

Madison County Department of Health

Addressing Community Health Concerns near the Proposed Site of a Gas Compressor Station

PHASE ONE: BASELINE COMMUNITY ENVIRONMENTAL MONITORING RESULTS



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INTRODUCTION

This report contains a summary of environmental monitoring activities conducted between October-December 2015, in seventeen homes in the community located within one and a quarter miles from the proposed gas compressor station site in the Town of Georgetown. Items selected for monitoring were those identified in the literature or by researchers as being associated with gas industry products, activities, and/or operations. The sampling results contained in this report represent the completion of phase one of the project and will be used to establish baseline levels in the community.

Home environmental sampling was conducted by Madison County Department of Health staff, except for methane. A series of six visits were made to households to collect environmental sampling data. The environmental sampling results presented in this report include:

- *Water Quality* data for individual onsite water systems (well/spring) and surface water (where applicable)
- *Air Quality* data for particulate matter, volatile organic compounds (VOCs)¹, formaldehyde, hydrogen sulfide, methane and radon
- *Noise Level* data for homes²

Concurrently, health history surveys and individual lung functions tests were conducted on individuals in each participating household, and a water system physical assessment and household assessment survey were conducted at each home. The results of the health survey, lung function tests, and complete home environmental survey are not included in this report. However, a section in this report provides a list of known conditions in homes that may impact home indoor air quality and health along with a subset of related survey response results from the home environmental surveys.

This report is not intended to provide recommendations to address potential concerns should test results exceed recommended threshold levels. For questions about results or a result above a threshold level, please contact Madison County Health Department Division of Environmental Health at 366-2526.

¹ Results for 60 additional VOCs parameters will be included in the phase two community report.

² In May 2016, baseline noise data was recollected following a new methodology to better address the potential health concerns expressed around noise near a gas compressor station.



Individual Onsite Water: Monitoring Water Contaminants

All participating households have individual onsite water systems. Water samples were collected from each household's individual onsite water source (well or spring) and tested for sources of contamination and physical characteristics. Contaminants found in water may cause illness or have the potential to impact health. The physical characteristics of the water samples were examined as they can impact the taste and/or look of the water, as well as, indicate other problems that could affect the performance of a water system, and subsequently impact water quality. In addition, visual observations of the physical water systems were made to identify factors that may impact water quality.

Water sample analysis was based on the New York Standards for Individual Onsite Water Supply and Individual Onsite Wastewater Treatment Systems ([NYSDOH, 2016](#)) and for contaminants associated with gas compressor station operations. Where a standard did not exist for a contaminant or physical characteristic, other sources, such as proposed standards and/or health advisory levels were used to provide guidance for comparison. In some cases, the level for comparison is yet to be determined (TBD) pending further research.

Table 1: Water Contaminants

Water Contaminant Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Water Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Total Coliform	(NYSDOH, 2006a)	Any positive result is unsatisfactory	Provides a general indication of the sanitary condition of a water supply and indicates the potential presence of other harmful bacteria	---	10 negative 7 positive	41%
E. coli	(NYSDOH, 2011)	Any positive result is unsatisfactory	Indicator of possible disease causing organism, e.g. gastrointestinal illness	---	14 negative 3 positive	18%
Barium	(NYSDOH, 2011)	2 ppm	Increase in blood pressure	0.101 ppm	0.012 – 0.6 ppm	0%
Sodium	(NYSDOH, 2006a)	20 ppm* 270 ppm**	Effects blood pressure; *Greater than 20 ppm should not be consumed if on a severely restrictive sodium diet and **Greater than 270 ppm is not recommended for consumption if on a moderately restricted sodium diet	53.541 ppm	1.6 – 560 ppm	24%

Water Contaminant Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Water Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Strontium	(ODOH)	4 ppm-lifetime health advisory 25 ppm-one day health advisory	Naturally occurring Strontium may cause growth deformities; Radioactive Strontium may attack bone marrow and soft tissues developing into anemia and leukemia	0.274 ppm	0.045 – 1.1 ppm	0%
Arsenic	(NYSDOH, 2006a)	0.01 ppm	Skin damage or problem with circulatory system	0.002 ppm	0.002 – 0.003 ppm	0%
Copper	(US EPA, n.d.)	1.3 ppm	Short-term gastrointestinal distress; Long-term liver or kidney damage; metallic taste; blue-green staining; Corrosion of household plumbing systems	0.026 ppm	0.001 – 0.25 ppm	0%
Lead	(NYSDOH, 2006a)	0.015 ppm	Brain, nerve and kidney damage (especially in infants and children)	0.001 ppm	0.001 ppm	0%
Mercury	(NYSDOH, 2011)	0.002 ppm	Kidney damage	Not detected	Not detected	0%
Toxaphene	(NYSDOH, 2011)	0.003 ppm	Kidney, liver, or thyroid problems; increased risk of cancer	Not detected	Not detected	0%
2,4 D	(NYSDOH, 2011)	0.05 ppm	Kidney, liver, or adrenal gland problems	Not detected	Not detected	0%
Dalapon	(US EPA, n.d.)	0.2 ppm	Minor kidney changes	Not detected	Not detected	0%
VOC's includes BTEX	(NYSDOH, 2011)	0.005 µg/l	Increased risk of cancer, anemia, blood problems depending on the specific VOC	Not detected	Not detected	0%
Nitrate	(NYSDOH, 2006a)	10 ppm	Infants: consuming could lead to <i>blue-baby syndrome</i> from lack of oxygen to the body's cells and tissues	2.169 ppm	0.038 – 9.6 ppm	0%
Nitrite	(NYSDOH, 2006a)	1 ppm	Infants: consuming could lead to <i>blue-baby syndrome</i> from lack of oxygen to the body's cells and tissues	Not detected	Not detected	0%
Gross Alpha	(NYSDOH, 2011)	15 pCi/l	Increased risk of cancer	0.86 ppm	-0.86 – 2.95 ppm	0%
Gross Beta	(NYSDOH, 2011)	50 pCi/l	Increased risk of cancer	0.92 ppm	-0.21 – 1.89 ppm	0%



WATER QUALITY

Individual Onsite Water: Monitoring Water Characteristics

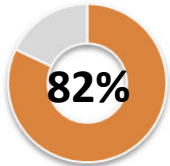
Table 2: Water Characteristics

Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Water Quality Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Ethane	TBD	TBD	Causes flammable vapors; inhalation may cause mild intoxication, drowsiness, or loss of coordination	Not detected	Not detected	TBD
Methane	(USGS, 2016)	>10 ppm > 28 ppm*	Breathing in high gas levels could lead to suffocation, and/or gas released into the air if allowed to accumulate in a confined space could ignite or explode *indicates a potential explosive environment in an enclosed area with an ignition source	4.56 ppm	0.013 – 23 ppm	6%
Oil and Grease (TPH)	(MA DEP, 2004)	0.2 ppm	Acute exposure at high concentrations can affect the central nervous system and with such symptoms as lethargy, confusion, headache, dizziness and nausea	Not detected	Not detected	0%
Calcium	(WHO, 2009)	TBD	TBD	39.563 ppm	14 – 87 ppm	TBD
Manganese	(NYSDOH, 2006a)	0.3 ppm (Iron plus manganese 0.5 ppm)	Black to brown staining of fixtures or clothes, bitter metallic taste	0.098 ppm	0.011 – 0.24 ppm	0%
Surfactants	TBD	TBD	TBD	Not detected	Not detected	TBD

Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Water Quality Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Chloride	(NYSDOH, 2011)	250 ppm	Salty taste; may increase rates of corrosion of metals in the distribution system, depending on the alkalinity of the water	57.53 ppm	1 – 380 ppm	6%
Fluoride	(NYSDOH, 2011)	2.2 ppm	Lack of fluoride may cause cavities; excessive fluoride may cause stained or pitted teeth	0.23 ppm	0.1 – 1 ppm	0%
Total Suspended Solids (TSS)	(State of Michigan)	>40 ppm* >150 ppm**	Increases water temperature and subsequently decreases levels of dissolved oxygen *Cloudy appearance **Dirty appearance	Not detected	Not detected	0%
Bromide	(WHO, 2010)	TBD	Large doses of bromide cause nausea and vomiting, abdominal pain, coma and paralysis	125.48 ppm	58.2 – 284 ppm	TBD
Total Dissolved Solids (TDS)	(US EPA, 2016)	500 ppm	Hardness; deposits; colored water; staining; salty taste	154.92 ppm	35.1 – 860 ppm	6%
pH	(NYSDOH, 2006a)	6.5-8.5	Water quality indicator; pipe corrosion; metallic-bitter taste; rain pH 5-6; Stream water pH 6-8	7.64	6.62 – 8.43 units	0%
Conductivity	TBD	TBD	Indicates the amount of solids, substances, minerals, and chemicals dissolved in water	240.4 uS/cm	54.7 – 1,326 uS/cm	TBD
Alkalinity	(NYSDOH, 2006a)	TBD	Dry skin; inhibits chlorine effectiveness; metallic bitter taste	385 mg/L	385 mg/L	TBD
Sulfate	(NYSDOH, 2011)	250 ppm	Salty taste	Not detected	Not detected	0%

Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Water Quality Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Temperature	Varies based on contaminant	Varies based on contaminant	Impacts water chemistry such as solubility of contaminants in water and disinfection measures	13.67 celsius	11 – 18.1 celsius	0%
Hardness	(NYSDOH, 2006a)	150 ppm	Mineral and soap deposits; detergents less effective	186.94 ppm	0 – 359.10 ppm	82%
Chlorine Residual	(NYSDOH, 2011)	0.2-4.0 ppm	Presence indicates the absence of disease-causing organisms by identifying recent disinfection; Presence may impact test results for bacterial contaminants; use of chlorine produces disinfection/disinfectant by-products that may present a small increase in cancer risk	Not detected	Not detected	0%
Iron	(NYSDOH, 2006a)	0.3 ppm	Rusty color and staining of fixtures or clothes	0.0925 ppm	0 – 1.0 ppm	12%

Individual Onsite Water: Visual Observations of Household Well or Spring Source Systems



(14 out of 17)

82% of homes had wells for a drinking water system.



(12 out of 14)

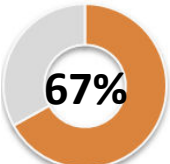
86% of wells were visually observed and assessed for potential risk of bacteriological contamination based well depth, construction, and casing.



(11 out of 12)

92% of wells observed did not have a well cap providing a proper sanitary seal.

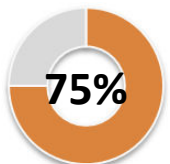
A sanitary seal prevents entry by insects, vermin, and contaminated from surface water runoff and above ground pollutants.



(8 out of 12)

67% of well casings observed did not extend at least 18 inches above ground.

A well casing that extends at least 18 inches above ground lowers the risk for bacteriological and/or chemical contamination from flooding and surface water run-off.



(9 out of 12)

75% of wells were reported to have a depth of 50 feet or greater.

A well depth of 50 feet of greater reduces the risk for potential bacteriological contamination from surface water impacts.





Surface water samples were collected at three locations in the project area in the fall of 2015 (first collection) and again in the summer of 2016 (*second collection, as noted by an asterisks * in tables 3a-c*). Currently different standards exist that pertain to bodies of water. The use of such bodies of water will determine which standard to apply to the results. MCDOH is in the process of reviewing and determining the most appropriate standard to apply to the bodies of water tested.

The water quality results from each surface water source sampled are included in table 3a through table 3c.

Surface Water Monitoring–Location 1: Pond

Water samples were collected from a surface water source (pond) located near the proposed site. The results are presented below.

Table 3a: Surface Water Monitoring at Location 1

Surface Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Location 1 Phase 1 (n=1)
Total Coliform	TBD	TBD	Provides a general indication of the sanitary condition of a water supply and indicates the potential presence of other harmful bacteria	Positive 30 colonies/100 mL
Fecal Coliform	TBD	TBD	Indicates the possible presence of organisms that can cause illness in people, and the potential for illness when fecal coliform is present may also depend on how the water is being used such as for swimming	30 colonies/100 mL*
Methane	TBD	TBD	Breathing in high gas concentrations can lead to suffocation; if methane gas released into the air from groundwater is allowed to accumulate in a confined space, when mixed with air could ignite or explode; *indicates gas levels in groundwater with the potential to cause an explosive environment in an enclosed area with an ignition source	Below detection levels
Arsenic	TBD	TBD	Skin damage or problem with circulatory system	Below detection levels
Barium	TBD	TBD	Increase in blood pressure	Below detection levels

Surface Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Location 1 Phase 1 (n=1)
Cadmium	TBD	TBD	High levels may severely irritates the stomach, leading to vomiting and diarrhea; lower levels over a long period of time may lead to kidneys damage and bones that may become fragile and break easily	Below detection levels
Strontium	TBD	TBD	Naturally occurring Strontium may cause growth deformities; Radioactive Strontium may attack bone marrow and soft tissues developing into anemia and leukemia	0.0580 ppm
Phenol	TBD	TBD	Vomiting and lethargy; ingestion of concentrated phenol may cause gastrointestinal damage	Below detection levels
Bromide	TBD	TBD	Large doses of bromide cause nausea and vomiting, abdominal pain, coma and paralysis	Below detection levels
Ethylene Glycol	TBD	TBD	High levels can damage the kidneys, nervous system, lungs, and heart	Below detection levels
Propylene Glycol	TBD	TBD	High levels increases the amount of acid in the body	Below detection levels
VOC's Includes BTEX	TBD	TBD	Increased risk of cancer, anemia, blood problems depending on the specific VOC	Below detection levels
Styrene	TBD	TBD	May affect the nervous system reasonably anticipated to be a human carcinogen	Below detection levels
Chloride	TBD	TBD	Salty taste; may increase rates of corrosion of metals in the distribution system, depending on the alkalinity of the water	<2 ppm*
Temperature	Varies based on contaminant	Varies based on contaminant	Impacts water chemistry such as solubility of contaminants in water and disinfection measures	23.7 celcius*
pH	TBD	TBD	Water quality indicator; rain pH 5-6; Stream water pH 6-8	6.86*
Conductivity	TBD	TBD	Indicates the amount of solids, substances, minerals, and chemicals dissolved in water	71.5 uS/cm*
Total Dissolved Solids (TDS)	TBD	TBD	Hardness; deposits; colored water; staining; salty taste	34.6 ppm*
Dissolved Oxygen (DO)	TBD	TBD	Lack of DO can cause aquatic life in a water body to die; DO concentrations fluctuate with water temperature seasonally and daily, with lower DO typically in the summer and fall	4 mg/L*



WATER QUALITY

Surface Water Monitoring –Location 2: Upstream

Water samples were collected from a second surface water source (stream) located near the proposed site. The results are presented below.

Table 3b: Surface Water Monitoring at Location 2

Surface Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Location 2 Phase 1 (n=1)
Total Coliform	TBD	TBD	Provides a general indication of the sanitary condition of a water supply and indicates the potential presence of other harmful bacteria	Positive 120 colonies/100 mL
Fecal Coliform	TBD	TBD	Indicates the possible presence of organisms that can cause illness in people, and the potential for illness when fecal coliform is present may also depend on how the water is being used such as for swimming	130 colonies/100 mL*
Methane	TBD	TBD	Breathing in high gas concentrations can lead to suffocation; if methane gas released into the air from groundwater is allowed to accumulate in a confined space, when mixed with air could ignite or explode	Below detection levels
Arsenic	TBD	TBD	Skin damage or problem with circulatory system	Below detection levels
Barium	TBD	TBD	Increase in blood pressure	Below detection levels
Cadmium	TBD	TBD	High levels may severely irritates the stomach, leading to vomiting and diarrhea; lower levels over a long period of time may lead to kidneys damage and bones that may become fragile and break easily	Below detection levels
Strontium	TBD	TBD	Naturally occurring Strontium may cause growth deformities; Radioactive Strontium may attack bone marrow and soft tissues developing into anemia and leukemia	0.058 ppm
Phenol	TBD	TBD	Vomiting and lethargy; ingestion of concentrated phenol may cause gastrointestinal damage	Below detection levels

Surface Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Location 2 Phase 1 (n=1)
Bromide	TBD	TBD	Large doses of bromide cause nausea and vomiting, abdominal pain, coma and paralysis	Below detection levels
Ethylene Glycol	TBD	TBD	High levels can damage the kidneys, nervous system, lungs, and heart	Below detection levels
Propylene Glycol	TBD	TBD	High levels increases the amount of acid in the body	Below detection levels
VOC's Includes BTEX	TBD	TBD	Increased risk of cancer, anemia, blood problems depending on the specific VOC	Below detection levels
Styrene	TBD	TBD	May affect the nervous system reasonably anticipated to be a human carcinogen	Below detection levels
Chloride	TBD	TBD	Salty taste; may increase rates of corrosion of metals in the distribution system, depending on the alkalinity of the water	13 ppm*
Temperature	Varies based on contaminant	Varies based on contaminant	Impacts water chemistry such as solubility of contaminants in water and disinfection measures	18 celcius*
pH	TBD	TBD	Water quality indicator; pipe corrosion; metallic-bitter taste; rain pH 5-6; Stream water pH 6-8	8.4*
Conductivity	TBD	TBD	Indicates the amount of solids, substances, minerals, and chemicals dissolved in water	179.9 uS/cm*
Total Dissolved Solids (TDS)	TBD	TBD	Hardness; deposits; colored water; staining; salty taste	99.5 ppm*
Dissolved Oxygen (DO)	TBD	TBD	Lack of DO can cause aquatic life in a water body to die; DO concentrations fluctuate with water temperature seasonally and daily, with lower DO typically in the summer and fall	5.2 mg/L*



WATER QUALITY

Surface Water Monitoring –Location 3: Downstream

Water samples were collected from a third surface water source (stream) located near the proposed site. The results are presented below.

Table 3c: Surface Water Monitoring at Location 3

Surface Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Location 3 Phase 1 (n=1)
Total Coliform	TBD	TBD	Provides a general indication of the sanitary condition of a water supply and indicates the potential presence of other harmful bacteria	Positive 50 colonies/100 mL
Fecal Coliform	TBD	TBD	Indicates the possible presence of organisms that can cause illness in people, and the potential for illness when fecal coliform is present may also depend on how the water is being used such as for swimming	80 colonies/100 mL*
Methane	TBD	TBD	Breathing in high gas concentrations can lead to suffocation; if methane gas released into the air from groundwater is allowed to accumulate in a confined space, when mixed with air could ignite or explode	0.005 ppm
Arsenic	TBD	TBD	Skin damage or problem with circulatory system	Below detection levels
Barium	TBD	TBD	Increase in blood pressure	Below detection levels
Cadmium	TBD	TBD	High levels may severely irritates the stomach, leading to vomiting and diarrhea; lower levels over a long period of time may lead to kidneys damage and bones that may become fragile and break easily	Below detection levels
Strontium	TBD	TBD	Naturally occurring Strontium may cause growth deformities; Radioactive Strontium may attack bone marrow and soft tissues developing into anemia and leukemia	0.06 ppm

Surface Water Quality Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Location 3 Phase 1 (n=1)
Phenol	TBD	TBD	Vomiting and lethargy; ingestion of concentrated phenol may cause gastrointestinal damage	Below detection levels
Bromide	TBD	TBD	Large doses of bromide cause nausea and vomiting, abdominal pain, coma and paralysis	Below detection levels
Ethylene Glycol	TBD	TBD	High levels can damage the kidneys, nervous system, lungs, and heart	Below detection levels
Propylene Glycol	TBD	TBD	High levels increases the amount of acid in the body	Below detection levels
VOC's Includes BTEX	TBD	TBD	Increased risk of cancer, anemia, blood problems depending on the specific VOC	Below detection levels
Styrene	TBD	TBD	May affect the nervous system reasonably anticipated to be a human carcinogen	Below detection levels
Chloride	TBD	TBD	Salty taste; may increase rates of corrosion of metals in the distribution system, depending on the alkalinity of the water	12 ppm*
Temperature	Varies based on contaminant	Varies based on contaminant	Impacts water chemistry such as solubility of contaminants in water and disinfection measures	16 celcius*
pH	TBD	TBD	Water quality indicator; pipe corrosion; metallic-bitter taste; rain pH 5-6; Stream water pH 6-8	7.89*
Conductivity	TBD	TBD	Indicates the amount of solids, substances, minerals, and chemicals dissolved in water	165 uS/cm*
Total Dissolved Solids (TDS)	TBD	TBD	Hardness; deposits; colored water; staining; salty taste	95.8 ppm*
Dissolved Oxygen (DO)	TBD	TBD	Lack of DO can cause aquatic life in a water body to die; DO concentrations fluctuate with water temperature seasonally and daily, with lower DO typically in the summer and fall	6.6 mg/L*





AIR QUALITY

Air quality data was collected for: volatile organic compounds (indoors and outdoors), fine particulate matter (indoors and outdoors), methane (outdoors), radon gas (indoors only), and hydrogen sulfide (indoors and outdoors). The parameters tested for air quality are those that may be commonly found in homes or have been associated with natural gas activities and have the potential to affect health.

Monitoring for Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) are a large group of carbon-based chemicals that easily evaporate or “off-gas” at room temperature. While most people can smell high levels of some VOCs, other VOCs have no odor. The VOCs tested for indoors and outdoors have been associated with or have the potential to result from gas industry activities, operations, and/or products.

Table 4a and 4b include the results of 24-hour VOC sampling using Suma Canisters, in homes both indoors and outdoors.

Table 4a: Indoors-VOCs

Indoor VOC Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average VOC Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Benzene (VOC)	(ATSDR, 2016)	0.009 ppm	Drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects of the bone marrow and can cause anemia and leukemia	0.002824 ppm	0.001 - 0.011 ppm	12%
Toulene (VOC)	(ATSDR, 2016)	2 ppm	Cardiovascular and neurological effects such as tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, hearing and color vision loss	0.007529 ppm	0.001 - 0.016 ppm	0%
Hexane (VOC)	(ATSDR, 2016)	0.6 ppm	Nerve damage and paralysis of the arms and legs	0.003706 ppm	0.001 - 0.016 ppm	0%
Ethylbenzene (VOC)	(ATSDR, 2016)	5 ppm	Eye and throat irritation. Exposure to higher levels may result in dizziness, decrease in developmental growth, and hearing loss	0.002588 ppm	0.001 – 0.01 ppm	0%

Indoor VOC Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average VOC Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
m-p- Xylene (VOC)	(ATSDR, 2016)	2 ppm	Headaches, lack of muscle coordination, dizziness, and confusion; skin, eyes, nose, and throat irritation; difficulty breathing or lung problems; delayed reaction time and memory difficulties; possibly liver and kidney changes	0.005882 ppm	0.002 - 0.023 ppm	0%
o- Xylene (VOC)	(ATSDR, 2016)	2 ppm	High levels can cause headaches, lack of muscle coordination, dizziness, and confusion; skin, eyes, nose, and throat irritation; difficulty breathing or lung problems; delayed reaction time and memory difficulties; and possibly changes in the liver and kidneys	0.002588 ppm	0.001 – 0.01 ppm	0%
Formaldehyde ³ (VOC)	(ATSDR, 2016)	0.04 ppm	Nasal and eye irritation, neurological effects, and increased risk of asthma and/or allergy, gastrointestinal ulcers, liver and kidney damage; a known human carcinogen	0.013941 ppm	0.004 – 0.042 ppm	6%

³ Formaldehyde was measured using a 24-hour formaldehyde badge



AIR QUALITY

Table 4b: Outdoors-VOCs

Outdoor VOC Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average VOC Test Result	Result Range (Low-High) (n=17)	Percent Above Threshold
Benzene (VOC)	(ATSDR, 2016)	0.009 ppm	Drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects of the bone marrow, anemia and leukemia	0.001 ppm	0.001 ppm	0%
Toulene (VOC)	(ATSDR, 2016)	2 ppm	Cardiovascular and neurological effects such as tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, hearing and color vision loss	0.001235 ppm	0.001-0.004 ppm	0%
Hexane (VOC)	(ATSDR, 2016)	0.6 ppm	Nerve damage and paralysis of the arms and legs	0.001 ppm	0.001 ppm	0%
Ethylbenzene (VOC)	(ATSDR, 2016)	5 ppm	Eye and throat irritation. Exposure to higher levels may result in dizziness, decrease in developmental growth, and hearing loss	0.001 ppm	0.001 ppm	0%
m-p- Xylene(VOC)	(ATSDR, 2016)	2 ppm	High levels can cause headaches, lack of muscle coordination, dizziness, and confusion; skin, eyes, nose, and throat irritation; difficulty breathing or lung problems; delayed reaction time and memory difficulties; possible changes in liver and kidneys	0.002 ppm	0.002 ppm	0%
o- Xylene (VOC)	(ATSDR, 2016)	2 ppm	High levels can cause headaches, lack of muscle coordination, dizziness, and confusion; skin, eyes, nose, and throat irritation; difficulty breathing or lung problems; delayed reaction time and memory difficulties; possible changes in liver and kidneys	0.001 ppm	0.001 ppm	0%
Formaldehyde (VOC)	(ATSDR, 2016)	0.04 ppm	Nasal and eye irritation, neurological effects, and increased risk of asthma and/or allergy, gastrointestinal ulcers, liver and kidney damage; a known human carcinogen	0.004294 ppm	0.004 - 0.007 ppm	0%



Monitoring for Fine Particulate Matter (PM2.5)

Particle pollution, also called particulate matter or PM, is a mixture of solids and liquid droplets floating in the air. Homes were tested for fine particulate matter (PM2.5) which refers to the tiny size of the solid and liquid particles floating in the air. There are outdoor and indoor sources of fine particles. Outdoors, fine particles primarily come from vehicle exhausts and the burning of fuels. Some indoor sources of fine particles are tobacco smoke, cooking, burning candles, and operating fireplaces or other fuel burning appliances.

Dylos air quality monitors were placed inside and outside homes to provide fine particle monitoring for six days.

Table 5 shows the overall average level of PM2.5 detected at homes located near the proposed site both indoors and outdoors during the six-day testing period.

Table 5: Fine Particulate Matter

PM 2.5 Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average 6-Day Air Test Result (n=17)	Single Daily Result Range (Low-High)
Indoor PM 2.5	TBD	TBD	Irritation of the eyes, nose and throat, coughing, chest tightness and shortness of breath, reduced lung function, irregular heartbeat, asthma attacks, and heart attacks	155.7 µg/m ³	2.4 – 4,310.2 µg/m ³
Outdoor PM 2.5	(EPA, 2015)	TBD		120.06 µg/m ³	1.8 – 5,451.1 µg/m ³

Figure 1A on page 21 represents the average indoor PM2.5 readings taken every minute across four days, representing a 24 hour average by time. Figure 1B on page 22 represents the average outdoor PM2.5 readings taken every minute across four days, representing a 24 hour average by time.



Figure 1A. Indoors- PM2.5 Community Average, with readings collected every minute during four, 24-hour monitoring periods, averaged across each time period.

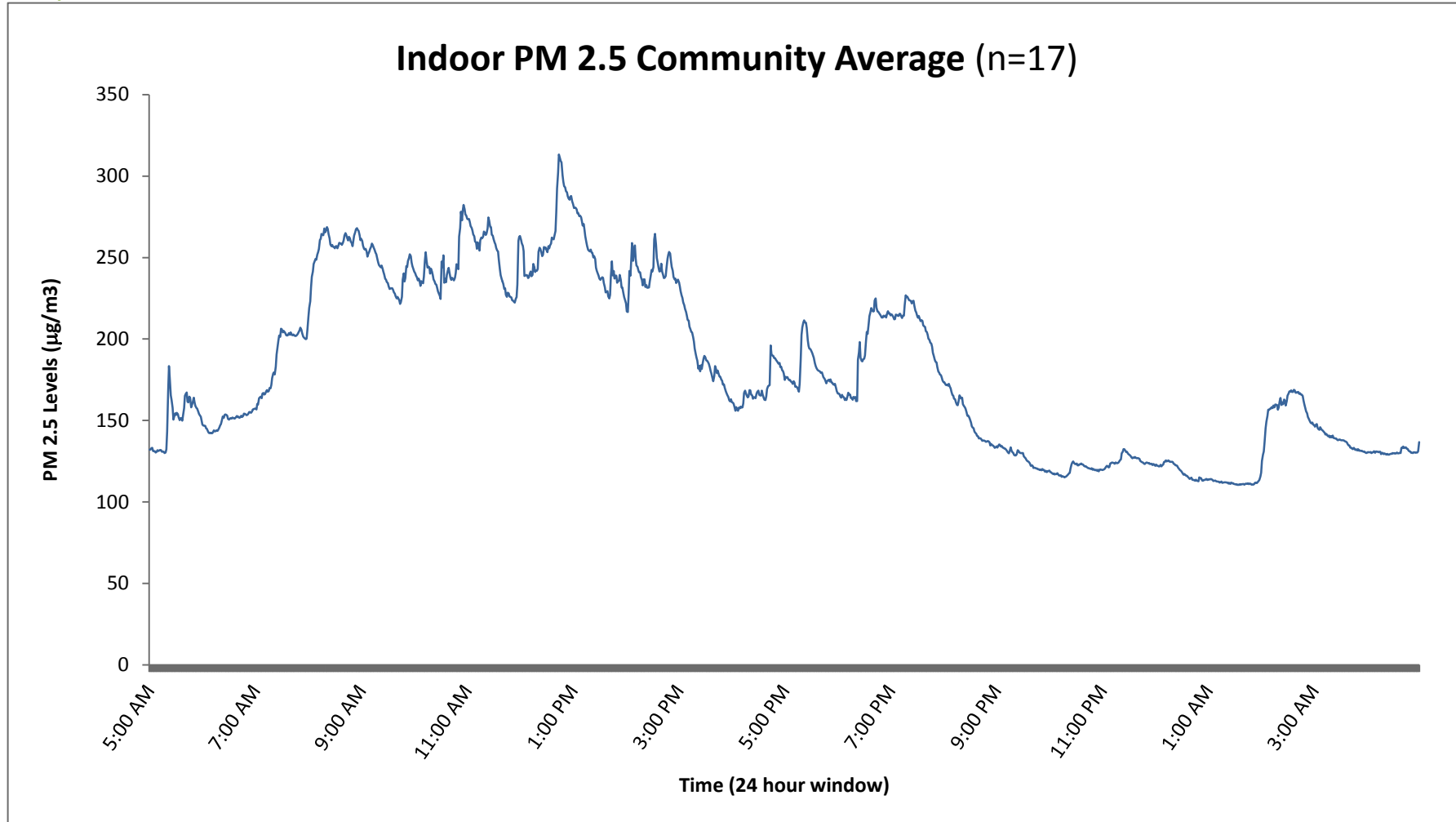
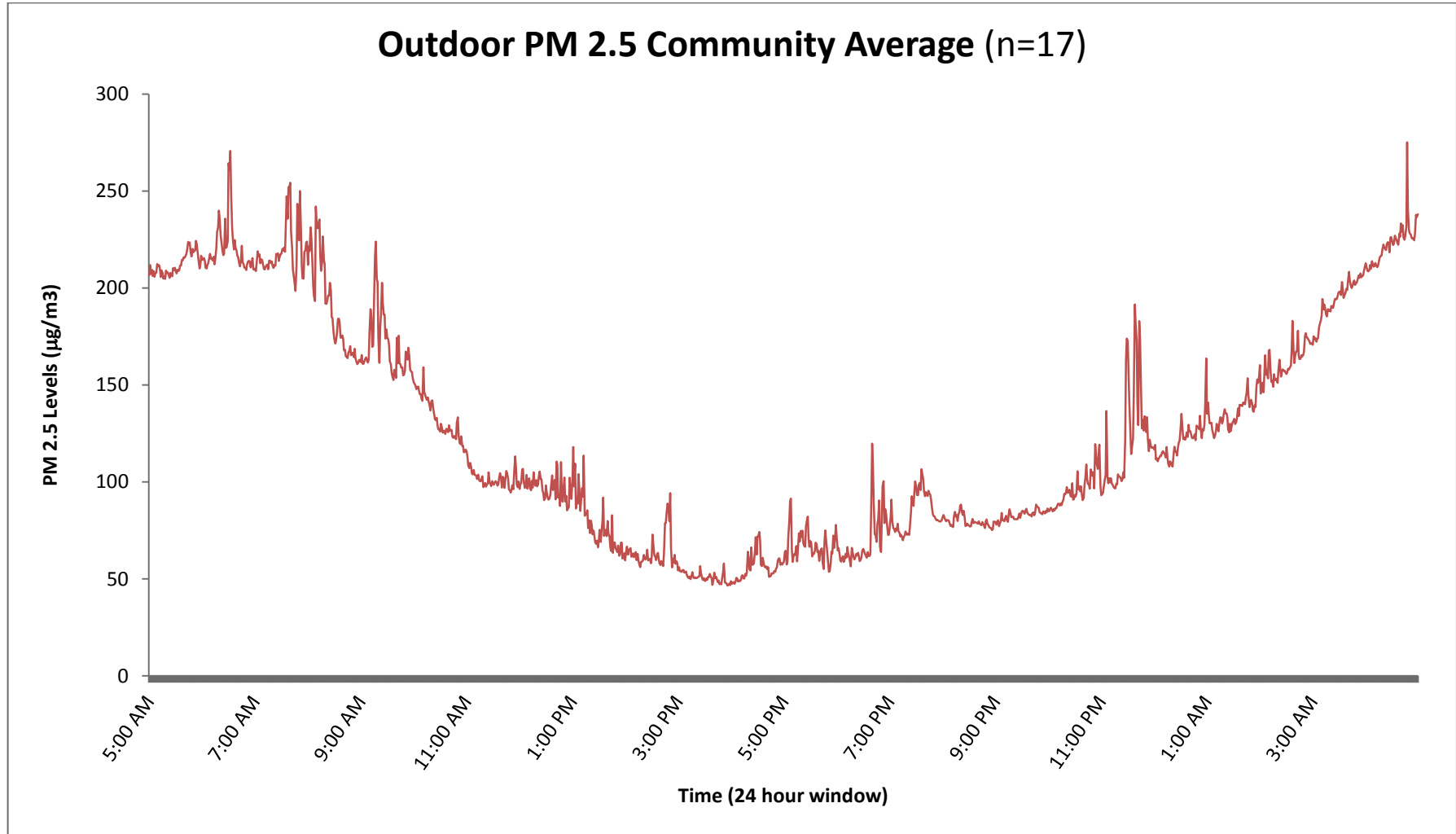


Figure 1B. Outdoors- PM_{2.5} Community Average, with readings collected every minute during four, 24-hour monitoring periods, averaged across each time period.






Extended Monitoring for Outdoor PM 2.5

The following outdoor PM_{2.5} was collected by Madison County Health Department in collaboration with the Southwest Pennsylvania Environmental Health Project (EHP). The EHP is conducting similar monitoring activities in other sites in New York and Pennsylvania using Speck Monitors. Speck monitors provided by EHP were run concurrently by Madison County Health Department staff and will be used for comparison with other PM_{2.5} data collected.

This section provides the additional outdoor PM_{2.5} data collected using the Speck monitors at three homes (**n=3**) near the proposed site during an extended monitoring period of approximately 30-32 days.

The figures (1C-G) shows the range of results for five components measured (Figure 1C-peaks per day, Fig. 1D-duration of peaks, Fig. 1E-time between peaks, Fig. 1F-baseline air quality, and Fig. 1G-accumulated particle matter) using Speck monitor data. The results are shown in relation to all the Speck monitor data reviewed so far at EHP.

Each dot  (see figures 1C-G), represents the averaged results for one Speck monitor over a 32-day period. For each result, except for time between peaks (figure E), the left side of the bar graph indicates a lower average score and the right side indicates a higher than average score. Take note that the duration of peaks (figure 1D) is the inverse of time between peaks, and a longer time between peaks would indicate less PM_{2.5} exposure; meaning that the lower the PM_{2.5}, the lower the chance of feeling or getting sick.

The results indicate overall good air quality in comparison to other results that the EHP has reviewed in both New York and Pennsylvania. This assessment is based on the relatively low baseline PM_{2.5} levels found and the low accumulated particle count. It is normal for peaks to occur occasionally, and there are many possible sources of peaks (see recommendations for home air quality on page 34 for more information).

Figure 1C. Peaks per day:

This bar graph shows the average number of large scale changes (peaks) in air quality per day recorded by each Speck over a 32-day period. These results range from about 2 - 4 peaks per day.

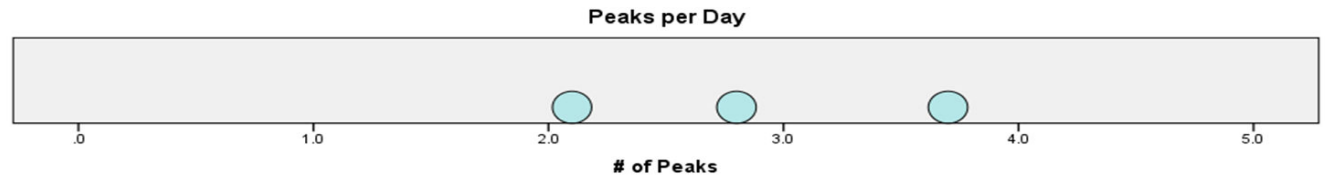


Figure 1D. Duration of peaks:

This bar graph shows the average length of time peaks lasted. These results show a range of slightly below average to above average: from about 24 - 31 minutes per peak.

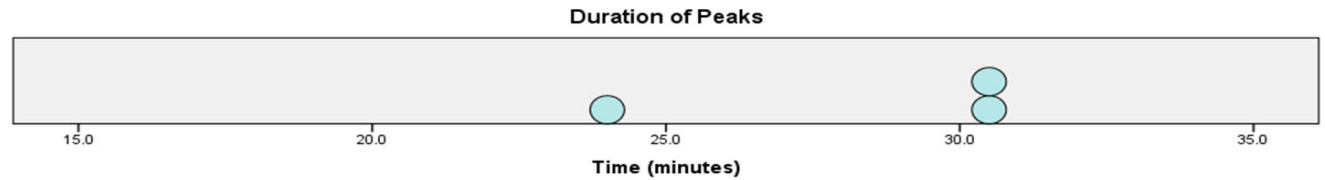


Figure 1E. Time between peaks:

This bar graph shows the average length of time between peaks. The fewer the number of peaks, the greater the time period between peaks. These results range from about 6-11 hours, lower than average to slightly above.

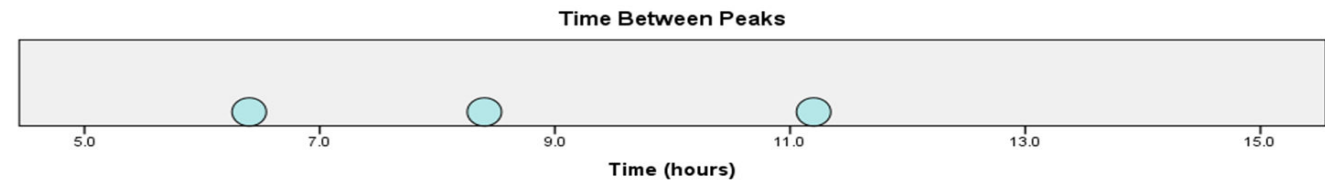


Figure 1F. Baseline air quality:

This bar graph shows the level of particles generally found outside when peaks are not occurring. These results show lower than average baseline outdoor air quality.

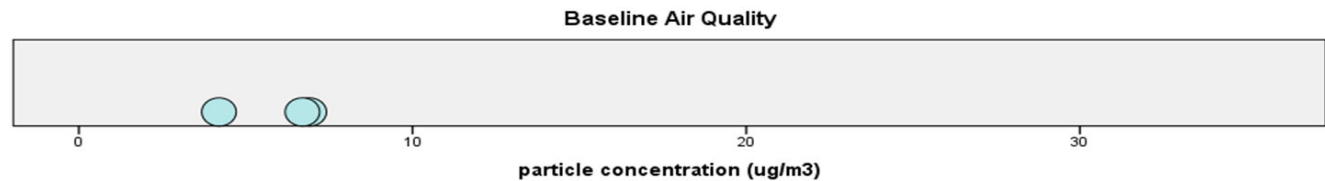
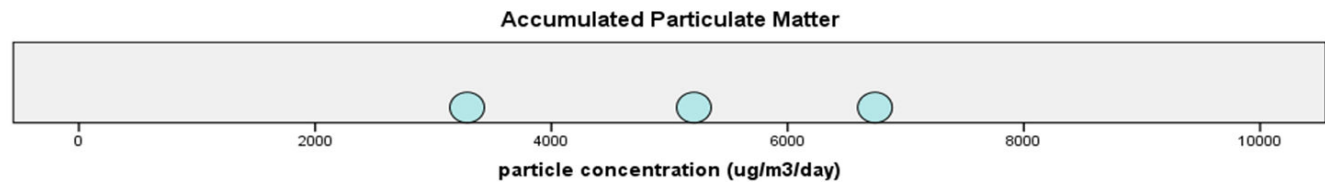


Figure 1G. Accumulated particle matter:

This bar graph shows the total sum of particle counts over the 32-day period for each outdoor Speck. These results show a range close to the average levels of accumulated PM2.5.





Monitoring for Methane

Methane is a component of natural gas. Methane gas has the potential to leak from facilities where natural gas is stored, compressed, or transported. A baseline methane survey was conducted to document typical local ambient air methane levels prior to construction and operation of the proposed compressor station and likely sources of any atypical methane concentrations within the study area.

Methane samples were collected from equipment mounted on a vehicle. Samples were collected along all roads within 1.25 miles of the proposed compressor station site location along with some additional surrounding areas (Figure 2). The methane survey was conducted on December 2, 2015, from noon to 6:30 pm.⁴

The methane data showed that over all 4 survey runs, the study area has an average methane concentration of 2.047 ppm (99% confidence interval 2.044 to 2.050 ppm). The survey runs, approximately 1 hour each, covered time intervals beginning at noon, 2:30, 3:40, and 5:50 PM.

The collected baseline methane data provided reasonable confirmation that methane levels in the study area display normal diurnal (daily) variations in methane concentration. The noon run had the highest average methane concentration at 2.096 ppm, which declined to 2.038 during the 2:30 run and 1.994 during the 3:40 PM run, rising again to 2.036 ppm during the 5:50 run. Methane concentrations in the study area and surrounding areas were consistent.

There were only 2 locations within the study area with notably elevated methane levels. The highest observed methane level was 3.29 ppm on Carpenter Road during the noon survey run (Figure 3). This elevated methane level appeared to be associated with a gas pipeline surface facility located just west (upwind) of Carpenter Road. However, the source of the methane causing this elevated methane level could not be confirmed as it occurred on only 1 of the 8 survey passes along Carpenter Road. It may have been due to a gas pressure vent or other brief operational release of gas from the pipeline facility.

⁴ *Gas Safety Incorporated* conducted the Methane Survey with the results provided in the December 2015 Report to Madison County, entitled "Ambient Air Methane Survey in the Vicinity of Dominion Transmission, Inc. Natural Gas Pipeline Compressor Station Proposed to be Constructed in the Town of Georgetown, Madison County, New York"

The next highest methane level, 2.72 ppm, occurred during the 2:30 survey run on Williams Road in the vicinity of an animal farm (Figure 4). The elevated levels were present only during one pass of the 2:30 survey run, but the methane levels in the area were also slightly elevated more broadly over the Williams Road area during both the other 2 runs (noon and 5:50). The slight elevations and extended area were coincident with the observed locations of animals during the survey, clearly indicating the animal farm operation was the methane source.

The methane levels in the study area were consistent and similar to other areas in southern New York away from recognizable methane sources (natural gas infrastructure, industrial facilities, landfills, other waste management facilities, wetlands, etc.). The time pattern of methane concentrations over the four survey runs was consistent with typical diurnal variations in ambient air methane concentrations. As shown by data for the only 2 locations in the study area with exceptional methane levels, sources as limited as a small number of cattle, or small, brief releases from natural gas infrastructure were rare, but distinguishable within the survey data. Any similar or larger methane emissions sources will be readily detected in future, similarly run methane surveys.

Table 6: Methane Gas

Methane Gas	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Test Result	Result Range (Low-High)	Percent Over Threshold
Methane in ambient air	TBD	TBD	Flammable; excessive levels inhaled in excess of 500,000 ppm may cause death	2.047 ppm	1.8 -3.29 ppm	TBD



 AIR QUALITY

Figure 2: Map of Methane Survey Area

Baseline methane survey (2 December 2015) of natural gas compressor station health impacts study area. Overhead view showing (red lines) road course of methane survey vehicle.

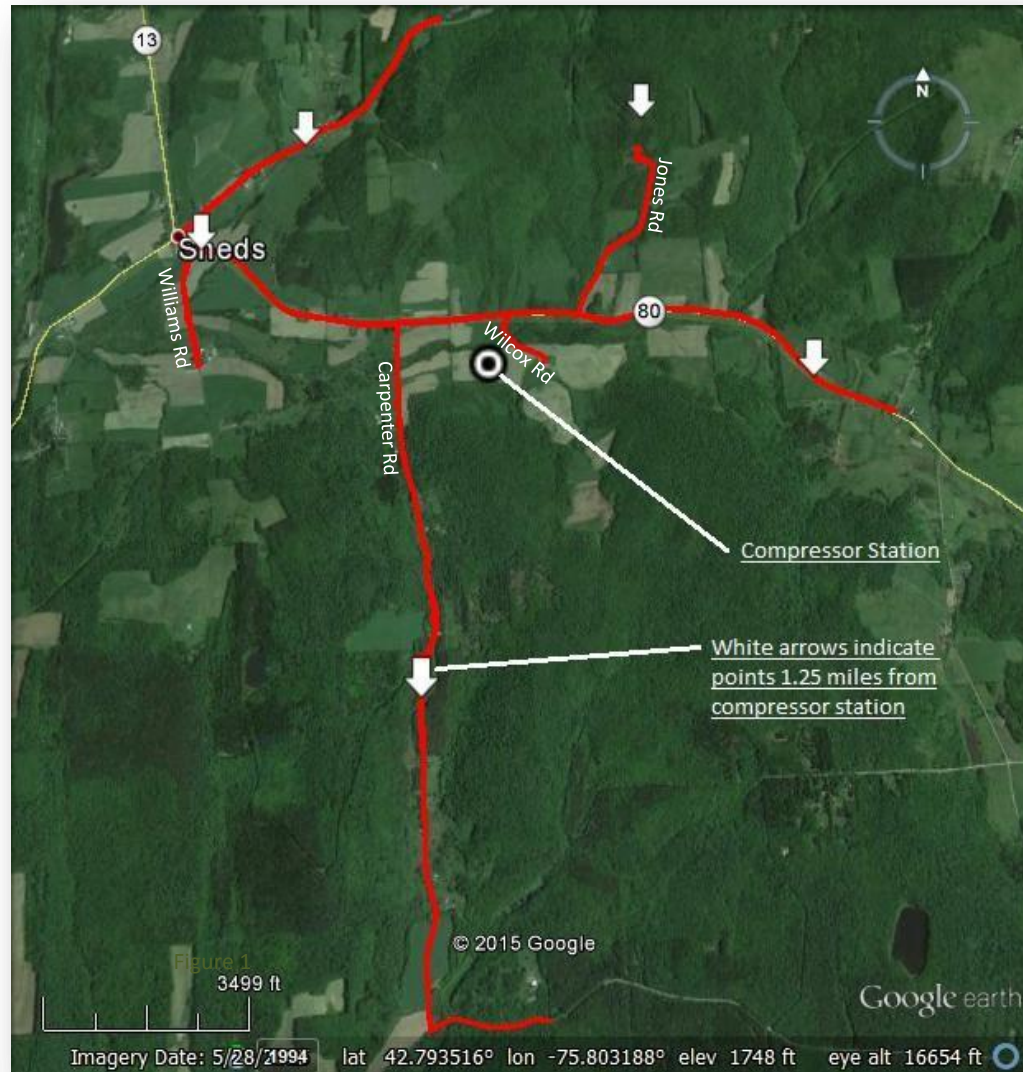


Figure 2

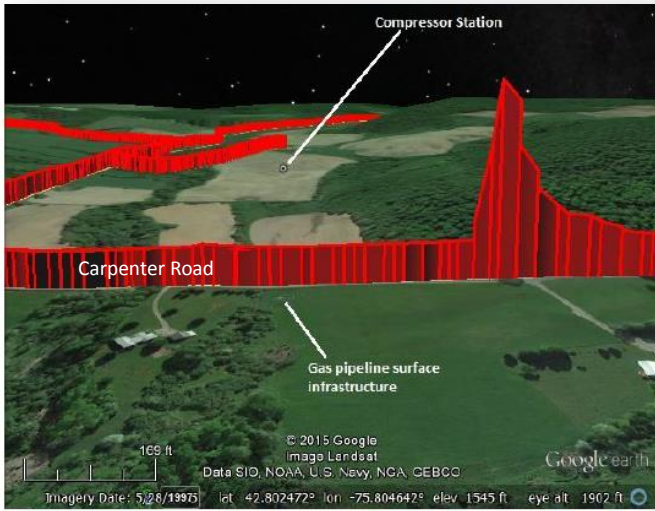


Figure 3

Figure 3. Highest Detected Methane Level.

Baseline methane survey (2 December 2015) of natural gas compressor station health impacts study area – highest methane level encountered, 3.29 ppm, probably due to emission from gas pipeline infrastructure on Carpenter Road. Methane measurement locations indicated by vertical red lines. Methane concentrations indicated by height of vertical red lines. Methane concentrations at bottom of all vertical lines is 1.80 ppm, top of most vertical lines 2.10 ppm, top of highest vertical line 3.29 ppm.

Figure 4. Second Highest Detected Methane Level.

Baseline methane survey (2 December 2015) of natural gas compressor station health impacts study area – 2nd highest methane level encountered, 2.72 ppm, associated with animal farm operation along Williams Road. Methane measurement locations indicated by vertical red lines. Methane concentrations indicated by height of vertical red lines. Methane concentrations at bottom of all vertical lines is 1.80 ppm, top of most vertical lines 2.04 ppm, top of highest vertical line 2.72 ppm.

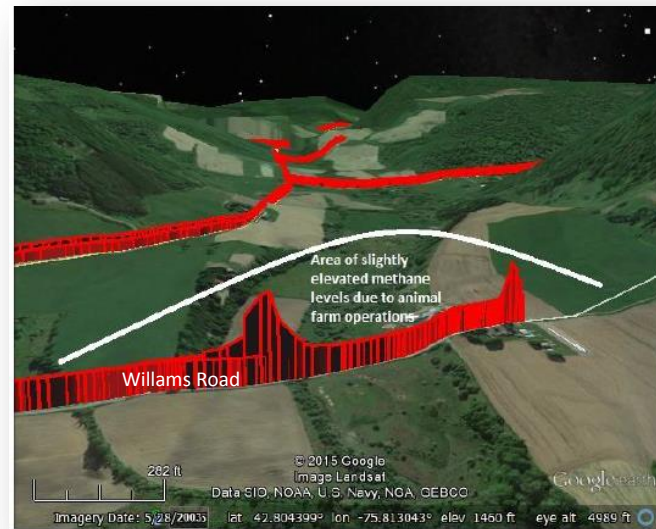


Figure 4



Monitoring for Radon

Radon is a cancer-causing radioactive gas that may be a problem in homes. Although the U.S. Environmental Protection Agency (U.S. EPA) believes that any exposure to radon carries some risk; no level is considered safe. The U.S. EPA recommends fixing a home to lower radon levels when test results are 4.0 picocuries per liter of air (pCi/L) or higher. Following the U.S. EPA guidance, a second follow-up test was recommended if a first result was 4.0 pCi/L or greater. When results were over 4.0 pCi/L, radon mitigation was recommended to lower the level of radon in a home.

A short-term charcoal radon detector from RTCA was deployed in each participating home for two to seven days; *table 7 shows the results.*

Table 7: Radon Indoors

Radon Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average First Floor Radon Test Result	Result Range (Low-High) (n=17)	Percent Over Threshold
Radon Indoors	(US EPA, 2012)	4.0 pCi/L	Long-term exposure increases risk of lung cancer	3.01 pCi/L (first floor)	0.1 – 13.3 pCi/L	29.4%



Monitoring for Hydrogen Sulfide

Hydrogen sulfide is a chemical that occurs naturally in natural gas and is associated with gas and oil operations, including gas compressor stations.

Hydrogen sulfide was measured using a badge monitor for 24 hours, indoors and outdoors; *table 8 shows the results.*

Table 8: Hydrogen Sulfide

Hydrogen Sulfide Gas Test Parameter	Threshold Source	Threshold to Consider Action	Potential Health Effects of Parameter	Average Test Result	Result Range (Low-High) (n=17)	Percent Over Threshold
Hydrogen Sulfide Indoors	ATSDR, 2016	.07 ppm	Eye irritation, headache, and fatigue at low levels. Poisonous, corrosive, flammable, and explosive at high levels	< 0.00062	< 0.00062 Below Detection Levels	0%
Hydrogen Sulfide Outdoors	ATSDR, 2016	TBD.07 ppm		< 0.00062	< 0.00062 Below Detection Levels	0%





NOISE MONITORING

Household Noise Levels

A sound becomes unwanted when it either interferes with normal activities such as sleeping or disrupts or diminishes one’s quality of life. Health problems related to unwanted noise exposure can occur and may include effects such as hearing loss, annoyance, stress, sleeplessness, hypertension, and cardiovascular disease.

Table 9 shows the average decibel ratings of some familiar sounds for comparison and how long it takes before a particular sound level becomes dangerous to the human ear. For example, without proper hearing protection, running a chain saw for only two minutes can become dangerous to the human ear.

Casella CEL-24X Series Sound Level Meters were used to collect 24-hours of noise data indoors and outdoors in June/July 2016.

Noise data was recorded every 10 seconds in decibels (dB). Noise meters were calibrated before placement in each home. Meters were set to measure A-weighted frequency and slow time weightings every 10 seconds. The meters only detect levels

down to 29 decibels and only record the level of sound in decibels; the meters used do not record sound for playback.

Table 9: Noise Levels of Familiar Sounds

Decibel Level (dB)	Average Noise Level by Activity (CDC, 2013)	Estimated Exposure Leading to Hearing Loss (CDC, 2013)	WHO Guidelines: Potential Critical Health Effects from Community Noise (WHO, 1999)	Community Noise Average (n=16)
30 dB	Library or inside bedroom at night	Hearing loss unlikely	May begin to cause sleep disturbance at night-time	Indoor LAeq 39 dB Outdoor LAeq 42 dB
50 dB	Outdoor living area	Hearing loss unlikely	May cause sleep disturbance and moderate annoyance to outdoor living, day & evening	
60 dB	Normal conversation or traffic	Hearing loss unlikely	May cause serious annoyance to outdoor living, day & evening	
75 dB	Vacuum	Hearing loss unlikely	May cause serious annoyance to outdoor living, day & evening; May cause hearing impairment	
85 dB	Garbage disposal	8 hrs	May cause hearing impairment	
88 dB	Power lawn mower	4 hrs	May cause hearing impairment	
91 dB	Food blender	2 hrs	May cause hearing impairment	
94 dB	Motorcycle	1 hr	May cause hearing impairment	
97 dB	Tractor	30 min.	May cause hearing impairment	
100 dB	Hand drill	15 min.	May cause hearing impairment	
103 dB	Impact wrench	7.5 min.	May cause hearing impairment	
106 dB	Spray painter	<4 min.	May cause hearing impairment	
109 dB	Chain saw	<2 min.	May cause hearing impairment	
112 dB	Rock band	<1 min.	May cause hearing impairment	
120 dB	Ambulance sirens	Immediate danger to hearing	May cause hearing impairment	
150 dB	Firecracker or firearms	Immediate danger to hearing	May cause hearing impairment	

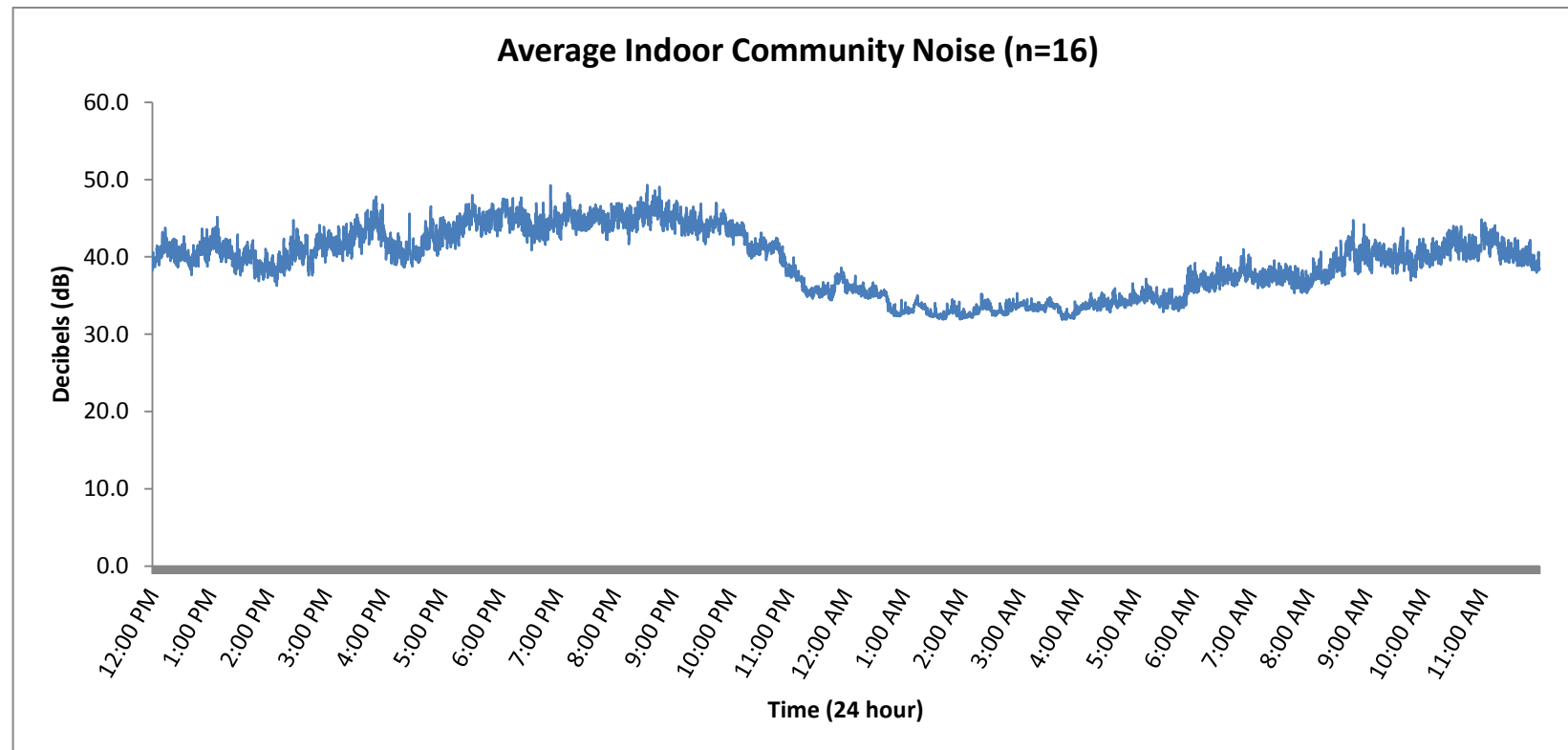
Noise-related metrics (L50, L90, LAeq, and Ldn) calculated at indoors and outdoors, are included in Table 10. The LAeq result is also included in Table 9 in the Analysis column. Figures 5A and 5B show 24-hour indoor and outdoor community noise levels averaged over 24 time points over varying days.

Table 10: Noise-related Metrics and Definitions

Noise Measurement	Indoor Community Average (n=16)	Outdoor Community Average (n=16)
L50	37 decibels	40 decibels
L90	33 decibels	34 decibels
LAeq	39 decibels	42 decibels
Ldn	46.9 decibels	48 decibels
Min	32 decibels	32 decibels
Max	50 decibels	50 decibels

Sound Level Statistic Definitions	
L50	The average background noise level exceeded 50% of the time
L90	The average background noise level exceeded 90% of the time
LAeq	The equivalent average sound level
Ldn	The average background noise level between the hours of 10 PM and 7 AM, with a 10 dB night-time penalty added, to reflect the impact of the noise.
Min	The lowest detectible noise level recorded during the monitoring period
Max	The highest detectible noise level recorded during the monitoring period

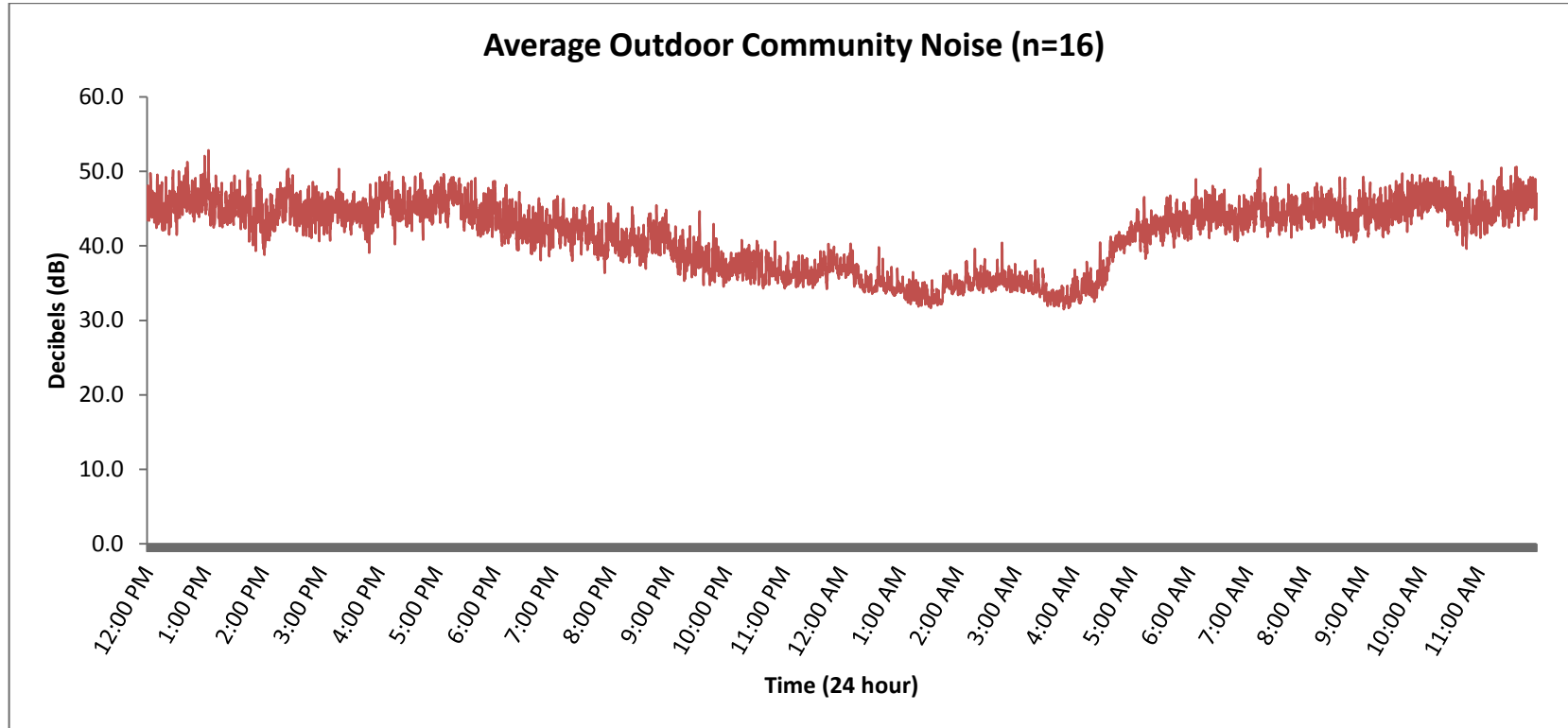
Figure 5A: Indoor community noise data from households averaged over 24 time points (distributed over a 24 hour monitoring period).





NOISE MONITORING

Figure 5B: Outdoor community noise data from households averaged over 24 time points (distributed over a 24 hour monitoring period).





HOME ENVIRONMENTAL ASSESSMENT

Home Environment and Health

Below is a descriptive list of by common conditions found in homes that are known to have the potential to impact air quality and health ([US HUD](#) and [US EPA](#)). The summary of the related responses provided from the self-administered home environmental assessment follow each list item below.

A. Pets and other animals can increase the amount of dust and dander in a home and trigger asthma and allergies. Other common triggers of asthma and allergies are: dust on carpets and other surfaces, mold, carbon monoxide from gas appliances or other fuel burning fireplaces or stoves, tobacco smoke, cleaning products like furniture polish or dusting sprays, personal care products like hair spray or perfume, and pests such as rodents, or dust mites.

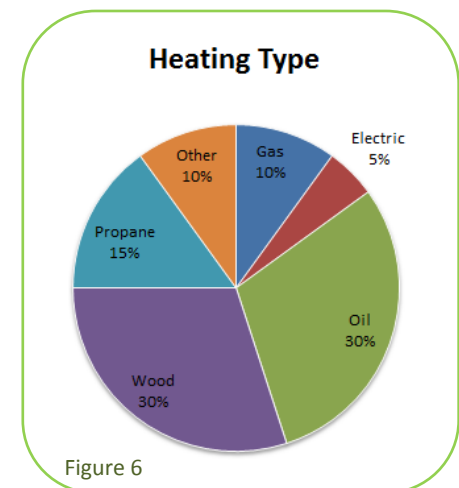
- 76% (13/17) of households reported having at least one pet.
- 18% (3/17) of households also reported having at least one farm animal.

B. Non-Vented Kitchens and Bathrooms may have poor ventilation and air circulation, which can increase moisture in a home and result in condensation and high humidity, mold, increase in odors, and an overall decrease in air quality. Symptoms associated with an increase in indoor moisture may include upper respiratory symptoms, cough, wheezing, and asthma.

- 71% (12/17) of households reported having a ventilated bathroom.
- 65% (11/17) of households reported having a ventilated kitchen.
- 13% (2/16) of households reported having had a mold problem.

C. Homes heating sources such as oil, kerosene, wood, propane, or coal add to the level of fine particulate matter in a home and the air, decreasing air quality which may affect health and lead to or trigger respiratory problems.

- The top three homes heating sources households reported was wood (30%), oil (30%), or propane (15%), see figure 6.
- 47% (8/17) of households reported having either a working gas or wood burning fireplace.





HOME ENVIRONMENTAL ASSESSMENT

- D. Carbon monoxide (CO) is an odorless gas that can be produced in homes with fuel burning appliances such as gas, oil or wood fuel-burning appliances and homes with a chimney. Exposure to CO gas may cause symptoms of headaches, dizziness, weakness, upset stomach, vomiting, chest pain, confusion, and death.
- 71% (12/17) of households reported having at least one gas appliance in their home.
 - 65% (11/17) of households reported having a carbon monoxide detector in their home.
- E. Radon is a cancer-causing, naturally occurring radioactive gas that may be present in homes, affected most by soil type and geology. Radon is the second leading cause of lung cancer in the U.S. today.
- 6% (1/17) of households reported having tested their home previously for radon.
 - 100% (17/17) of households have now had their homes tests for radon as part of this project's baseline monitoring. *The summary of radon results is on page 29 of this report.*
- F. Homes built before 1950 are most likely to have lead in paint and water pipes or have lead in the solder that joins pipes together. Risk of exposure to lead and lead poisoning is higher in older homes. Lead in household paint was banned in 1978, however many older homes still have lead in them. Lead is highly toxic and exposure through ingestion or inhalation may cause damage to the brain and nervous system, hearing loss, and learning and behavior problems.
- 19% (3/16) of households that responded reported that their home was built before 1970.



- G. Houses built between 1930 and 1950 are most likely to have asbestos as insulation. Asbestos materials in a home may become damaged over time. Damaged asbestos may release asbestos fibers and become a health hazard. Asbestos may also be present in textured paint and in patching compounds used on wall and ceiling joints. Their use was banned in 1977. Some roofing and siding shingles are made of asbestos cement. Artificial ashes and embers sold for use in gas-fired fireplaces may contain asbestos. Older products such as stove-top pads may have some asbestos compounds. Walls and floors around wood burning stoves may be protected with asbestos paper, millboard, or cement sheets. Asbestos is found in some vinyl floor tiles and the backing on vinyl sheet flooring and adhesives. Hot water and steam pipes in older houses may be coated with an asbestos material or covered with an asbestos blanket or tape. Oil and coal furnaces and door gaskets may have asbestos insulation. Breathing in asbestos can affect respiratory health and may lead to lung disease through long-term exposure.
- 100% (17/17) of households reported that no asbestos was known to be in their home.
- H. The use of pesticides or herbicides (bug or weed killers, flea or tick sprays, collars, powders, or shampoos) in a home, lawn, garden, or on pets may pose a health concern. Contact with pesticides or herbicides may cause skin or respiratory problems, or may increase the chance of accidental poisoning from ingestion when products are not used or stored properly.
- 50% (8/16) of households that responded reported having used pesticides or herbicides in their house or garden.
- I. New furniture, carpet, vinyl flooring or refinished furniture may contain high levels of formaldehyde, which is a chemical that is a known carcinogen (cancer-causing agent). Exposure to formaldehyde can lead to symptoms such as a sore throat, cough, scratchy eyes, and/or nosebleeds.
- 12% (2/17) of households reported having recently acquired new furniture, carpet, vinyl flooring or refinished furniture.
- J. Winterizing a home may increase efficiency of heating or cooling systems, but it also can prevent harmful gases from “leaking out” of the home. As such, winterized homes have the potential to increase both home radon levels and the levels of indoor air contaminants.
- 12% (2/17) of households reported recently winterizing their home.
 - 12% (2/17) of households also reported remodeling their home in the last six months.

ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
AQI	Air Quality Index (from the US EPA)
CDC	Centers for Disease Control and Prevention
cfu	colony forming units (also referred to as <i>colonies</i>)
dB	Decibel→noise quality measurement
EHP	Southwest Pennsylvania Environmental Health Project (EHP)
EPA	Environmental Protection Agency, of the United States
HUD	United States Department of Housing and Urban Development
MA DEP	Massachusetts Department of Environmental Protection
mL	milliliter
N	Total sample size (total number of participating households)
n	Subset of sample (number of households a data parameter is reported out for)
mg/L	Milligram per liter (equals ppm)
NYCRR	New York Compilation of the Rules and Regulations
NYS	New York State
NYSDOH	New York State Department of Health
ODH	Ohio Department of Health
ppm	Parts per million→air quality measurement (equals mg/L)
pCi/L	Pico curies per liter→water AND air quality measurement
TBD	To be determined
µg/l	Micrograms per liter→water quality measurement
µg/m ³	Micrograms per cubic meter→ air quality measurement
USGS	United States Geological Survey (of the United States Department of Interior)
µS/cm	Conductivity→water quality measurement
VOC	Volatile organic compound
WHO	World Health Organization

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