TCEQ Interoffice Memorandum

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

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

From: Shannon Ethridge, M.S. SE.
Toxicology Division, Chief Engineer's Office

Date: February 24, 2011

Subject: Health Effects Evaluation of Region 4 Carbonyl Monitoring Project, November 6 – 10, 2010, Sampling for Carbonyl Compounds in Dish and Fort Worth, Texas

Conclusions

- 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.

Background

The Texas Commission on Environmental Quality (TCEQ) Mobile Response Team (MRT) conducted an ambient air monitoring project in the TCEQ Dallas/Fort Worth Region from November 6 - 10, 2010. Monitoring and site assessment was conducted downwind of possible combustion processes at natural gas-related production facilities in the Barnett Shale Formation area including compressor stations in Dish and the Lake Arlington Compressor Station. In addition to sampling specific sources, airshed samples were collected to assess general area concentrations of formaldehyde. Two sampling vans equipped with automated carbonyl analyzers were used to collect 31 one-hour Sep-Pak Dinitrophenylhydrazine (DNPH) Coated Silica Cartridge samples. Samples were analyzed for 18 target carbonyls (methyl ethyl ketone and methacrolein co-elute) using a reverse phase C-18 column and an Ultraviolet/Visible (UV/VIS) photo diode array (PDA) detector in the TCEQ Air and Emissions Laboratory in Austin, Texas. More details on the project including sampling results and maps of sampling locations can be obtained from the report entitled *Region 4 Carbonyl Monitoring Project, November 6 – 10, 2010, Sampling for Carbonyl Compounds in Dish and Fort Worth, Texas*.

Results

Reported carbonyl concentrations in 31 one-hour samples were compared to TCEQ's short-term health- and odor-based AMCVs. 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 1 provides a list of target compounds and their associated odor and short-term health AMCVs. 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 report experiencing the apple-like odor associated with isovaleradehyde (HSDB 2010). 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. Formaldehyde, the primary target compound for this project, ranged from 1.0 parts per billion by volume (ppb_v) to 5.4 ppb_v. The one-hour formaldehyde concentrations measured in this investigation are lower than the 2005 – 2008 statewide one-hour average formaldehyde concentration of 6 ppb_v measured at seven stationary monitors in Texas. The investigators experienced intermittent exhaust odors downwind of the compressor stations in Dish as well as light and intermittent natural gas odors downwind of the Chesapeake Energy Ponder facility during sampling. It is likely that the chemical(s) causing the odors experienced by the investigators were not target analyte(s) for this project.

If you have any questions regarding the contents of this review, please do not hesitate to contact me at (512) 239-1822 or via email at shannon.ethridge@tceq.texas.gov.

Table 1. Target Carbonyls and Associated Odor and Short-Term Health AMCVs

Compound	Odor AMCV (ppb_v)	Short-Term Health AMCV (ppb_v)
formaldehyde	500	41
acetaldehyde	50	250
acetone	3600	2500
acrolein	3.6	4.8
propionaldehyde	5	21
crotonaldehyde	23	3
methyl ethyl ketone/methacrolein	8.5	19
butyraldehyde	5	2700
benzaldehyde	5	21
isovaleraldehyde	0.1	500
valeraldehyde	30	500
o-tolualdehyde	Not Available	21
m-tolualdehyde	Not Available	21
p-tolualdehyde	Not Available	21
hexaldehyde	20	2000
2,5-dimethyl-benzaldehyde	Not Available	21
heptaldehyde	50	2000

ppb_v - parts per billion by volume

Table 2. Target Carbonyls and Associated Long-Term 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)
formaldehyde	8.9
acetaldehyde	25
acetone	250
acrolein	0.22
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

ppb_v - parts per billion by volume

References

Hazardous Substances Data Bank (HSDB). 2010. http://toxnet.nlm.nih.gov/. Last accessed on December 7, 2010.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
REGION 4 CARBONYL MONITORING PROJECT
NOVEMBER 6 - 10, 2010

CONDUCTED BY
MOBILE RESPONSE TEAM
FIELD OPERATIONS SUPPORT DIVISION
Document Number R4C1011-FR
Issued: 12/21/10

Project Manager: for Tom Randolph Date: 12-30-10

Quality Control Officer: Gina Mullen for Sally Kleiza Date: 12-30-10

Technical Director: Gina Mullen Date: 12/30/10

Team Leader: for Patti DeLaCruz Date: 12-30-10

Section Manager: Date: 12-30-10

Assistant Director: Date: 1/3/11

Executive Summary
Barnett Shale Formation
Region 4 Carbonyl Monitoring Project
November 6 - 10, 2010

Issued 12/21/10

Background

In response to observations and findings during a Mobile Response Team (MRT) monitoring trip to the Dish, Texas area from June 15 - 18, 2010, and a City of Fort Worth independent study on formaldehyde concentrations associated with natural gas production and processing in the Barnett Shale Formation area in northeast Texas, further monitoring for 17 carbonyl compounds, including formaldehyde, was performed at new and previously monitored sites in Dish, Texas and the Lake Arlington area of Fort Worth in November 2010.

General Monitoring Information

Monitoring staff collected samples downwind of natural gas production or processing equipment where formaldehyde might be present as a bi-product of combustion. In addition to sampling specific sources, airshed samples were collected to assess general concentrations of formaldehyde. Monitoring sites were designated based on 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 downwind of these source types and general airshed samples were collected in Dish, Texas and the Lake Arlington area of Fort Worth, Texas. In addition, simultaneous upwind and downwind samples were collected at compressor stations in Dish, Texas. A GasFindIR (infrared) camera was used to survey emissions and to determine where quantitative downwind carbonyl samples might be collected. One-hour carbonyl samples were collected downwind of the identified sources, and the samples were subsequently analyzed in the TCEQ Air and Emissions Laboratory in Austin, Texas, using a reverse phase C-18 column and an Ultraviolet/Visible (UV/VIS) photo diode array (PDA) detector.

Observations and Findings

Monitoring staff surveyed a total of 18 locations during the project (see Attachment 1), and collected 31 carbonyl samples downwind of various sources (see Maps 1 and 2). Meteorological data including wind speed, wind direction, and ambient temperature was also collected (see Attachments 3 and 4). Twenty one samples were collected downwind of a variety of facilities, including Chesapeake Energy Ponder Compressor Station (Sites 3 and 5), Atmos Energy Corporation Ponder and Energy Transfer Hog Branch Compressor Stations (Sites 2, 3, and 5), Enbridge Gathering North Texas LP Justin East Compressor Station (Sites 2 and 3), Devon Energy Company (Co.) LP DCCO 3, S.H. Griffin Estate 3, 17H and 18H (Site 13), Devon Energy Co. LP DCCO 3, Mae C Naler, 21H, 22H, and 23H (Site 10) Devon Energy Co. LP DCCO 3, S.H. Griffin Estate, 11, 26H, and 27H (Site 11), Devon Energy Co. LP DCCO 3, S.H. Griffin Estate, 20H, 21H, and 23H (Site 18), Atmos Energy Metering Station (Site 14), Quicksilver Resources Lake Arlington Compressor Station (Site 7), and Quicksilver Resources Exelon North Wellheads 1H, 2H, 3H, 4H, 13H, 15H, 17H, 19H, and 21H (Site 16 and 17). Four upwind samples (Site 12) and seven general airshed samples (Sites 1, 4, 6, 8, 9, and 15) were also collected.

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. For the project, the maximum one-hour concentration of 5.4 parts per billion by volume (ppbv) of formaldehyde was detected in Sample **R4C1011C5-19** on November 10, 2010, from 11:20 – 12:20 in a residential area just north of the Quicksilver Resources Lake Arlington Compressor Station. The maximum formaldehyde concentration in the Dish, Texas area was 3.7 ppbv measured in Sample **R4C1011C5-03** on November 7, 2010, from 17:15 – 18:15.

TCEQ Interoffice Memorandum

To: Michael Honeycutt, Ph.D., Director, Toxicology Division, Chief Engineer's Office (MC 168)

Thru: Matthew R. Baker, P.E., Assistant Director, Field Operations Support Division (MC 165)

Patricia De La Cruz, Acting Section Manager, Mobile Monitoring & Deployment Section, Field Operations Support Division (MC 165)

Tim Doty, Team Leader, Mobile Response Team, Mobile Monitoring & Deployment Section, Field Operations Support Division (MC 165)

From: Tom Randolph, Mobile Monitoring & Deployment Section, Field Operations Support Division (MC 165)

Date: December 21, 2010

Subject: **Region 4 Carbonyl Monitoring Project, November 6 – 10, 2010, Sampling for Carbonyl Compounds in Dish and Fort Worth, Texas**

Project Summary

The Texas Commission on Environmental Quality (TCEQ) Mobile Response Team (MRT) conducted an ambient air monitoring project in the TCEQ Dallas/Fort Worth Region from November 6 - 10, 2010. Monitoring and site assessment was conducted downwind of possible combustion processes at natural gas-related production facilities in the Barnett Shale Formation area. The primary target compound for this study was formaldehyde, while secondary target compounds included 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. Technical information including sample locations (Attachment 1), maps, carbonyl results (Attachment 2), and meteorological data (Attachments 3 and 4) is intended to be used as supplemental information when reviewing this monitoring report. Key findings and observations from the November 2010, air monitoring event include the following:

- A maximum Dish, Texas formaldehyde concentration of 3.7 parts per billion by volume (ppbv) was measured in airshed Sample **R4C1011C5-03** on November 7, 2010, from 17:15 – 18:15.

- A maximum one-hour formaldehyde concentration of 5.4 ppbv was detected in Sample **R4C1011C5-19** on November 10, 2010, from 11:20 – 12:20, while located in a residential area just north of the Quicksilver Resources Lake Arlington Compressor Station.

Background

Monitoring staff collected samples downwind of natural gas production or processing equipment where formaldehyde might be present as a bi-product of combustion. In addition to sampling specific sources, airshed samples were collected to assess general area concentrations of formaldehyde. Monitoring sites were designated based on 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 downwind of these source types and general airshed samples were collected in Dish, Texas and the Lake Arlington area of Fort Worth, Texas. In addition, simultaneous upwind and downwind samples were collected at compressor stations in Dish, Texas.

Sampling and Analysis

Two sampling vans equipped with ATEC Model 4004 carbonyl analyzers were used to collect samples. A GasFindIR Camera was utilized to provide real-time monitoring information about emission sources. Each van was equipped with AIO Meteorological equipment to collect real-time weather data including wind direction, wind speed, and temperature. The sample collection locations were documented using global positioning system (GPS) data. A more thorough description of the equipment used to collect data is included in each data table.

The survey instruments, staff observations, and meteorological data were used to determine movement and location of the emission plume in relation to sampling locations downwind of specific sources. This technical information was used in assessing monitoring results from this project.

Upon completion of the monitoring, samples were analyzed in the TCEQ Air and Emissions Laboratory in Austin, Texas, using a reverse phase C-18 column and an Ultraviolet/Visible (UV/VIS) photo diode array (PDA) detector.

Quality Control (QC) Summary

QC samples were analyzed along with the field samples to assess data quality and data limitations for this monitoring project. QC data results were reviewed to assess method precision and accuracy and to estimate the possible effects on the field measurement data when the QC data did not meet specifications outlined in the method- or project-specific Standard Operating Procedures.

Data completeness was measured as a percentage of valid primary target compound data that met the established accuracy and precision acceptance criteria in relation to the total amount of primary target compound data collected. Invalidated samples were included in the data completeness calculation. However, data qualifiers for concentrations below the limit of detection (LOD) (J qualifier), concentrations greater than or equal to the LOD but less than the lowest calibration standard (L qualifier), and concentrations that exceeded the upper limit of instrument calibration (E qualifier) were not included.

Table 1: Project Data Completeness

Primary Target	Total Collected Data Points	Valid Data Points[a]	Data Meeting DQOs	Meets The Data Completeness Objective Of At Least 75%
Formaldehyde by Automated Cartridge Sampler	31	31	100%	Yes

[a]Did not require any qualification.
DQO = Data Quality Objective
% = percent

More detailed QC information is available in Attachment 5.

Observations

Dish, Texas Area

Eleven carbonyl samples were collected downwind of the Atmos Energy Corporation Ponder, Energy Transfer Hog Branch, Chesapeake Energy Ponder, and Enbridge Gathering Justin East Compressor Stations in Dish, Texas including Samples **R4C1011C1-01**, **R4C1011C1-02**, **R4C1011C1-03**, **R4C1011C1-04**, **R4C1011C1-05**, **R4C1011C1-06**, **R4C1011C1-07**, **R4C1011C1-08**, **R4C1011C5-04**, **R4C1011C5-05**, and **R4C1011C5-06**. Four of these downwind compressor samples had associated upwind samples, including **R4C1011C5-09**, **R4C1011C5-10**, **R4C1011C5-11**, and **R4C1011C5-14**, collected simultaneously. Slight exhaust odors were noted intermittently downwind of the compressor stations, as well as light and intermittent natural gas odors downwind of the Chesapeake Energy Ponder facility during sampling. The maximum formaldehyde concentration measured downwind of these emission sources was 3.4 ppbv.

Four airshed samples were collected around Dish, Texas during the project. Samples **R4C1011C5-01**, **R4C1011C5-02**, and **R4C1011C5-08** were collected on the north side of Dish with south to south/southeast winds, while Sample **R4C1011C5-03** was collected in the middle of the Dish geographic area with south/southeast to southeast winds. The maximum formaldehyde concentration measured in these samples was 3.7 ppbv.

Four additional samples, including **R4C1011C5-07**, **R4C1011C5-12**, **R4C1011C5-15**, and **R4C1011C5-16** were collected downwind of tank battery gathering facilities within the Dish, Texas area, while a final carbonyl sample, **R4C1011C5-13**, was collected downwind of the Atmos Gas Metering Station. A maximum formaldehyde concentration of 2.9 ppbv was reported in these samples.

Lake Arlington Compressor Station

The Lake Arlington Compressor Station was surveyed during the late afternoon and early evening of November 9, 2010. In using thermal capabilities of the GasFindIR Camera, one of five compressors appeared to be operational. Downwind monitoring van parking access for southerly wind conditions was limited by a narrow shoulder and a steep ditch, as well as an appropriate 30-foot high sound barrier wall. There appeared to be no other storage tank batteries in the area, though there were a number of scrubber vents nearby. The adjacent Lake Arlington power plant appeared to be completely shut down, as information indicates that it mostly operates during peak energy usage from May through September.

Efforts were made to sample downwind of the scrubber vents, as well as the one operational compressor. Due to logistical issues, samples were collected from a distance downwind of the compressor and vehicular traffic along East Rosedale Street and East Lancaster Avenue. In addition, monitoring staff also collected carbonyl samples at the edge of residential areas both to the north of the compressor station and to the south of the power plant. This was done in an effort to characterize formaldehyde concentrations near receptor areas.

Three carbonyl samples were collected downwind of the Quicksilver Resources Compressor Station including **R4C1011C1-11**, **R4C1011C1-12**, and **R4C1011C5-19**, while two carbonyl samples were collected downwind of the Quicksilver Exelon North Unit wellheads and scrubber vents (**R4C1011C1-09** and **R4C1011C1-10**). Two airshed samples, including **R4C1011C5-17** and **R4C1011C5-18**, were also collected in residential areas south of the power plant. The maximum formaldehyde concentration measured in these samples was 5.4 ppbv.

If you have questions, please contact Tom Randolph at (512) 239-1218 or trandolp@tceq.state.tx.us or Tim Doty at (512) 239-1685 or tdoty@tceq.state.tx.us.

List of Attachments & Maps
Region 4 Carbonyl Monitoring Project
November 6 - 10, 2010

Attachment 1: Sample Locations

Map 1: Dish, Texas

Map 2: Lake Arlington

Attachment 2: Carbonyl Data

Attachment 3: Meteorological Data – Van 151

Attachment 4: Meteorological Data – Van 555

Attachment 5: Quality Control Report

Attachment 1

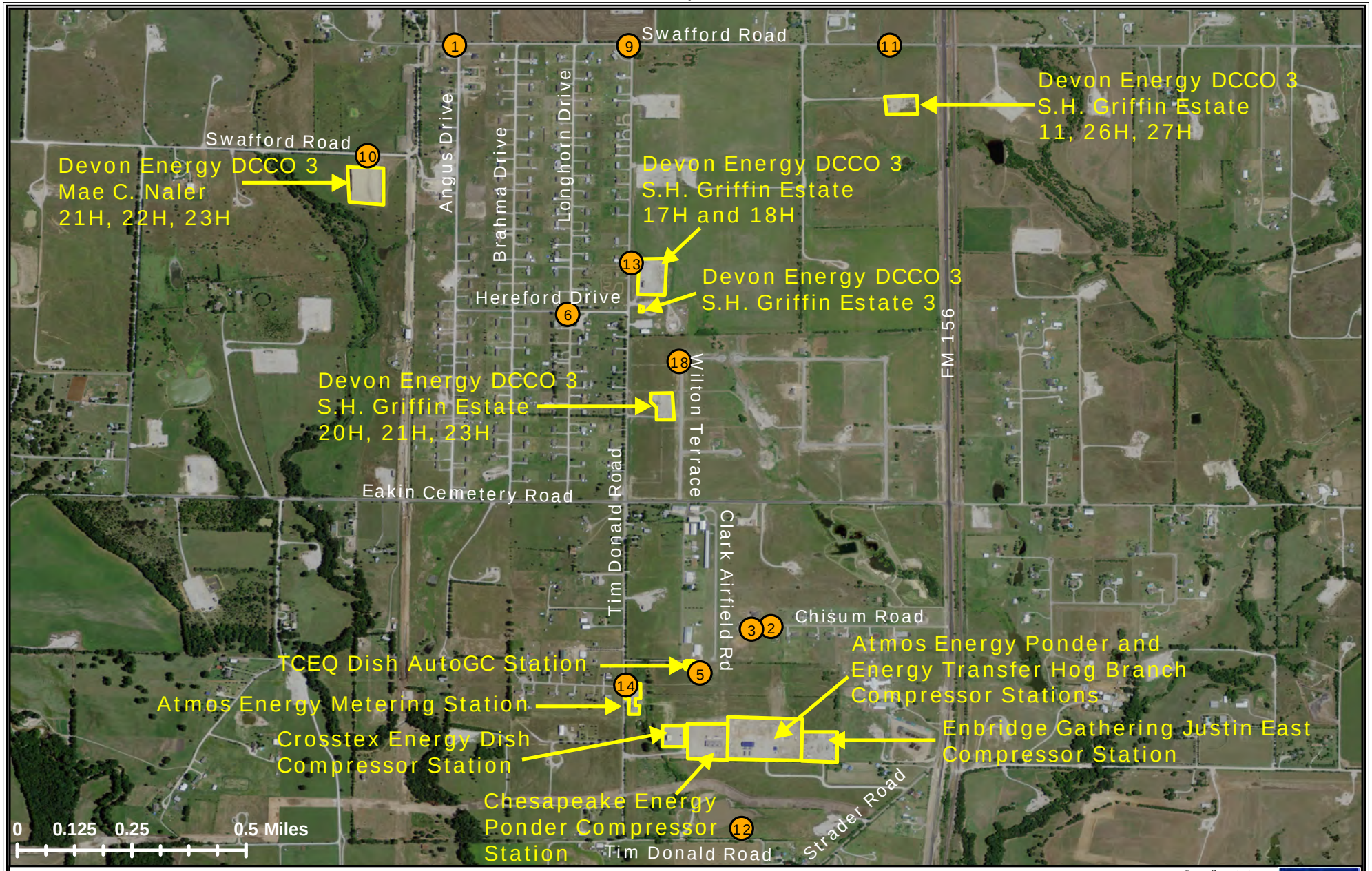
Sample Locations
Region 4 Carbonyl Monitoring Project
November 6 - 10, 2010

This data was collected using a Starlink Invicta 210 GPS receiver and antenna used with a TDS Recon hand-held GPS unit and SoloField CE software to collect Differential GPS (DGPS) coordinates.

Number	Description	GPS Coordinates	
		North Latitude	West Longitude
1	At the intersection of Angus Drive and Swafford Road	33.1505694	-97.3052452
2	On Chisum Road, approximately 0.3 mile west of Farm-to-Market (FM) 156	33.1321936	-97.2953720
3	On Chisum Road, approximately 0.35 mile west of FM 156	33.1321246	-97.2957604
4	At the intersection of Church Street and Major Street	32.7332523	-97.2087357
5	On Clark Airfield Road, approximately 0.35 mile south of Eakin Cemetery Road	33.1307756	-97.2975966
6	At the intersection of Hereford Drive and Longhorn Drive	33.1420719	-97.3016841
7	At the intersection of Milam Street and E Lancaster Avenue	32.7311583	-97.2114192
8	At the intersection of Quail Road and Willard Road	32.7193755	-97.2169952
9	At the intersection of Swafford Road and Tim Donald Road	33.1505572	-97.2997521
10	On Swafford Road, approximately 0.3 mile west of Angus Drive	33.1470944	-97.3080006
11	On Swafford Road, approximately 0.05 mile west of FM 156	33.1505649	-97.2915023
12	On Tim Donald Road, approximately 0.2 mile north of Strader Road	33.1258228	-97.2961771
13	On Tim Donald Road, approximately 0.4 mile south of Swafford Road	33.1436883	-97.2996614
14	On Tim Donald Road, approximately 0.4 mile south of Eakin Cemetery Road	33.1303525	-97.2998501
15	On Truman Court, approximately 40 yards east of Truman Drive	32.7226075	-97.2173920
16	On a utility access road, approximately 0.2 mile south of East Arkansas Lane	32.7250278	-97.2110984
17	On a utility access road, approximately 0.15 mile south of East Arkansas Lane	32.7258767	-97.2107244
18	On Wilton Terrace, approximately 0.3 mile north of Eakin Cemetery Road	33.1405771	-97.2981573

GPS = Global Positioning System.

Map 1



Dish, Texas Sample Locations
Region 4 Carbonyl Monitoring Project
November 7 - 10, 2010

The following sample locations are included: 1-3, 5, 6, 9-14, and 18.

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: 11/19/10
Created By: RFE
Revised On: 12/10/10
Revised By: RFE

TCEQ

Map 2

N

Lake Arlington Sample Locations
Region 4 Carbonyl Monitoring Project
November 7 - 10, 2010

The following sample locations are included: 4, 7, 8, and 15-17.

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: 11/19/10
Created By: RFE
Revised On: 12/10/10
Revised By: RFE

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Carbonyl Data
Region 4 Carbonyl Monitoring Project
November 6 - 10, 2010

These samples were collected on Waters Sep-Pak7 dinitrophenylhydrazine (DNPH)-Silica cartridges using an Atmospheric Technology (ATEC) Model 4004 Automated Cartridge Sampler.

Laboratory ID		101127-0009			101127-0010			101127-0011		
Field ID		R4C1011C1-01			R4C1011C1-02			R4C1011C1-03		
Sample Date		11/8/10			11/8/10			11/8/10		
Sample Time		14:15 - 15:15			15:50 - 16:50			17:00 - 18:00		
Sample Period		2			2			2		
Sample Location[a]		2			5			5		
Predominantly Downwind Of		Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering Justin East Compressor Stations			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Chesapeake Energy Ponder 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**
formaldehyde	2.0	1.8	2.0	J	3.4	2.0	L	2.1	2.0	L
acetaldehyde	2.0	0.66	2.0	J	0.70	2.0	J	0.72	2.0	J
acetone	3.4	0.84	3.4	A1,F,J	0.82	3.4	A1,F,J	0.97	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	ND	0.51		0.10	0.51	J	0.09	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.11	0.75	J	0.12	0.75	J	0.14	0.75	J
butyraldehyde	0.22	ND	0.22		0.12	0.22	J	ND	0.22	
benzaldehyde	0.15	0.08	0.15	J	ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.18	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.06	0.22	J	0.06	0.22	J	0.06	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0012			101127-0013			101127-0014		
Field ID		R4C1011C1-04			R4C1011C1-05			R4C1011C1-06		
Sample Date		11/9/10			11/9/10			11/9/10		
Sample Time		06:55 - 07:55			08:00 - 09:00			09:05 - 10:05		
Sample Period		3			3			3		
Sample Location[a]		5			5			5		
Predominantly Downwind Of		Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Chesapeake Energy Ponder Compressor Stations			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Chesapeake Energy Ponder Compressor Stations			Chesapeake Energy Ponder Compressor Stations		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	1.6	2.0	J	1.2	2.0	J	1.5	2.1	J
acetaldehyde	2.0	0.56	2.0	J	0.57	2.0	J	0.61	2.0	J
acetone	3.4	0.71	3.4	A1,F,J	0.64	3.4	A1,F,J	0.92	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.10	0.51	J	ND	0.51		0.15	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	ND	0.75		0.10	0.75	J	0.10	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.21	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.27	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.07	0.22	J	0.07	0.22	J	0.07	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0015			101127-0016			101127-0017		
Field ID		R4C1011C1-07			R4C1011C1-08			R4C1011C1-09		
Sample Date		11/9/10			11/9/10			11/10/10		
Sample Time		10:10 - 11:10			11:20 - 12:20			07:00 - 08:00		
Sample Period		3			3			4		
Sample Location[a]		5			2			16		
Predominantly Downwind Of		Chesapeake Energy Ponder Compressor Stations			Chesapeake Energy Ponder Compressor Stations			Quicksilver Resources Exelon North Unit		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	1.1	2.0	J	2.3	2.0	L	1.2	2.0	J
acetaldehyde	2.0	0.58	2.0	J	0.62	2.0	J	0.54	2.0	J
acetone	3.4	0.83	3.4	A1,F,J	0.91	3.4	A1,F,J	0.66	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.12	0.51	J	0.13	0.51	J	0.11	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.10	0.75	J	0.11	0.75	J	ND	0.75	
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.19	ND	0.18		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.27	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.07	0.22	J	0.08	0.22	J	0.08	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0018			101127-0019			101127-0020		
Field ID		R4C1011C1-10			R4C1011C1-11			R4C1011C1-12		
Sample Date		11/10/10			11/10/10			11/10/10		
Sample Time		08:30 - 09:30			10:25 - 11:25			11:25 - 12:25		
Sample Period		4			4			4		
Sample Location[a]		17			7			7		
Predominantly Downwind Of		Quicksilver Resources Exelon North Unit			Quicksilver Resources Compressor Station			Quicksilver Resources Compressor Station		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	1.0	2.0	J	2.8	2.0	L	2.5	2.0	L
acetaldehyde	2.0	0.56	2.0	J	0.77	2.0	J	0.71	2.0	J
acetone	3.4	0.42	3.4	A1,F,J	0.67	3.4	A1,F,J	0.67	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.11	0.51	J	0.16	0.51	J	0.12	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	ND	0.75		ND	0.75		ND	0.75	
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.18		ND	0.18	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	ND	0.22		0.09	0.22	J	0.08	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0023			101127-0024			101127-0025		
Field ID		R4C1011C5-01			R4C1011C5-02			R4C1011C5-03		
Sample Date		11/7/10			11/7/10			11/7/10		
Sample Time		14:45 - 15:45			16:00 - 17:00			17:15 - 18:15		
Sample Period		1			1			1		
Sample Location[a]		9			9			6		
Predominantly Downwind Of		Airshed			Airshed			Airshed		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.6	2.0	L	2.9	2.0	L	3.7	2.0	L
acetaldehyde	2.0	0.97	2.0	J	1.0	2.0	J	1.0	2.0	J
acetone	3.4	1.2	3.4	A1,F,J	1.2	3.4	A1,F,J	1.6	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.13	0.51	J	0.09	0.51	J	0.10	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.15	0.75	J	0.15	0.75	J	0.18	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.27		ND	0.26		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.08	0.22	J	0.08	0.22	J	0.08	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0026			101127-0027			101127-0028		
Field ID		R4C1011C5-04			R4C1011C5-05			R4C1011C5-06		
Sample Date		11/7/10			11/8/10			11/8/10		
Sample Time		18:30 - 19:30			08:25 - 09:25			09:25 - 10:25		
Sample Period		1			2			2		
Sample Location[a]		3			3			3		
Predominantly Downwind Of		Enbridge Gathering Justin East Compressor Station			Atmos Energy Corp. Ponder, Energy Transfer Hog Branch, and Enbridge Gathering 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**
formaldehyde	2.0	3.1	2.0	L	1.8	2.0	J	1.6	2.0	J
acetaldehyde	2.0	1.3	2.0	J	0.97	2.0	J	0.71	2.0	J
acetone	3.4	1.9	3.4	A1,F,J	0.86	3.4	A1,F,J	0.75	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.11	0.51	J	0.17	0.51	J	0.10	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.18	0.75	J	0.10	0.75	J	0.10	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.08	0.22	J	0.09	0.22	J	0.08	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0029			101127-0030			101127-0031		
Field ID		R4C1011C5-07			R4C1011C5-08			R4C1011C5-09		
Sample Date		11/8/10			11/8/10			11/8/10		
Sample Time		10:55 - 11:55			12:25 - 13:25			14:15 - 15:15		
Sample Period		2			2			2		
Sample Location[a]		18			1			12		
Predominantly Downwind Of		Devon Energy Co. LP DCCO 3, S.H. Griffin Estate 20H, 21H, and 23H			Airshed			Upwind		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.0	2.0	L	2.7	2.0	L	2.2	2.0	L
acetaldehyde	2.0	0.78	2.0	J	0.82	2.0	J	0.90	2.0	J
acetone	3.4	0.99	3.4	A1,F,J	1.3	3.4	A1,F,J	1.4	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.10	0.51	J	0.09	0.51	J	0.11	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.12	0.75	J	0.17	0.75	J	0.18	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.27		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.08	0.22	J	0.10	0.22	J	0.09	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0032			101127-0033			101127-0034		
Field ID		R4C1011C5-10			R4C1011C5-11			R4C1011C5-12		
Sample Date		11/8/10			11/8/10			11/8/10		
Sample Time		15:50 - 16:50			17:00 - 18:00			20:00 - 21:00		
Sample Period		2			2			2		
Sample Location[a]		12			12			13		
Predominantly Downwind Of		Upwind			Upwind			Devon Energy Company (Co.) LP DCCO 3, S.H. Griffin Estate 17H and 18H and DCCO 3, S.H. Griffin Estate 3		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.2	2.0	L	2.2	2.0	L	2.6	2.0	L
acetaldehyde	2.0	0.93	2.0	J	0.86	2.0	J	1.5	2.0	J
acetone	3.4	1.2	3.4	A1,F,J	1.3	3.4	A1,F,J	1.5	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.10	0.51	J	0.10	0.51	J	0.38	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.15	0.75	J	0.15	0.75	J	0.15	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.18	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.27		ND	0.26		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.12	0.22	J	0.11	0.22	J	0.12	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0035			101127-0036			101127-0037		
Field ID		R4C1011C5-13			R4C1011C5-14			R4C1011C5-15		
Sample Date		11/8/10			11/9/10			11/9/10		
Sample Time		21:25 - 22:25			11:20 - 12:20			12:55 - 13:55		
Sample Period		2			3			3		
Sample Location[a]		14			12			10		
Predominantly Downwind Of		Atmos Energy Metering Station			Upwind			Devon Energy Company (Co.) LP DCCO 3, Mae C. Naler 21H, 22H and 23H		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.9	2.0	L	2.3	2.0	L	2.2	2.0	L
acetaldehyde	2.0	0.95	2.0	J	0.73	2.0	J	0.74	2.0	J
acetone	3.4	1.2	3.4	A1,F,J	0.89	3.4	A1,F,J	0.96	3.4	A1,F,J
acrolein	0.31	ND	0.31		ND	0.31		ND	0.31	
propionaldehyde	0.51	0.13	0.51	J	0.11	0.51	J	0.09	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.16	0.75	J	0.10	0.75	J	0.11	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.26	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.11	0.22	J	0.14	0.22	J	0.13	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

Laboratory ID		101127-0038			101127-0039			101127-0040			101127-0041		
Field ID		R4C1011C5-16			R4C1011C5-17			R4C1011C5-18			R4C1011C5-19		
Sample Date		11/9/10			11/10/10			11/10/10			11/10/10		
Sample Time		14:25 - 15:25			08:30 - 09:30			09:45 - 10:45			11:20 - 12:20		
Sample Period		3			4			4			4		
Sample Location[a]		11			15			8			4		
Predominantly Downwind Of		Devon Energy Company (Co.) LP DCCO 3, S.H. Griffin Estate 11, 26H and 27H			Airshed			Airshed			Quicksilver Resources Compressor Station		
Compound	**LOD**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**	**Concentration**	**SDL**	**Flag**
formaldehyde	2.0	2.1	2.0	L	4.7	2.0		2.4	2.0	L	5.4	2.0	
acetaldehyde	2.0	0.65	2.0	J	0.94	2.0	J	0.76	2.0	J	1.1	2.0	J
acetone	3.4	0.87	3.4	A1,F,J	0.87	3.4	A1,F,J	0.93	3.4	A1,F,J	0.84	3.4	A1,F,J
acrolein	0.31	ND	0.31		0.08	0.31	J	ND	0.31		0.10	0.31	J
propionaldehyde	0.51	ND	0.51		0.15	0.51	J	0.13	0.51	J	0.19	0.51	J
crotonaldehyde	0.23	ND	0.23		ND	0.23		ND	0.23		ND	0.23	
methyl ethyl ketone/methacrolein	0.75	0.09	0.75	J	0.09	0.75	J	ND	0.75		0.10	0.75	J
butyraldehyde	0.22	ND	0.22		ND	0.22		ND	0.22		ND	0.22	
benzaldehyde	0.15	ND	0.15		0.07	0.15	J	ND	0.15		ND	0.15	
isovaleraldehyde	0.18	ND	0.19		ND	0.19		ND	0.19		ND	0.19	
valeraldehyde	0.20	ND	0.20		ND	0.20		ND	0.20		ND	0.20	
o-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34		ND	0.34	
m-tolualdehyde	0.34	ND	0.34		ND	0.34		ND	0.34		ND	0.34	
p-tolualdehyde	0.26	ND	0.26		ND	0.26		ND	0.26		ND	0.27	
hexaldehyde	0.34	ND	0.34		ND	0.34		ND	0.34		ND	0.34	
2,5-dimethyl-benzaldehyde	0.22	0.12	0.22	J	0.13	0.22	J	0.13	0.22	J	0.13	0.22	J
heptaldehyde	0.27	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P	ND	0.27	A2,P

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

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

F = Established acceptance criteria were not met due to factors outside the laboratory's control.

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).

A1 = not all associated QC data met the accuracy specification. Data may be an average of 50 percent (%) low with a range of -58% to -41%.

A2 = not all associated QC data met the accuracy specification. Data may be an average of 18% high with a range of 0% to 70%.

P = not all associated QC data met the precision specification. On average, data may vary by 25% with a range of 0.6% to 49%.

Attachment 3

Meteorological Data
Region 4 Carbonyl Monitoring Project
November 6 - 10, 2010
Van 151*

This data was collected using a Climatronics All-In-One Compact Weather Station with a folded-path, low power sonic anemometer, internal flux-gate compass, triple-element thermistor, and capacitive relative humidity sensor.

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C1-01			
11/8/10	14:20	2	12	170		73
11/8/10	14:25	2	11	173		73
11/8/10	14:30	2	9	175		73
11/8/10	14:35	2	10	170		72
11/8/10	14:40	2	12	172		73
11/8/10	14:45	2	10	167		73
11/8/10	14:50	2	11	167		73
11/8/10	14:55	2	12	168		73
11/8/10	15:00	2	11	169		73
11/8/10	15:05	2	11	175		73
11/8/10	15:10	2	10	172		73
11/8/10	15:15	2	10	168		74
			R4C1011C1-02			
11/8/10	15:55	5	12	163		74
11/8/10	16:00	5	10	169		74
11/8/10	16:05	5	12	166		74
11/8/10	16:10	5	12	165		74
11/8/10	16:15	5	10	175		74
11/8/10	16:20	5	10	180		74
11/8/10	16:25	5	9	170		74
11/8/10	16:30	5	11	175		74
11/8/10	16:35	5	8	166		73
11/8/10	16:40	5	9	160		73
11/8/10	16:45	5	9	162		73
11/8/10	16:50	5	10	163		73

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C1-03			
11/8/10	17:05	5	10	163		72
11/8/10	17:10	5	10	164		72
11/8/10	17:15	5	9	165		72
11/8/10	17:20	5	8	165		71
11/8/10	17:25	5	8	165		71
11/8/10	17:30	5	7	165		70
11/8/10	17:35	5	7	161		70
11/8/10	17:40	5	7	158		70
11/8/10	17:45	5	7	158		70
11/8/10	17:50	5	7	151		69
11/8/10	17:55	5	7	150		69
11/8/10	18:00	5	8	152		69
			R4C1011C1-04			
11/9/10	07:00	5	7	161		56
11/9/10	07:05	5	6	162		56
11/9/10	07:10	5	6	164		56
11/9/10	07:15	5	7	159		56
11/9/10	07:20	5	7	158		56
11/9/10	07:25	5	7	158		56
11/9/10	07:30	5	7	159		56
11/9/10	07:35	5	8	160		57
11/9/10	07:40	5	8	161		57
11/9/10	07:45	5	9	160		57
11/9/10	07:50	5	10	159		58
11/9/10	07:55	5	9	161		58
			R4C1011C1-05			
11/9/10	08:05	5	9	161		58
11/9/10	08:10	5	8	166		58
11/9/10	08:15	5	9	167		59
11/9/10	08:20	5	9	165		59
11/9/10	08:25	5	9	165		59
11/9/10	08:30	5	10	176		60
11/9/10	08:35	5	9	175		60
11/9/10	08:40	5	11	167		60
11/9/10	08:45	5	9	167		61
11/9/10	08:50	5	10	173		61
11/9/10	08:55	5	12	169		62
11/9/10	09:00	5	9	164		62

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C1-06			
11/9/10	09:10	5	10	176		62
11/9/10	09:15	5	10	171		63
11/9/10	09:20	5	13	167		63
11/9/10	09:25	5	11	175		63
11/9/10	09:30	5	11	177		63
11/9/10	09:35	5	10	170		64
11/9/10	09:40	5	12	169		64
11/9/10	09:45	5	12	174		64
11/9/10	09:50	5	11	181		64
11/9/10	09:55	5	9	179		64
11/9/10	10:00	5	10	175		65
11/9/10	10:05	5	10	172		64
			R4C1011C1-07			
11/9/10	10:15	5	12	166		65
11/9/10	10:20	5	11	172		65
11/9/10	10:25	5	10	169		66
11/9/10	10:30	5	11	169		67
11/9/10	10:35	5	11	175		67
11/9/10	10:40	5	12	181		67
11/9/10	10:45	5	10	180		68
11/9/10	10:50	5	11	171		69
11/9/10	10:55	5	13	174		69
11/9/10	11:00	5	12	179		69
11/9/10	11:05	5	12	185		70
11/9/10	11:10	5	11	191		70
			R4C1011C1-08			
11/9/10	11:25	2	15	170	A	70
11/9/10	11:30	2	13	173	A	69
11/9/10	11:35	2	11	180	A	70
11/9/10	11:40	2	14	181	A	70
11/9/10	11:45	2	11	187	A	71
11/9/10	11:50	2	11	173	A	72
11/9/10	11:55	2	14	175	A	71
11/9/10	12:00	2	13	170	A	71
11/9/10	12:05	2	13	164	A	71
11/9/10	12:10	2	14	166	A	71
11/9/10	12:15	2	15	166	A	71
11/9/10	12:20	2	16	171	A	71

Attachment 3 (continued)

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
R4C1011C1-09						
11/10/10	07:05	16	4	150		59
11/10/10	07:10	16	4	160		59
11/10/10	07:15	16	5	165		59
11/10/10	07:20	16	5	163		59
11/10/10	07:25	16	5	171		59
11/10/10	07:30	16	5	173		59
11/10/10	07:35	16	4	170		59
11/10/10	07:40	16	6	172		59
11/10/10	07:45	16	4	168		59
11/10/10	07:50	16	5	163		60
11/10/10	07:55	16	4	166		60
11/10/10	08:00	16	5	179		60
R4C1011C1-10						
11/10/10	08:35	17	4	180		62
11/10/10	08:40	17	4	182		62
11/10/10	08:45	17	5	172		62
11/10/10	08:50	17	4	172		62
11/10/10	08:55	17	3	177		63
11/10/10	09:00	17	4	173		63
11/10/10	09:05	17	4	166		63
11/10/10	09:10	17	4	163		64
11/10/10	09:15	17	4	160		64
11/10/10	09:20	17	5	169		65
11/10/10	09:25	17	5	167		65
11/10/10	09:30	17	4	167		65
R4C1011C1-11						
11/10/10	10:30	7	6	203		71
11/10/10	10:35	7	8	203		71
11/10/10	10:40	7	8	207		71
11/10/10	10:45	7	6	203		72
11/10/10	10:50	7	7	205		72
11/10/10	10:55	7	7	216		72
11/10/10	11:00	7	6	219		73
11/10/10	11:05	7	8	206		72
11/10/10	11:10	7	8	207		72
11/10/10	11:15	7	7	208		73
11/10/10	11:20	7	8	210		73
11/10/10	11:25	7	6	213		73

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C1-12			
11/10/10	11:30	7	8	214		73
11/10/10	11:35	7	6	195		74
11/10/10	11:40	7	6	192		74
11/10/10	11:45	7	7	164		74
11/10/10	11:50	7	8	199		74
11/10/10	11:55	7	7	182		74
11/10/10	12:00	7	7	194		74
11/10/10	12:05	7	10	209		74
11/10/10	12:10	7	9	212		74
11/10/10	12:15	7	8	166		75
11/10/10	12:20	7	8	201		75
11/10/10	12:25	7	7	188		75

* Meteorological data collection not continuous; data collected only during the distinct time periods noted.

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

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

A = the vertical angle of the mast was not recorded after the vehicle was moved. Data may vary by ±15 degrees.

Attachment 4

Meteorological Data
Region 4 Carbonyl Monitoring Project
November 6 - 10, 2010
Van 555*

This data was collected using a Climatronics All-In-One Compact Weather Station with a folded-path, low power sonic anemometer, internal flux-gate compass, triple-element thermistor, and capacitive relative humidity sensor.

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C5-01			
11/7/10	14:50	9	9	157		70
11/7/10	14:55	9	11	162		70
11/7/10	15:00	9	10	161		70
11/7/10	15:05	9	11	170		70
11/7/10	15:10	9	10	163		69
11/7/10	15:15	9	8	148		69
11/7/10	15:20	9	9	146		69
11/7/10	15:25	9	8	144		69
11/7/10	15:30	9	9	154		70
11/7/10	15:35	9	9	165		70
11/7/10	15:40	9	9	150		69
11/7/10	15:45	9	9	153		69
			R4C1011C5-02			
11/7/10	16:05	9	9	150		69
11/7/10	16:10	9	9	149		69
11/7/10	16:15	9	8	148		69
11/7/10	16:20	9	8	155		69
11/7/10	16:25	9	9	153		68
11/7/10	16:30	9	8	147		68
11/7/10	16:35	9	8	151		68
11/7/10	16:40	9	8	154		68
11/7/10	16:45	9	8	155		68
11/7/10	16:50	9	9	148		67
11/7/10	16:55	9	8	147		67
11/7/10	17:00	9	7	149		67

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C5-03			
11/7/10	17:20	6	7	161		66
11/7/10	17:25	6	7	162		65
11/7/10	17:30	6	6	158		65
11/7/10	17:35	6	7	161		65
11/7/10	17:40	6	6	161		64
11/7/10	17:45	6	5	155		64
11/7/10	17:50	6	5	157		64
11/7/10	17:55	6	5	156		63
11/7/10	18:00	6	5	156		63
11/7/10	18:05	6	4	153		62
11/7/10	18:10	6	4	147		62
11/7/10	18:15	6	5	140		61
			R4C1011C5-04			
11/7/10	18:35	3	5	115		60
11/7/10	18:40	3	6	116		60
11/7/10	18:45	3	5	114		60
11/7/10	18:50	3	5	114		60
11/7/10	18:55	3	5	118		59
11/7/10	19:00	3	6	117		59
11/7/10	19:05	3	6	122		59
11/7/10	19:10	3	5	126		59
11/7/10	19:15	3	5	127		59
11/7/10	19:20	3	5	129		59
11/7/10	19:25	3	4	130		59
11/7/10	19:30	3	3	137		58
			R4C1011C5-05			
11/8/10	08:30	3	5	156		55
11/8/10	08:35	3	5	161		55
11/8/10	08:40	3	5	166		56
11/8/10	08:45	3	6	167		56
11/8/10	08:50	3	5	164		56
11/8/10	08:55	3	6	166		57
11/8/10	09:00	3	7	171		58
11/8/10	09:05	3	7	171		59
11/8/10	09:10	3	7	169		60
11/8/10	09:15	3	9	187		61
11/8/10	09:20	3	12	179		61
11/8/10	09:25	3	11	187		62

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C5-06			
11/8/10	09:30	3	13	178		62
11/8/10	09:35	3	12	183		63
11/8/10	09:40	3	12	177		63
11/8/10	09:45	3	11	179		64
11/8/10	09:50	3	12	182		64
11/8/10	09:55	3	14	184		64
11/8/10	10:00	3	13	185		64
11/8/10	10:05	3	17	188		64
11/8/10	10:10	3	15	186		64
11/8/10	10:15	3	13	187		65
11/8/10	10:20	3	15	181		65
11/8/10	10:25	3	13	183		65
			R4C1011C5-07			
11/8/10	11:00	18	11	186		67
11/8/10	11:05	18	15	178		67
11/8/10	11:10	18	14	179		67
11/8/10	11:15	18	14	184		67
11/8/10	11:20	18	15	177		67
11/8/10	11:25	18	16	180		67
11/8/10	11:30	18	16	176		68
11/8/10	11:35	18	15	181		68
11/8/10	11:40	18	14	184		68
11/8/10	11:45	18	16	180		68
11/8/10	11:50	18	15	178		68
11/8/10	11:55	18	15	178		69
			R4C1011C5-08			
11/8/10	12:30	1	14	178		70
11/8/10	12:35	1	13	182		70
11/8/10	12:40	1	14	180		70
11/8/10	12:45	1	11	190		70
11/8/10	12:50	1	14	180		71
11/8/10	12:55	1	12	191		71
11/8/10	13:00	1	9	184		71
11/8/10	13:05	1	13	180		71
11/8/10	13:10	1	15	169		71
11/8/10	13:15	1	13	182		71
11/8/10	13:20	1	14	174		71
11/8/10	13:25	1	13	164		71

Attachment 4 (continued)

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C5-09			
11/8/10	14:20	12	12	166		73
11/8/10	14:25	12	13	166		73
11/8/10	14:30	12	11	161		73
11/8/10	14:35	12	9	166		73
11/8/10	14:40	12	11	159		73
11/8/10	14:45	12	9	157		73
11/8/10	14:50	12	11	170		73
11/8/10	14:55	12	10	158		74
11/8/10	15:00	12	10	166		73
11/8/10	15:05	12	9	166		74
11/8/10	15:10	12	11	166		73
11/8/10	15:15	12	10	165		74
			R4C1011C5-10			
11/8/10	15:55	12	11	162		74
11/8/10	16:00	12	11	160		74
11/8/10	16:05	12	9	158		74
11/8/10	16:10	12	11	158		74
11/8/10	16:15	12	10	168		74
11/8/10	16:20	12	8	164		74
11/8/10	16:25	12	9	162		74
11/8/10	16:30	12	9	169		73
11/8/10	16:35	12	7	156		73
11/8/10	16:40	12	7	157		73
11/8/10	16:45	12	7	154		73
11/8/10	16:50	12	7	158		73
			R4C1011C5-11			
11/8/10	17:05	12	8	152		72
11/8/10	17:10	12	7	156		72
11/8/10	17:15	12	8	154		72
11/8/10	17:20	12	7	154		71
11/8/10	17:25	12	6	153		70
11/8/10	17:30	12	4	145		70
11/8/10	17:35	12	4	150		69
11/8/10	17:40	12	5	153		69
11/8/10	17:45	12	4	154		69
11/8/10	17:50	12	4	153		69
11/8/10	17:55	12	5	154		69
11/8/10	18:00	12	5	151		68

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
R4C1011C5-12						
11/8/10	20:05	13	4	124		62
11/8/10	20:10	13	4	124		61
11/8/10	20:15	13	3	129		61
11/8/10	20:20	13	3	127		61
11/8/10	20:25	13	3	127		61
11/8/10	20:30	13	4	126		61
11/8/10	20:35	13	3	133		60
11/8/10	20:40	13	4	141		61
11/8/10	20:45	13	5	144		61
11/8/10	20:50	13	5	144		62
11/8/10	20:55	13	7	147		62
11/8/10	21:00	13	8	148		63
R4C1011C5-13						
11/8/10	21:30	14	2	124		63
11/8/10	21:35	14	3	123		63
11/8/10	21:40	14	3	127		62
11/8/10	21:45	14	2	130		62
11/8/10	21:50	14	2	133		62
11/8/10	21:55	14	3	142		62
11/8/10	22:00	14	3	141		62
11/8/10	22:05	14	3	144		62
11/8/10	22:10	14	3	144		62
11/8/10	22:15	14	3	145		62
11/8/10	22:20	14	4	146		62
11/8/10	22:25	14	4	148		63
R4C1011C5-14						
11/9/10	11:25	12	15	169		70
11/9/10	11:30	12	13	176		70
11/9/10	11:35	12	11	176		70
11/9/10	11:40	12	10	180		71
11/9/10	11:45	12	8	178		71
11/9/10	11:50	12	14	170		71
11/9/10	11:55	12	16	172		71
11/9/10	12:00	12	12	166		71
11/9/10	12:05	12	14	165		72
11/9/10	12:10	12	12	161		72
11/9/10	12:15	12	15	165		72

11/9/10	12:20	12	14	164		72

Attachment 4 (continued)

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C5-15			
11/9/10	13:00	10	14	181		73
11/9/10	13:05	10	15	184		73
11/9/10	13:10	10	16	180		73
11/9/10	13:15	10	16	185		73
11/9/10	13:20	10	14	182		73
11/9/10	13:25	10	15	176		73
11/9/10	13:30	10	17	176		73
11/9/10	13:35	10	17	179		73
11/9/10	13:40	10	16	174		73
11/9/10	13:45	10	17	165		73
11/9/10	13:50	10	19	167		73
11/9/10	13:55	10	17	165		73
			R4C1011C5-16			
11/9/10	14:30	11	14	155	A	75
11/9/10	14:35	11	16	153	A	74
11/9/10	14:40	11	15	152	A	74
11/9/10	14:45	11	15	149	A	75
11/9/10	14:50	11	14	158	A	75
11/9/10	14:55	11	16	167	A	75
11/9/10	15:00	11	14	156	A	75
11/9/10	15:05	11	17	158	A	75
11/9/10	15:10	11	17	148	A	75
11/9/10	15:15	11	17	158	A	75
11/9/10	15:20	11	17	164	A	75
11/9/10	15:25	11	16	171	A	75
			R4C1011C5-17			
11/10/10	08:35	15	Calm	Calm		67
11/10/10	08:40	15	Calm	Calm		65
11/10/10	08:45	15	Calm	Calm		65
11/10/10	08:50	15	Calm	Calm		64
11/10/10	08:55	15	Calm	Calm		64
11/10/10	09:00	15	Calm	Calm		64
11/10/10	09:05	15	Calm	Calm		64
11/10/10	09:10	15	Calm	Calm		64
11/10/10	09:15	15	Calm	Calm		64
11/10/10	09:20	15	Calm	Calm		65

11/10/10	09:25	15	Calm	Calm		65
11/10/10	09:30	15	Calm	Calm		65

Attachment 4 (continued)

Date	Time	Sample Location[a]	Average Wind Speed (mph)	Average Wind Direction (degrees)[b]	Data Flag	Average Temperature (degrees F)
			R4C1011C5-18			
11/10/10	09:50	8	6	174		68
11/10/10	09:55	8	6	182		68
11/10/10	10:00	8	6	182		69
11/10/10	10:05	8	8	187		69
11/10/10	10:10	8	6	193		70
11/10/10	10:15	8	6	182		71
11/10/10	10:20	8	7	188		71
11/10/10	10:25	8	6	188		71
11/10/10	10:30	8	7	192		71
11/10/10	10:35	8	7	193		71
11/10/10	10:40	8	7	183		72
11/10/10	10:45	8	5	188		72
			R4C1011C5-19			
11/10/10	11:25	4	2	231		76
11/10/10	11:30	4	2	204		75
11/10/10	11:35	4	2	209		75
11/10/10	11:40	4	2	212		76
11/10/10	11:45	4	2	202		76
11/10/10	11:50	4	2	185		76
11/10/10	11:55	4	2	192		76
11/10/10	12:00	4	2	211		76
11/10/10	12:05	4	2	219		76
11/10/10	12:10	4	2	196		77
11/10/10	12:15	4	2	185		76
11/10/10	12:20	4	2	223		77

* Meteorological data collection not continuous; data collected only during the distinct time periods noted.

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

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

A = the vertical angle of the mast was not recorded after the vehicle was moved. Data may vary by ±15 degrees.

Quality Control (QC) Report
Region 4 Carbonyl Monitoring Project
November 6 – 10, 2010

The Mobile Response Team (MRT) conducted follow-up sampling in Dish, Texas and the Lake Arlington area of Fort Worth after a monitoring trip to the Dish, Texas area from June 15 - 18, 2010, and a City of Fort Worth independent study on formaldehyde concentrations associated with natural gas production and processing in the Barnett Shale Formation area in northeast Texas. Dinitrophenylhydrazine (DNPH)-Silica cartridges were used to collect carbonyl samples on an automated cartridge sampler. The cartridges were analyzed by the Air and Emissions Laboratory (AEL) in Austin, Texas. Meteorological data using All-In-One (AIO) weather heads and global positioning system (GPS) sample collection location data were also collected.

The project primary target compound was formaldehyde.

Carbonyl sample collection was conducted in accordance with MRT Standard Operating Procedures (SOP) SAMP-014, revision 4. Carbonyl analyses were conducted in accordance with AEL SOP AMOR-002, revision 14. Meteorological data was collected in accordance with MRT SOP SAMP-006, revision 6. GPS data was collected in accordance with MRT SOP SAMP-023, revision 1.

The QC effort was designed and implemented to ensure that all data were of known quality. The frequency requirements and acceptance criteria from the SOPs were used to determine any sample data limitations. These limitations are listed in each SOP and are available on request.

DATA COMPLETENESS

Data completeness (Table 1) was measured as a percentage of valid primary target compound data that met the established accuracy, precision, and bias acceptance criteria in relation to the total amount of primary target compound data collected. Invalidated samples were included in the data completeness calculation. However, data qualifiers for concentrations below the limit of detection (LOD) (J qualifier), concentrations greater than or equal to the LOD but less than the lowest calibration standard (L qualifier), and concentrations that exceeded the upper limit of instrument calibration (E qualifier) were not included.

Table 1: Project Data Completeness

Primary Target	Total Collected Data Points	Valid Data Points[a]	Data Meeting DQOs	Meets The Data Completeness Objective Of At Least 75%
Formaldehyde by Automated Cartridge Sampler	31	31	100%	Yes

[a]Did not require any qualification.
DQO = Data Quality Objective
% = percent

DATA ASSESSMENT

Carbonyl Data

Five-minute temperature averages for each van's cold storage system did not meet the acceptance criterion of remaining at or below 6°C during sample storage on three occasions. On November 7, 2010,

the five-minute average for the cold storage system in Van 555 was 1130°C from 14:25 – 14:30 and 6.7°C from 17:20 to 17:25. On November 11, 2010, the five-minute average for the cold storage system in Van 151 was 7.6 °C from 17:35 – 17:40. The 1130°C from 14:25 – 14:30 on November 7, 2010, was caused by a loose connection between the thermister and the measuring unit. The 6.7°C average from 17:20 to 17:25 on November 7, and the 7.6 °C average from 17:35 – 17:40 on November 11, are unknown, but may have been caused by keeping the cooler lid open too long. All samples collected for the project were affected. Samples with the nomenclature R4C1011C1-## were in Van 151's cold storage system and samples marked R4C1011C5-## were in Van 555's cold storage system. Additionally, the matrix spike (MS)/matrix spike duplicate (MSD) precision for acetone did not meet the established acceptance criterion possibly due to the temperature increases or an unidentified matrix effect. As a result acetone data was qualified for accuracy in the data table. These non-conformances were documented in Exception Report (ER) 1582.

Incorrect data summary labels were attached to three Field Data Sheets; R4C1011C-06 on November 9, 2010, and R4C1011C5-06 and R4C1011C5-08 on November 8, 2010, due to analyst oversight. The correct sample summary data was documented on the *Field Data Sheets* from the instrument logged data for each of the samples. As a result, there was no impact on the data. This non-conformance was documented in ER 1583.

Meteorological Data

Mast angle measurements were not recorded after the sampling vehicles were moved due to analyst oversight. All wind direction data collected from November 9, 2010, at 11:18 through November 9, 2010, at 12:27 in Van 151, and from November 9, 2010, at 14:19 through November 9, 2010, at 15:28 in Van 555 may be biased ±15 degrees. As a result, the data for these time periods was qualified with an accuracy qualifier A in the data table. This non-conformance was documented in ER 1581.

GPS Data

All GPS data met the established acceptance criteria.