

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Mark R. Vickery, P.G.
Executive Director

Date: May 25, 2010

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Chief Engineer's Office
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From: Shannon Ethridge, M.S. *SE*
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Subject: Health Effects Evaluation of Barnett Shale Follow-Up Survey Project
Dallas/Fort Worth, Texas Area, March 1 – 5, 2010.

Key Findings

- Three chemicals were detected at concentrations that exceeded their short-term, health air monitoring comparison values (AMCVs): n-octane, n-pentane, and 1,2-dibromoethane. These three chemicals were detected above their short-term, health AMCVs downwind of two facilities. However, the measured concentrations of these chemicals were well below known health effects levels, so short-term exposure to these concentrations would not be expected to cause adverse health effects.
- Several chemicals were detected at concentrations that exceeded their odor AMCVs and could cause odors: 2-methylpentane, methylcyclohexane, toluene, m&p-xylene, n-propylbenzene, p-diethylbenzene, n-heptane, m-ethyltoluene, p-ethyltoluene, and n-pentane. Chemicals were detected above their odor AMCVs downwind of three facilities. This is consistent with Texas Commission on Environmental Quality (TCEQ) staff reporting odors during this investigation as well as citizen reports of odors in the area. Persistent or recurrent exposure to levels which significantly exceed the odor AMCV may cause odor-related effects such as headache and nausea. These odor issues are referred to the TCEQ Office of Compliance and Enforcement for their investigation and appropriate action.
- Elevated concentrations of benzene detected downwind of six facilities did not exceed the short-term, health AMCV, but could potentially contribute to long-term (i.e., lifetime) cumulative exposure. Monitored concentrations at these facilities were similar to concentrations detected during previous mobile monitoring events in 2009.
- The TD recommends continued surveillance and monitoring in the Barnett Shale area.

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, and November 2009, personnel from the TCEQ Mobile Monitoring Team conducted an additional volatile organic compound (VOC) survey project from March 1 – 5, 2010, at previously monitored sites in Denton, Hood, Johnson, Parker, and Wise Counties. The monitoring and field assessments during these projects included multiple natural gas emission source types involved in the production and processing of products including, but not limited to, those associated with well-heads, condensate and product storage tank batteries, compressor stations, saltwater disposal wells, and natural gas processing facilities. For a complete description of this project, please see the March 29, 2010 report entitled *Barnett Shale Follow-Up Survey Project Dallas/Fort Worth, Texas Area, March 1 – 5, 2010*.

TCEQ staff used Toxic Vapor Analyzers and GasFind Infrared (IR) cameras to document emissions and to determine where quantitative upwind and downwind canister samples should be collected. Where warranted, 30-minute, time-integrated canister samples were collected downwind of identified sources. Canisters were subsequently analyzed for VOCs in the TCEQ laboratory in Austin, TX, by gas chromatography/mass spectrometry (GC/MS). A list of the target compounds is included in Table 7.

Data Quality

Analytical detection limits were not adequate to evaluate some chemicals in some samples from a human health risk perspective. In these cases, it was not possible to determine if concentrations were below health AMCVs.

Data have been fully qualified in data tables located in the TCEQ Mobile Monitoring report. More detailed QC information is available upon request.

Results

A total of 39 canister samples were collected. This included four general airshed samples (Sites 26, 27, 29, and 31), as well as 26 instantaneous, and nine, 30-minute, time-integrated canister samples collected near a variety of facilities, including Arrowhead Production (Sites 16 and 24), Crosstex (Sites 1, 2, 11, 12, 17, 19, and 21), Devon Energy (Sites 23 and 28), Enbridge Gathering (Sites 4, 9, and 24), ETC (Sites 7 and 32), Quicksilver Resources (Sites 5 and 6), Stallion Oilfield Services Salty's Disposal Wells (Sites 10, 13, 14, and 15), and five compressor stations near Dish, TX (Sites 18 and 25). Reported VOC concentrations were compared to TCEQ short-term health- and/or welfare-protective AMCVs. Short-term AMCVs are guidelines used to evaluate ambient concentrations of a chemical in air and determine its potential to result in adverse health effects, adverse vegetative effects, or odors. In general, health AMCVs are set to provide a margin of safety, and are set well below levels at which adverse health effects are reported in the scientific literature. If a chemical concentration in ambient air is less than its 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.

A health effects evaluation of reported concentrations follows this *Results* section. Chemicals with concentrations that exceeded short-term AMCVs are highlighted below by county and facility with a reference to the map showing the location of the facility and associated monitoring site(s). Please refer to the TCEQ Mobile Monitoring report for associated maps. In addition, because elevated short-term levels of benzene contribute to long-term exposure levels, all samples with elevated benzene concentrations are noted by county and facility. All facilities discussed in this *Results* section appear to be within 0.25 miles or less of residential property.

Denton County

Devon Energy Company (Co.) LP Justin Compressor Station (Map 1)

Benzene was detected at 8.2 ppb in 30-minute canister sample BSFS1003-042 collected downwind of Devon Energy Justin Compressor Station on 3/3/10 on Jim Baker Road, approximately 1.8 miles north of FM 1384. An instantaneous canister sample was collected on 3/3/10 upwind of this facility and benzene was detected at 0.14 ppb¹. Benzene was detected at 37 ppb in a second, 30-minute canister sample BSFS1003-045 collected at the same downwind location on 3/4/10. The benzene concentrations detected downwind of this facility are similar to the 5.6 ppb benzene concentration detected in an instantaneous canister sample collected on 10/14/09 at the same location.

Parker County

Stallion Oilfield Services Salty's Disposal Wells Parker Salty Lease (Map 5)

Chemicals that were detected above their short-term AMCVs in instantaneous canister sample BSF1003-013 are listed in Table 1. In addition, benzene was detected at 72 ppb. This sample was collected on 3/4/10, downwind of Salty's Disposal Facility, on the utility access road, approximately 0.11 mile east of FM 51. Chemicals that were detected above their short-term AMCVs in 30-minute canister sample BSFS1003-020 are listed in Table 2. In addition, benzene was detected at 14 ppb². This sample was collected on 3/4/10, downwind of Salty's Disposal Facility, on utility access road, approximately 0.1 mile east of FM 51. Chemicals that were detected above their short-term AMCVs in instantaneous canister sample BSFS1003-008 are listed in Table 3. In addition, benzene was detected at 95 ppb. This sample was collected on 3/4/10, downwind of Salty's Disposal Facility, on the utility access road, approximately 0.1 mile east of FM 51. m & p -Xylene, styrene, and p-diethylbenzene were detected at this facility above their short-

¹ The reported concentration of benzene was estimated based on a sample detection limit of 0.27 parts per billion by volume. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

² The reported concentration of benzene was estimated because it was greater than the sample detection limit of 7.8 ppbv, but less than the sample quantitation limit. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

term, odor AMCVs during the sampling event on 8/26/09. Benzene was detected at 3.2 ppb and 93 ppb at this facility on 8/26/09.

Table 1. Short-term Exceedances in Instantaneous Canister Sample Number BSFS1003-013					
Chemical	Measured Concentration (ppb)	Short-term health AMCV (ppb)	Short-term odor AMCV (ppb)	Does it exceed the short-term, health AMCV?	Does it exceed the short-term, odor AMCV?
2-Methylpentane	150	1,000	83	No	Yes
Methylcyclohexane	220	4000	150	No	Yes
Toluene	220	4000	170	No	Yes
1,2-Dibromoethane	1.3 ³	0.5	10000	Yes	No
m & p-Xylene	210	1700	80	No	Yes

Table 2. Short-term Exceedances in 30-minute Canister Sample Number BSFS1003-020					
Chemical	Measured Concentration (ppb)	Short-term health AMCV (ppb)	Short-term odor AMCV (ppb)	Does it exceed the short-term, health AMCV?	Does it exceed the short-term, odor AMCV?
m & p-Xylene	180	1700	80	No	Yes
n-Propylbenzene	5.4 ⁴	250	4	No	Yes
p-Diethylbenzene	6.6 ⁵	460	0.39	No	Yes

³ The reported concentration of 1,2-dibromoethane was estimated based on a sample detection limit of 10 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of 1,2-dibromoethane is the best estimate of the actual concentration.

⁴ The reported concentration of n-propylbenzene was estimated based on a sample detection limit of 7.8 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of n-propylbenzene is the best estimate of the actual concentration.

⁵ The reported concentration of p-diethylbenzene was estimated based on a sample detection limit of 7.8 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of p-diethylbenzene is the best estimate of the actual concentration.

Table 3. Short-term Exceedances in Instantaneous Canister Sample Number BSFS1003-008					
Chemical	Measured Concentration (ppb)	Short-term health AMCV (ppb)	Short-term odor AMCV (ppb)	Does it exceed the short-term, health AMCV?	Does it exceed the short-term, odor AMCV?
2-Methylpentane	190	1,000	83	No	Yes
n-Heptane	790	850	670	No	Yes
Methylcyclohexane	640	4000	150	No	Yes
Toluene	710	4000	170	No	Yes
1,2-Dibromoethane	3.2 ⁶	0.5	10000	Yes	No
n-Octane	820	750	1700	Yes	No
m & p-Xylene	980	1700	80	No	Yes
n-Propylbenzene	22 ⁷	250	4	No	Yes
m-Ethyltoluene	72	250	18	No	Yes
p-Ethyltoluene	25 ⁸	250	8.3	No	Yes

Crosstex North Texas Gathering LP Kemp Compressor Station (Map 6)

2-Methylpentane was detected above its short-term AMCV in instantaneous canister sample BSFS1003-018 and is listed in Table 4. In addition, benzene was detected at 30 ppb. This sample was collected on 3/3/10, downwind of Crosstex Gathering Kemp Compressor Station, on utility access road, approximately 0.5 mile southeast of FM 730 and 0.1 mile south of Pearson Ranch Road. A 30-minute canister sample (BSFS1003-002) was collected downwind of this facility on 3/3/10 and no chemicals were detected above their short-term AMCVs in this sample, but benzene was detected at 18 ppb. Instantaneous canister samples were collected upwind of this facility on 3/3/10 and 3/5/10 and no chemicals were detected above their short-term AMCVs and benzene was

⁶ The reported concentration of 1,2-dibromoethane was estimated based on a sample detection limit of 19 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of 1,2-dibromoethane is the best estimate of the actual concentration.

⁷ The reported concentration of n-propylbenzene was estimated based on a sample detection limit of 25 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of n-propylbenzene is the best estimate of the actual concentration.

⁸ The reported concentration of p-ethyltoluene was estimated because it was greater than the sample detection limit of 15 ppbv, but less than the sample quantitation limit. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of p-ethyltoluene is the best estimate of the actual concentration.

detected at a maximum concentration of 0.22 ppb⁹. Several chemicals were detected above their short-term AMCVs at this facility on 8/25/09. The benzene concentrations are similar to the benzene concentration of 24 ppb detected in an instantaneous canister sample collected on 8/25/09.

Table 4. Short-term Exceedances in Instantaneous Canister Sample Number BSFS1003-018					
Chemical	Measured Concentration (ppb)	Short-term health AMCV (ppb)	Short-term odor AMCV (ppb)	Does it exceed the short-term, health AMCV?	Does it exceed the short-term, odor AMCV?
2-Methylpentane	89	1,000	83	No	Yes

Crosstex Energy White Settlement Compressor Station (Map 7)

Benzene was detected at 3.3 ppb in a 30-minute canister sample (BSFS1003-057) collected on 3/2/10 downwind of the Crosstex Energy White Settlement Compressor Station, on FM3325, approximately 0.05 mile north of Stacy Lane. Benzene was detected at 3.7 ppb in an instantaneous canister sample (BSFS1003-62) that was collected at the same location on 3/2/10. Benzene was detected at a maximum concentration of 0.14 ppb⁹ in an instantaneous canister sample collected upwind of this facility on 3/2/10. Additionally, benzene was detected at 16 ppb in an instantaneous canister sample collected on 10/15/09 downwind of this facility.

Enbridge Gathering North Texas LP Springtown Plant (Map 4)

Benzene was detected at 5.7 ppb¹⁰ in a 30-minute canister sample (BSFS1003-055) collected on 3/3/10 downwind of Enbridge Gathering North Texas LP Springtown Plant on Scroggins Road, approximately 0.1 mile east of FM 51. Benzene was detected at 9.4 ppb¹¹ in instantaneous canister sample BSFS1003-011 collected on 3/4/10 at the same location. The upwind sample collected on 3/3/10 reported a benzene concentration of

⁹ The reported concentration of benzene was estimated based on a sample detection limit of 0.27 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

¹⁰ The reported concentration of benzene was estimated because it was greater than the sample detection limit of 3.5 ppbv, but less than the sample quantitation limit. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

¹¹ The reported concentration of benzene was estimated because it was greater than the sample detection limit of 8.1 ppbv, but less than the sample quantitation limit. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

0.15 ppb¹² in instantaneous canister sample BSFS1003-060. These downwind benzene concentrations are similar to those previously monitored at this facility on 10/12/09 – 10/13/09.

Hood County

Quicksilver Resources T & P Unit (Map 9)

Chemicals that were detected above their short-term AMCVs in 30-minute canister sample BSFS1003-056 collected on 3/2/10 are listed in Table 5. This sample was collected on 3/3/10, downwind of Quicksilver Resources T & P Unit on FM 4, approximately 0.75 mile south of State Highway (SH) 377. In addition, benzene was detected at 15 ppb in BSF1003-056. Chemicals that were detected above their short-term AMCVs in instantaneous canister sample BSFS1003-052 collected downwind of Quicksilver Resources T&P Unit on 3/3/10 are listed in Table 6. Benzene was detected at 20 ppb¹³ in this sample. The upwind sample collected on 3/3/10 reported a benzene concentration of 0.2 ppb¹⁴ in instantaneous canister sample BSFS1003-054. The downwind concentrations of 2-methylpentane and benzene are similar to those previously monitored downwind of this facility on 10/15/09.

Table 5. Short-term Exceedances in 30-Minute Canister Sample Number BSFS1003-056					
Chemical	Measured Concentration (ppb)	Short-term health AMCV (ppb)	Short-term odor AMCV (ppb)	Does it exceed the short-term, health AMCV?	Does it exceed the short-term, odor AMCV?
n-Pentane	1300	1200	1400	Yes	Yes
2-Methylpentane	260	1,000	83	No	Yes

¹² The reported concentration of benzene was estimated based on a sample detection limit of 0.27 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

¹³ The reported concentration of benzene was estimated based on a sample detection limit of 22 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

¹⁴ The reported concentration of benzene was estimated based on a sample detection limit of 0.54 ppbv. Estimated results are results that the analytical method cannot reliably quantitate. The estimated reported concentration of benzene is the best estimate of the actual concentration.

Table 6. Short-term Exceedances in Instantaneous Canister Sample Number BSFS1003-052					
Chemical	Measured Concentration (ppb)	Short-term health AMCV (ppb)	Short-term odor AMCV (ppb)	Does it exceed the short-term, health AMCV?	Does it exceed the short-term, odor AMCV?
n-Pentane	1600	1200	1400	Yes	Yes
2-Methylpentane	300	1,000	83	No	Yes

Evaluation

Three chemicals were detected at concentrations that exceeded their short-term, health AMCVs: n-octane, n-pentane, and 1,2-dibromoethane. Chemicals were detected above their short-term, health AMCVs downwind of two facilities (Stallion Oilfield Services Salty's Disposal Wells Parker Salty Lease and Quicksilver Resources T & P Unit). However, the measured concentrations of these chemicals were well below known health effects levels, so short-term exposure to these concentrations is not expected to cause adverse health effects.

Chemicals were detected above their odor AMCVs downwind of three facilities: Stallion Oilfield Services Salty's Disposal Wells Parker Salty Lease, Crosstex North Texas Gathering LP Kemp Compressor Station, and Quicksilver Resources T & P Unit. These chemicals were 2-methylpentane, methylcyclohexane, toluene, m&p-xylene, n-propylbenzene, p-diethylbenzene, n-heptane, m-ethyltoluene, p-ethyltoluene, and n-pentane. At these concentration levels, exposure to these chemicals could cause. This is consistent with TCEQ staff reporting odors during this investigation as well as citizen reports of odors in the area. Persistent or recurrent exposure to levels that significantly exceed the AMCV may cause odor-related effects such as headache and nausea. These odor issues are referred to the TCEQ Office of Compliance and Enforcement for their investigation and appropriate action. In a January 27, 2010 health effects evaluation of TCEQ 2009 mobile monitoring investigations in the Barnett Shale area, the TD identified a total of 21 individual monitoring sites with elevated instantaneous benzene concentrations (2009 Monitoring Sites 2, 5, 7, 8, 12, 25, 32, 33, 34, 35, 47, 48, 56, 58, 62, 63, 71, 77, 80, 93, and 94). The TD recommended reductions in emissions in the area near Monitoring Sites 7, 8, and 47. The TCEQ re-sampled the area near Monitoring Sites 7, 8, and 47 (Targa North Texas LP Bryan Compressor Station (Fall 2009 Monitoring Sites 8 and 47) and Devon Energy Glen P. Shoop Wellhead (Fall 2009 Monitoring Site 7)) to verify reductions in emissions prior to the March 2010 follow-up survey. Table 8 provides a comparison of maximum instantaneous benzene concentrations detected at the remaining 18 monitoring sites the TD identified as sites with elevated benzene concentrations from 2009 mobile monitoring investigations to maximum short-term benzene concentrations detected during the March 2010 follow-up survey. The TD recognizes that the monitored elevated concentrations of benzene

downwind of six facilities (Devon Energy Company (Co.) LP Justin Compressor Station, Stallion Oilfield Services Salty's Disposal Wells Parker Salty Lease, Crosstex North Texas Gathering LP Kemp Compressor Station, Crosstex Energy White Settlement Compressor Station, Enbridge Gathering North Texas LP Springtown Plant, and Quicksilver Resources T & P Unit) did not exceed the short-term, health AMCV and are below levels of short-term health concern. However, elevated short-term levels are of potential concern due to their contribution to long-term (i.e., lifetime) cumulative exposure levels because benzene is a known human carcinogen. Monitored concentrations at these facilities were similar to concentrations detected during previous sampling events in 2009 (Table 8).

TD Recommendations

The TD recommends continued surveillance and monitoring in the Barnett Shale area.

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 Teri Whiteley at (512) 239-6859 or Tim Doty at (512)239-1685.

Table 7. Target Analytes for Canister Samples

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

Table 8. Comparison of Fall 2009 Instantaneous Maximum Benzene Concentrations at 18 Monitoring Sites to March 2010 Short-term Maximum Benzene Concentrations at Corresponding Monitoring Sites.

Fall 2009 Monitoring Site Number	Facility	Date	Fall 2009 Max Benzene Concentration (ppb)	Flags	Sample Duration	March 2010 Corresponding Monitoring Site Number	Facility	Sample Date	March 2010 Max Benzene concentration (ppb)	Flags	Canister Sample Duration
58	Airshed	10/14/2009	1.5	J, D11	Inst	29	Airshed	3/2/2010	0.17	J	Inst
62	Airshed	10/14/2009	1.5	J, D1	Inst	27	Airshed	3/3/2010	0.15	J	Inst
56	Airshed	10/14/2009	3.2	J, D1	Inst	26	Airshed (Downwind)	3/3/2010	0.19	J	Inst
12	Crosstex Energy Justin Plant	11/11/2009	24	L	Inst	21	Crosstex Energy Justin Plant (downwind)	3/2/2010	0.41	J, D3	30-min
2	Crosstex Gathering Kemp Compressor Station	8/25/2009	24	J, D4	Inst	11	Crosstex Gathering Kemp Compressor Station (Downwind)	3/3/2010	30	D8	Inst
25	Crosstex White Settlement Compressor Station	10/15/2009	16	L, D3	Inst	2	Crosstex White Settlement Compressor Station (Downwind)	3/2/2010	3.7		Inst
94	Devon Energy Justin Compressor Station	11/19/2009	3.7	D2	Inst	23	Devon Energy Justin Compressor Station (Downwind)	3/4/2010	37	D4	30 min
63	Devon Energy Justin Compressor Station	10/14/2009	5.6	J, D1	Inst	23	Devon Energy Justin Compressor Station (Downwind)	3/4/2010	37	D4	30 min
93	Dish, TX Compressor Stations	11/18/2009	1.6	D1	Inst	25	Dish, TX Compressor Stations (downwind)	3/4/2010	0.31	J, D2	30 min
33	Enbridge Gathering Springtown Plant	10/11/2009	8.8	J, D6	Inst	24	Enbridge Gathering Springtown Plant (Downwind)	3/4/2010	9.4	L, D16	Inst
32	Enbridge Gathering Springtown Plant	10/12/2009	13	D1	Inst	4	Enbridge Gathering Springtown Plant (Downwind)	3/3/2010	5.7	L, D15	30 min
34	Enbridge Gathering Springtown Plant	10/12/2009	23	L	Inst	4	Enbridge Gathering Springtown Plant (Downwind)	3/3/2010	5.7	L, D15	30 min
35	Enbridge Gathering Springtown Plant	10/12/2009	26		Inst	4	Enbridge Gathering Springtown Plant (Downwind)	3/3/2010	5.7	L, D15	30 min
48	Enbridge Springtown Plant/Arrowhead Production	10/15/2009	1.9	J, D10	Inst	24	Enbridge Springtown Plant/Arrowhead Production (Downwind/Upwind)	3/5/2010	1.4	J, D22	Inst
80	ETC Godley Plant	10/14/2009	2.3	L, D6	Inst	32	ETC Godley Plant (Downwind)	3/3/2010	0.15	J	Inst
77	On Jim Baker Road, between Crosstex Energy Justin Plant and Devon Energy Justin Compressor Station	10/14/2009	46	D7	Inst	22	On Jim Baker Road, between Crosstex Energy Justin Plant and Devon Energy Justin Compressor Station	no sample	no sample	no sample	no sample
71	Quicksilver Resources T&P Unit	10/15/2009	11	L, D2	Inst	5	Quicksilver Resources T&P Unit (Downwind)	3/3/2010	20	J, D14	Inst
5	Stallion Oilfield Services Sally's Disposal Wells	8/26/2009	93	D5	Inst	14	Stallion Oilfield Services Sally's Disposal Wells (Downwind)	3/4/2010	95	D11	Inst

ppb = part per billion by volume

Inst = Instantaneous

Min = Minute

Note: Highlighted rows indicate March 2010 maximum benzene concentrations were similarly elevated compared to Fall 2009 maximum benzene concentrations.

*TCEQ did not survey Targa North Texas LP Bryan Compressor Station (Fall 2009 Monitoring Sites 8 and 47) or Devon Energy Glen P. Shoop Wellhead (Fall 2009 Monitoring Site 7) during the March 2010 follow-up survey because these sites were re-sampled during a separate sampling event.

Footnotes/Flags for Fall 2009 data:

J = reported concentration is below the SDL.

L = reported concentration is greater than or equal to the SDL but less than the LOQ.

LOD = limit of detection.

LOQ = limit of quantitation.

SDL = sample detection limit (LOD adjusted for dilutions).

Site	Dilution Flag
2	D4 = Sample BSF0908-17 was diluted 402.0 times to determine the compound concentrations.
5	D5 = Sample BSF0908-25 was diluted 100.5 times to determine the compound concentrations.
25	D3 = sample BSII0910-027 was diluted 100.62 times to determine compound concentrations.
32	D1 = sample BSII0910-001 was diluted 39.92 times to determine compound concentrations.
33	D6 = sample BSII0910-084 was diluted 90.44 times to determine compound concentrations.
48	D10 = sample BSII0910-122 was diluted 68.26 times to determine compound concentrations.
56	D1 = sample BSII0910-007 was diluted 72.36 times to determine compound concentrations.
58	D11 = sample BSII0910-080 was diluted 29.02 times to determine compound concentrations.
62	D1 = sample BSII0910-016 was diluted 17.94 times to determine compound concentrations.
63	D1 = sample BSII0910-019 was diluted 116.00 times to determine compound concentrations.
71	D2 = sample BSII0910-035 was diluted 60.28 times to determine compound concentrations.
77	D7 = sample BSII0910-077 was diluted 30.04 times to determine compound concentrations.
80	D6 = sample BSII0910-103 was diluted 8.12 times to determine compound concentrations.
93	D1 = sample BSIII0911-001 was diluted 4.02 times to determine the compound concentrations.
94	D2 = sample BSIII0911-006 was diluted 10.00 times to determine the compound concentrations.

Footnotes/Flags for March 2010 data:

J = reported concentration is below the SDL.

L = reported concentration is greater than or equal to the SDL but less than the LOQ.

LOD = limit of detection.

LOQ = limit of quantitation.

SDL = sample detection limit (LOD adjusted for dilutions).

D1 = sample concentration was calculated using a dilution factor of 3.58.

D2 = sample concentration was calculated using a dilution factor of 4.02.

D3 = sample concentration was calculated using a dilution factor of 4.00.
D4 = sample concentration was calculated using a dilution factor of 8.04.
D5 = sample concentration was calculated using a dilution factor of 8.08.
D6 = sample concentration was calculated using a dilution factor of 3.68.
D7 = sample concentration was calculated using a dilution factor of 3.92.
D8 = sample concentration was calculated using a dilution factor of 54.12.
D9 = sample concentration was calculated using a dilution factor of 3.46.
D10 = sample concentration was calculated using a dilution factor of 58.12.
D11 = sample concentration was calculated using a dilution factor of 187.88.
D12 = sample concentration was calculated using a dilution factor of 100.49.
D13 = sample concentration was calculated using a dilution factor of 7.60.
D14 = sample concentration was calculated using a dilution factor of 163.75.
D15 = sample concentration was calculated using a dilution factor of 25.65.
D16 = sample concentration was calculated using a dilution factor of 59.77.
D17 = sample concentration was calculated using a dilution factor of 3.52.
D18 = sample concentration was calculated using a dilution factor of 3.48.
D19 = sample concentration was calculated using a dilution factor of 87.52.
D20 = sample concentration was calculated using a dilution factor of 175.92.
D21 = sample concentration was calculated using a dilution factor of 38.75.
D22 = sample concentration was calculated using a dilution factor of 17.90.
D23 = sample concentration was calculated using a dilution factor of 3.44.
X1 = sample collection time exceeded the established acceptance criteria.
X2 = sample collection time and flow rate relative percent error exceeded the established acceptance criteria. Data may be biased.
X3 = sample collection volume exceeded established acceptance criteria.