46	C8 Hydrocarbon	0.18	0.06	-0.05	0.07	0.39	0.17	0.33	0.04	0.08
47	C9 Hydrocarbon	0.14	0.25	0.2	0.24	0.08	0.05	0.35	0.17	0.25
48	C10 Hydrocarbon	0.15	-0.09	0.21	-0.01	0.33	0.03	0.37	0.04	0.1
49	C11 Hydrocarbon	0.1	0.27	0.33	0.51	0.56	0.19	0.27	0.36	0.48
50	C12 hydrocarbon	0.14	0.18	0.43	0.17	-0.04	0	-0.16	0.23	0.27
51	C13 Hydrocarbon	0.18	0.38	0.48	0.44	0.12	-0.06	0.02	0.39	0.45
52	Propane / ppmv	0.2	-0.04	-0.03	0.02	0.16	0.1	0.33	-0.07	-0.04
53	Butane / ppmv	0.19	-0.05	-0.03	0.02	0.15	0.1	0.32	-0.08	-0.04
54	Isobutane	0.22	-0.2	-0.21	-0.18	-0.09	0.15	0.21	-0.25	-0.29
55	Diethyl trisulfide	0.21	0.03	0.13	-0.08	0.13	0.09	0.36	0.04	0.03
56	Methylpentane/Isohexane	0.13	-0.04	-0.21	-0.13	0.05	0.06	0.16	-0.13	-0.17
57	Hexane	0.21	-0.05	-0.21	-0.12	0.08	0.1	0.28	-0.14	-0.17
58	Limonene	0.23	-0.06	-0.08	-0.08	0.05	0.11	0.56	-0.12	-0.07
59	Ethylmethylcyclohexane	0.33	0.05	-0.03	-0.03	0.06	0.17	0.5	0.01	0.03
60	Thieno[3,2b] thiophene	0.05	0	0.27	-0.04	0.08	-0.01	0.14	0.09	0.1
61	1,4 Dichlorobenzene	0.52	-0.21	-0.06	-0.13	0.09	0.43	0.47	-0.18	-0.14
62	methylhexane	0.27	-0.03	-0.18	-0.08	0.09	0.14	0.35	-0.09	-0.12
63	Difluorochloromethane	0.24	-0.01	-0.08	-0.07	0.05	0.12	0.37	-0.05	-0.05
64	Ethylmethyl cyclohexane	0.35	0	-0.03	-0.03	0.09	0.18	0.53	-0.02	-0.01

		Carbon-disulfide**	Carbonyl sulfide**	Dimethyl-disulfide	Methyl-ethyl-disulphide	Ethyl-methyl-benzene	Diethyl disulfide C4H10S2	Ethyl, methyl-ethyl disulfide	Dimethyl-trisulfide	Ethyl n-propyl disulfide
44	C6 Hydrocarbon	0.31	0.4	0.25	0.02	0.41	0.02	-0.04	0.06	0.06
45	C7 Hydrocarbon	-0.27	0.13	-0.03	-0.01	0.2	0.09	0.09	-0.1	0.11
46	C8 Hydrocarbon	-0.05	0.12	-0.03	-0.04	0.13	0.06	0.09	-0.01	0.17
47	C9 Hydrocarbon	0.13	0.25	-0.15	-0.13	0.14	0.05	0.06	-0.17	0.16
48	C10 Hydrocarbon	-0.04	-0.2	-0.27	-0.25	-0.06	-0.11	-0.05	0.03	-0.06
49	C11 Hydrocarbon	0.3	0.4	-0.01	-0.07	-0.04	-0.15	-0.12	0.28	-0.09
50	C12 hydrocarbon	0.05	-0.15	0	0.01	-0.01	-0.19	0.04	0.06	-0.31
51	C13 Hydrocarbon	0.08	0.11	0.17	0.21	0.33	-0.01	0.3	0	0.02
52	Propane / ppmv	-0.09	0.09	-0.13	-0.12	0.11	-0.02	0.02	-0.08	0.1
53	Butane / ppmv	-0.1	0.09	-0.13	-0.11	0.11	-0.02	0.01	-0.09	0.1
54	Isobutane	-0.12	-0.02	-0.12	-0.12	0.11	0.15	0.11	-0.12	0.12
55	Diethyl trisulfide	0.28	0.19	0.43	0.43	0.26	0.25	0.13	0.59	0.26
56	Methylpentane/Isohexane	-0.19	0.03	-0.07	-0.06	0.15	0.05	0.07	-0.12	0.14
57	Hexane	-0.16	0.09	-0.03	-0.01	0.24	0.12	0.13	-0.11	0.24
58	Limonene	-0.14	0.12	0.14	0.19	0.29	0.42	0.44	0.03	0.62
59	Ethylmethylcyclohexane	0.09	0.2	0.2	0.22	0.39	0.23	0.24	0.13	0.39
60	Thieno[3,2b] thiophene	0.29	-0.05	0.27	0.29	-0.11	0.11	-0.01	0.67	0.03
61	1,4 Dichlorobenzene	0.18	0.14	-0.02	0.1	0.13	0.35	0.28	0.11	0.36
62	methylhexane	-0.07	0.15	0.04	0.05	0.32	0.18	0.19	-0.07	0.31
63	Difluorochloromethane	-0.06	0.15	0.03	0.05	0.3	0.17	0.18	-0.06	0.3
64	Ethylmethyl cyclohexane	0.12	0.23	0.24	0.26	0.43	0.26	0.27	0.15	0.43

		Trimethyl benzene	Diethyl benzene	Methyl-methyl-ethyl benzene, methyl-Cumene	Tetra-methyl-benzene	Napthalene/ Trimethyl Bicyclo 2.2.1 heptane	2-Methyl-butane	Pentane	Methyl-cyclo-pentane	2-Methyl-hexane
44	C6 Hydrocarbon	0.41	0.45	0.27	0.34	0.17	0.22	0.13	0.35	0.3
45	C7 Hydrocarbon	0.05	0.04	0.1	0.27	0.06	0.01	0.07	0.09	0.24
46	C8 Hydrocarbon	0.13	0.08	0.15	0.42	0.12	0.37	0.31	0.38	0.12
47	C9 Hydrocarbon	0.29	0.39	0.14	0.13	0.11	-0.02	0	0.14	0.41
48	C10 Hydrocarbon	-0.15	-0.09	-0.05	-0.06	-0.1	-0.09	-0.04	-0.07	0.17
49	C11 Hydrocarbon	0.52	0.4	0.52	0.71	0.35	-0.12	-0.13	-0.09	-0.1
50	C12 hydrocarbon	0.07	-0.09	-0.25	-0.29	-0.15	-0.16	-0.25	-0.31	-0.11
51	C13 Hydrocarbon	0.43	0.26	0.03	0.01	0.1	-0.1	-0.09	0.01	0
52	Propane / ppmv	0.07	0.14	0.09	0.1	0.06	0.4	0.43	0.11	0.1
53	Butane / ppmv	0.07	0.13	0.09	0.09	0.06	0.39	0.43	0.11	0.09
54	Isobutane	-0.05	0.04	0.11	0.1	0.07	0.69	0.68	0.4	0.08
55	Diethyl trisulfide	0.03	0.14	0.22	0.22	0.52	0.03	0.04	0.23	0.2
56	Methylpentane/Isohexane	0.01	0.07	0.12	0.12	0.1	0.7	0.81	0.63	0.11
57	Hexane	0.05	0.14	0.21	0.21	0.19	0.69	0.79	0.68	0.19
58	Limonene	0.07	0.17	0.25	0.26	0.23	0.07	0.08	0.26	0.23
59	Ethylmethylcyclohexane	0.12	0.24	0.34	0.35	0.32	0.12	0.14	0.35	0.67
60	Thieno[3,2b] thiophene	-0.17	-0.15	-0.13	-0.14	0.22	-0.18	-0.19	-0.16	-0.16
61	1,4 Dichlorobenzene	-0.06	0.04	0.12	0.11	0.17	0.06	0.12	0.13	0.11
62	methylhexane	0.09	0.19	0.27	0.28	0.25	0.57	0.65	0.77	0.25
63	Difluorochloromethane	0.09	0.19	0.26	0.27	0.24	0.09	0.1	0.27	0.24
64	Ethylmethyl cyclohexane	0.14	0.27	0.37	0.38	0.35	0.14	0.16	0.39	0.35

		2,3-Dimethylpentane	3-Methyl-hexane	Methyl-cyclo-hexane	2,2,4-Trimethyl-pentane	C3 Hydro-carbon	C4 Hydro-carbon	C5 Hydro-carbon	C6 Hydro-carbon	C7 Hydro-carbon
44	C6 Hydrocarbon	0.49	0.2	0.46	0.49	0.04	0.33	0.58	1	0.1
45	C7 Hydrocarbon	0.1	0.17	0.12	0.18	0.04	-0.02	0.37	0.1	1
46	C8 Hydrocarbon	0.15	0.28	0.18	0.25	-0.05	-0.06	0.31	0.19	0.39
47	C9 Hydrocarbon	0.14	0.33	0.16	0.23	0.16	-0.09	0.27	0.36	0.17
48	C10 Hydrocarbon	-0.04	0.1	-0.05	-0.02	-0.02	0.22	-0.08	-0.11	-0.03
49	C11 Hydrocarbon	-0.07	-0.12	-0.08	-0.06	0.18	0.15	0.03	0.13	0.05
50	C12 hydrocarbon	-0.24	-0.18	-0.29	-0.26	-0.18	-0.13	0	-0.14	0.01
51	C13 Hydrocarbon	0.03	-0.04	0.03	0.08	-0.04	-0.17	0.19	0.2	0.08
52	Propane / ppmv	0.13	0.05	0.38	0.19	0	0.1	0.07	0.05	0.02
53	Butane / ppmv	0.13	0.05	0.38	0.18	0	0.09	0.07	0.04	0.02
54	Isobutane	0.11	0.3	0.26	0.2	0.08	-0.14	0.34	0.07	0.07
55	Diethyl trisulfide	0.23	0.13	0.26	0.35	0.21	-0.1	0.24	0.04	0.06
56	Methylpentane/Isohexane	0.13	0.53	0.27	0.2	0.03	-0.08	0.03	-0.01	0.03
57	Hexane	0.21	0.56	0.36	0.32	0.09	-0.06	0.11	0.05	0.1
58	Limonene	0.25	0.17	0.29	0.38	0.11	-0.05	0.19	0.14	0.11
59	Ethylmethylcyclohexane	0.34	0.56	0.39	0.5	0.39	-0.03	0.24	0.14	0.31
60	Thieno[3,2b] thiophene	-0.12	-0.18	-0.15	-0.13	-0.15	0.07	-0.03	-0.18	-0.2
61	1,4 Dichlorobenzene	0.12	0.06	0.15	0.22	-0.06	0.02	0.1	-0.12	0.06
62	methylhexane	0.27	0.64	0.31	0.4	0.16	-0.03	0.19	0.11	0.16
63	Difluorochloromethane	0.26	0.19	0.3	0.38	0.14	-0.02	0.17	0.1	0.15
64	Ethylmethyl cyclohexane	0.37	0.28	0.43	0.55	0.23	-0.01	0.27	0.17	0.23

		C8 Hydro-carbon	C9 Hydro-carbon	C10 Hydro-carbon	C11 Hydro-carbon	C12 hydro-carbon	C13 Hydro-carbon	Propane / ppmv	Butane / ppmv	Iso-butane
44	C6 Hydrocarbon	0.19	0.36	-0.11	0.13	-0.14	0.2	0.05	0.04	0.07
45	C7 Hydrocarbon	0.39	0.17	-0.03	0.05	0.01	0.08	0.02	0.02	0.07
46	C8 Hydrocarbon	1	0.46	0.21	0.2	-0.04	0.13	0.1	0.1	0.31
47	C9 Hydrocarbon	0.46	1	0.32	-0.1	0.11	0.39	0.14	0.14	0
48	C10 Hydrocarbon	0.21	0.32	1	0.19	0.29	0.02	0.06	0.06	-0.02
49	C11 Hydrocarbon	0.2	-0.1	0.19	1	-0.12	-0.18	0.05	0.04	-0.16
50	C12 hydrocarbon	-0.04	0.11	0.29	-0.12	1	0.49	-0.17	-0.17	-0.06
51	C13 Hydrocarbon	0.13	0.39	0.02	-0.18	0.49	1	0.01	0	-0.04
52	Propane / ppmv	0.1	0.14	0.06	0.05	-0.17	0.01	1	1	0.47
53	Butane / ppmv	0.1	0.14	0.06	0.04	-0.17	0	1	1	0.47
54	Isobutane	0.31	0	-0.02	-0.16	-0.06	-0.04	0.47	0.47	1
55	Diethyl trisulfide	0.14	0.13	-0.04	-0.09	0.01	0.26	0.06	0.06	0.12
56	Methylpentane/Isohexane	0.4	0.07	-0.09	-0.1	-0.29	-0.03	0.5	0.5	0.7
57	Hexane	0.46	0.14	-0.07	-0.1	-0.31	0.01	0.5	0.49	0.71
58	Limonene	0.21	0.31	0.11	0.02	-0.25	0.02	0.12	0.12	0.13
59	Ethylmethylcyclohexane	0.27	0.46	0.15	-0.07	-0.17	0.08	0.16	0.15	0.21
60	Thieno[3,2b] thiophene	-0.16	-0.17	0.11	0.06	0.12	0.01	-0.05	-0.06	-0.15
61	1,4 Dichlorobenzene	0.14	0.1	0.33	0.02	0	0.02	0.12	0.12	0.27
62	methylhexane	0.53	0.2	-0.03	-0.07	-0.27	0.06	0.13	0.13	0.56
63	Difluorochloromethane	0.2	0.19	-0.02	-0.05	-0.09	0.06	0.14	0.13	0.16
64	Ethylmethyl cyclohexane	0.31	0.28	0	-0.06	-0.23	0.1	0.19	0.18	0.25

		Diethyl trisulfide	Methyl-pentane/ Isohexane	Hex-ane	Limo-nene	Ethyl-methyl-cyclo-hexane	Thieno [3,2b] thiophene	1,4 Dichloro benzene	methyl-hexane	Difluoro-chloro-methane	Ethyl-methyl cyclo-hexane
44	C6 Hydrocarbon	0.04	-0.01	0.05	0.14	0.14	-0.18	-0.12	0.11	0.1	0.17
45	C7 Hydrocarbon	0.06	0.03	0.1	0.11	0.31	-0.2	0.06	0.16	0.15	0.23
46	C8 Hydrocarbon	0.14	0.4	0.46	0.21	0.27	-0.16	0.14	0.53	0.2	0.31
47	C9 Hydrocarbon	0.13	0.07	0.14	0.31	0.46	-0.17	0.1	0.2	0.19	0.28
48	C10 Hydrocarbon	-0.04	-0.09	-0.07	0.11	0.15	0.11	0.33	-0.03	-0.02	0
49	C11 Hydrocarbon	-0.09	-0.1	-0.1	0.02	-0.07	0.06	0.02	-0.07	-0.05	-0.06
50	C12 hydrocarbon	0.01	-0.29	-0.31	-0.25	-0.17	0.12	0	-0.27	-0.09	-0.23
51	C13 Hydrocarbon	0.26	-0.03	0.01	0.02	0.08	0.01	0.02	0.06	0.06	0.1
52	Propane / ppmv	0.06	0.5	0.5	0.12	0.16	-0.05	0.12	0.13	0.14	0.19
53	Butane / ppmv	0.06	0.5	0.49	0.12	0.15	-0.06	0.12	0.13	0.13	0.18
54	Isobutane	0.12	0.7	0.71	0.13	0.21	-0.15	0.27	0.56	0.16	0.25
55	Diethyl trisulfide	1	0.12	0.23	0.36	0.58	0.5	0.23	0.31	0.3	0.63
56	Methylpentane/Isohexane	0.12	1	0.98	0.16	0.22	-0.15	0.07	0.84	0.17	0.25
57	Hexane	0.23	0.98	1	0.26	0.35	-0.16	0.15	0.9	0.27	0.39
58	Limonene	0.36	0.16	0.26	1	0.43	-0.04	0.18	0.34	0.33	0.47
59	Ethylmethylcyclohexane	0.58	0.22	0.35	0.43	1	0.08	0.28	0.45	0.43	0.81
60	Thieno[3,2b] thiophene	0.5	-0.15	-0.16	-0.04	0.08	1	0.12	-0.14	-0.11	0.1
61	1,4 Dichlorobenzene	0.23	0.07	0.15	0.18	0.28	0.12	1	0.21	0.48	0.44
62	methylhexane	0.31	0.84	0.9	0.34	0.45	-0.14	0.21	1	0.34	0.49
63	Difluorochloromethane	0.3	0.17	0.27	0.33	0.43	-0.11	0.48	0.34	1	0.76
64	Ethylmethyl cyclohexane	0.63	0.25	0.39	0.47	0.81	0.1	0.44	0.49	0.76	1

APPENDIX H
U.S.EPA LIST OF 189 TOXIC CHEMICALS (HAZARDOUS AIR POLLUTANTS)
REGULATION ENACTED BY 1990 CLEAN AIR ACT (CAA). MANY
CHEMICALS HAVE BEEN IDENTIFIED TO BE KNOWN OR
SUSPECTED CARCINOGENS AND DETERMINED TO
BE A THREAT TO HUMAN HEALTH
AND THE ENVIRONMENT.

CAS #	CHEMICAL NAME	NATURAL GAS CHEMICAL
75070	Acetaldehyde	
60355	Acetamide	
75058	Acetonitrile	
98862	Acetophenone	
53963	2-Acetylaminofluorene	
107028	Acrolein	X
79061	Acrylamide	
79107	Acrylic acid	
107131	Acrylonitrile	
8107051	Allyl chloride	
92671	4-Aminobiphenyl	
62533	Aniline	
90040	o-Anisidine	
1332214	Asbestos	
71432	Benzene (including from gasoline)	X
92875	Benzidine	
98077	Benzotrichloride	
100447	Benzyl chloride	
92524	Biphenyl	
117817	Bis (2-ethylhexyl) phthalate (DEHP)	
542881	Bis(chloromethyl) ether	
75252	Bromoform	X
106990	1,3-Butadiene	X
156627	Calcium cyanamide	
105602	Caprolactam	
133062	Captan	
63252	Carbaryl	
75150	Carbon disulfide	X
56235	Carbon tetrachloride	X
463581	Carbonyl sulfide	X
120809	Catechol	
133904	Chloramben	
57749	Chlordane	
7782505	Chorine	
79118	Chloroacetophenone	
532274	2-Chloroacetophenone	

CAS #	CHEMICAL NAME	NATURAL GAS CHEMICAL
108907	Chlorobenzene	X
510156	Chlorobenzilate	
67663	Chloroform	X
107302	Chlromethyl methyl ether	
126998	Chloroprene	
19773	Cresols/Cresylic acid (isomers & mixtures)	
95487	o-Cresol	
108394	m-Cresol	
106445	p-Cresol	
98828	Cumene	X
94757	2,4-D, salts and esters	
3547044	DDE	
334883	Diazomethane	
132649	Dibenzofurans	
96128	1,2-Dibromo-3-chloropropane	
84742	Dibutylphthalate	
106467	1,4-Dichlorobenzene	X
91941	3,3-Dichlorobenzidene	
111444	Dichlorethyl ether (Bis(2chloroethyl)ether)	
542756	1,3-Dichloropropene	X
62737	Dichlorvos	
111422	Diethanolamine	
121697	N,N-Diethyl aniline (N,N-Dimethylaniline)	
64675	Diethyl sulfate	
119904	3,3-Dimethoxybenzidine	
60117	Dimethyl aminoazobenzene	
119937	3,3-Dimethylbenzidine	
79447	Dimethylo carbamoyl chloride	
68122	Dimethyl formamide	
57147	1,1, Diemthylhydrazine	
131113	Diemethl phthalate	
77781	Dimethyl sulfate	
534521	4,6-Dinitro-o-cresol, and salts	
51285	2,4-Dinitrophenol	
121142	2,4-Dinitrotoluene	
123911	1,4-Dioxane (1,4-Diethyleneoxide)	

CAS #	CHEMICAL NAME	NATURAL GAS CHEMICAL
122667	1,2-Diphenylhydrazine	
106898	Epichlorohydrin/1-Chloro-2,3epoxypropane	
106887	1,2-Epoxybutane	
140885	Ethyl acrylate	
100414	Ethyl benzene	
51796	Ethyl carbamate (Urethane)	
75003	Ethyl chloride (Chloroethane)	x
106934	Ethyl enedibromide (Dibromoethane)	X
107062	Ethyl enedichloride (1,2-Dichloroethane	X
75003	Ethyl chloride (Chloroethane)	X
106934	Ethyl enedibromide (Dibromoethane)	X
107062	Ethyl enedichloride (1,2-Dichloroethane)	X
107211	Ethylene glycol	
151564	Ethyleneimine (Aziridine)	
75218	Ethylene oxide	
96457	Ethylene thiourea	
75343	Ethylidene dichloride (1,1-Dichloroethane)	
50000	Formaldehyde	X
76448	Heptachlor	
118741	Hexachlorobenzene	X
87683	Hexachlorobutadiene	X
77474	Hexachlorocyclopentadiene	X
67721	Hexachloroethane	X
822060	Hexamethylene-1,6-diisocyanate	
680319	Hexamethylphosphoramide	
110543	Hexane	X
302012	Hydrazine	
7647010	Hydrochloric acid	
7664393	Hydrogen fluoride (Hydrofluoric acid)	
123319	Hydroquinone	
78591	Isophorone	
58899	Lindane (all isomers)	
108316	Maleic anhydride	
67561	Methanol	
72435	Methoxychlor	
74839	Methyl bromide (Bromomethane)	X

CAS #	CHEMICAL NAME	NATURAL GAS CHEMICAL
74873	Methyl chloride (Chloromethane)	X
71556	Methyl chloroform (1,1,1-Trichloroethane)	X
78933	Methyl ethyl ketone (2-Butanone)/MEK	
60344	Methyl hydrazine	
74884	Methyl iodide (Iodomethane)	
108101	Methyl isobutyl ketone (Hexone)	
624839	Methyl isocyanate	
80626	Methyl methacrylate	
1634044	Methyl tert butyl ether	X
101144	4,4-Methylene bis (2-chloroaniline)	
75092	Methylene chloride (Dichloromethane)	X
101688	Methylene diphenyl diisocyanate (MDI)	
101779	4,4'-Methylenedianiline	
91203	Naphthalene	X
98953	Nitrobenzene	
92933	4-Nitrobiphenyl	
100027	4-Nitrophenol	
79469	2-Nitropropane	
684935	N-Nitroso-N-methylurea	
62759	N-Nitrosodimethylamine	
59892	N-Nitrosomorpholine	
56382	Parathion	
82688	Pentachloronitrobenzene (Quintobenzene)	
87865	Pentachlorophenol	
108952	Phenol	
106503	p-Phenylenediamine	
75445	Phosgene	
7803512	Phosphine	
7723140	Phosphorus	
85449	Phthalic anhydride	
1336363	Polychlorinated biphenyls (Aroclors)	
1120714	1,3-Propane sultone	
57578	beta-Propiolactone	
123386	Propionaldehyde	
114261	Propoxur (Baygon)	
78875	Propylene dichloride (1,2-Dichloropropane)	X

CAS #	CHEMICAL NAME	NATURAL GAS CHEMICAL
75569	Propylene oxide	
75558	1,2-Propylenimine (2-Methyl aziridine)	
91225	Quinoline	
106514	Quinone	
100425	Styrene	X
96093	Styrene oxide	
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	
79345	1,1,2,2-Tetrachloroethane	X
127184	Tetrachloroethylene (Perchloroethylene)	X
7550450	Titanium tetrachloride	
108883	Toluene	X
95807	2,4-Toluene diamine	
584849	2,4-Toluene diisocyanate	
95534	o-Toluidine	
8001352	Toxaphene (chlorinated camphene)	
120821	1,2,4-Trichlorobenzene	X
79005	1,1,2-Trichloroethane	X
79016	Trichloroethylene	X
95954	2,4,5-Trichlorophenol	
88062	2,4,6-Trichlorophenol	
121448	Triethylamine	
1582098	Trifluralin	
540841	2,2,4-Trimethylpentane	
108054	Vinyl acetate	
593602	Vinyl bromide	X
75014	Vinyl chloride	X
75354	Vinylidene chloride (1,1-Dichloroethylene)	X
1330207	Xylenes (isomers and mixture)	X
95476	o-Xylenes	X
108383	m-Xylenes	X
106423	p-Xylenes	X
0	Antimony compounds	
0	Arsenic compounds (inorganic, including arsine)	
0	Beryllium compounds	
0	Cadmium compounds	

CAS #	CHEMICAL NAME	NATURAL GAS CHEMICAL
0	Chromium compounds	
0	Cobalt compounds	
0	Coke oven emissions	
0	Cyanide compounds[1]	
0	Mercury compounds	
0	Mineral fibers[3]	
0	Nickel compounds	
0	Polycyclic organic matter[4]	
0	Radionuclides (including radon)[5]	
0	Selenium compounds	

APPENDIX I
COMPARISON OF CHEMICAL COMPOUND LIST
TO-14a AND TO-15 TO TCEQ TARGET LIST

CHEMICAL COMPOUND	CAS #	TO-14A	TO-15	TCEQ
1,1,1-Trichloroethane/methyl chloroform	71556	x	x	x
1,1,2,2-Tetrachloroethane	79345	x	x	x
1,1,2-Trichloroethane/vinyl trichloride	79005	x	x	x
1,1-Dichloroethane/ethylidene chloride	74343	x	x	x
1,2,4-Trichlorobenzene	120821	x	x	
1,2,4-Trimethylbenzene/pseudocumene	95636	x		x
1,2-Dibromoethane/ethylene dibromide	106934	x	x	
1,2-Dichloro/1,1,2,2-tetrafluoroethane	76142	x		
1,2-Dichlorobenzene	95501	x		
1,1-Dichloroethene/vinylidene chloride	75354	x	x	x
1,2-Dichloropropane/propylene dichloride	78875	x	x	x
1,3,5-Trimethylbenzene/mesitylene	108678	x	x	x
1,3-Dichlorobenzene	541731	x	x	
1,4-Dichlorobenzene	106467	x	x	
Benzene	71432	x	x	x
Benzyl chloride/α-chlorotoluene	100447	x	x	
Bromomethane/methylbromide	74839	x	x	x
Carbon tetrachloride	56235	x	x	x
Chlorobenzene	108907	x	x	x
Chloroethane/ethylchloride	75003	x	x	
Chloroform/trichloromethane	67663	x	x	x
Chloromethane/ Methyl Chloride	74873	x	x	x
cis-1,2-Dichloroethylene	156592	x	x	x
Dichlorodifluoromethane (F12)	75718	x		x
Ethylbenzene	100414	x	x	x
Hexachlorobutadiene	87683	x	x	
m-Xylene/ 1,3-Dimethylbenzene	108383	x	x	x
p-Xylene/1,4-Dimethylbenzene	100423	x	x	x
Methylene chloride/Dichloromethane	75092	x	x	x
o-Xylene/1,2-Dimethylbenzene	95476	x	x	x
Styrene/Vinyl benzene	100425	x	x	x
Tetrachloroethylene	127184	x	x	x
Toluene/Methyl benzene	108883	x	x	x
Trichlorofluoromethane (F11)	75694	x	x	x
1,1,3-Trichloro1,2,2-trifluormethane (F113)	76131	x	x	
Vinyl chloride/Chloroethylene	75014	x	x	
Trichloroethylene/trichloroethene	79016	x	x	x
c-1,3-dichloropropylene/1,3-dichloropropene	542756	x	x	x
t-1,3-dichloropropylene	78875	x	x	x
1,2-dichloroethane/Ethylene dichloride	107062	x	x	x
1,3-Butadiene	106990		x	x
1,4-Dioxane	123911		x	
2,2,4-Trimethylpentane	540841		x	x
2-Butanone	4840828		x	
Methyl Isobutyl Ketone(Hexone) 4-Methyl-2-pentanone	108101		x	

CHEMICAL COMPOUND	CAS #	TO-14A	TO-15	TCEQ
Acrylonitrile	107131		x	
3-Chloropropene/Allyl Chloride	107051		x	
Bromoform	75252		x	
Carbon Disulfide	75150		x	x
Ethyl tert-butly ether	637923		x	
Hexane	110543		x	x
Methyl tert-butyl ether	1634044		x	
t-Butyl Alcohol	75650		x	
Trichloroethene	79016		x	
Vinyl acetate	108054		x	
Vinyl bromide/bromoethene	593602		x	
Diazomethane	334883		x	
Formaldehyde	50000		x	
Phosgene	75445		x	
Ethylene oxide	75218		x	
Acetaldehyde/ethanal	75070		x	
Propylene oxide	75569		x	
Methyl iodide/iodomethane	74884		x	
Allyl chloride/3-chloropropene	107051		x	
Carbonyl sulfide	463581		x	
Propionaldehyde	123386		x	
chloroprene	126998		x	
2-Chloromethyl methyl ether	107302		x	
Acrolein/2-propenalx	107028		x	
1,2-butylene oxide	106887		x	
ethylene imine/aziridine	151564		x	
1,1-dimethyl hydrazine	57147		x	
1,2-propylene imine/ 2-methylazinidine	75558		x	
methanol/wood alcohol/wood naptha	67561		x	
acetonitrile/cyanomethane	75058		x	
1,2-dichloro ethane/ethylene dichloride (EDC)	107062		x	
triethylamine	121448		x	
methylhydrazine (group like xylenes)	60344		x	
bis(chloromethyl)ether	542881		x	
ethyl acrylate	140885		x	
methyl methacrylate	80626		x	
epichlorohydrin (1-chloro-2,3-epoxy propane)	106898		x	
N-nitro N methyl urea	684935		x	
2-Nitropropane	79469		x	
Methyl isobutyl ketone (hexone)	108101		x	
Dimethyl carbanyl chloride	79447		x	
N-Nitrosodimethylamine	62759		x	
beta-propiolactone	57578		x	
Cumene/Isopropylbenzene	98828		x	x
Acrylic acid	79107		x	
N,N-Dimethyl formamide	68122		x	

CHEMICAL COMPOUND	CAS #	TO-14A	TO-15	TCEQ
1,3-Propane sultone	1120714		x	
Acetophenone	98862		x	
Dimethyl sulfate	77781		x	
1,2-dibromo-3-chloropropane	96128		x	
Analytical List Specific only to TCEQ				
Cyclohexane	110827			x
Ethane	74840			x
Acetylene	74862			x
Propane	74986			x
Isobutane/methyl propane	75285			x
Vinyl chloride	75014			x
1-butene	106989			x
n-butane	106978			x
t-2-butane	577117			x
c-2-butene	590181			x
3-methyl-1-butene	563451			x
1-pentene	109671			x
n-pentane	109660			x
t-2-pentene	760203			x
c-2-pentene	None			x
2-methyl-2-butene	513359			x
2,2-dimethylbutane	75832			x
cyclopentene	142290			x
4-methyl-1-pentene	691372			x
cyclopentane	287923			x
2-methylpentane	107835			x
3-methylpentane	96140			x
2-methyl-1-pentene+1-hexene	691372			x
t-2-hexene	592438			x
c-2-hexene	7688213			x
methylcyclopentane	96377			x
2,4-dimethylpentane	108087			x
2-methylhexane	589344			x
2,3-dimethylpentane	565593			x
2-methylhexane	591764			x
2-chloropentane	625296			x
methylcyclohexane	108872			x
2,3,4-trimethylpentane	565753			x
2-methylheptane	592278			x
3-methylheptane	589811			x
n-nonane	111842			x
n-propylbenzene	103651			x
m-ethyltoluene	620144			x
p-ethyltoluene	622968			x
o-ethyltoluene	611143			x
1,2,3-trimethylbenzene	526738			x

CHEMICAL COMPOUND	CAS #	TO-14A	TO-15	TCEQ
n-decane	124185			x
n-undecane	1120214			x
n-octane	111659			x
2,3-dimethylbutane	79298			x
n-heptane	142825			x
ethene/ethylene	74851			x
propylene	115071			x
isopentane/methylbutane	78784			x
3-methylhexane	589344			x
2-methyl-1,3-butadiene (isoprene)	78795			x
CHEMICAL COMPOUND	CAS #	TO-14A	TO-15	TCEQ

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BIOGRAPHICAL INFORMATION

Alisa Rich was raised in Arizona and spent many summers on the Indian Reservations of Arizona and New Mexico hiking, learning about nature and enjoying Native American culture. She began her undergraduate work at Arizona State University, completing her degree at the University of Nebraska at Omaha. After moving to Dallas, she completed her masters at the University of North Texas Health Science Center in Fort Worth, focusing on environmental and occupational exposures. During her studies, she became focused on learning about industrial processes and how specific processes created the pollutants found in air, water and soil. This led to her doctorate interest in engineering and specialization in air pollution. Her doctoral studies began at the University of Texas at Arlington, in the Program of Environmental Science and Engineering, which later was renamed Environmental and Earth Science in the College of Science. With the expansion of urban drilling in the Texas Barnett Shale geologic formation, she was able to pursue her interests in industrial pollution which has led to numerous papers and presentations on air-borne pollutants from natural gas industrial processes and the impact of hydraulic fracturing on hydrogeologic formations. She has been the lead scientist on numerous high profile environmental contamination cases including the Town of DISH, Texas, and the U.S. EPA vs. Range Resources (Parker County). After completing her doctorate, she plans to continue to pursue her interest in environmental contaminants and the deleterious effect of environmental toxins on human health through her work at Wolf Eagle Environmental, LLC.