TCEQ Interoffice Memorandum

To: Tony Walker
Director, TCEQ Region 4, Dallas/Fort Worth
Alyssa Taylor
Air Section Manager, TCEQ Region 4, Dallas/Fort Worth

From: Tiffany Bredfeldt, Ph.D. TB
Toxicology Division, Chief Engineer's Office

Date: October 5, 2011

Subject: Toxicological Evaluation of Results from an Ambient Air Sample for Volatile Organic Compounds Collected at Latitude 32.4677850, Longitude -97.3097380, Downwind of the Devon Energy – TL Jones Gas Well Site near Cleburne, Johnson County, Texas

Sample Collected on June 23, 2011, ACL 1107001 (Lab Sample 1107001-001)

Key Points

- Reported concentrations of target volatile organic compounds (VOCs) were either not detected or were detected below levels of short-term health and/or welfare concern.

Background

On June 23, 2011, a Texas Commission on Environmental Quality (TCEQ) Region 4 Air Investigator collected a 30-minute canister sample (Lab Sample 1107001-001) downwind of the Devon Energy – TL Jones Gas Well Site near Cleburne, Johnson County, Texas (Latitude 32.4677850, Longitude -97.3097380). The sample was collected in response to a citizen complaint of a chemical odor. The responding investigator did not observe odors or experience adverse health effects during the sampling event. Meteorological conditions measured at the site or nearest stationary ambient air monitoring site indicated that the ambient temperature was 93°F with a relative humidity of 38.6%, and winds were from the southeast at 3 miles per hour. The sampling site was approximately 101 to 300 feet downwind of the facility. The nearest location where the public could have access was less than 100 feet from the possible source and/or the facility. The sample was sent to the TCEQ laboratory in Austin, Texas, and analyzed for a range of VOCs. The list of the target analytes that were evaluated in this review are provided in Attachment A. The VOC concentrations were reported in parts per billion by volume (ppb_v) (Attachment B and Table 1). Please note that the available canister technology and analysis method cannot capture and/or analyze for all chemicals.

Results and Evaluation

Reported VOC concentrations were compared to TCEQ's short-term health- and/or welfare-based air monitoring comparison values (AMCVs) (Table 1). Short-term AMCVs are guidelines used to evaluate ambient concentrations of a chemical in air and to determine its potential to result in adverse health effects, adverse vegetative effects, or odors. Health AMCVs are set to provide a margin of safety and are set well below levels at which adverse health effects are reported in the scientific literature. If a chemical concentration in ambient air is less than its comparison value, no adverse health effects are expected to occur. If a chemical concentration exceeds its comparison value it does not necessarily mean that adverse effects will occur, but rather that further evaluation is warranted.

All of the 84 VOCs were either not detected or were detected below their respective short-term AMCVs. Exposure to levels of VOCs measured in this sample would not be expected to cause short-term adverse health effects, adverse vegetative effects, or odors.

Please call me at (512) 239-1799 if you have any questions regarding this evaluation.

Attachment A

List of Target Analytes for Canister Samples

ethane	4-methyl-1-pentene	t-1,3-dichloropropylene
ethylene	1,1-dichloroethane	1,1,2-trichloroethane
acetylene	cyclopentane	2,3,4-trimethylpentane
propane	2,3-dimethylbutane	toluene
propylene	2-methylpentane	2-methylheptane
dichlorodifluoromethane	3-methylpentane	3-methylheptane
methyl chloride	2-methyl-1-pentene + 1-hexene	1,2-dibromoethane
isobutane	n-hexane	n-octane
vinyl chloride	chloroform	tetrachloroethylene
1-butene	t-2-hexene	chlorobenzene
1,3-butadiene	c-2-hexene	ethylbenzene
n-butane	1,2-dichloroethane	m & p-xylene
t-2-butene	methylcyclopentane	styrene
bromomethane	2,4-dimethylpentane	1,1,2,2-tetrachloroethane
c-2-butene	1,1,1-trichloroethane	o-xylene
3-methyl-1-butene	benzene	n-nonane
isopentane	carbon tetrachloride	isopropylbenzene
trichlorofluoromethane	cyclohexane	n-propylbenzene
1-pentene	2-methylhexane	m-ethyltoluene
n-pentane	2,3-dimethylpentane	p-ethyltoluene
isoprene	3-methylhexane	1,3,5-trimethylbenzene
t-2-pentene	1,2-dichloropropane	o-ethyltoluene
1,1-dichloroethylene	trichloroethylene	1,2,4-trimethylbenzene
c-2-pentene	2,2,4-trimethylpentane	n-decane
methylene chloride	2-chloropentane	1,2,3-trimethylbenzene
2-methyl-2-butene	n-heptane	m-diethylbenzene
2,2-dimethylbutane	c-1,3-dichloropropylene	p-diethylbenzene
cyclopentene	methylcyclohexane	n-undecane

Attachment B

7/12/2011

Texas Commission on Environmental Quality

Laboratory and Quality Assurance Section
P.O. Box 13087, MC-165
Austin, Texas 78711-3087
(512) 239-1716

Laboratory Analysis Results
ACL Number: 1107001

ACL Lead: David Manis Region: T04 Date Received: 7/1/2011
Project(s): Barnett Shale

Facility(ies) Sampled	City	County	Facility Type
Devon Energy	Cleburne	Johnson	

Laboratory Procedure(s) Performed:

Analysis: AMOR006
Determination of VOC Canisters by GC/MS Using Modified Method TO-15
Procedure:
Prior to analysis, subatmospheric samples are pressurized to twice the collected volume using a sample dilution system. For analysis, a known volume of a sample is directed from the canister into a multitrap cryogenic concentrator. Internal standards are added to the sample stream prior to the trap. The concentrated sample is thermally desorbed and carried onto a GC column for separation. The analytical strategy involves using a GC with dual columns that are coupled to a mass selective detector (MSD) and a flame ionization detector (FID). Mass spectra for individual peaks in the total ion chromatogram are then used for target compound identification and quantitation. The fragmentation pattern is compared with stored spectra taken under similar conditions in order to identify the compound. For any given compound, the intensity of the quantitation fragment is compared with the system response to the fragment for known amounts of the compound. This establishes the compound concentration in the sample. For non-target compound peaks which are at least one-half the height of the internal standard, a library search is performed in an attempt to identify the compound solely upon fracture patterns. These tentatively identified compounds (TIC's) are reported as a sample specific footnote. Accurate quantitation of TICs is not possible. The FID is used for the quantitation of ethane, ethylene, acetylene, propylene and propane and identification is based on matching retention times of standards containing known analytes.

Sample(s) Received

Field ID Number: N1097 Laboratory Sample Number: 1107001-001 Sampled by: Brian Yerkes
Sampling Site: TL Jones Gas Well Date & Time Sampled: 06/23/11 15:10:00 Valid Sample: Yes
Comments:
Canister N1097 was used to collect a 30-minute sample using OFC-059.

Please note that this analytical technique is not capable of measuring all compounds which might have adverse health effects. For questions on the analytical procedures please contact the laboratory manager at (512) 239-4894. For an update on the health effects evaluation of these data, please contact the Toxicology Division at (512) 239-1795.

Analyst: Jaydeep Patel Date: 07/12/11
Jaydeep Patel

Reviewed By: David Manis Date: 7/14/11
David Manis (Acting)

Technical Specialist: David Manis Date: 7/14/11
David Manis

Laboratory Analysis Results

ACL Number: 1107001

Analysis Code: AMOR006

Note: Results are reported in units of parts per billion by volume (ppbv)

Lab ID		1107001-001					
Field ID		N1097					
Canister ID		N1097					
Analysis Date		07/07/11					
Compound	LOD	Concentration	SDL	Flags**	Concentration	SDL	Flags**
ethane	0.50	280	1.0	T,D1			
ethylene	0.50	0.27	1.0	J,T,D1			
acetylene	0.50	ND	1.0	T,D1			
propane	0.50	8.2	1.0	T,D1			
propylene	0.50	ND	1.0	T,D1			
dichlorodifluoromethane	0.20	0.52	0.40	L,D1			
methyl chloride	0.20	0.61	0.40	L,D1			
isobutane	0.23	0.26	0.46	J,D1			
vinyl chloride	0.17	ND	0.34	D1			
1-butene	0.20	ND	0.40	D1			
1,3-butadiene	0.27	ND	0.54	D1			
n-butane	0.20	0.57	0.40	L,D1			
t-2-butene	0.18	ND	0.36	D1			
bromomethane	0.27	ND	0.54	D1			
c-2-butene	0.27	ND	0.54	D1			
3-methyl-1-butene	0.23	ND	0.46	D1			
isopentane	0.27	ND	0.54	D1			
trichlorofluoromethane	0.29	0.23	0.58	J,D1			
1-pentene	0.27	ND	0.54	D1			
n-pentane	0.27	ND	0.54	D1			
isoprene	0.27	1.6	0.54	D1			
t-2-pentene	0.27	ND	0.54	D1			
1,1-dichloroethylene	0.18	ND	0.36	D1			
c-2-pentene	0.25	ND	0.50	D1			
methylene chloride	0.14	ND	0.28	D1			
2-methyl-2-butene	0.23	ND	0.46	D1			
2,2-dimethylbutane	0.21	ND	0.42	D1			
cyclopentene	0.20	ND	0.40	D1			
4-methyl-1-pentene	0.22	ND	0.44	D1			
1,1-dichloroethane	0.19	ND	0.38	D1			
cyclopentane	0.27	ND	0.54	D1			
2,3-dimethylbutane	0.28	ND	0.56	D1			
2-methylpentane	0.27	ND	0.54	D1			
3-methylpentane	0.23	ND	0.46	D1			
2-methyl-1-pentene + 1-hexene	0.20	ND	0.40	D1			
n-hexane	0.20	ND	0.40	D1			
chloroform	0.21	ND	0.42	D1			
t-2-hexene	0.27	ND	0.54	D1			
c-2-hexene	0.27	ND	0.54	D1			
1,2-dichloroethane	0.27	ND	0.54	D1			
methylcyclopentane	0.27	ND	0.54	D1			
2,4-dimethylpentane	0.27	ND	0.54	D1			
1,1,1-trichloroethane	0.26	ND	0.52	D1			
benzene	0.27	0.09	0.54	J,D1			
carbon tetrachloride	0.27	ND	0.54	D1			
cyclohexane	0.24	ND	0.48	D1			
2-methylhexane	0.27	ND	0.54	D1			
2,3-dimethylpentane	0.26	ND	0.52	D1			

Laboratory Analysis Results

ACL Number: 1107001

Analysis Code: AMOR006

Note: Results are reported in units of parts per billion by volume (ppbv)

Lab ID		1107001-001					
Compound	LOD	Concentration	SDL	Flags**	Concentration	SDL	Flags**
3-methylhexane	0.20	ND	0.40	D1			
1,2-dichloropropane	0.17	ND	0.34	D1			
trichloroethylene	0.29	ND	0.58	D1			
2,2,4-trimethylpentane	0.24	ND	0.48	D1			
2-chloropentane	0.27	ND	0.54	D1			
n-heptane	0.25	ND	0.50	D1			
c-1,3-dichloropropylene	0.20	ND	0.40	D1			
methylcyclohexane	0.26	ND	0.52	D1			
t-1,3-dichloropropylene	0.20	ND	0.40	D1			
1,1,2-trichloroethane	0.21	ND	0.42	D1			
2,3,4-trimethylpentane	0.24	ND	0.48	D1			
toluene	0.27	ND	0.54	D1			
2-methylheptane	0.20	ND	0.40	D1			
3-methylheptane	0.23	ND	0.46	D1			
1,2-dibromoethane	0.20	ND	0.40	D1			
n-octane	0.19	ND	0.38	D1			
tetrachloroethylene	0.24	ND	0.48	D1			
chlorobenzene	0.27	ND	0.54	D1			
ethylbenzene	0.27	0.04	0.54	J,D1			
m & p-xylene	0.27	0.01	0.54	J,D1			
styrene	0.27	ND	0.54	D1			
1,1,2,2-tetrachloroethane	0.20	ND	0.40	D1			
o-xylene	0.27	ND	0.54	D1			
n-nonane	0.22	ND	0.44	D1			
isopropylbenzene	0.24	ND	0.48	D1			
n-propylbenzene	0.27	ND	0.54	D1			
m-ethyltoluene	0.11	ND	0.22	D1			
p-ethyltoluene	0.16	ND	0.32	D1			
1,3,5-trimethylbenzene	0.25	ND	0.50	D1			
o-ethyltoluene	0.13	ND	0.26	D1			
1,2,4-trimethylbenzene	0.27	ND	0.54	D1			
n-decane	0.27	ND	0.54	D1			
1,2,3-trimethylbenzene	0.27	ND	0.54	D1			
m-diethylbenzene	0.27	ND	0.54	D1			
p-diethylbenzene	0.27	ND	0.54	D1			
n-undecane	0.27	ND	0.54	D1			

Laboratory Analysis Results

ACL Number: 1107001

Analysis Code: AMOR006

Laboratory Analysis Results
ACL Number: 1107001
Analysis Code: AMOR006

Quality Control Notes:

D1-sample concentration was calculated using a dilution factor of 4.00

TCEQ laboratory customer support may be reached at kbachtel@tceq.state.tx.us

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Table 1. Comparison of Monitored Concentrations in Lab Sample 1107001-001 to TCEQ Short-Term AMCVs

Lab Sample ID	1107001-001					
Compound	**Odor AMCV (ppb_v)**	**Short-Term Health AMCV (ppb_v)**	**LOD (ppb_v)**	**Concentrations (ppb_v)**	**Flags**	**SDL (ppb_v)**
1,1,1-Trichloroethane	380,000	1,700	0.26	ND	D1	0.52
1,1,2,2-Tetrachloroethane	7,300	10	0.2	ND	D1	0.4
1,1,2-Trichloroethane	Not Available	100	0.21	ND	D1	0.42
1,1-Dichloroethane	110,000	1,000	0.19	ND	D1	0.38
1,1-Dichloroethylene	Not Available	180	0.18	ND	D1	0.36
1,2,3-Trimethylbenzene	Not Available	250	0.27	ND	D1	0.54
1,2,4-Trimethylbenzene	Not Available	250	0.27	ND	D1	0.54
1,2-Dibromoethane	10,000	0.5	0.2	ND	D1	0.4
1,2-Dichloroethane	6,000	40	0.27	ND	D1	0.54
1,2-Dichloropropane	250	100	0.17	ND	D1	0.34
1,3,5-Trimethylbenzene	Not Available	250	0.25	ND	D1	0.5
1,3-Butadiene	230	1,700	0.27	ND	D1	0.54
1-Butene	360	50,000	0.2	ND	D1	0.4
1-Pentene	100	2,600	0.27	ND	D1	0.54
2,2,4-Trimethylpentane	Not Available	750	0.24	ND	D1	0.48
2,2-Dimethylbutane (Neohexane)	Not Available	1,000	0.21	ND	D1	0.42
2,3,4-Trimethylpentane	Not Available	750	0.24	ND	D1	0.48
2,3-Dimethylbutane	Not Available	990	0.28	ND	D1	0.56
2,3-Dimethylpentane	Not Available	850	0.26	ND	D1	0.52
2,4-Dimethylpentane	290,000	850	0.27	ND	D1	0.54
2-Chloropentane (as chloroethane)	Not Available	190	0.27	ND	D1	0.54
2-Methyl-1-Pentene +1-Hexene	20	500	0.2	ND	D1	0.4
2-Methyl-2-Butene	250	500	0.23	ND	D1	0.46
2-Methylheptane	Not Available	750	0.2	ND	D1	0.4

Lab Sample ID	1107001-001					
Compound	**Odor AMCV (ppb_v)**	**Short-Term Health AMCV (ppb_v)**	**LOD (ppb_v)**	**Concentrations (ppb_v)**	**Flags**	**SDL (ppb_v)**
2-Methylhexane	Not Available	750	0.27	ND	D1	0.54
2-Methylpentane (Isohexane)	83	1,000	0.27	ND	D1	0.54
3-Methyl-1-Butene	250	8,000	0.23	ND	D1	0.46
3-Methylheptane	Not Available	750	0.23	ND	D1	0.46
3-Methylhexane	Not Available	750	0.2	ND	D1	0.4
3-Methylpentane	Not Available	1000	0.23	ND	D1	0.46
4-Methyl-1-Pentene (as hexene)	20	500	0.22	ND	D1	0.44
Acetylene	620000	25000	0.5	ND	T,D1	1
Benzene	2700	180	0.27	0.09	J,D1	0.54
Bromomethane (methyl bromide)	21000	30	0.27	ND	D1	0.54
c-1,3-Dichloropropylene	Not Available	10	0.2	ND	D1	0.4
c-2-Butene	2100	15000	0.27	ND	D1	0.54
c-2-Hexene	Not Available	500	0.27	ND	D1	0.54
c-2-Pentene	Not Available	2600	0.25	ND	D1	0.5
Carbon Tetrachloride	97000	20	0.27	ND	D1	0.54
Chlorobenzene (phenyl chloride)	210	100	0.27	ND	D1	0.54
Chloroform (trichloromethane)	85,000	20	0.21	ND	D1	0.42
Cyclohexane	420	1,000	0.24	ND	D1	0.48
Cyclopentane	Not Available	1,200	0.27	ND	D1	0.54
Cyclopentene	Not Available	2,900	0.2	ND	D1	0.4
Dichlorodifluoromethane	Not Available	10,000	0.2	0.52	L,D1	0.4
Ethane	180,000	Simple Asphyxiant*	0.5	280	T,D1	1
Ethylbenzene	170	20,000	0.27	0.04	J,D1	0.54
Ethylene	270,000	500,000	0.5	0.27	J,T,D1	1
Isobutane	2,040	8,000	0.23	0.26	J,D1	0.46
Isopentane (2-methylbutane)	1,300	68,000	0.27	ND	D1	0.54

Lab Sample ID	1107001-001					
Compound	**Odor AMCV (ppb_v)**	**Short-Term Health AMCV (ppb_v)**	**LOD (ppb_v)**	**Concentrations (ppb_v)**	**Flags**	**SDL (ppb_v)**
Isoprene	5	20	0.27	1.6	D1	0.54
Isopropylbenzene (cumene)	100	500	0.24	ND	D1	0.48
m & p-Xylene (as mixed isomers)	80	1,700	0.27	0.01	J,D1	0.54
m-Diethylbenzene	70	460	0.27	ND	D1	0.54
Methyl Chloride (chloromethane)	Not Available	500	0.2	0.61	L,D1	0.4
Methylcyclohexane	150	4,000	0.26	ND	D1	0.52
Methylcyclopentane	1,700	750	0.27	ND	D1	0.54
Methylene Chloride (dichloromethane)	160,000	3,500	0.14	ND	D1	0.28
m-Ethyltoluene	18	250	0.11	ND	D1	0.22
n-Butane	1,200,000	8,000	0.2	0.57	L,D1	0.4
n-Decane	620	1,750	0.27	ND	D1	0.54
n-Heptane	670	850	0.25	ND	D1	0.5
n-Hexane	1,500	1,800	0.2	ND	D1	0.4
n-Nonane	2,200	2,000	0.22	ND	D1	0.44
n-Octane	1,700	750	0.19	ND	D1	0.38
n-Pentane	1,400	68,000	0.27	ND	D1	0.54
n-Propylbenzene	3.8	250	0.27	ND	D1	0.54
n-Undecane	Not Available	550	0.27	ND	D1	0.54
o-Ethyltoluene	Not Available	250	0.13	ND	D1	0.26
o-Xylene	380	1,700	0.27	ND	D1	0.54
p-Diethylbenzene	0.39	460	0.27	ND	D1	0.54
p-Ethyltoluene	8.3	250	0.16	ND	D1	0.32
Propane	1,500,000	Simple Asphyxiant*	0.5	8.2	T,D1	1
Propylene	13,000	Simple Asphyxiant*	0.5	ND	T,D1	1
Styrene	25	5,100	0.27	ND	D1	0.54
t-1,3-Dichloropropylene	Not Available	10	0.2	ND	D1	0.4

Lab Sample ID	1107001-001					
Compound	**Odor AMCV (ppb_v)**	**Short-Term Health AMCV (ppb_v)**	**LOD (ppb_v)**	**Concentrations (ppb_v)**	**Flags**	**SDL (ppb_v)**
t-2-Butene	2,100	15,000	0.18	ND	D1	0.36
t-2-Hexene	Not Available	500	0.27	ND	D1	0.54
t-2-Pentene	Not Available	2,600	0.27	ND	D1	0.54
Tetrachloroethylene	770	1,000	0.24	ND	D1	0.48
Toluene	170	4,000	0.27	ND	D1	0.54
Trichloroethylene	3,900	100	0.29	ND	D1	0.58
Trichlorofluoromethane	5,000	10,000	0.29	0.23	J,D1	0.58
Vinyl Chloride	Not Available	26,000	0.17	ND	D1	0.34

*A simple asphyxiant displaces air, lowering the partial pressure of oxygen and causing hypoxia at sufficiently high concentrations.
ppbv - Parts per billion by volume.
ND - Not detected.
NQ - Concentration can not be quantified.
LOD - Limit of detection.
SDL - Sample Detection Limit (LOD adjusted for dilutions).
INV - Invalid.
J - Reported concentration is below SDL.
L - Reported concentration is at or above the SDL and is below the lower limit of quantitation.
E - Reported concentration exceeds the upper limit of instrument calibration.
M - Result modified from previous result.
T - Data was not confirmed by a confirmational analysis. Data is tentatively identified.
D1 - Sample concentration was calculated using a dilution factor of 4.00.

Table 2. TCEQ Long-Term Air Monitoring Comparison Values (AMCVs)

Please Note: The long-term AMCVs are provided for informational purposes only because it is scientifically inappropriate to compare short-term monitored values to the long-term AMCV.

Compound	Long-Term Health AMCV (ppb_v)	Compound	Long-Term Health AMCV (ppb_v)
1,1,1-Trichloroethane	940	Cyclopentane	120
1,1,2,2-Tetrachloroethane	1	Cyclopentene	290
1,1,2-Trichloroethane	10	Dichlorodifluoromethane	1,000
1,1-Dichloroethane	100	Ethane	Simple Asphyxiant*
1,1-Dichloroethylene	86	Ethylbenzene	450
1,2,3-Trimethylbenzene	25	Ethylene**	5,300
1,2,4-Trimethylbenzene	25	Isobutane	800
1,2-Dibromoethane	0.05	Isopentane (2-methylbutane)	8,000
1,2-Dichloroethane	1	Isoprene	2
1,2-Dichloropropane	10	Isopropylbenzene (cumene)	50
1,3,5-Trimethylbenzene	25	m & p-Xylene (as mixed isomers)	140
1,3-Butadiene	9.1	m-Diethylbenzene	46
1-Butene	Not Available	Methyl Chloride (chloromethane)	50
1-Pentene	Not Available	Methylcyclohexane	400
2,2,4-Trimethylpentane	75	Methylcyclopentane	75
2,2-Dimethylbutane (Neohexane)	100	Methylene Chloride (dichloromethane)	100
2,3,4-Trimethylpentane	75	m-Ethyltoluene	25
2,3-Dimethylbutane	99	n-Butane	800
2,3-Dimethylpentane	85	n-Decane	175
2,4-Dimethylpentane	85	n-Heptane	85
2-Chloropentane (as chloroethane)	19	n-Hexane	190
2-Methyl-1-Pentene +1-Hexene	50	n-Nonane	200

Compound	Long-Term Health AMCV (ppb_v)	Compound	Long-Term Health AMCV (ppb_v)
2-Methyl-2-Butene	50	n-Octane	75
2-Methylheptane	75	n-Pentane	8,000
2-Methylhexane	75	n-Propylbenzene	25
2-Methylpentane (Isohexane)	100	n-Undecane	55
3-Methyl-1-Butene	800	o-Ethyltoluene	25
3-Methylheptane	75	o-Xylene	140
3-Methylhexane	75	p-Diethylbenzene	46
3-Methylpentane	100	p-Ethyltoluene	25
4-Methyl-1-Pentene (as hexene)	50	Propane	Simple Asphyxiant*
Acetylene	2,500	Propylene	Simple Asphyxiant*
Benzene	1.4	Styrene	110
Bromomethane (methyl bromide)	3	t-1,3-Dichloropropylene	1
c-1,3-Dichloropropylene	1	t-2-Butene	Not Available
c-2-Butene	Not Available	t-2-Hexene	50
c-2-Hexene	50	t-2-Pentene	Not Available
c-2-Pentene	Not Available	Tetrachloroethylene***	3.8
Carbon Tetrachloride	2	Toluene	1,100
Chlorobenzene (phenyl chloride)	10	Trichloroethylene	10
Chloroform (trichloromethane)	2	Trichlorofluoromethane	1,000
Cyclohexane	100	Vinyl Chloride	0.45

*A simple asphyxiant displaces air, lowering the partial pressure of oxygen and causing hypoxia at sufficiently high concentrations.
**Long-term vegetation AMCV for Ethylene is 30 ppb.
***Long-term vegetation AMCV for Tetrachloroethylene is 12 ppb.