Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: John Sadlier, Deputy Director
Office of Compliance and Enforcement

Date: December 13, 2010

Thru: Michael Honeycutt, Ph.D., Director MH
Toxicology Division, Chief Engineer's Office

From: Shannon Ethridge, M.S. SE.
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Subject: Health Effects Evaluation of Carbonyl Survey Project, Dish, Denton County, Texas, Area June 16 - 18, 2010 (ACL 100648, Lab Samples 100648-0003 to 100648-0020)

Key Findings

- All reported target carbonyl concentrations were either non-detect or below their respective short-term air monitoring comparison values (AMCVs) and are not of any short-term health or welfare concern.
- During the sampling period, carbonyls were detected in a relatively consistent pattern independent of sampling location in relation to possible oil and gas-related sources, time of day, and wind direction. In contrast, the majority of volatile organic compounds (VOCs) detected at the Dish Airfield Automated Gas Chromatograph (AutoGC) during the same time period trended upward/downward in concentration depending on wind direction. This may indicate VOC concentrations measured at the AutoGC were dependent on the location of oil and gas-related sources in relation to the AutoGC.
- The Dish one-hour average formaldehyde concentration of 3.6 ppb_v (3.22 – 3.98 ppb_v) is lower than the Dallas/Fort Worth area June one-hour average formaldehyde concentration of 6.35 ppb_v (5.77 – 6.93 ppb_v). Data are reported as the mean and 95% Confidence Interval (CI).

Background

In response to concerns about carbonyl emissions from natural gas compressor stations, personnel from the Texas Commission on Environmental Quality (TCEQ) Mobile Monitoring Team conducted an ambient air monitoring survey project in the Justin/Dish, Texas, area from June 16 - 18, 2010. Staff collected 23 one-hour Sep-Pak Dinitrophenylhydrazine (DNPH) Coated Silica Cartridge samples (see Figure 1 for sampling locations). Of the 23 samples, five were quality control/quality assurance samples. Cartridge samples were analyzed for 18 target

carbonyls (methyl ethyl ketone and methacrolein co-elute) by High Performance Liquid Chromatography (HPLC) using modified EPA Method TO-11 at the TCEQ laboratory in Austin, TX.

Results

Reported carbonyl concentrations in 18 samples were compared to TCEQ's short-term health- and odor-based AMCVs (Table 1). Short-term AMCVs are used to evaluate ambient concentrations of chemicals in air to determine whether the monitored concentrations have the potential to cause adverse health effects, adverse vegetative effects, or odors. Health AMCVs are set to provide a margin of safety and are well below levels at which adverse health effects are reported to occur in the scientific literature. If a chemical concentration in ambient air is less than its AMCV, no adverse health effects are expected to occur. If a chemical concentration exceeds its AMCV it does not necessarily mean that adverse effects will occur, but rather that further evaluation is warranted. Table 2 provides a list of target compounds and their associated long-term AMCVs for informational purposes only.

Evaluation

Isovaleraldehyde was not detected in any sample but the limit of detection was above the short-term odor AMCV, and below the short-term health AMCV. It is possible that isovaleraldehyde was present at concentrations above the odor AMCV although investigators did not experience the apple-like odor associated with isovaleradehyde (HSDB 2010). The investigators noted exhaust and natural gas odors during the investigation. Detection limits were adequate to evaluate all other target analytes. All other reported concentrations of target carbonyls were either non-detect or below their respective short-term AMCVs and are not of any short-term health or welfare concern.

In response to concerns expressed by Mayor Tillman of Dish, the TD conducted additional analyses of formaldehyde concentrations measured in Dish in comparison to area and statewide concentrations as well as a trend analysis of VOC concentrations measured at the Dish Airfield AutoGC in relation to carbonyl concentrations measured during the TCEQ mobile monitoring event. Additional analyses begin on Page 10.

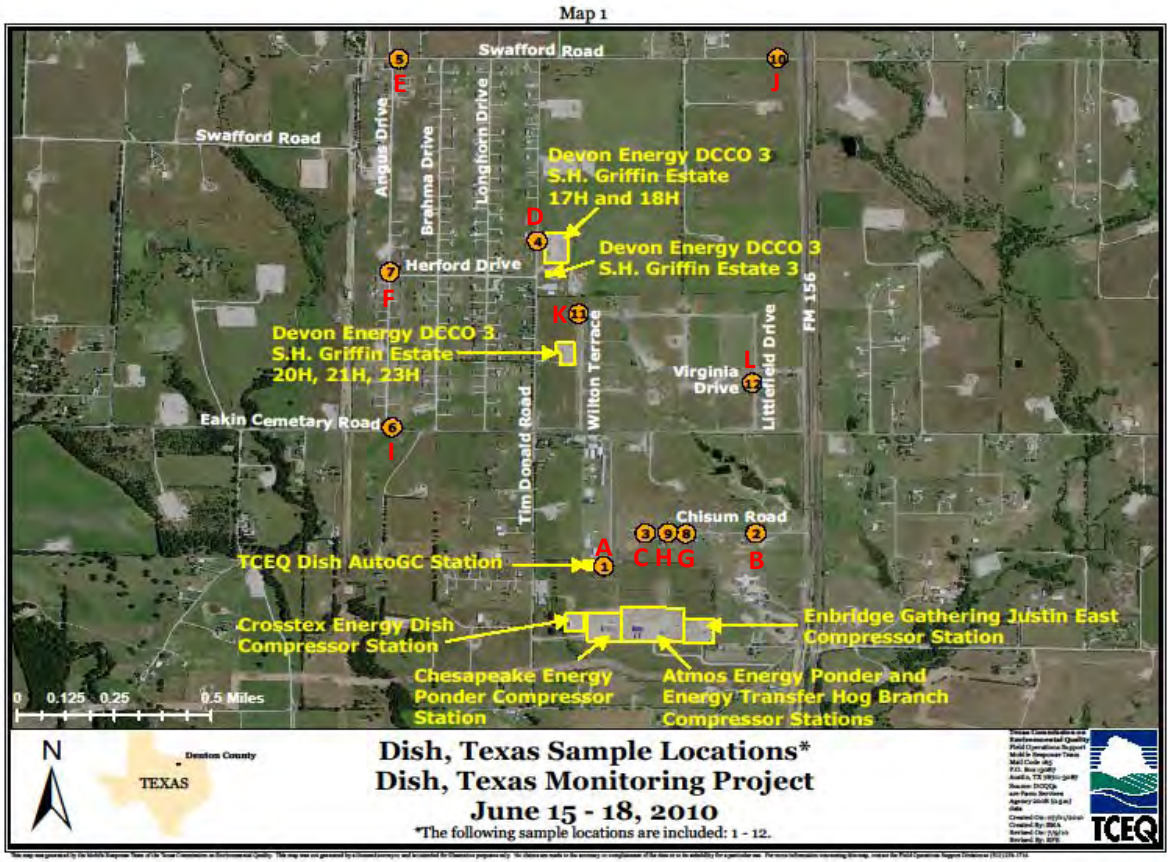

Figure 1. Map of Sample Locations for the Dish, TX, Carbonyl Monitoring Project on June 15 - 18, 2010.

Table 1. Carbonyl samples collected in Dish, TX, on June 16 and 17, 2010, in comparison to TCEQ short-term AMCVs.

		Laboratory ID		100648-0003			100648-0004			100648-0005			100648-0006		
		Sampling Site		A			A			B			C		
		Sample Date		6/16/2010			6/16/2010			6/16/2010			6/16/2010		
		Sample Time		9:20			10:50			12:25			13:50		
Compound	**Odor AMCV**	**Short-term Health AMCV**	**LOD**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**
formaldehyde	500	41	2.04	2.80	1.70	L	4.50	1.70		4.30	1.80		4.20	1.80	
acetaldehyde	50	250	1.95	0.69	1.60	J	0.78	1.60	J	1.20	1.70	J	1.10	1.80	J
acetone	3600	2500	3.37	1.20	2.80	J	0.97	2.70	J	1.50	3.00	J	1.30	3.00	J
acrolein	3.6	1	0.31	ND	0.25		ND	0.25		ND	0.27		ND	0.27	
propionaldehyde	5	21	0.51	0.15	0.42	J	0.17	0.41	J	0.24	0.45	J	0.21	0.45	J
crotonaldehyde	23	3	0.23	ND	0.19		ND	0.19		ND	0.21		ND	0.21	
methyl ethyl ketone/methacrolein	8.5	19	0.75	0.19	0.62	J	0.12	0.61	J	0.14	0.66	J	0.11	0.67	J
butyraldehyde	5	2700	0.22	0.10	0.18	J	0.22	0.18	L	0.17	0.20	J	0.18	0.20	J
benzaldehyde	5	21	0.15	ND	0.13		ND	0.12		ND	0.14		ND	0.14	
isovaleraldehyde	0.1	500	0.18	ND	0.15		ND	0.15		ND	0.16		ND	0.17	
valeraldehyde	30	500	0.20	ND	0.17		ND	0.17		ND	0.18		ND	0.18	
o-tolualdehyde	-	21	0.34	ND	0.28		ND	0.28		ND	0.30		ND	0.30	
m-tolualdehyde	-	21	0.34	ND	0.28		ND	0.28		ND	0.30		ND	0.30	
p-tolualdehyde	-	21	0.26	ND	0.22		ND	0.21		ND	0.23		ND	0.24	
hexaldehyde	20	2000	0.34	ND	0.28		ND	0.27		0.08	0.30	J	0.08	0.30	J
2,5-dimethyl-benzaldehyde	-	21	0.22	0.07	0.18	J	0.06	0.18	J	0.07	0.19	J	0.07	0.19	J
heptaldehyde	50	2000	0.27	ND	0.22		ND	0.22		ND	0.24		ND	0.24	

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

J=Reported concentration is below the SDL

L=Reported concentration is greater than or equal to the SDL but less than the Sample Quantitation Limit

LOD - Limit of Detection based on a 60 Liter sample volume

ND - not detected

SDL - Sample Detection Limit (LOD adjusted for sample volume)

Table 1 (continued). Carbonyl samples collected in Dish, TX, on June 16 and 17, 2010, in comparison to TCEQ short-term AMCVs.

		Laboratory ID		100648-0007			100648-0008			100648-0009			100648-0010		
		Sampling Site		C			D			E			F		
		Sample Date		6/16/2010			6/16/2010			6/16/2010			6/16/2010		
		Sample Time		15:05			16:30			17:50			19:10		
Compound	**Odor AMCV**	**Short-term Health AMCV**	**LOD**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**
formaldehyde	500	41	2.04	4.80	1.60		4.80	2.10		4.10	1.80		3.60	1.60	
acetaldehyde	50	250	1.95	1.10	1.50	J	1.00	2.10	J	0.90	1.70	J	0.75	1.50	J
acetone	3600	2500	3.37	1.20	2.70	J	1.50	3.50	J	1.10	3.00	J	0.99	2.70	J
acrolein	3.6	1	0.31	ND	0.24		ND	0.32		ND	0.27		0.09	0.24	J
propionaldehyde	5	21	0.51	0.21	0.40	J	0.26	0.53	J	0.20	0.45	J	0.18	0.40	J
crotonaldehyde	23	3	0.23	ND	0.18		ND	0.24		ND	0.21		ND	0.18	
methyl ethyl ketone/methacrolein	8.5	19	0.75	0.12	0.59	J	0.18	0.78	J	0.16	0.66	J	0.19	0.59	J
butyraldehyde	5	2700	0.22	0.15	0.17	J	0.17	0.23	J	0.14	0.19	J	0.12	0.17	J
benzaldehyde	5	21	0.15	ND	0.12		ND	0.16		ND	0.14		ND	0.12	
isovaleraldehyde	0.1	500	0.18	ND	0.15		ND	0.19		ND	0.16		ND	0.15	
valeraldehyde	30	500	0.20	ND	0.16		ND	0.21		ND	0.18		ND	0.16	
o-tolualdehyde	-	21	0.34	ND	0.27		ND	0.36		ND	0.30		ND	0.27	
m-tolualdehyde	-	21	0.34	ND	0.27		ND	0.36		ND	0.30		ND	0.27	
p-tolualdehyde	-	21	0.26	ND	0.21		ND	0.28		ND	0.23		ND	0.21	
hexaldehyde	20	2000	0.34	0.07	0.27	J	0.08	0.35	J	0.07	0.30	J	ND	0.27	
2,5-dimethyl-benzaldehyde	-	21	0.22	0.06	0.17	J	0.09	0.23	J	0.07	0.19	J	0.06	0.17	J
heptaldehyde	50	2000	0.27	ND	0.22		ND	0.28		ND	0.24		ND	0.21	

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

J=Reported concentration is below the SDL

L=Reported concentration is greater than or equal to the SDL but less than the Sample Quantitation Limit

LOD - Limit of Detection based on a 60 Liter sample volume

ND - not detected

SDL - Sample Detection Limit (LOD adjusted for sample volume)

Table 1 (continued). Carbonyl samples collected in Dish, TX, on June 16 and 17, 2010, in comparison to TCEQ short-term AMCVs.

		Laboratory ID		100648-0011			100648-0012			100648-0013			100648-0014		
		Sampling Site		G			H			H			I		
		Sample Date		6/17/2010			6/17/2010			6/17/2010			6/17/2010		
		Sample Time		4:55			6:05			7:15			8:45		
Compound	**Odor AMCV**	**Short-term Health AMCV**	**LOD**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**
formaldehyde	500	41	2.04	3.30	1.60	L	2.70	1.80	L	3.20	1.60	L	2.50	1.70	L
acetaldehyde	50	250	1.95	0.73	1.50	J	0.64	1.70	J	0.63	1.50	J	0.68	1.60	J
acetone	3600	2500	3.37	0.87	2.70	J	0.79	2.90	J	0.74	2.70	J	0.98	2.80	J
acrolein	3.6	1	0.31	0.11	0.24	J	0.10	0.26	J	ND	0.24		0.06	0.25	J
propionaldehyde	5	21	0.51	0.15	0.40	J	0.14	0.43	J	0.15	0.40	J	0.25	0.41	J
crotonaldehyde	23	3	0.23	ND	0.18		ND	0.20		ND	0.18		ND	0.19	
methyl ethyl ketone/methacrolein	8.5	19	0.75	0.33	0.59	J	0.27	0.64	J	0.24	0.59	J	0.26	0.61	J
butyraldehyde	5	2700	0.22	0.11	0.17	J	ND	0.19		0.10	0.17	J	0.17	0.18	J
benzaldehyde	5	21	0.15	0.06	0.12	J	ND	0.13		ND	0.12		ND	0.13	
isovaleraldehyde	0.1	500	0.18	ND	0.15		ND	0.16		ND	0.15		ND	0.15	
valeraldehyde	30	500	0.20	ND	0.16		ND	0.18		ND	0.16		ND	0.17	
o-tolualdehyde	-	21	0.34	ND	0.27		ND	0.29		ND	0.27		ND	0.28	
m-tolualdehyde	-	21	0.34	ND	0.27		ND	0.29		ND	0.27		ND	0.28	
p-tolualdehyde	-	21	0.26	ND	0.21		ND	0.23		ND	0.21		ND	0.22	
hexaldehyde	20	2000	0.34	0.08	0.27	J	0.07	0.29	J	0.07	0.27	J	0.10	0.28	J
2,5-dimethyl-benzaldehyde	-	21	0.22	0.06	0.17	J	0.07	0.19	J	0.07	0.17	J	0.11	0.18	J
heptaldehyde	50	2000	0.27	ND	0.21		ND	0.23		ND	0.21		ND	0.22	

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Table 1 (continued). Carbonyl samples collected in Dish, TX, on June 16 and 17, 2010, in comparison to TCEQ short-term AMCVs.

		Laboratory ID		100648-0015			100648-0016			100648-0017			100648-0018		
		Sampling Site		A			J			K			L		
		Sample Date		6/17/2010			6/17/2010			6/17/2010			6/17/2010		
		Sample Time		10:15			11:55			13:25			21:00		
Compound	**Odor AMCV**	**Short-term Health AMCV**	**LOD**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**
formaldehyde	500	41	2.04	3.20	1.80	L	3.30	1.50	L	3.20	1.60	L	3.40	1.70	L
acetaldehyde	50	250	1.95	0.82	1.70	J	0.81	1.50	J	0.73	1.50	J	0.83	1.60	J
acetone	3600	2500	3.37	0.90	3.00	J	0.65	2.50	J	0.86	2.60	J	0.88	2.80	J
acrolein	3.6	1	0.31	ND	0.27		ND	0.23		ND	0.24		ND	0.25	
propionaldehyde	5	21	0.51	0.17	0.44	J	0.12	0.38	J	0.16	0.40	J	0.21	0.41	J
crotonaldehyde	23	3	0.23	ND	0.20		ND	0.18		ND	0.18		ND	0.19	
methyl ethyl ketone/methacrolein	8.5	19	0.75	ND	0.65		0.11	0.56	J	0.09	0.59	J	0.15	0.61	J
butyraldehyde	5	2700	0.22	ND	0.19		ND	0.17		0.10	0.17	J	0.11	0.18	J
benzaldehyde	5	21	0.15	ND	0.13		ND	0.12		ND	0.12		ND	0.13	
isovaleraldehyde	0.1	500	0.18	ND	0.16		ND	0.14		ND	0.15		ND	0.15	
valeraldehyde	30	500	0.20	ND	0.18		ND	0.15		ND	0.16		ND	0.17	
o-tolualdehyde	-	21	0.34	ND	0.30		ND	0.26		ND	0.27		ND	0.28	
m-tolualdehyde	-	21	0.34	ND	0.30		ND	0.26		ND	0.27		ND	0.28	
p-tolualdehyde	-	21	0.26	ND	0.23		ND	0.20		ND	0.21		ND	0.22	
hexaldehyde	20	2000	0.34	ND	0.30		ND	0.26		ND	0.27		0.08	0.28	J
2,5-dimethyl-benzaldehyde	-	21	0.22	0.12	0.19	J	0.06	0.16	J	0.07	0.17	J	ND	0.18	
heptaldehyde	50	2000	0.27	ND	0.24		ND	0.20		ND	0.21		ND	0.22	

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ND - not detected

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Table 1 (continued). Carbonyl samples collected in Dish, TX, on June 16 and 17, 2010, in comparison to TCEQ short-term AMCVs.

		Laboratory ID		100648-0019			100648-0020		
		Sampling Site		C			A		
		Sample Date		6/17/2010			6/17/2010		
		Sample Time		22:20			23:40		
Compound	**Odor AMCV**	**Short-term Health AMCV**	**LOD**	**ppbv**	**SDL**	**Flag**	**ppbv**	**SDL**	**Flag**
formaldehyde	500	41	2.04	4.20	2.00		3.90	1.60	
acetaldehyde	50	250	1.95	1.00	1.90	J	0.79	1.50	J
acetone	3600	2500	3.37	1.20	3.40	J	0.98	2.60	J
acrolein	3.6	1	0.31	0.15	0.30	J	0.12	0.24	J
propionaldehyde	5	21	0.51	0.22	0.50	J	0.19	0.40	J
crotonaldehyde	23	3	0.23	ND	0.23		ND	0.18	
methyl ethyl ketone/methacrolein	8.5	19	0.75	0.31	0.74	J	0.30	0.59	J
butyraldehyde	5	2700	0.22	0.25	0.22	L	ND	0.17	
benzaldehyde	5	21	0.15	ND	0.15		ND	0.12	
isovaleraldehyde	0.1	500	0.18	ND	0.18		ND	0.15	
valeraldehyde	30	500	0.20	ND	0.20		ND	0.16	
o-tolualdehyde	-	21	0.34	ND	0.34		ND	0.27	
m-tolualdehyde	-	21	0.34	ND	0.34		ND	0.27	
p-tolualdehyde	-	21	0.26	ND	0.26		ND	0.21	
hexaldehyde	20	2000	0.34	0.09	0.34	J	0.08	0.27	J
2,5-dimethyl-benzaldehyde	-	21	0.22	0.09	0.21	J	0.07	0.17	J
heptaldehyde	50	2000	0.27	ND	0.27		ND	0.21	

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

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LOD - Limit of Detection based on a 60 Liter sample volume

ND - not detected

SDL - Sample Detection Limit (LOD adjusted for sample volume)

Table 2. Long-term Health AMCVs*	
Compound	**Long-term Health AMCV (ppb_v)**
formaldehyde	8.9
acetaldehyde	25
acetone	250
acrolein	0.1
propionaldehyde	20
crotonaldehyde	0.3
methyl ethyl ketone/methacrolein	0.43
butyraldehyde	270
benzaldehyde	2.1
isovaleraldehyde	50
valeraldehyde	50
o-tolualdehyde	2.1
m-tolualdehyde	2.1
p-tolualdehyde	2.1
hexaldehyde	200
2,5-dimethyl-benzaldehyde	2.1
heptaldehyde	200

*Long-term AMCVs are provided for informational purposes only. It is not appropriate to compare a short-term concentration to a long-term AMCV.

Formaldehyde Concentrations in Dish

Dish one-hour formaldehyde concentrations ranged from 2.5 to 4.8 ppb_v, with an average concentration of 3.6 ppb_v (3.22 – 3.98 ppb_v). In addition, the Dish one-hour average formaldehyde concentration of 3.6 ppb_v (3.22 – 3.98 ppb_v) is lower than the Dallas/Fort Worth area June one-hour average formaldehyde concentration of 6.35 ppb_v (5.77 – 6.93 ppb_v). Data are reported as the mean and 95% CI. The Dish one-hour average formaldehyde concentration is also lower than the average 2005 – 2008 statewide one-hour average concentration of 6 ppb_v. Carbonyl data is collected at seven stationary monitors in Texas (Table 3).

Table 3. Carbonyl monitoring sites in Texas

City	Site Name	EPA ID
Houston	Channelview	48-201-0026
Houston	Houston Deer Park #2	48-201-1039
Houston	Clinton	48-201-1035
Dallas	Dallas Hinton	48-113-0069
Fort Worth	Forth Worth Northwest	48-439-1002
El Paso	El Paso Chamizal	48-141-0044
Not in a city	Karnack	48-203-0002

Formaldehyde Concentrations in General

The majority of formaldehyde entering the environment comes from combustion processes. Combustion sources that produce formaldehyde include diesel and gasoline-powered engines/automobiles, power plants, incinerators, refineries, and cigarettes (TCEQ 2008, ATSDR 1999). Formaldehyde can also be produced indirectly by the photochemical oxidation of formaldehyde precursors released from combustion processes (TCEQ 2008, ATSDR 1999).

Anthropogenic sources usually contribute most to formaldehyde concentrations in populated areas. Typical ambient concentrations of formaldehyde in populated areas can vary depending on local conditions and usually range from 0.8 – 16 ppb (ATSDR 1999). Concentrations can be higher in heavy traffic (up to 81 ppb) (ATSDR 1999). Formaldehyde concentrations in remote areas like the unpopulated Eniwetok Atoll in the Pacific Ocean are generally less than 0.8 ppb (ATSDR 1999).

As discussed in TCEQ (2008), the levels of formaldehyde in indoor air are often an order of magnitude higher (or more) than levels outdoors, depending on many factors (e.g., ventilation, indoor sources such as pressed wood products, carpets, paints, cooking) (IARC 2006). In US residential indoor air, including manufactured homes, reported mean levels range from approximately 10-374 ppb, with the majority of reported means falling below 40 ppb (IARC 2006). In US office building indoor air, the range of geometric mean concentrations reported for one study (Reynolds et al. 2001, as cited in IARC 2006) was approximately 1.4-10.8 ppb, and the median in another study (Shah and Singh 1988, as cited in IARC 2006) was reported to be 65 ppb.

Formaldehyde is also produced endogenously by the human body. Moser et al. (2005) reported a median concentration in human breath of 4.3 ppb with a maximum concentration of 73 ppb.

Similarly, Kushch et al. (2008) reported the median formaldehyde concentration in human breath to be 4.9 ppb.

Based on the review of available literature, formaldehyde concentrations measured in Dish are within the range of concentrations typically measured in a populated area (ATSDR 1999) and are similar to concentrations measured in human breath (Moser et al. 2005, and Kushch et al. 2008).

Trend Analysis of VOCs Detected by Dish Airfield AutoGC and Carbonyls Detected in Dish

The TD conducted an analysis of VOC data collected on June 16 and 17, 2010, at the Dish Airfield AutoGC stationary air monitor in relation to carbonyl data collected on June 16 and 17, 2010, at various locations in Dish. This analysis was conducted to determine if there was a correlation between VOC and carbonyl concentrations. Wind rose graphics were developed using meteorological data from the Dish Airfield AutoGC for June 16 and 17, 2010 (Figures 2 and 3).

Carbonyls were detected in a relatively consistent pattern independent of sampling location in relation of location of potential oil and gas-related sources, time of day, and wind direction with formaldehyde, acetaldehyde, and acetone being the most abundant carbonyls detected. Figures 4 – 9 are bar graphs of carbonyl data collected at each mobile monitoring site.

Our analysis of VOC data indicated that the majority of detected VOCs trended upward/downward dependent on wind direction. Figures 11 – 16 are line graphs of VOC data in relation to wind direction (in degrees) collected at the Dish Airfield AutoGC monitor on June 16 and 17, 2010. Figure 10 shows how wind direction in degrees relates to cardinal direction. Blank and calibration runs occurred at 6:00 and 7:00 am, respectively, on June 16 and 8:00 and 9:00 am, respectively, on June 17, so no VOC data were collected during these time periods. Figure 11 illustrates an increase in concentrations of benzene and toluene that begins at approximately 1:00 am when wind direction changed slightly to originate from the south, southeast. Similar concentrations of benzene and toluene were detected at 10:00 am when winds originated from the south, southwest. Benzene and toluene concentrations decreased after 10:00 am as wind direction changed to originate from the south, southeast. Figures 12, 13, and 14 illustrate a similar pattern for some VOCs (e.g., m & p xylene, 1,2,3-trimethylbenzene, pentane, and isopentane) on June 16, 2010. On June 17, 2010, some VOCs (acetylene, propylene, ethylene, and propane) increased in concentration when wind direction shifted from the south, southwest to originate from the south, southeast at approximately 3:00 pm (Figures 15 and 16). Some VOCs (e.g., ethane, propane, butane, and isobutane) increased in concentration at 7:00 pm although wind direction remained out of the southeast (Figure 16).

Conclusions

- All reported target carbonyl concentrations were either non-detect or below their respective short-term AMCVs and are not of any short-term health or welfare concern.
- During the sampling period, carbonyls were detected in a relatively consistent pattern independent of sampling location in relation to possible oil and gas-related sources, time of day, and wind direction. In contrast, the majority of VOCs detected at the Dish

Airfield AutoGC during the same time period trended upward/downward in concentration depending on wind direction. This may indicate VOC concentrations measured at the AutoGC were dependent on the location of oil and gas-related sources in relation to the AutoGC.

- Formaldehyde concentrations measured in Dish are within the range of concentrations typically measured in a populated area (ATSDR 1999). The Dish one-hour average formaldehyde concentration of 3.6 ppb_v (3.22 – 3.98 ppb_v) is lower than the Dallas/Fort Worth area June one-hour average formaldehyde concentration of 6.35 ppb_v (5.77 – 6.93 ppb_v). Data are reported as the mean and 95% CI.

If you have any questions regarding the contents of this review, please do not hesitate to contact me at (512) 239-1822. If you have questions about the air monitoring project, please contact Tom Randolph at (512) 239-1218.

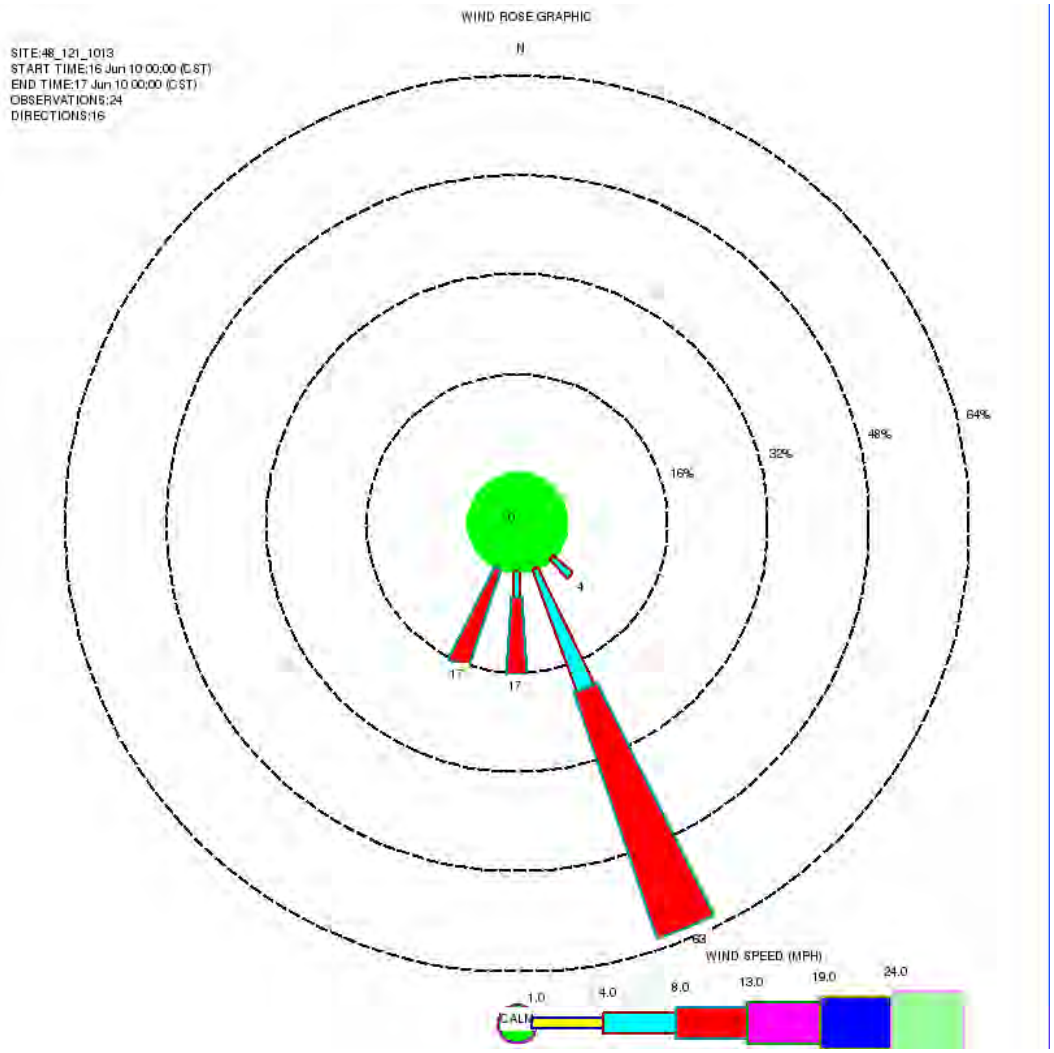


Figure 2. Wind Rose Graphic Developed from Dish Airfield AutoGC Meteorological Data: June 16, 2010.

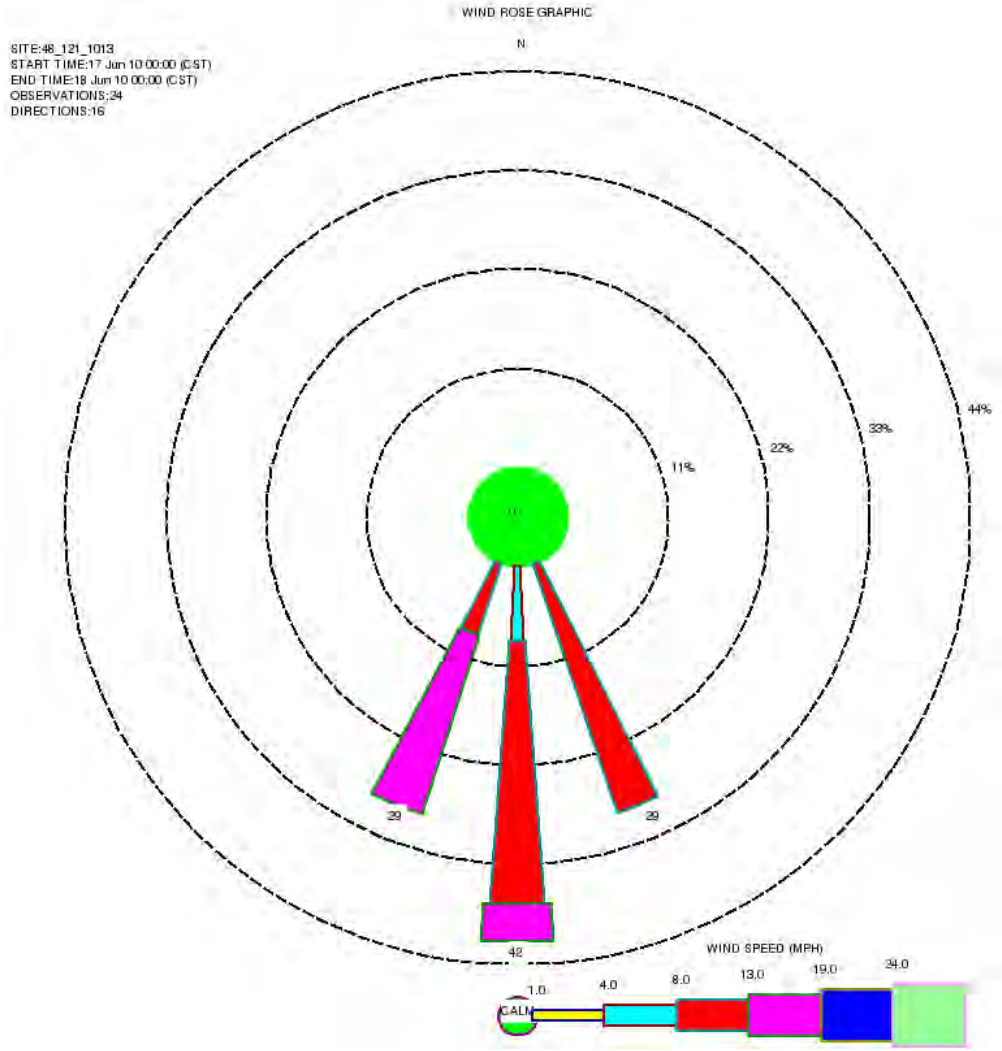
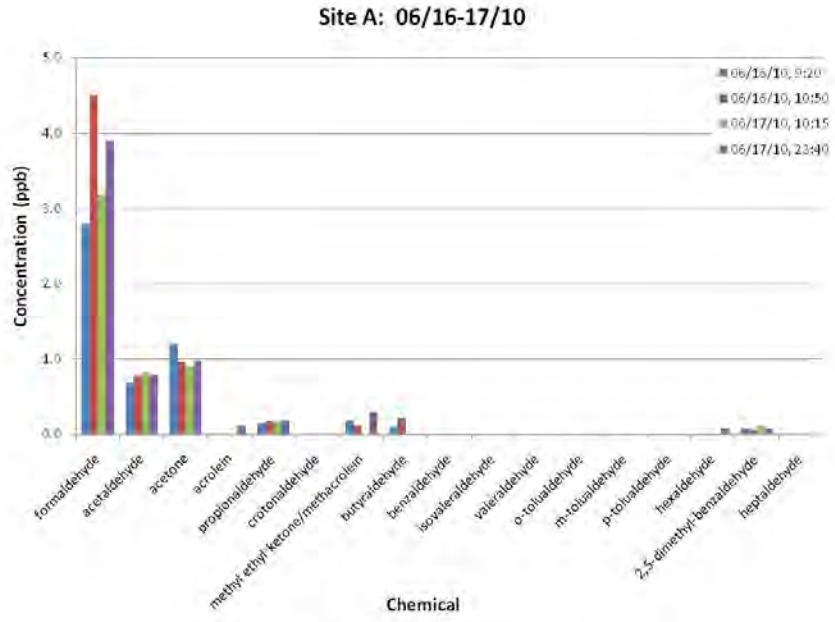
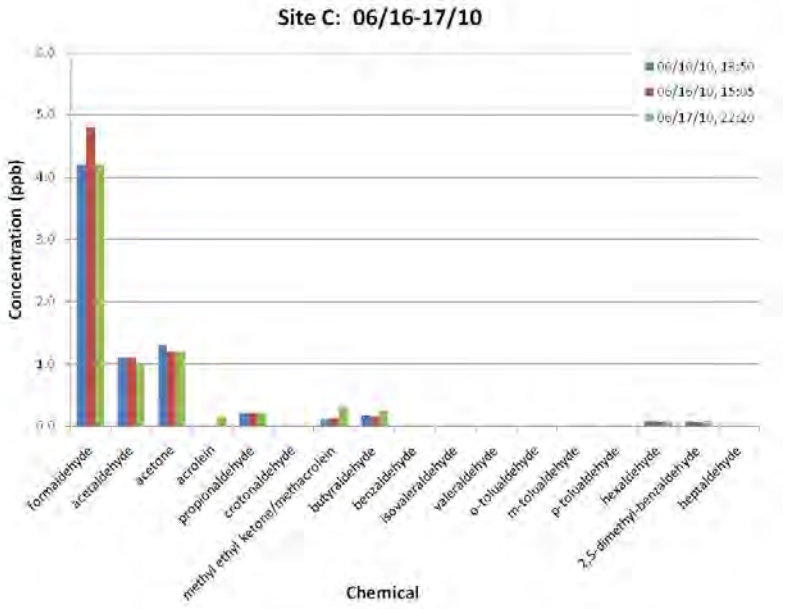


Figure 3. Wind Rose Graphic Developed from Dish Airfield AutoGC Meteoroligical Data: June 17, 2010.

Figure 4. Carbonyl Data from Monitoring Sites A and C.

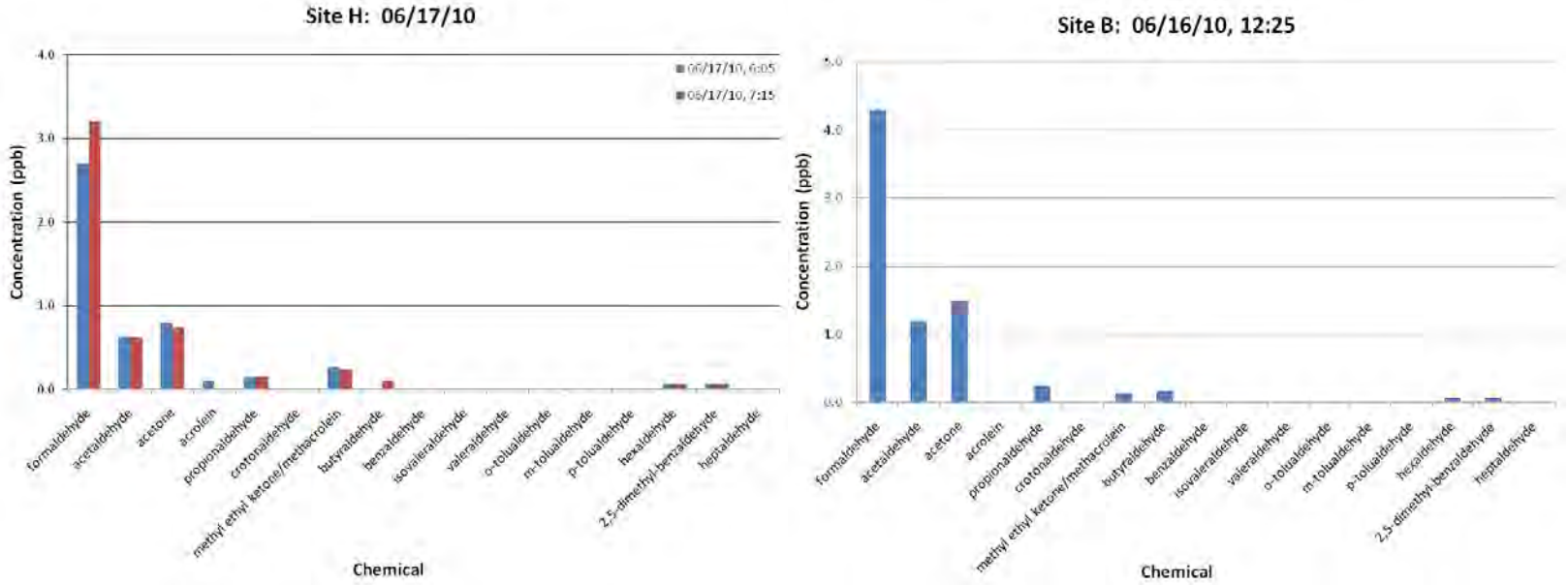




Analyte List

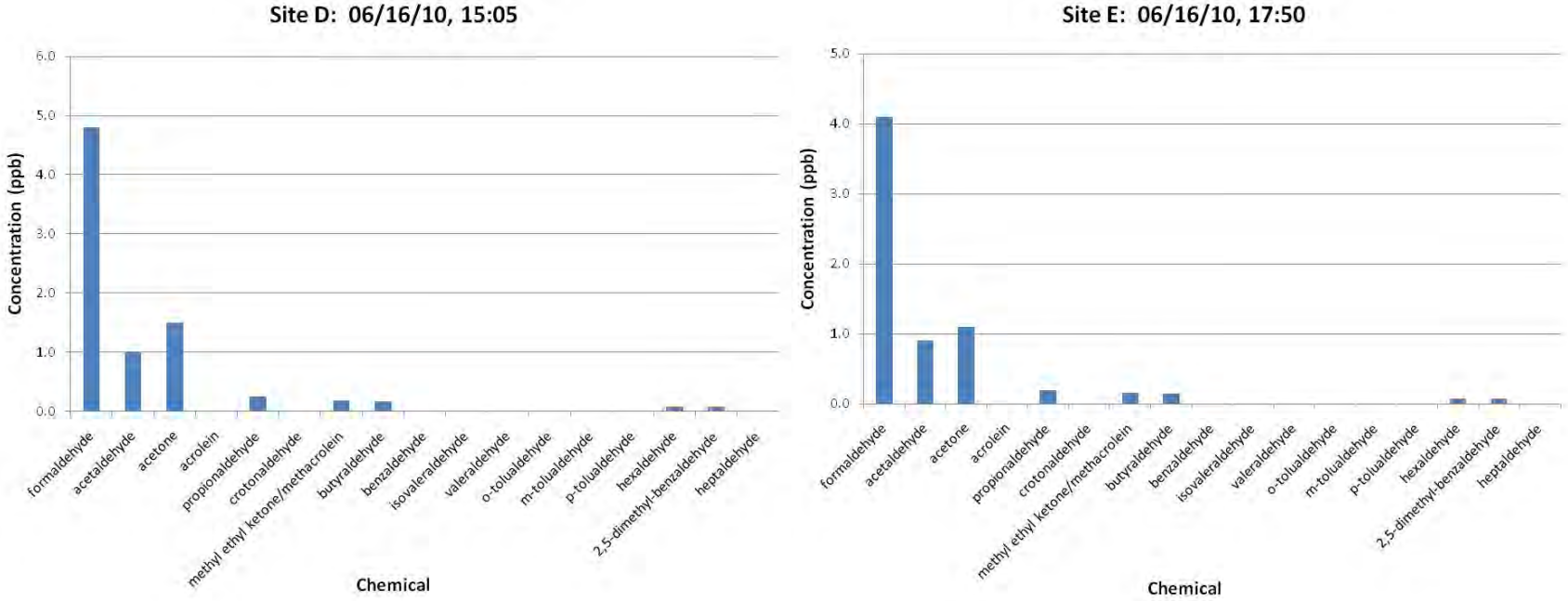
	AMCV (short-term)
Formaldehyde	41
acetaldehyde	250
acetone	2500
acrolein	1
propionaldehyde	200
crotonaldehyde	3
methyl ethyl ketone/methacrolein	19
butyraldehyde	2700
benzaldehyde	21
isovaleraldehyde	500
valeraldehyde	500
o-tolualdehyde	21
m-tolualdehyde	21
p-tolualdehyde	21
hexaldehyde	2000
2,5-dimethyl-benzaldehyde	21
heptaldehyde	2000

Figure 5. Carbonyl Data from Monitoring Sites H and B.



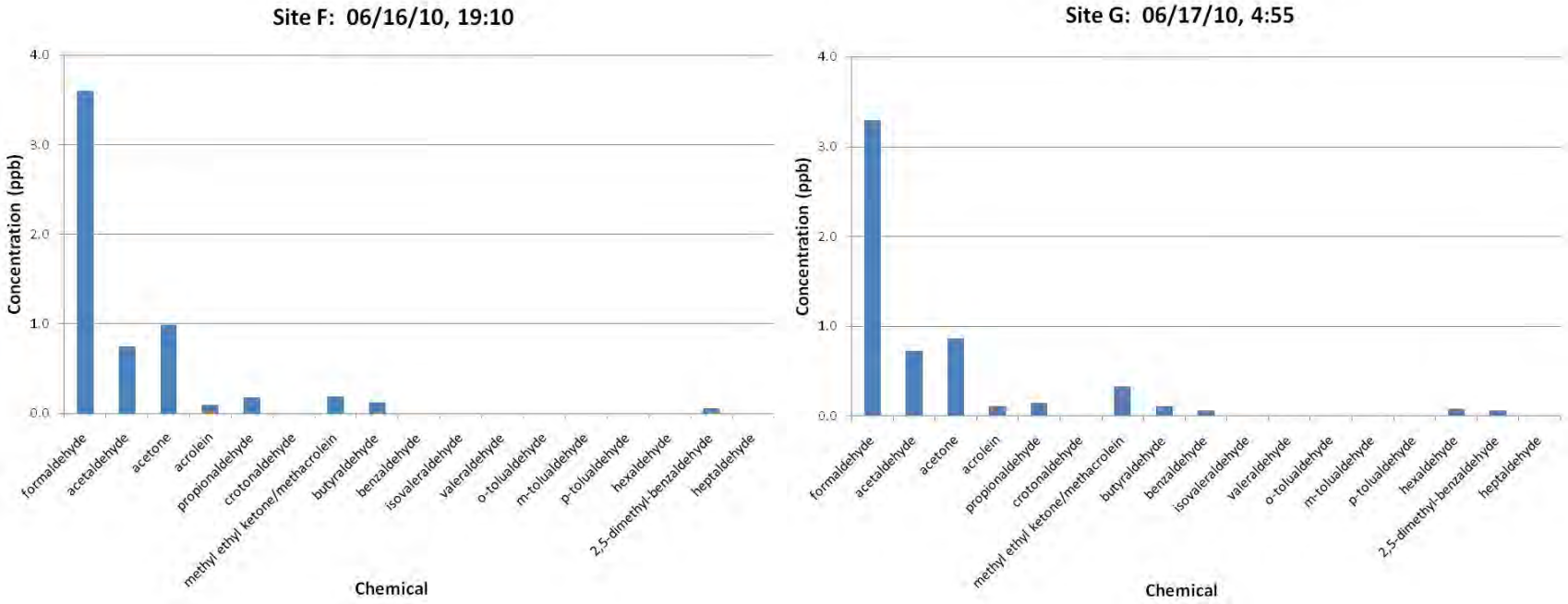
Analyte List	AMCV (short-term)
Formaldehyde	41
acetaldehyde	250
acetone	2500
acrolein	1
propionaldehyde	200
crotonaldehyde	3
methyl ethyl ketone/methacrolein	19
butyraldehyde	2700
benzaldehyde	21
isovaleraldehyde	500
valeraldehyde	500
o-tolualdehyde	21
m-tolualdehyde	21
p-tolualdehyde	21
hexaldehyde	2000
2,5-dimethyl-benzaldehyde	21
heptaldehyde	2000

Figure 6. Carbonyl Data from Monitoring Sites D and E.



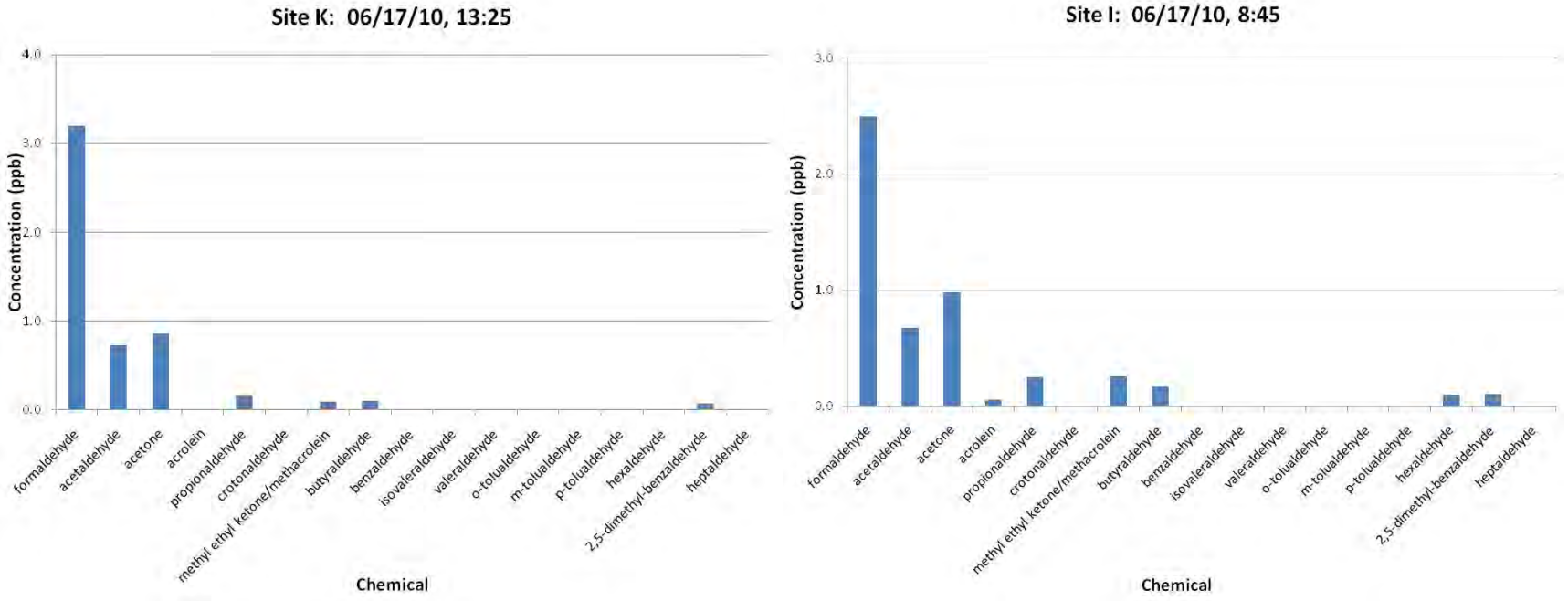
Analyte List	AMCV (short-term)
Formaldehyde	41
acetaldehyde	250
acetone	2500
acrolein	1
propionaldehyde	200
crotonaldehyde	3
methyl ethyl ketone/methacrolein	19
butyraldehyde	2700
benzaldehyde	21
isovaleraldehyde	500
valeraldehyde	500
o-tolualdehyde	21
m-tolualdehyde	21
p-tolualdehyde	21
hexaldehyde	2000
2,5-dimethyl-benzaldehyde	21
heptaldehyde	2000

Figure 7. Carbonyl Data from Monitoring Sites F and G.



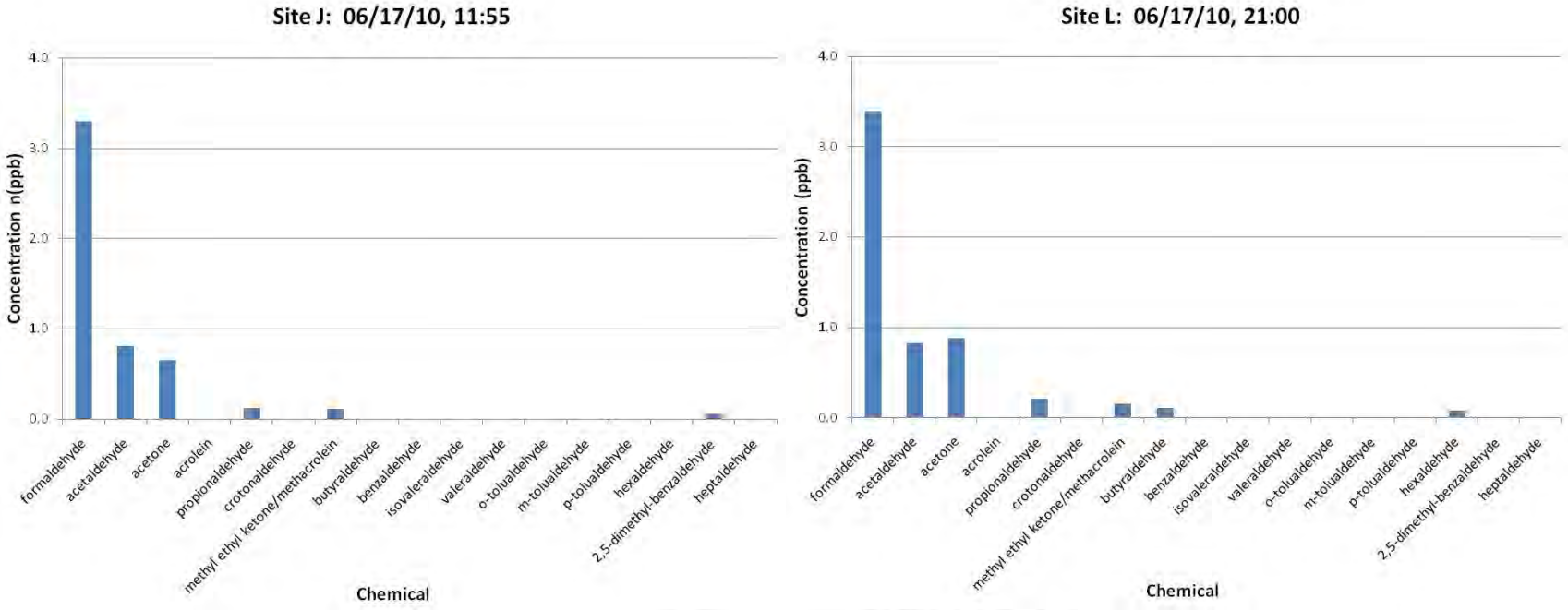
Analyte List	AMCV (short-term)
Formaldehyde	41
acetaldehyde	250
acetone	2500
acrolein	1
propionaldehyde	200
crotonaldehyde	3
methyl ethyl ketone/methacrolein	19
butyraldehyde	2700
benzaldehyde	21
isovaleraldehyde	500
valeraldehyde	500
o-tolualdehyde	21
m-tolualdehyde	21
p-tolualdehyde	21
hexaldehyde	2000
2,5-dimethyl-benzaldehyde	21
heptaldehyde	2000

Figure 8. Carbonyl Data from Monitoring Sites K and I.



Analyte List	AMCV (short-term)
Formaldehyde	41
acetaldehyde	250
acetone	2500
acrolein	1
propionaldehyde	200
crotonaldehyde	3
methyl ethyl ketone/methacrolein	19
butyraldehyde	2700
benzaldehyde	21
isovaleraldehyde	500
valeraldehyde	500
o-tolualdehyde	21
m-tolualdehyde	21
p-tolualdehyde	21
hexaldehyde	2000
2,5-dimethyl-benzaldehyde	21
heptaldehyde	2000

Figure 9. Carbonyl Data from Monitoring Sites J and L.



Analyte List	AMCV (short-term)
Formaldehyde	41
acetaldehyde	250
acetone	2500
acrolein	1
propionaldehyde	200
crotonaldehyde	3
methyl ethyl ketone/methacrolein	19
butyraldehyde	2700
benzaldehyde	21
isovaleraldehyde	500
valeraldehyde	500
o-tolualdehyde	21
m-tolualdehyde	21
p-tolualdehyde	21
hexaldehyde	2000
2,5-dimethyl-benzaldehyde	21
heptaldehyde	2000

Cardinal Direction	Degree Direction
N	348.75 – 11.25
NNE	11.25 – 33.75
NE	33.75 – 56.25
ENE	56.25 – 78.75
E	78.75 – 101.25
ESE	101.25 – 123.75
SE	123.75 – 146.25
SSE	146.25 – 168.75
S	168.75 – 191.25
SSW	191.25 – 213.75
SW	213.75 – 236.25
WSW	236.25 – 258.75
W	258.75 – 281.25
WNW	281.25 – 303.75
NW	303.75 – 326.25
NNW	326.25 – 348.75

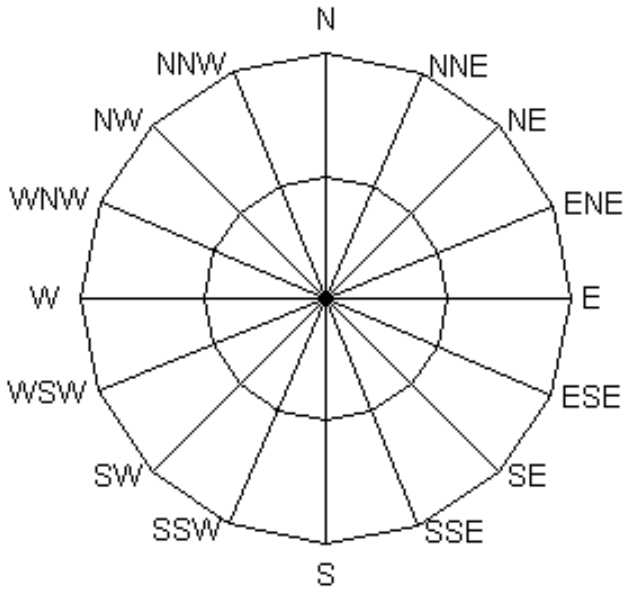
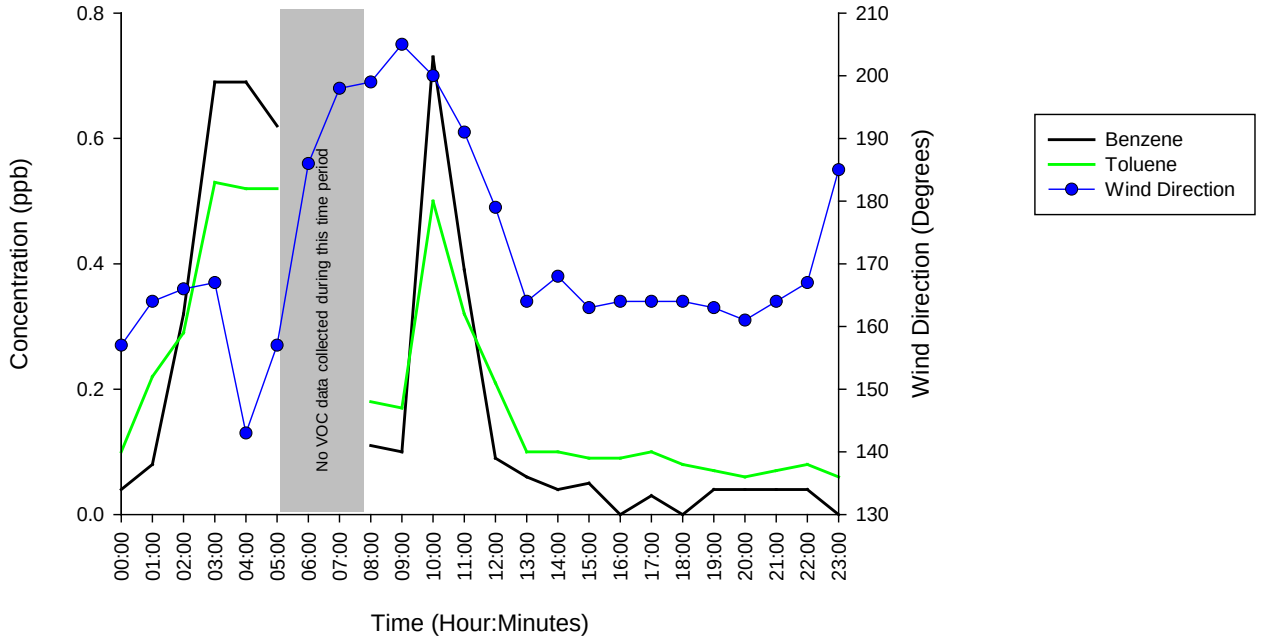
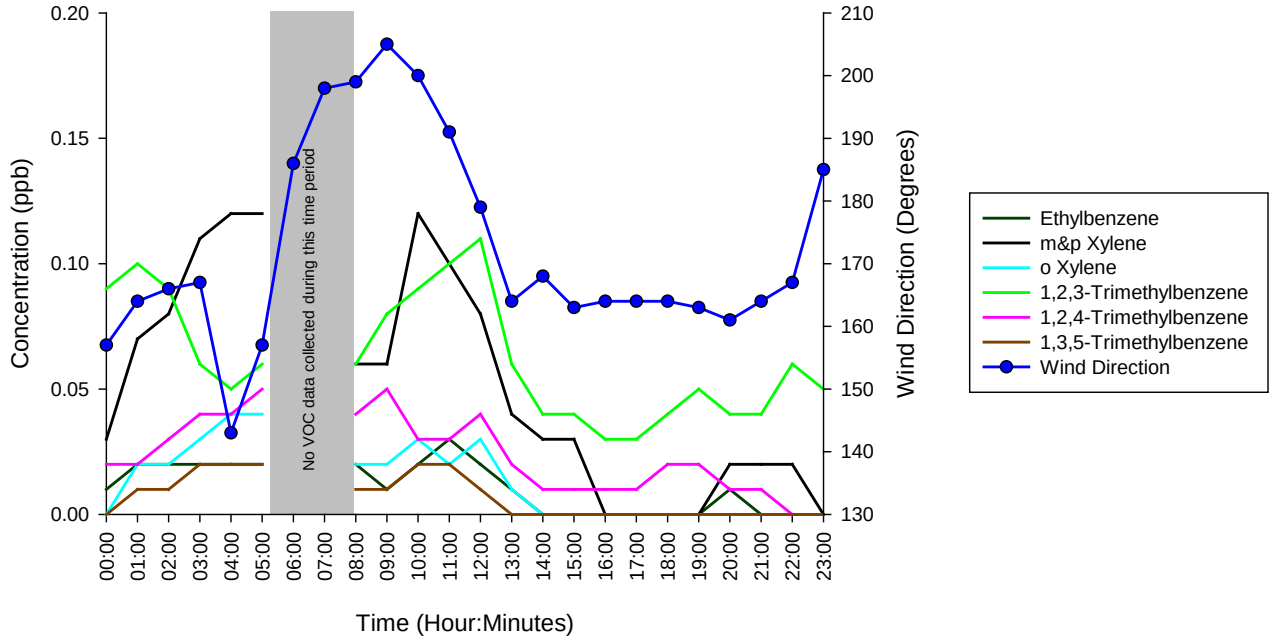


Figure 10. Wind Direction in Degrees in Relation to Cardinal Direction.



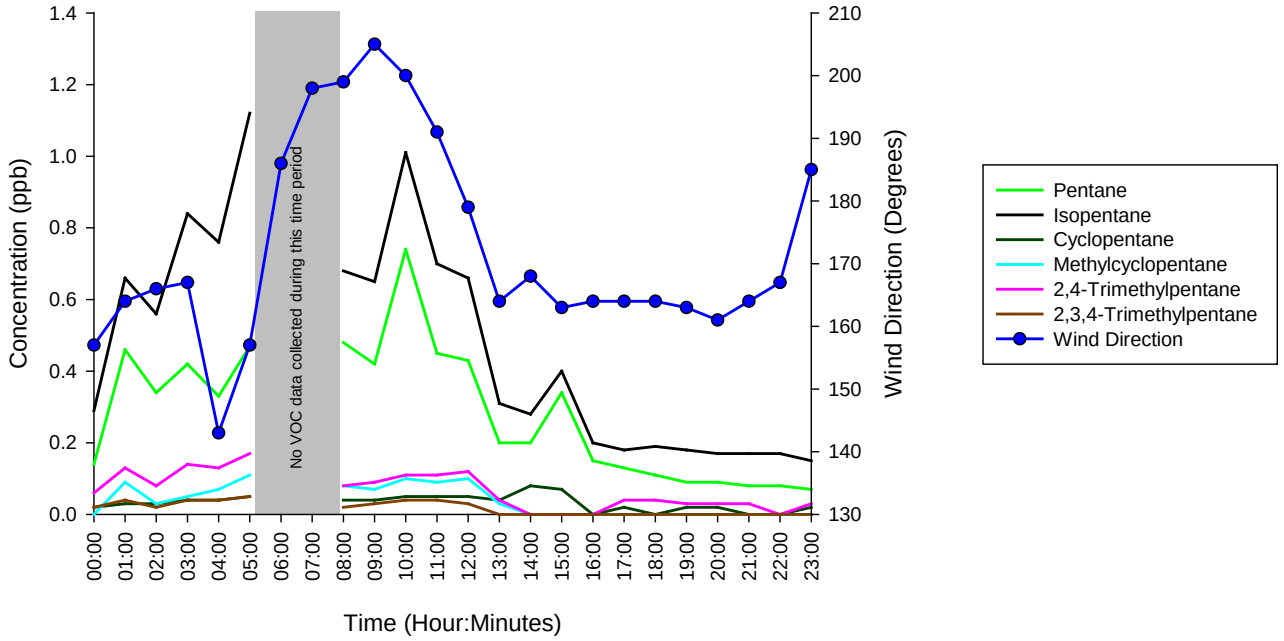
*Concentration scale varies from figure to figure

Figure 11. VOC Concentrations and Wind Direction Monitored by Dish Airfield AutoGC on 6/16/2010.



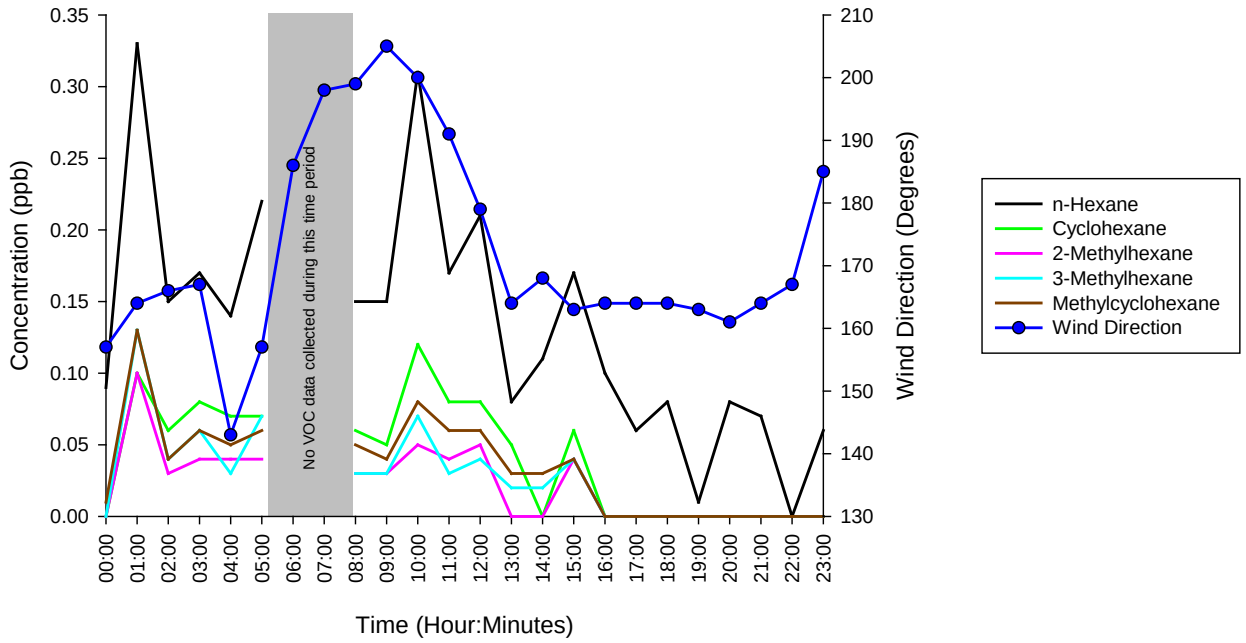
*Concentration scale varies from figure to figure

Figure 12. VOC Concentrations and Wind Direction Monitored by Dish Airfield AutoGC on 6/16/2010.



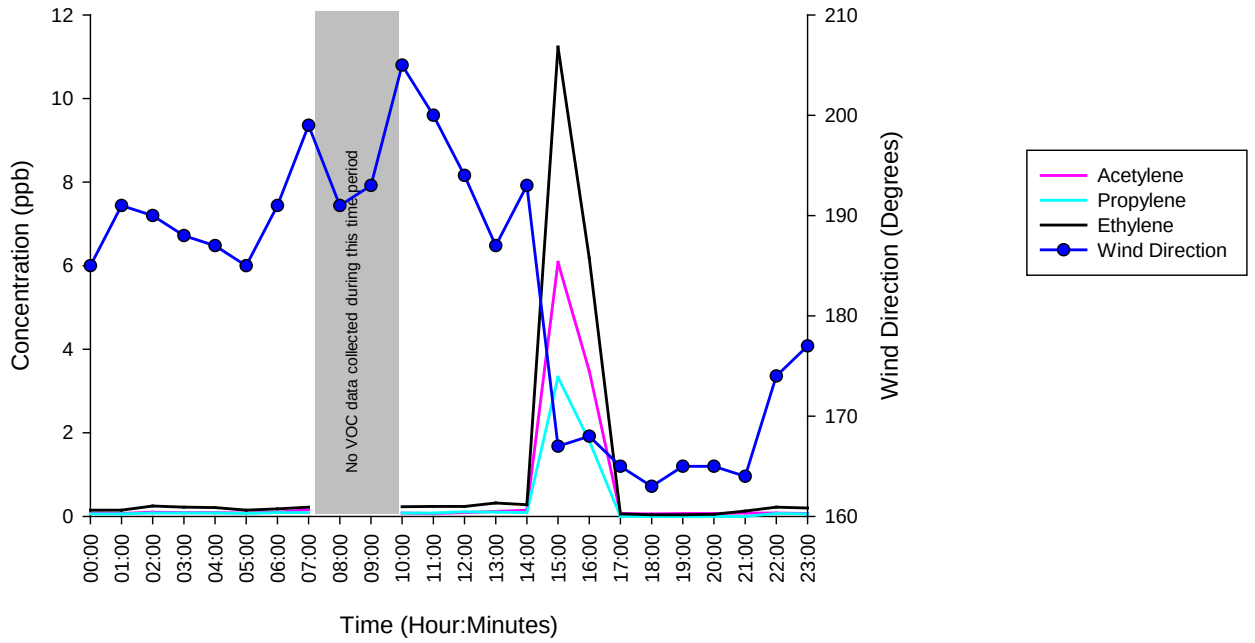
*Concentration scale varies from figure to figure

Figure 13. VOC Concentrations and Wind Direction Monitored by Dish Airfield AutoGC on 6/16/2010.



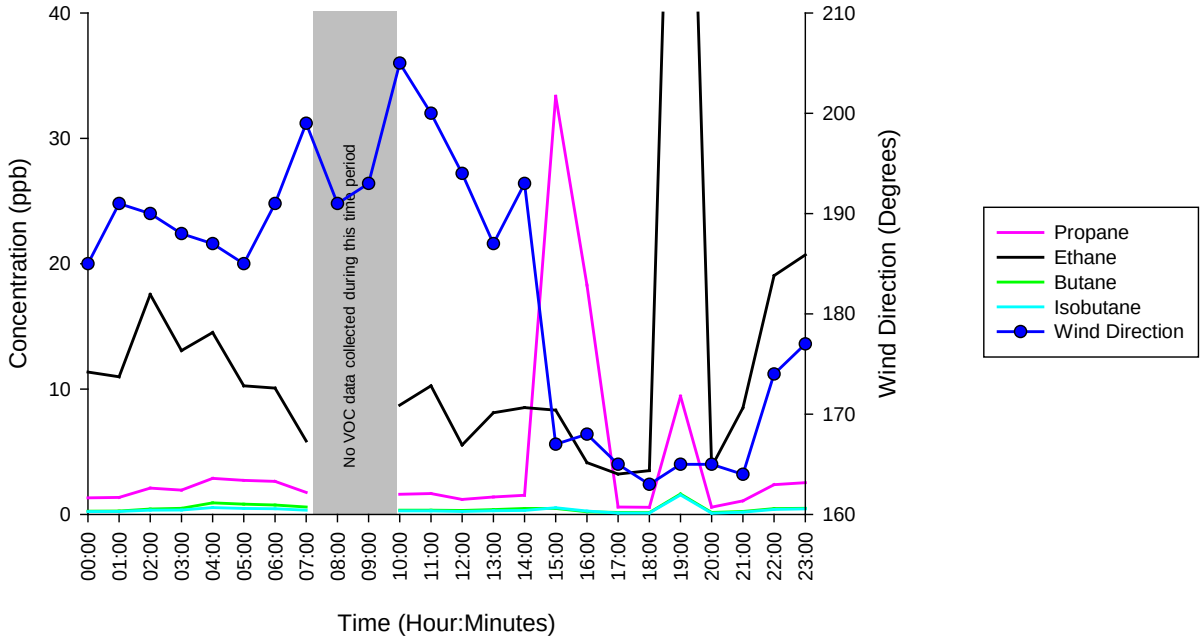
*Concentration scale varies from figure to figure

Figure 14. VOC Concentrations and Wind Direction Monitored by Dish Airfield AutoGC on 6/16/2010.



*Concentration scale varies from figure to figure

Figure 15. VOC Concentrations and Wind Direction Monitored by Dish Airfield AutoGC on 6/17/2010.



*Concentration scale varies from figure to figure

Figure 16. VOC Concentrations and Wind Direction Monitored by Dish Airfield AutoGC on 6/17/2010.

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Moser B, Bodrogi F, Eibl G, et al. 2005. Mass spectrometric profile of exhaled breath-field study by PTR-MS. Respir Physiol Neurobiol 145:295-300.

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Dish, Texas Monitoring Project
Dish, Texas Area
June 15 – 18, 2010

Background

In response to observations and findings associated with oil and natural gas production and processing in the Barnett Shale Formation area in August, October, November, and December 2009, and March and April 2010, the Texas Commission on Environmental Quality made it a priority to conduct monitoring for 17 carbonyl compounds from June 15 - 18, 2010, at new and previously monitored sites in the Dish, Texas, Denton County area.

General Monitoring Information

Monitoring staff collected samples downwind of natural gas production or processing equipment where formaldehyde might be present as a by-product of combustion. Monitoring sites were designated based on individual physical locations distinguished by a specific address or geographic location.

Monitoring and field assessments during this project were conducted at multiple natural gas emission source types involved in the production and processing of products, including but not limited to condensate and product storage tank batteries and compressor stations. Samples were collected downwind of these source types, and general airshed samples were also collected in the Dish, Texas area. A GasFindIR (infrared) camera was used to document emissions and to determine where quantitative downwind carbonyl samples should be collected. One-hour carbonyl samples were collected downwind of the identified sources, and the samples were subsequently analyzed in the TCEQ Organic Analysis Laboratory in Austin, Texas, using a reverse phase C-18 column and either an Ultraviolet/Visible (UV/VIS) photo diode array (PDA) detector or a diode array detector (DAD).

Dish, Texas Area Observations and Findings

Monitoring staff surveyed a total of 12 locations in and around Dish, Texas (see Attachment 1), and collected 18 carbonyl samples downwind of various sources (see Attachment 2). Meteorological data including wind speed, wind direction, and ambient temperature was also collected (see Attachment 3). Twelve samples were collected downwind of a variety of facilities, including Crosstex Energy Services Dish Compressor Station (Site 1), Chesapeake Energy Ponder Compressor Station (Site 1), Atmos Energy Corporation Ponder and Energy Transfer Hog Branch Compressor Stations (Site 1, 3, 8, and 9), Enbridge Gathering North Texas LP Justin East Compressor Station (Sites 3, 8, and 9), Devon Energy Company (Co.) LP DCCO 3, S.H. Griffin Estate 3, 17H and 18H (Site 4), and Devon Energy Co. LP DCCO 3, S.H. Griffin Estate, 2oH, 21H, and 23H (Site 11). Six general airshed samples were also collected (Sites 2, 5, 6, 7, 10, and 12).

Though formaldehyde was the main compound of interest, samples were analyzed for a variety of other target analytes including: acetaldehyde, acetone, acrolein, propionaldehyde, crotonaldehyde, methyl ethyl ketone/methacrolein, butyraldehyde, benzaldehyde, isovaleraldehyde, valeraldehyde, o-tolualdehyde, m-tolualdehyde, p-tolualdehyde, hexaldehyde, 2,5-dimethyl-benzaldehyde, and heptaldehyde. Of these samples, collected during both daytime and nighttime hours, the maximum one-hour concentration of 4.8 parts per billion by volume (ppbv) of formaldehyde was detected in Samples DT1006C-05 and DT1006C-06 on June 16, 2010, from 15:05 – 16:05 and 16:30 – 17:30, respectively. In addition, the maximum one-hour acrolein concentration of 0.15 ppbv was measured in Sample DT1006C-17 on June 17, 2010, from 22:20 – 23:20.

ATTACHMENT 1
SAMPLE LOCATIONS/MAP

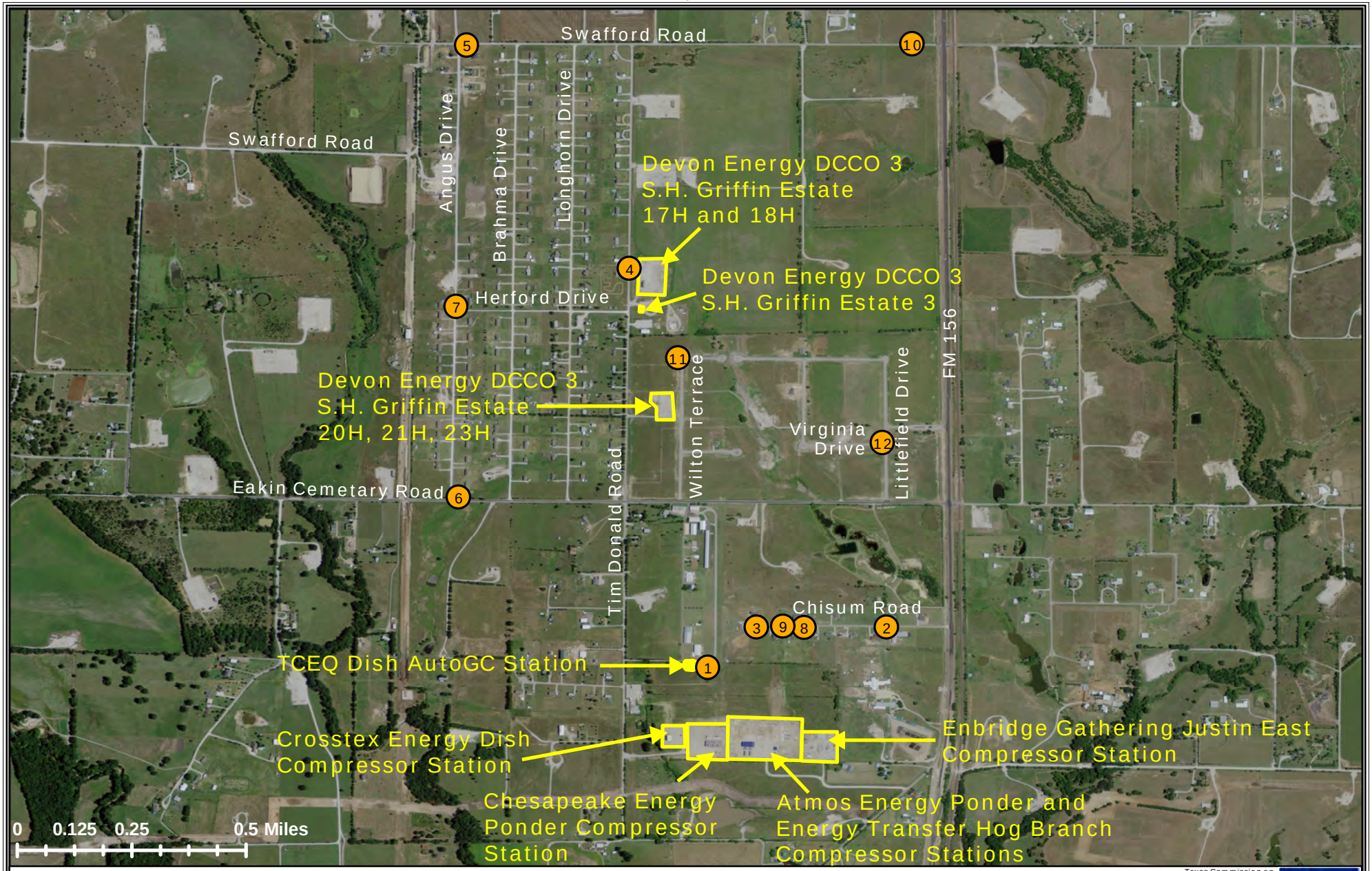
Attachment 1

Sample Locations
Dish, Texas Monitoring Project
June 15 - 18, 2010

Number	Description	GPS Coordinates	
		North Latitude	West Longitude
1	At the Dish AutoGC Station, approximately 0.1 mile east of Tim Donald Road	33.1308977	-97.2975374
2	On Chisum Road, approximately 0.1 mile west of Farm-to-Market (FM) 156	33.1321898	-97.2916086
3	On Chisum Road, approximately 0.35 mile west of FM 156	33.1321889	-97.2957230
4	On Tim Donald Road, approximately 0.1 mile north of Herford Drive	33.1435288	-97.2997292
5	At the intersection of Angus Drive and Swafford Road	33.1505903	-97.3048761
6	At the intersection of Angus Drive and Eakin Cemetary Road	33.1362930	-97.3051421
7	At the intersection of Angus Drive and Herford Drive	33.1423290	-97.3052054
8	On Chisum Road, approximately 0.25 mile west of FM 156	33.1321681	-97.2942210
9	On Chisum Road, approximately 0.3 mile west of FM 156	33.1322145	-97.2948836
10	On Swafford Road, approximately 0.05 mile west of FM 156	33.1506203	-97.2908124
11	On Wilton Terrace, approximately 0.3 mile north of Eakin Cemetary Road	33.1406919	-97.2982075
12	At the intersection of Littlefield Drive and Virginia Drive	33.1380147	-97.2917352

GPS = Global Positioning System.

Map 1



Dish, Texas Sample Locations*
Dish, Texas Monitoring Project
June 15 - 18, 2010

*The following sample locations are included: 1 - 12.

Texas Commission on Environmental Quality
Field Operations Support
Mobile Response Team
Mail Code 165
P.O. Box 13087
Austin, TX 78711-3087

Source: DOQQs are Farm Services Agency 2008 (0.5m) data

Created On: 07/01/2010
Created By: SMA
Revised On: 7/9/10
Revised By: RFE

TCEQ

ATTACHMENT 2
CARBONYL SAMPLE RESULTS

Attachment 2

Carbonyl Data
Dish, Texas Monitoring Project
June 15 - 18, 2010
Van 555

Laboratory ID		100648-0003			100648-0004			100648-0005			100648-0006		
Field ID		DT1006C-01			DT1006C-02			DT1006C-03			DT1006C-04		
Sample Date		6/16/10			6/16/10			6/16/10			6/16/10		
Sample Time		09:20 - 10:20			10:50 - 11:50			12:25 - 13:25			13:50 - 14:50		
Sample Period		1			1			1			1		
Sample Location[a]		1			1			2			3		
Potential Sources		Crosstex Energy Services Dish Compressor Station, Chesapeake Energy Ponder Compressor Station			Crosstex Energy Services Dish Compressor Station, Chesapeake Energy Ponder Compressor Station			Airshed Sample			Atmos Energy Corporation (Corp.) Ponder, Energy Transfer Hog Branch, and Enbridge Gathering North Texas LP Justin East		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.8	1.7	L	4.5	1.7		4.3	1.8		4.2	1.8	
acetaldehyde	2.0	0.69	1.6	J	0.78	1.6	J	1.2	1.7	J	1.1	1.8	J
acetone	3.4	1.2	2.8	J	0.97	2.7	J	1.5	3.0	J	1.3	3.0	J
acrolein	0.31	ND	0.25		ND	0.25		ND	0.27		ND	0.27	
propionaldehyde	0.51	0.15	0.42	J	0.17	0.41	J	0.24	0.45	J	0.21	0.45	J
crotonaldehyde	0.23	ND	0.19		ND	0.19		ND	0.21		ND	0.21	
methyl ethyl ketone/methacrolein	0.75	0.19	0.62	J	0.12	0.61	J	0.14	0.66	J	0.11	0.67	J
butyraldehyde	0.22	0.10	0.18	J	0.22	0.18	L	0.17	0.20	J	0.18	0.20	J
benzaldehyde	0.15	ND	0.13		ND	0.12		ND	0.14		ND	0.14	
isovaleraldehyde	0.18	ND	0.15		ND	0.15		ND	0.16		ND	0.17	
valeraldehyde	0.20	ND	0.17		ND	0.17		ND	0.18		ND	0.18	
o-tolualdehyde	0.34	ND	0.28		ND	0.28		ND	0.30		ND	0.30	
m-tolualdehyde	0.34	ND	0.28		ND	0.28		ND	0.30		ND	0.30	
p-tolualdehyde	0.26	ND	0.22		ND	0.21		ND	0.23		ND	0.24	
hexaldehyde	0.34	ND	0.28		ND	0.27		0.08	0.30	J	0.08	0.30	J
2,5-dimethyl-benzaldehyde	0.22	0.07	0.18	J	0.06	0.18	J	0.07	0.19	J	0.07	0.19	J
heptaldehyde	0.27	ND	0.22		ND	0.22		ND	0.24		ND	0.24	

Laboratory ID		100648-0007			100648-0008			100648-0009			100648-0010			100648-0011		
Field ID		DT1006C-05			DT1006C-06			DT1006C-07			DT1006C-08			DT1006C-09		
Sample Date		6/16/10			6/16/10			6/16/10			6/16/10			6/17/10		
Sample Time		15:05 - 16:05			16:30 - 17:30			17:50 - 18:50			19:10 - 20:10			04:55 - 05:55		
Sample Period		1			1			1			1			2		
Sample Location[a]		3			4			5			7			8		
Potential Sources		Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering North Texas LP Justin East Compressor Stations			Devon Energy Company (Co.) LP DCCO 3, S.H. Griffin Estate 17H and 18H and DCCO 3, S.H. Griffin Estate 3			Airshed Sample			Airshed Sample			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering North Texas LP Justin East Compressor Stations		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	4.8	1.6		4.8	2.1		4.1	1.8		3.6	1.6		3.3	1.6	L
acetaldehyde	2.0	1.1	1.5	J	1.0	2.1	J	0.90	1.7	J	0.75	1.5	J	0.73	1.5	J
acetone	3.4	1.2	2.7	J	1.5	3.5	J	1.1	3.0	J	1.0	2.7	J	0.87	2.7	J
acrolein	0.31	ND	0.24		ND	0.32		ND	0.27		0.09	0.24	J	0.11	0.24	J
propionaldehyde	0.51	0.21	0.40	J	0.26	0.53	J	0.20	0.45	J	0.18	0.40	J	0.15	0.40	J
crotonaldehyde	0.23	ND	0.18		ND	0.24		ND	0.21		ND	0.18		ND	0.18	
methyl ethyl ketone/methacrolein	0.75	0.12	0.59	J	0.18	0.78	J	0.16	0.66	J	0.19	0.59	J	0.33	0.59	J
butyraldehyde	0.22	0.15	0.17	J	0.17	0.23	J	0.14	0.19	J	0.12	0.17	J	0.11	0.17	J
benzaldehyde	0.15	ND	0.12		ND	0.16		ND	0.14		ND	0.12		0.06	0.12	J
isovaleraldehyde	0.18	ND	0.15		ND	0.19		ND	0.16		ND	0.15		ND	0.15	
valeraldehyde	0.20	ND	0.16		ND	0.21		ND	0.18		ND	0.16		ND	0.16	
o-tolualdehyde	0.34	ND	0.27		ND	0.36		ND	0.30		ND	0.27		ND	0.27	
m-tolualdehyde	0.34	ND	0.27		ND	0.36		ND	0.30		ND	0.27		ND	0.27	
p-tolualdehyde	0.26	ND	0.21		ND	0.28		ND	0.23		ND	0.21		ND	0.21	
hexaldehyde	0.34	0.07	0.27	J	0.08	0.35	J	0.07	0.30	J	ND	0.27		0.08	0.27	J
2,5-dimethyl-benzaldehyde	0.22	0.06	0.17	J	0.09	0.23	J	0.07	0.19	J	0.06	0.17	J	0.06	0.17	J
heptaldehyde	0.27	ND	0.22		ND	0.28		ND	0.24		ND	0.21		ND	0.21	

Laboratory ID		100648-0012			100648-0013			100648-0014			100648-0015			100648-0016		
Field ID		DT1006C-10			DT1006C-11			DT1006C-12			DT1006C-13			DT1006C-14		
Sample Date		6/17/10			6/17/10			6/17/10			6/17/10			6/17/10		
Sample Time		06:05 - 07:05			07:15 - 08:15			08:45 - 09:45			10:15 - 11:15			11:55 - 12:55		
Sample Period		2			2			2			2			2		
Sample Location[a]		9			9			6			1			10		
Potential Sources		Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering North Texas LP Justin East Compressor Stations			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering North Texas LP Justin East Compressor Stations			Airshed Sample			Crosstex Energy Services Dish Compressor Station and Chesapeake Energy Ponder Compressor Station			Airshed Sample		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.7	1.8	L	3.2	1.6	L	2.5	1.7	L	3.2	1.8	L	3.3	1.5	L
acetaldehyde	2.0	0.64	1.7	J	0.63	1.5	J	0.68	1.6	J	0.82	1.7	J	0.81	1.5	J
acetone	3.4	0.79	2.9	J	0.74	2.7	J	0.98	2.8	J	0.90	3.0	J	0.65	2.5	J
acrolein	0.31	0.10	0.26	J	ND	0.24		0.06	0.25	J	ND	0.27		ND	0.23	
propionaldehyde	0.51	0.14	0.43	J	0.15	0.40	J	0.25	0.41	J	0.17	0.44	J	0.12	0.38	J
crotonaldehyde	0.23	ND	0.20		ND	0.18		ND	0.19		ND	0.20		ND	0.18	
methyl ethyl ketone/methacrolein	0.75	0.27	0.64	J	0.24	0.59	J	0.26	0.61	J	ND	0.65		0.11	0.56	J
butyraldehyde	0.22	ND	0.19		0.10	0.17	J	0.17	0.18	J	ND	0.19		ND	0.17	
benzaldehyde	0.15	ND	0.13		ND	0.12		ND	0.13		ND	0.13		ND	0.12	
isovaleraldehyde	0.18	ND	0.16		ND	0.15		ND	0.15		ND	0.16		ND	0.14	
valeraldehyde	0.20	ND	0.18		ND	0.16		ND	0.17		ND	0.18		ND	0.15	
o-tolualdehyde	0.34	ND	0.29		ND	0.27		ND	0.28		ND	0.30		ND	0.26	
m-tolualdehyde	0.34	ND	0.29		ND	0.27		ND	0.28		ND	0.30		ND	0.26	
p-tolualdehyde	0.26	ND	0.23		ND	0.21		ND	0.22		ND	0.23		ND	0.20	
hexaldehyde	0.34	0.07	0.29	J	0.07	0.27	J	0.10	0.28	J	ND	0.30		ND	0.26	
2,5-dimethyl-benzaldehyde	0.22	0.07	0.19	J	0.07	0.17	J	0.11	0.18	J	0.12	0.19	J	0.06	0.16	J
heptaldehyde	0.27	ND	0.23		ND	0.21		ND	0.22		ND	0.24		ND	0.20	

Laboratory ID		100648-0017			100648-0018			100648-0019			100648-0020		
Field ID		DT1006C-15			DT1006C-16			DT1006C-17			DT1006C-18		
Sample Date		6/17/10			6/17/10			6/17/10			6/17 - 6/18/10		
Sample Time		13:25 - 14:25			21:00 - 22:00			22:20 - 23:20			23:40 - 00:40		
Sample Period		2			3			3			3		
Sample Location[a]		11			12			3			1		
Potential Sources		Devon Energy Co. LP DCCO 3, S.H. Griffin Estate 20H, 21H, and 23H			Airshed Sample			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering North Texas LP Justin East Compressor Stations			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Chesapeake Energy Ponder Compressor Stations		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	3.2	1.6	L	3.4	1.7	L	4.2	2.0		3.9	1.6	
acetaldehyde	2.0	0.73	1.5	J	0.83	1.6	J	1.0	1.9	J	0.79	1.5	J
acetone	3.4	0.86	2.6	J	0.88	2.8	J	1.2	3.4	J	0.98	2.6	J
acrolein	0.31	ND	0.24		ND	0.25		0.15	0.30	J	0.12	0.24	J
propionaldehyde	0.51	0.16	0.40	J	0.21	0.41	J	0.22	0.50	J	0.19	0.40	J
crotonaldehyde	0.23	ND	0.18		ND	0.19		ND	0.23		ND	0.18	
methyl ethyl ketone/methacrolein	0.75	0.09	0.59	J	0.15	0.61	J	0.31	0.74	J	0.30	0.59	J
butyraldehyde	0.22	0.10	0.17	J	0.11	0.18	J	0.25	0.22	L	ND	0.17	
benzaldehyde	0.15	ND	0.12		ND	0.13		ND	0.15		ND	0.12	
isovaleraldehyde	0.18	ND	0.15		ND	0.15		ND	0.18		ND	0.15	
valeraldehyde	0.20	ND	0.16		ND	0.17		ND	0.20		ND	0.16	
o-tolualdehyde	0.34	ND	0.27		ND	0.28		ND	0.34		ND	0.27	
m-tolualdehyde	0.34	ND	0.27		ND	0.28		ND	0.34		ND	0.27	
p-tolualdehyde	0.26	ND	0.21		ND	0.22		ND	0.26		ND	0.21	
hexaldehyde	0.34	ND	0.27		0.08	0.28	J	0.09	0.34	J	0.08	0.27	J
2,5-dimethyl-benzaldehyde	0.22	0.07	0.17	J	ND	0.18		0.09	0.21	J	0.07	0.17	J
heptaldehyde	0.27	ND	0.21		ND	0.22		ND	0.27		ND	0.21	

[a]See Table 1 and Map for sample location information.

All concentrations are reported in parts per billion by volume (ppbv).

J = reported concentration is below the Sample Detection Limit (SDL).

L = reported concentration is greater than or equal to the SDL but less than the Sample Quantitation Limit.

LOD = Limit of Detection, based on a 60-liter sample volume.

ND = not detected.

SDL = Sample Detection Limit (LOD adjusted for sample volume).

ATTACHMENT 3
METEOROLOGICAL DATA

Attachment 3

Carbonyl Meteorological Data
Dish, Texas Monitoring Project
June 15 - 18, 2010
Van 555

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-01					
6/16/10	09:25	1	11	203	85
6/16/10	09:30	1	11	203	85
6/16/10	09:35	1	10	191	85
6/16/10	09:40	1	9	184	86
6/16/10	09:45	1	8	198	86
6/16/10	09:50	1	8	204	87
6/16/10	09:55	1	8	195	87
6/16/10	10:00	1	9	187	86
6/16/10	10:05	1	9	197	87
6/16/10	10:10	1	10	196	87
6/16/10	10:15	1	10	203	87
6/16/10	10:20	1	10	193	87
Sample DT1006C-02					
6/16/10	10:55	1	9	206	88
6/16/10	11:00	1	8	212	88
6/16/10	11:05	1	8	214	89
6/16/10	11:10	1	9	199	89
6/16/10	11:15	1	8	207	89
6/16/10	11:20	1	7	207	90
6/16/10	11:25	1	7	212	89
6/16/10	11:30	1	9	216	90
6/16/10	11:35	1	8	196	90
6/16/10	11:40	1	11	189	90
6/16/10	11:45	1	9	184	90
6/16/10	11:50	1	8	183	90

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-03					
6/16/10	12:30	2	8	176	92
6/16/10	12:35	2	8	161	93
6/16/10	12:40	2	6	183	93
6/16/10	12:45	2	8	153	93
6/16/10	12:50	2	9	150	93
6/16/10	12:55	2	8	149	93
6/16/10	13:00	2	8	154	94
6/16/10	13:05	2	9	154	93
6/16/10	13:10	2	7	177	94
6/16/10	13:15	2	9	147	94
6/16/10	13:20	2	9	153	94
6/16/10	13:25	2	9	167	94
Sample DT1006C-04					
6/16/10	13:55	3	9	179	94
6/16/10	14:00	3	10	174	94
6/16/10	14:05	3	9	176	94
6/16/10	14:10	3	7	166	94
6/16/10	14:15	3	6	154	94
6/16/10	14:20	3	6	154	95
6/16/10	14:25	3	8	172	95
6/16/10	14:30	3	6	155	95
6/16/10	14:35	3	5	144	95
6/16/10	14:40	3	7	158	95
6/16/10	14:45	3	6	142	95
6/16/10	14:50	3	5	127	94

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-05					
6/16/10	15:10	3	6	140	95
6/16/10	15:15	3	7	155	96
6/16/10	15:20	3	9	167	96
6/16/10	15:25	3	8	179	95
6/16/10	15:30	3	5	129	94
6/16/10	15:35	3	5	129	95
6/16/10	15:40	3	8	172	96
6/16/10	15:45	3	6	158	96
6/16/10	15:50	3	7	138	94
6/16/10	15:55	3	5	126	94
6/16/10	16:00	3	6	138	95
6/16/10	16:05	3	5	129	94
Sample DT1006C-06					
6/16/10	16:35	4	9	152	96
6/16/10	16:40	4	9	155	95
6/16/10	16:45	4	9	148	94
6/16/10	16:50	4	9	152	95
6/16/10	16:55	4	10	150	96
6/16/10	17:00	4	9	140	96
6/16/10	17:05	4	10	154	96
6/16/10	17:10	4	9	154	96
6/16/10	17:15	4	13	156	95
6/16/10	17:20	4	9	144	95
6/16/10	17:25	4	9	139	96
6/16/10	17:30	4	10	149	96

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-07					
6/16/10	17:55	5	9	168	96
6/16/10	18:00	5	11	175	95
6/16/10	18:05	5	10	183	96
6/16/10	18:10	5	11	182	95
6/16/10	18:15	5	9	171	95
6/16/10	18:20	5	9	163	95
6/16/10	18:25	5	9	151	95
6/16/10	18:30	5	8	155	95
6/16/10	18:35	5	8	159	95
6/16/10	18:40	5	9	166	95
6/16/10	18:45	5	9	170	95
6/16/10	18:50	5	9	160	94
Sample DT1006C-08					
6/16/10	19:15	7	9	147	93
6/16/10	19:20	7	9	157	93
6/16/10	19:25	7	9	160	93
6/16/10	19:30	7	9	150	93
6/16/10	19:35	7	8	151	93
6/16/10	19:40	7	8	149	92
6/16/10	19:45	7	8	148	92
6/16/10	19:50	7	9	147	92
6/16/10	19:55	7	10	143	92
6/16/10	20:00	7	9	145	92
6/16/10	20:05	7	8	145	91
6/16/10	20:10	7	8	150	91

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-09					
6/17/10	05:00	8	4	160	80
6/17/10	05:05	8	4	162	79
6/17/10	05:10	8	4	166	79
6/17/10	05:15	8	4	171	79
6/17/10	05:20	8	3	172	79
6/17/10	05:25	8	3	169	79
6/17/10	05:30	8	4	169	79
6/17/10	05:35	8	5	167	79
6/17/10	05:40	8	4	165	78
6/17/10	05:45	8	5	172	78
6/17/10	05:50	8	5	171	78
6/17/10	05:55	8	5	176	78
Sample DT1006C-10					
6/17/10	06:10	9	6	178	78
6/17/10	06:15	9	5	168	78
6/17/10	06:20	9	6	168	78
6/17/10	06:25	9	5	168	78
6/17/10	06:30	9	6	168	78
6/17/10	06:35	9	7	165	78
6/17/10	06:40	9	6	166	78
6/17/10	06:45	9	5	170	78
6/17/10	06:50	9	6	173	78
6/17/10	06:55	9	7	171	78
6/17/10	07:00	9	7	174	78
6/17/10	07:05	9	7	174	79

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-11					
6/17/10	07:20	9	8	176	79
6/17/10	07:25	9	8	175	79
6/17/10	07:30	9	6	183	79
6/17/10	07:35	9	7	180	79
6/17/10	07:40	9	7	180	79
6/17/10	07:45	9	8	179	80
6/17/10	07:50	9	8	181	80
6/17/10	07:55	9	6	181	80
6/17/10	08:00	9	6	179	80
6/17/10	08:05	9	6	187	81
6/17/10	08:10	9	9	184	81
6/17/10	08:15	9	8	187	81
Sample DT1006C-12					
6/17/10	08:50	6	9	191	83
6/17/10	08:55	6	9	189	83
6/17/10	09:00	6	12	196	83
6/17/10	09:05	6	10	196	84
6/17/10	09:10	6	9	190	84
6/17/10	09:15	6	12	191	84
6/17/10	09:20	6	11	200	84
6/17/10	09:25	6	10	192	85
6/17/10	09:30	6	10	185	85
6/17/10	09:35	6	8	190	86
6/17/10	09:40	6	12	182	85
6/17/10	09:45	6	11	181	85

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-13					
6/17/10	10:20	1	10	194	87
6/17/10	10:25	1	14	190	87
6/17/10	10:30	1	12	188	87
6/17/10	10:35	1	11	180	88
6/17/10	10:40	1	12	172	87
6/17/10	10:45	1	12	179	88
6/17/10	10:50	1	14	187	87
6/17/10	10:55	1	11	196	88
6/17/10	11:00	1	13	178	88
6/17/10	11:05	1	12	182	88
6/17/10	11:10	1	12	202	88
6/17/10	11:15	1	15	195	88
Sample DT1006C-14					
6/17/10	12:00	10	16	188	91
6/17/10	12:05	10	15	181	92
6/17/10	12:10	10	14	191	91
6/17/10	12:15	10	16	196	91
6/17/10	12:20	10	16	187	92
6/17/10	12:25	10	14	196	92
6/17/10	12:30	10	18	182	92
6/17/10	12:35	10	17	194	93
6/17/10	12:40	10	15	184	93
6/17/10	12:45	10	13	192	93
6/17/10	12:50	10	13	188	93
6/17/10	12:55	10	14	196	93

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-15					
6/17/10	13:30	11	11	204	92
6/17/10	13:35	11	13	195	93
6/17/10	13:40	11	12	190	94
6/17/10	13:45	11	13	180	93
6/17/10	13:50	11	11	180	93
6/17/10	13:55	11	14	186	93
6/17/10	14:00	11	13	181	94
6/17/10	14:05	11	14	176	93
6/17/10	14:10	11	15	185	93
6/17/10	14:15	11	14	172	93
6/17/10	14:20	11	13	175	93
6/17/10	14:25	11	15	167	94
Sample DT1006C-16					
6/17/10	21:05	12	6	156	89
6/17/10	21:10	12	7	158	89
6/17/10	21:15	12	7	159	89
6/17/10	21:20	12	7	156	89
6/17/10	21:25	12	7	155	88
6/17/10	21:30	12	6	155	88
6/17/10	21:35	12	6	156	88
6/17/10	21:40	12	8	159	88
6/17/10	21:45	12	8	156	88
6/17/10	21:50	12	7	156	87
6/17/10	21:55	12	7	159	87
6/17/10	22:00	12	6	153	87

Attachment 3 (continued)

Date	Time	Site[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Average Temperature (degrees F)
Sample DT1006C-17					
6/17/10	22:25	3	5	154	87
6/17/10	22:30	3	6	158	87
6/17/10	22:35	3	6	153	87
6/17/10	22:40	3	5	155	87
6/17/10	22:45	3	5	153	87
6/17/10	22:50	3	5	156	86
6/17/10	22:55	3	6	158	86
6/17/10	23:00	3	6	161	86
6/17/10	23:05	3	8	165	86
6/17/10	23:10	3	8	162	86
6/17/10	23:15	3	7	164	86
6/17/10	23:20	3	7	165	86
Sample DT1006C-18					
6/17/10	23:45	1	6	161	86
6/17/10	23:50	1	7	154	85
6/17/10	23:55	1	8	160	86
6/18/10	00:00	1	8	154	86
6/18/10	00:05	1	8	155	85
6/18/10	00:10	1	8	162	86
6/18/10	00:15	1	8	166	85
6/18/10	00:20	1	6	168	85
6/18/10	00:25	1	5	164	85
6/18/10	00:30	1	6	152	84
6/18/10	00:35	1	5	154	84
6/18/10	00:40	1	6	158	84

[a]See Table 1 and Map for site location information.

[b]All wind direction data based on magnetic north.

Date Printed: 6/30/2010

Texas Commission on Environmental Quality

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

Laboratory Analysis Results
ACL Number: 100648

ACL Lead: Karen Bachtel Region: T04 Date Received: 6/18/2010

Project(s): Dish Texas Monitoring Project

Facility(ies) Sampled	City	County	Facility Type
Dish Area Comp. Sta. & Nat. Gas Gatherin	Dish	Denton	Oil and Gas Extraction

Laboratory Procedure(s) Performed:

Analysis: AMOR002
Determination of Aldehydes and Ketones in Ambient Air Samples Collected on Sep-Pak Dinitrophenylhydrazine (DNPH) Coated Silica Cartridges by High Performance Liquid Chromatography (HPLC) Using Modified Method TO-11
Procedure:
Ambient air samples are collected using DNPH-coated cartridges. Samples are extracted using acetonitrile and water and brought to a final volume of 5.0 ml. Extracts are analyzed using an HPLC with a Waters Symmetry C18 column to achieve separation and a Ultra Violet/Visible (UV/VIS) detector. Analytes are quantitated using external standards and the average blank values are subtracted from the measured values to correct for positive bias inherent to the sampling technique. This method is based on the specific reaction of organic aldehyde and ketone compounds with DNPH-coated cartridges in the presence of an acid to form stable derivatives.

Sample(s) Received

Field ID Number: DT1006C-FB Laboratory Sample Number: 100648-0001FB Sampled by: Tom Randolph / Rober
Sampling Site: A Date & Time Sampled: 06/16/10 09:20:00 Valid Sample: Yes
Comments:
At the Dish, TX Auto GC Site ~ 0.1 mile E from Tim Donald Rd

Field ID Number: DT1006C-TB Laboratory Sample Number: 100648-0002TB Sampled by: Tom Randolph
Sampling Site: N/A Date & Time Sampled: 06/18/10 14:30:00 Valid Sample: Yes
Comments:
TCEQ Bldg B Room 143

Field ID Number: DT1006C-01 Laboratory Sample Number: 100648-0003 Sampled by: Tom Randolph / Rober
Sampling Site: A Date & Time Sampled: 06/16/10 09:20:00 Valid Sample: Yes
Comments:
At the Dish, TX Auto GC Site ~ 0.1 mile E from Tim Donald Rd

Field ID Number: DT1006C-01D Laboratory Sample Number: 100648-0003FD Sampled by: Tom Randolph / Rober
Sampling Site: A Date & Time Sampled: 06/16/10 09:20:00 Valid Sample: Yes
Comments:
At the Dish, TX Auto GC Site ~ 0.1 mile E from Tim Donald Rd

Field ID Number: DT1006C-02 Laboratory Sample Number: 100648-0004 Sampled by: Tom Randolph / Rober
Sampling Site: A Date & Time Sampled: 06/16/10 10:50:00 Valid Sample: Yes
Comments:
At the Dish, TX Auto GC Site ~ 0.1 mile E from Tim Donald Rd

Date Printed: 6/30/2010

Texas Commission on Environmental Quality

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

Laboratory Analysis Results
ACL Number: 100648

Sample(s) Received

Field ID Number: DT1006C-02MS Laboratory Sample Number: 100648-0004MS Sampled by: Tom Randolph / Robei
Sampling Site: A Date & Time Sampled: 06/16/10 10:50:00 Valid Sample: Yes
Comments:
At the Dish, TX Auto GC Site ~ 0.1 mile E from Tim Donald Rd

Field ID Number: DT1006C-02MSD Laboratory Sample Number: 100648-0004MSD Sampled by: Tom Randolph / Robei
Sampling Site: A Date & Time Sampled: 06/16/10 10:50:00 Valid Sample: Yes
Comments:
At the Dish, TX Auto GC Site ~ 0.1 mile E from Tim Donald Rd

Field ID Number: DT1006C-03 Laboratory Sample Number: 100648-0005 Sampled by: Robert Eby
Sampling Site: B Date & Time Sampled: 06/16/10 12:25:00 Valid Sample: Yes
Comments:
On Chisum Rd ~ 0.1 mile West from FM 156

Field ID Number: DT1006C-04 Laboratory Sample Number: 100648-0006 Sampled by: Tom Randolph / Robei
Sampling Site: C Date & Time Sampled: 06/16/10 13:50:00 Valid Sample: Yes
Comments:
On Chisum Rd ~ 0.35 mile West from FM 156

Field ID Number: DT1006C-05 Laboratory Sample Number: 100648-0007 Sampled by: Tom Randolph
Sampling Site: C Date & Time Sampled: 06/16/10 15:05:00 Valid Sample: Yes
Comments:
On Chisum Rd ~ 0.35 mile West from FM 156

Field ID Number: DT1006C-06 Laboratory Sample Number: 100648-0008 Sampled by: Tom Randolph / Robei
Sampling Site: D Date & Time Sampled: 06/16/10 16:30:00 Valid Sample: Yes
Comments:
On Tim Donald Rd ~ 0.1 mile North of Hereford Dr

Field ID Number: DT1006C-07 Laboratory Sample Number: 100648-0009 Sampled by: Robert Eby
Sampling Site: E Date & Time Sampled: 06/16/10 17:50:00 Valid Sample: Yes
Comments:
Intersection of Angus Dr and Swafford Rd

Field ID Number: DT1006C-08 Laboratory Sample Number: 100648-0010 Sampled by: Robert Eby
Sampling Site: F Date & Time Sampled: 06/16/10 19:10:00 Valid Sample: Yes
Comments:
Intersection of Angus and Hereford

Field ID Number: DT1006C-09 Laboratory Sample Number: 100648-0011 Sampled by: Tom Randolph
Sampling Site: G Date & Time Sampled: 06/17/10 04:55:00 Valid Sample: Yes
Comments:
Chisum Rd ~ 0.25 mile West of FM 156

Date Printed: 6/30/2010

Texas Commission on Environmental Quality

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

Laboratory Analysis Results
ACL Number: 100648

Sample(s) Received

Field ID Number: DT1006C-10 Laboratory Sample Number: 100648-0012 Sampled by: Tom Randolph
Sampling Site: H Date & Time Sampled: 06/17/10 06:05:00 Valid Sample: Yes
Comments:
Chisum Rd ~ 0.3 mile West of FM 156

Field ID Number: DT1006C-11 Laboratory Sample Number: 100648-0013 Sampled by: Tom Randolph
Sampling Site: H Date & Time Sampled: 06/17/10 07:15:00 Valid Sample: Yes
Comments:
Chisum Rd ~ 0.3 mile West of FM 156

Field ID Number: DT1006C-12 Laboratory Sample Number: 100648-0014 Sampled by: Robert Eby
Sampling Site: I Date & Time Sampled: 06/17/10 08:45:00 Valid Sample: Yes
Comments:
Intersection of Angus Dr and Eakin Cemetery Rd

Field ID Number: DT1006C-13 Laboratory Sample Number: 100648-0015 Sampled by: Robert Eby
Sampling Site: A Date & Time Sampled: 06/17/10 10:15:00 Valid Sample: Yes
Comments:
Dish TX Auto GC

Field ID Number: DT1006C-14 Laboratory Sample Number: 100648-0016 Sampled by: Robert Eby
Sampling Site: J Date & Time Sampled: 06/17/10 11:55:00 Valid Sample: Yes
Comments:
On Swafford Rd ~ 0.05 mile West of FM 156

Field ID Number: DT1006C-15 Laboratory Sample Number: 100648-0017 Sampled by: Robert Eby
Sampling Site: K Date & Time Sampled: 06/17/10 13:25:00 Valid Sample: Yes
Comments:
On Wilton Terrace ~ 0.3 mile North of Eakin Cemetery Rd

Field ID Number: DT1006C-16 Laboratory Sample Number: 100648-0018 Sampled by: Robert Eby
Sampling Site: L Date & Time Sampled: 06/17/10 21:00:00 Valid Sample: Yes
Comments:
At intersection of Virginia Dr and Littlefield Dr

Field ID Number: DT1006C-17 Laboratory Sample Number: 100648-0019 Sampled by: Robert Eby
Sampling Site: C Date & Time Sampled: 06/17/10 22:20:00 Valid Sample: Yes
Comments:
On Chisum Rd ~ 0.35 mile West from FM 156

Field ID Number: DT1006C-18 Laboratory Sample Number: 100648-0020 Sampled by: Robert Eby
Sampling Site: A Date & Time Sampled: 06/17/10 23:40:00 Valid Sample: Yes
Comments:
Dish TX Auto GC Site ~ 0.1 mile East from Tim Donald Rd

Date Printed: 6/30/2010

Texas Commission on Environmental Quality

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

Laboratory Analysis Results

ACL Number: 100648

Analyst: A Mathew — Date: 6/30/10
Anita Mathew

Reviewed By: Bachtel — Date: 6/30/2010
Karen Bachtel

Technical Specialist: D. Manis — Date: 6/30/10
David Manis

ACL # 100648

Laboratory ID		100648-0001FB			100648-0002TB			100648-0003			100648-0003FD			100648-0004		
Field ID		DT1006C-FB			DT1006C-TB			DT1006C-01			DT1006C-01D			DT1006C-02		
Analysis Date		6/21/2010			6/21/2010			6/21/2010			6/21/2010			6/21/2010		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	0.20	1.7	J	0.07	1.7	J	2.8	1.7	L	2.5	1.6	L	4.5	1.7	
acetaldehyde	2.0	0.12	1.7	J	ND	1.7		0.69	1.6	J	0.73	1.6	J	0.78	1.6	J
acetone	3.4	0.09	2.9	J	0.05	2.9	J	1.2	2.8	J	1.1	2.7	J	0.97	2.7	J
acrolein	0.31	ND	0.26		ND	0.26		ND	0.25		ND	0.25		ND	0.25	
propionaldehyde	0.51	ND	0.43		ND	0.43		0.15	0.42	J	0.26	0.41	J	0.17	0.41	J
crotonaldehyde	0.23	ND	0.20		ND	0.20		ND	0.19		ND	0.19		ND	0.19	
methyl ethyl ketone/methacrolein	0.75	ND	0.64		ND	0.64		0.19	0.62	J	0.22	0.60	J	0.12	0.61	J
butyraldehyde	0.22	ND	0.19		ND	0.19		0.10	0.18	J	0.11	0.18	J	0.22	0.18	L
benzaldehyde	0.15	ND	0.13		ND	0.13		ND	0.13		ND	0.12		ND	0.12	
isovaleraldehyde	0.18	ND	0.16		ND	0.16		ND	0.15		ND	0.15		ND	0.15	
valeraldehyde	0.20	ND	0.17		ND	0.17		ND	0.17		ND	0.16		ND	0.17	
o-tolualdehyde	0.34	ND	0.29		ND	0.29		ND	0.28		ND	0.27		ND	0.28	
m-tolualdehyde	0.34	ND	0.29		ND	0.29		ND	0.28		ND	0.27		ND	0.28	
p-tolualdehyde	0.26	ND	0.23		ND	0.23		ND	0.22		ND	0.21		ND	0.21	
hexaldehyde	0.34	ND	0.29		ND	0.29		ND	0.28		ND	0.27		ND	0.27	
2,5-dimethyl-benzaldehyde	0.22	ND	0.19		ND	0.19		0.07	0.18	J	0.06	0.17	J	0.06	0.18	J
heptaldehyde	0.27	ND	0.23		ND	0.23		ND	0.22		ND	0.22		ND	0.22	

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

J=Reported concentration is below the SDL

L=Reported concentration is greater than or equal to the SDL but less than the Sample Quantitation Limit

LOD - Limit of Detection based on a 60 Liter sample volume

ND - not detected

SDL - Sample Detection Limit (LOD adjusted for sample volume)

VERIFIED 6/30/10

ACL # 100648

Laboratory ID		100648-0004MS			100648-0004MSD			100648-0005			100648-0006			100648-0007		
Field ID		DT1006C-02MS			DT1006C-02MSD			DT1006C-03			DT1006C-04			DT1006C-05		
Analysis Date		6/21/2010			6/21/2010			6/21/2010			6/21/2010			6/22/2010		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	15	2.1		14	2.1		4.3	1.8		4.2	1.8		4.8	1.6	
acetaldehyde	2.0	7.2	2.0		6.9	2.0		1.2	1.7	J	1.1	1.8	J	1.1	1.5	J
acetone	3.4	3.8	3.5	L	3.7	3.5	L	1.5	3.0	J	1.3	3.0	J	1.2	2.7	J
acrolein	0.31	4.0	0.32		3.9	0.32		ND	0.27		ND	0.27		ND	0.24	
propionaldehyde	0.51	4.6	0.52		4.5	0.53		0.24	0.45	J	0.21	0.45	J	0.21	0.40	J
crotonaldehyde	0.23	3.5	0.24		3.4	0.24		ND	0.21		ND	0.21		ND	0.18	
methyl ethyl ketone/methacrolein	0.75	3.2	0.77		3.3	0.78		0.14	0.66	J	0.11	0.67	J	0.12	0.59	J
butyraldehyde	0.22	4.0	0.23		3.9	0.23		0.17	0.20	J	0.18	0.20	J	0.15	0.17	J
benzaldehyde	0.15	3.0	0.16		2.9	0.16		ND	0.14		ND	0.14		ND	0.12	
isovaleraldehyde	0.18	3.0	0.19		3.1	0.19		ND	0.16		ND	0.17		ND	0.15	
valeraldehyde	0.20	3.1	0.21		3.1	0.21		ND	0.18		ND	0.18		ND	0.16	
o-tolualdehyde	0.34	2.4	0.35		2.4	0.35		ND	0.30		ND	0.30		ND	0.27	
m-tolualdehyde	0.34	2.5	0.35		2.5	0.35		ND	0.30		ND	0.30		ND	0.27	
p-tolualdehyde	0.26	2.6	0.27		2.6	0.28		ND	0.23		ND	0.24		ND	0.21	
hexaldehyde	0.34	2.5	0.35		2.5	0.35		0.08	0.30	J	0.08	0.30	J	0.07	0.27	J
2,5-dimethyl-benzaldehyde	0.22	2.3	0.22		2.4	0.23		0.07	0.19	J	0.07	0.19	J	0.06	0.17	J
heptaldehyde	0.27	2.9	0.28		2.8	0.28		ND	0.24		ND	0.24		ND	0.22	

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SDL - Sample Detection Limit (LOD adjusted for sample volume)

VERIFIED 6/30/10

ACL # 100648

Laboratory ID		100648-0008			100648-0009			100648-0010			100648-0011			100648-0012		
Field ID		DT1006C-06			DT1006C-07			DT1006C-08			DT1006C-09			DT1006C-10		
Analysis Date		6/22/2010			6/22/2010			6/22/2010			6/22/2010			6/22/2010		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	4.8	2.1		4.1	1.8		3.6	1.6		3.3	1.6	L	2.7	1.8	L
acetaldehyde	2.0	1.0	2.1	J	0.90	1.7	J	0.75	1.5	J	0.73	1.5	J	0.64	1.7	J
acetone	3.4	1.5	3.5	J	1.1	3.0	J	1.0	2.7	J	0.87	2.7	J	0.79	2.9	J
acrolein	0.31	ND	0.32		ND	0.27		0.09	0.24	J	0.11	0.24	J	0.10	0.26	J
propionaldehyde	0.51	0.26	0.53	J	0.20	0.45	J	0.18	0.40	J	0.15	0.40	J	0.14	0.43	J
crotonaldehyde	0.23	ND	0.24		ND	0.21		ND	0.18		ND	0.18		ND	0.20	
methyl ethyl ketone/methacrolein	0.75	0.18	0.78	J	0.16	0.66	J	0.19	0.59	J	0.33	0.59	J	0.27	0.64	J
butyraldehyde	0.22	0.17	0.23	J	0.14	0.19	J	0.12	0.17	J	0.11	0.17	J	ND	0.19	
benzaldehyde	0.15	ND	0.16		ND	0.14		ND	0.12		0.06	0.12	J	ND	0.13	
isovaleraldehyde	0.18	ND	0.19		ND	0.16		ND	0.15		ND	0.15		ND	0.16	
valeraldehyde	0.20	ND	0.21		ND	0.18		ND	0.16		ND	0.16		ND	0.18	
o-tolualdehyde	0.34	ND	0.36		ND	0.30		ND	0.27		ND	0.27		ND	0.29	
m-tolualdehyde	0.34	ND	0.36		ND	0.30		ND	0.27		ND	0.27		ND	0.29	
p-tolualdehyde	0.26	ND	0.28		ND	0.23		ND	0.21		ND	0.21		ND	0.23	
hexaldehyde	0.34	0.08	0.35	J	0.07	0.30	J	ND	0.27		0.08	0.27	J	0.07	0.29	J
2,5-dimethyl-benzaldehyde	0.22	0.09	0.23	J	0.07	0.19	J	0.06	0.17	J	0.06	0.17	J	0.07	0.19	J
heptaldehyde	0.27	ND	0.28		ND	0.24		ND	0.21		ND	0.21		ND	0.23	

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SDL - Sample Detection Limit (LOD adjusted for sample volume)

VERIFIED AM 6/30/10

ACL # 100648

Laboratory ID		100648-0013			100648-0014			100648-0015			100648-0016			100648-0017		
Field ID		DT1006C-11			DT1006C-12			DT1006C-13			DT1006C-14			DT1006C-15		
Analysis Date		6/22/2010			6/23/2010			6/23/2010			6/23/2010			6/23/2010		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	3.2	1.6	L	2.5	1.7	L	3.2	1.8	L	3.3	1.5	L	3.2	1.6	L
acetaldehyde	2.0	0.63	1.5	J	0.68	1.6	J	0.82	1.7	J	0.81	1.5	J	0.73	1.5	J
acetone	3.4	0.74	2.7	J	0.98	2.8	J	0.90	3.0	J	0.65	2.5	J	0.86	2.6	J
acrolein	0.31	ND	0.24		0.06	0.25	J	ND	0.27		ND	0.23		ND	0.24	
propionaldehyde	0.51	0.15	0.40	J	0.25	0.41	J	0.17	0.44	J	0.12	0.38	J	0.16	0.40	J
crotonaldehyde	0.23	ND	0.18		ND	0.19		ND	0.20		ND	0.18		ND	0.18	
methyl ethyl ketone/methacrolein	0.75	0.24	0.59	J	0.26	0.61	J	ND	0.65		0.11	0.56	J	0.09	0.59	J
butyraldehyde	0.22	0.10	0.17	J	0.17	0.18	J	ND	0.19		ND	0.17		0.10	0.17	J
benzaldehyde	0.15	ND	0.12		ND	0.13		ND	0.13		ND	0.12		ND	0.12	
isovaleraldehyde	0.18	ND	0.15		ND	0.15		ND	0.16		ND	0.14		ND	0.15	
valeraldehyde	0.20	ND	0.16		ND	0.17		ND	0.18		ND	0.15		ND	0.16	
o-tolualdehyde	0.34	ND	0.27		ND	0.28		ND	0.30		ND	0.26		ND	0.27	
m-tolualdehyde	0.34	ND	0.27		ND	0.28		ND	0.30		ND	0.26		ND	0.27	
p-tolualdehyde	0.26	ND	0.21		ND	0.22		ND	0.23		ND	0.20		ND	0.21	
hexaldehyde	0.34	0.07	0.27	J	0.10	0.28	J	ND	0.30		ND	0.26		ND	0.27	
2,5-dimethyl-benzaldehyde	0.22	0.07	0.17	J	0.11	0.18	J	0.12	0.19	J	0.06	0.16	J	0.07	0.17	J
heptaldehyde	0.27	ND	0.21		ND	0.22		ND	0.24		ND	0.20		ND	0.21	

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UNIFIED AM 6/30/10

ACL # 100648

Laboratory ID		100648-0018			100648-0019			100648-0020		
Field ID		DT1006C-16			DT1006C-17			DT1006C-18		
Analysis Date		6/23/2010			6/23/2010			6/23/2010		
Compound	**LOD**	**Concentration**	**SDL**	Flag	**Concentration**	**SDL**	Flag	**Concentration**	**SDL**	Flag
formaldehyde	2.0	3.4	1.7	L	4.2	2.0		3.9	1.6	
acetaldehyde	2.0	0.83	1.6	J	1.0	1.9	J	0.79	1.5	J
acetone	3.4	0.88	2.8	J	1.2	3.4	J	0.98	2.6	J
acrolein	0.31	ND	0.25		0.15	0.30	J	0.12	0.24	J
propionaldehyde	0.51	0.21	0.41	J	0.22	0.50	J	0.19	0.40	J
crotonaldehyde	0.23	ND	0.19		ND	0.23		ND	0.18	
methyl ethyl ketone/methacrolein	0.75	0.15	0.61	J	0.31	0.74	J	0.30	0.59	J
butyraldehyde	0.22	0.11	0.18	J	0.25	0.22	L	ND	0.17	
benzaldehyde	0.15	ND	0.13		ND	0.15		ND	0.12	
isovaleraldehyde	0.18	ND	0.15		ND	0.18		ND	0.15	
valeraldehyde	0.20	ND	0.17		ND	0.20		ND	0.16	
o-tolualdehyde	0.34	ND	0.28		ND	0.34		ND	0.27	
m-tolualdehyde	0.34	ND	0.28		ND	0.34		ND	0.27	
p-tolualdehyde	0.26	ND	0.22		ND	0.26		ND	0.21	
hexaldehyde	0.34	0.08	0.28	J	0.09	0.34	J	0.08	0.27	J
2,5-dimethyl-benzaldehyde	0.22	ND	0.18		0.09	0.21	J	0.07	0.17	J
heptaldehyde	0.27	ND	0.22		ND	0.27		ND	0.21	

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USR IF, LOD 6/30/10