

TCEQ Interoffice Memorandum

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Date: October 15, 2012

Subject: Health Effects Review of 2011 Ambient Air Network Monitoring Data in Region 12, Houston

Key Points

- Notably, annual averages for all chemicals and metals were below their respective long-term air monitoring comparison values (AMCVs) for the second time in many years of sampling.
- The 2011 benzene concentration at the Marathon-sponsored site in Texas City is below TCEQ's long-term AMCV for the second time since monitoring began in 2005. Also in Texas City, recent annual average benzene concentrations (2007-2011) at the British Petroleum (BP)-sponsored site continue to meet TCEQ's long-term AMCV.
- Although currently on the Air Pollutant Watch List (Site# [APWL1202](#)) for elevated long-term concentrations of benzene monitored in previous years, data from recent years for the BP- and Marathon-sponsored sites indicate sufficient achievements in reducing ambient air concentrations such that the levels reported for recent years are not of concern for potential long-term, adverse health effects. This determination should be considered in context with the [APWL protocol](#).
- For the last four years, the annual benzene averages at the Lynchburg Ferry and Galena Park sites have been below the long-term AMCV, which represents a significant and maintained air quality improvement in these areas.
- Although the Galena Park site is currently on the APWL (Site# [APWL1206](#)), data from 2008 to date indicate sufficient achievements in reducing ambient air concentrations such that the reported levels are no longer of concern for potential long-term, adverse health effects. This determination should be considered in context with the [APWL protocol](#).
- For the second consecutive year, there were no odorous styrene concentrations monitored at the Milby Park site (i.e., the frequency of styrene odor-based AMCV exceedances at Milby Park has been reduced 100%).

- A few hourly levels of two chemicals (isoprene and styrene) monitored at five Region 12 sites would result in the perception of odors if people were exposed. However, the monitored concentrations would not be expected to cause direct, short-term health effects (e.g., eye irritation), or indirect odor-related effects (e.g., nausea, headache) due to the infrequency and low magnitude of exceedances and other considerations (e.g., odor characteristic and likely conservative nature of odor-based AMCV for isoprene).
- While the Lynchburg Ferry site autoGC did not operate at the north crossing site after September 12, 2011 as it had to be relocated per the US Department of Homeland Security, data from January 1-September 12, 2011 demonstrate significant improvement in both the frequency and magnitude of odorous styrene concentrations monitored at the Lynchburg Ferry site, with preliminary 2012 data for this period showing the same. Thus, although styrene is currently listed on the APWL for this area (Site# [APWL1204](#)), 2011-2012 data indicate sufficient achievements in reducing ambient air concentrations such that the reported levels are no longer of concern for persistent, strong odors. This determination should be considered in context with the [APWL protocol](#).

Background

The primary purpose of this memorandum is to convey the Toxicology Division's (TD) evaluation of ambient air toxics sampling conducted at monitoring sites in Region 12-Houston during 2011. Additionally, summary information concerning various specific TCEQ actions (e.g., investigations) relevant to identifying and/or reducing emissions is provided for several of the areas/chemicals discussed. The TD reviewed summary results for volatile organic compounds (VOCs) from 24-hour canister samples, 1-hour automated gas-chromatography (autoGC) VOC samples, 24- and 3-hour carbonyl samples, 24-hour polycyclic aromatic hydrocarbon (PAH)/semivolatile organic compound (SVOC) samples, and 24-hour metals samples from filters designed to collect particulate matter with an aerodynamic diameter of 2.5 microns or less (PM_{2.5}) and from filters collecting particulate matter with an aerodynamic diameter of 10 microns or less (PM₁₀). Except for lead, data for criteria pollutants (i.e., compounds having National Ambient Air Quality Standards) were not evaluated for this memorandum. Appendix 1 contains a list of the target analytes evaluated for this review. Information regarding monitoring sites and target analyte data reviewed by the TD is presented in Table 1 and summarized below:

- 24-hour canister VOC sampling at 16 sites
- 24-hour carbonyl sampling at 2 sites
- 3-hour carbonyl sampling at 1 site
- 24-hour metals sampling at 4 sites
- 24-hour PAH/SVOC sampling at 1 site
- 1-hour autoGC VOC monitoring at:
 - 5 TCEQ sites
 - 6 Enhanced Industry-Sponsored Monitoring (EISM) sites
 - 2 Attorney General-Temporary Injunction Monitoring sites (TIM)
 - 1 US Environmental Protection Agency (EPA)/DOJ-Industry Agreement Monitoring site (EPA/DOJAM)

Table 1. Monitoring Sites Located in TCEQ Region 12

County	EPA Site ID	Site Location	Network	Monitored Compounds
Brazoria	48-039-1003	Clute 426 Commerce St.	TCEQ	VOC (24-hour canister)
Brazoria	48-039-0618	Danciger Along US Hwy 1459 in Brazoria County	EISM	VOC (autoGC)
Brazoria	48-039-1016	Lake Jackson 109-B Brazoria Hwy 332-W	EISM	VOC (autoGC)
Galveston	48-167-0005	Texas City, Ball Park 2516 ½ Texas Ave.	TCEQ	VOC (24-hour canister)
Galveston	48-167-0056	Texas City, 34th St. 2212 North 34th St.	EISM	VOC (autoGC)
Galveston	48-167-1034	Galveston, 99th St. 9511 Avenue V ½	TCEQ	VOC (24-hour canister)
Harris	48-201-0036	Jacinto Port 1st St. and Elsbeth St.	TCEQ	VOC (24-hour canister)
Harris	48-201-1039	Deer Park 4514 ½ Durant St.	TCEQ	VOC (autoGC, 24-hour canister), Carbonyls, Metals, PAHs/SVOCs
Harris	48-201-0024	Houston, Aldine 4510 ½ Aldine Mail Rd.	TCEQ	VOC (24-hour canister), Metals
Harris	48-201-1035	Houston, Clinton 9525 ½ Clinton Dr.	TCEQ	VOC (autoGC), Carbonyls, Metals
Harris	48-201-1034	Houston, East 1262 1/2 Mae Drive	TCEQ	Lead (TSP)
Harris	48-201-0057	Galena Park 304 Stewart St.	TCEQ	VOC (24-hour canister)
Harris	48-201-0026	Houston, Channelview 1405 Sheldon Rd.	TCEQ	VOC (autoGC)
Harris	48-201-0061	La Porte, Shoreacres 3903 ½ Old Hwy 146	TCEQ	VOC (24-hour canister)
Harris	48-201-0069	Houston, Milby Park 2201-a Central St.	TCEQ	VOC (autoGC)

County	EPA Site ID	Site Location	Network	Monitored Compounds
Harris	48-201-6000	Houston, Cesar Chavez 4829A Galveston Rd.	TCEQ	VOC (autoGC)
Harris	48-201-1015	Baytown, Lynchburg Ferry 1001 B Lynchburg Rd.	TCEQ/EISM	VOC (autoGC, 24-hour canister)
Harris	48-201-0617	Baytown, Wallisville Rd. 4727 Wallisville Rd.	EISM	VOC (autoGC)
Harris	48-201-0307	Houston, Manchester/Central 9401 ½ Manchester Rd.	TCEQ	VOC (24-hour canister)
Harris	48-201-0029	Tomball, NW Harris County 16822 Kitzman St.	TCEQ	VOC (24-hour canister)
Harris	48-201-0055	Houston, Bayland Park 6400 Bissonnet St.	TCEQ	VOC (24-hour canister)
Harris	48-201-0058	Baytown 7201 ½ Bayway Dr.	TCEQ	VOC (24-hour canister)
Harris	48-201-0803	Haden Rd. (HRM-3) 1504 ½ Haden Dr.	TCEQ/EISM	VOC (autoGC, 24-hour canister)
Harris	48-201-1049	Pasadena North 702 Light Company Rd.	TCEQ	VOC (24-hour canister)
Galveston	N/A	BP North America Products, Inc.-Texas City 31st St. (Between Texas Ave. and 5th Ave.)	TIM	Benzene (autoGC)
Galveston	N/A	BP North America Products, Inc.-Texas City Logan St.	TIM	Benzene (autoGC)
Galveston	N/A	Marathon Petroleum Company, LLC-Texas City 11st St. S. at 6th Ave. S.	EPA/DOJAM	Benzene (autoGC)
Montgomery	48-339-0078	Conroe 9472A Hwy 1484	TCEQ	VOC (24-hour canister)

All data collected at TCEQ monitors are analyzed by the TCEQ laboratory and should meet a 75% data completeness objective. At EISM monitors, data are collected by a third party contractor and should also meet a 75% data completeness objective. The data collected at the EPA/DOJAM and TIM monitors are analyzed by a third party contractor and should meet an 85% data completeness objective. One-hour autoGC VOC and 3-hour carbonyl data were evaluated for potential acute health (e.g., irritation) and odor concerns, as were any 24-hour sample results (VOCs, carbonyls, and metals) that exceeded short-term air monitoring

comparison values (AMCVs). The annual averages from 1-hour autoGC and 24-hour samples (VOCs, carbonyls, and metals) were evaluated for potential chronic health concerns. Measured chemical concentrations were compared to appropriate TCEQ health-, odor-, and vegetation-based AMCVs. Information on AMCVs may be obtained via the internet (<http://www.tceq.state.tx.us/implementation/tox/AirToxics.html>) or by contacting the TD (512-239-3900).

Evaluation

1- and 3-Hour Concentrations

The vast majority of the 1-hour autoGC VOC and 3-hour carbonyl concentrations were below their respective TCEQ short-term, health- and/or odor-based AMCVs. More specifically, about 99.9995% of the approximately 3,673,000 1-hour VOC measurements from TCEQ and EISM autoGC monitors in Region 12 in 2011 were below their short-term AMCVs. Only one (approximately 0.00003%) of the hourly autoGC measurements collected in Region 12 in 2011 exceeded a TCEQ short-term, health-based AMCV. Approximately 0.0005% exceeded odor-based AMCVs, with no more than six exceedances for a chemical at any one site. Additionally, except for three exceedances of the odor-based AMCV for isovaleraldehyde at Clinton Dr. (down from eighteen last year), all of the approximately 2,900 3-hour carbonyl concentrations measured in Region 12 in 2011 were below their respective AMCVs. That is, approximately 99.9% of the 3-hour carbonyl levels were below their respective short-term, health- and odor-based AMCVs. Therefore, we would not expect short-term, adverse health effects or odors to be associated with the vast majority of 1- and 3-hour measurements monitored in Region 12 in 2011.

Further evaluation was conducted for the monitored concentrations that exceeded their respective short-term, health- and/or odor-based AMCVs to determine the potential for adverse health effects or odors. A single concentration of isoprene was the only instance in which any of the monitored 1-hour concentrations exceeded their respective short-term, health-based AMCVs in 2011. This one exceedance occurred at the Lynchburg Ferry site monitor, where there was one hourly isoprene concentration (22.6 ppb_v) that was slightly above the short-term, health-based AMCV of 20 ppb_v. This maximum monitored hourly isoprene concentration is significantly below levels attributable to short-term, adverse health effects. Therefore, exposure to this 1-hour concentration would not be expected to cause short-term, adverse health effects.

The monitored 1-hour autoGC VOC concentrations that exceeded their respective odor-based comparison levels are shown below in Table 2. The total number of odor-based AMCV autoGC exceedances in Region 12 in 2011 (19 exceedances) is 75% lower than that in 2010 (75 exceedances), and also significantly lower compared to 2009 (37 exceedances), 2008 (82 exceedances), and 2007 (103 exceedances). In regard to 3-hour carbonyl sample results, three 3-hour isovaleraldehyde concentrations (0.13-0.16 ppb_v) monitored at the Clinton Dr. site exceeded the odor-based AMCV (0.1 ppb_v). This is a reduction in frequency of 83% compared to 2010, with the magnitude of isovaleraldehyde odor-based AMCV exceedances decreasing as well (e.g., 2011 maximum of 0.16 ppb_v is 76% lower than the 2010 maximum of 0.66 ppb_v).

Table 2. Odor-Based AMCV Exceedances by 1-Hour AutoGC VOC Concentrations

Site	Chemical	Number of 1-Hour Concentrations above Odor-Based AMCV	Maximum Measured Concentration (ppb _v)	Odor-Based AMCV (ppb _v)
Deer Park	Isoprene	2	8.3	5
Haden Rd.	Isoprene	2	8.7	5
Lynchburg Ferry	Styrene	3	38.4	25
	Isoprene	5	22.6	5
Clinton Dr.	Isoprene	1	5.3	5
Channelview	Isoprene	6	10.2	5

The monitored odor-based AMCV exceedances would not be expected to cause direct acute health effects (e.g., eye irritation). Additionally, although the perception of sufficiently strong and persistent unpleasant odors has the potential to cause odor-related health effects (e.g., nausea, headache), these concentrations would not be expected to cause odor-related health effects due to the infrequency and low magnitude of exceedances and other considerations (e.g., odor characteristic and likely conservative nature of the odor-based AMCV for isoprene).

It is noted that for the second consecutive year, no odor-based AMCV exceedances occurred at the Milby Park site in 2011. Furthermore, even taking into account that the Lynchburg Ferry site did not operate for the full year in 2011, there was a considerable decrease in the frequency and magnitude of styrene odor-based AMCV exceedances. These sites warrant further discussion as they have been of historic interest due to frequent odor-based exceedances for styrene in previous years.

Lynchburg Ferry – Styrene

There were only three hourly styrene concentrations (maximum concentration of 38.4 ppb_v) monitored above the odor-based AMCV (25 ppb_v) in 2011 at the Lynchburg Ferry site compared to 27 hourly exceedances in 2010 (maximum concentration of 265 ppb_v) (see Figure 1). However, the autoGC did not operate at the site after September 12 as it had to be relocated from the north side of the ferry crossing to the south side per the US Department of Homeland Security. Nevertheless, monitoring data from January 1-September 12 show that there was a significant decrease in the number of styrene odor-based AMCV exceedances in 2011 (3 exceedances) compared to the same period for 2010 (13 exceedances). For the same period, this

represents an approximate 77% decrease in the number of odorous styrene concentrations in 2011 compared to 2010, a 67% decrease compared to the 9 odorous levels in 2009, a 83% decrease compared to the 18 odorous levels in 2008, a 83% decrease compared to the 18 odorous levels in 2007, a 89% decrease compared to the 27 odorous levels in 2006, and a 96% decreased compared to the 69 odorous levels during the same period in 2005. Thus, overall as can be seen from Figure 1, there has been a significant improvement in the frequency of styrene odor-based AMCV exceedances over the 2005-2011 period.

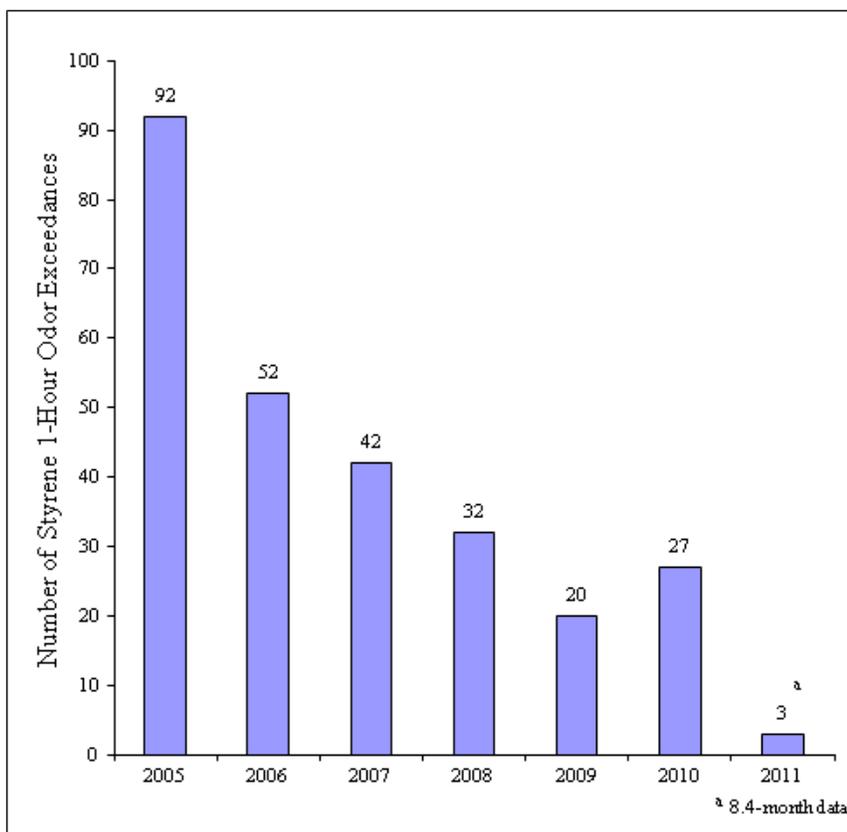


Figure 1. Exceedances of the Styrene Odor-Based AMCV at the Lynchburg Ferry Site

This improvement is likely the result of efforts in the area to reduce styrene emissions in recent years. The significant improvement in the frequency of odorous styrene concentrations appears to be persisting as preliminary data indicate there has been a similar low number of exceedances (four) from January 1- September 12, 2012 as compared to the same period in 2011 (three). Additionally, the maximum concentrations over this period in 2011-2012 (maximum concentrations of 38.4-47.5 ppb_v) are much lower than those over the same period for 2005-2010 (maximum concentrations of 433.0, 358.4, 154.9, 494.4, 102.0, and 265.0 ppb_v, respectively). Thus, both the frequency and magnitude of odorous styrene concentrations monitored at the Lynchburg Ferry site have shown significant improvement. Although styrene is currently listed on the APWL for this area (Site# [APWL1204](#)), the data discussed above from 2011-2012 indicate sufficient achievements in reducing ambient air concentrations such that the reported levels are no longer of concern for persistent, strong odors. This determination should be considered in context with the [APWL protocol](#).

Milby Park - Styrene

Milby Park styrene odor exceedance data from recent years show obvious improvement compared to previous years (see Figure 2). There were no odorous styrene concentrations monitored at the Milby Park site in 2011 (maximum of 20.9 ppb_v) or 2010 (maximum of 18.3 ppb_v) compared to two odor-based AMCV exceedances in 2009 (maximum of 28.7 ppb_v), 33 exceedances in 2008 (maximum of 69.7 ppb_v), 28 such instances in 2007 (maximum of 49.4 ppb_v), and 16 exceedances in 2006 (maximum of 53.8 ppb_v). Additionally, the maximum 1-hour concentrations for 2010-2011 (18.3-20.9 ppb_v) are generally well below those for 2006-2009 (28.7-69.7 ppb_v). Thus, there has been a significant improvement in both the frequency and magnitude of odorous styrene levels at the Milby Park monitor.

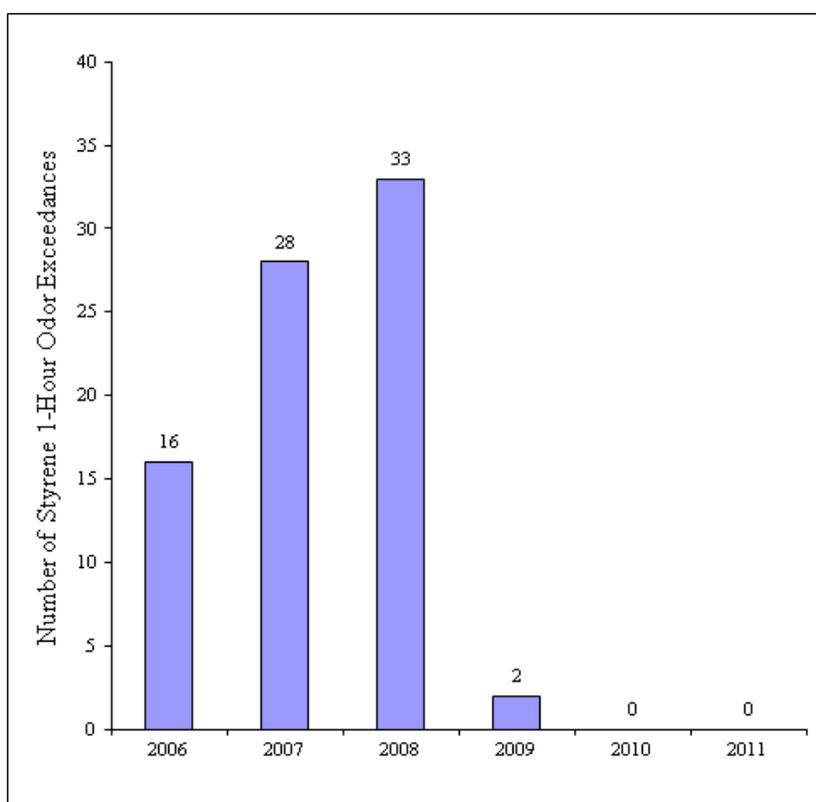


Figure 2. Exceedances of the Styrene Odor-Based AMCV at the Milby Park Site

As mentioned in the evaluation of [2010 Region 12 data](#), Goodyear took steps beginning in 2008 to address a potential source of the elevated styrene emissions detected at the Milby Park monitor. More specifically, Goodyear altered operational practices, amended their permit to include a 25% reduction in allowable styrene emissions, and signed a voluntary Emissions Reduction Agreement (ERA) with the TCEQ. As a result of these efforts, a decreasing trend in the monitored levels of styrene in Milby Park was evident beginning in mid-2008 (e.g., there was only 1 exceedance of the odor-based AMCV for styrene from July through December 2008 as compared to 19 exceedances over the same period in 2007). The improvements in recent years appear to be persisting as preliminary data indicate there were no exceedances of the styrene odor-based AMCV from January 1 through August 29, 2012.

24-Hour Concentrations

The highest 24-hour Summa canister isoprene concentrations in 2011 at the Shore Acres site (13.9 ppb_v) exceeded the odor-based AMCV for this chemical (5 ppb_v), which is reported to have a mild aromatic odor. The isoprene concentration monitored would not be expected to cause direct acute health effects. Additionally, although the perception of sufficiently strong and persistent unpleasant odors has the potential to cause odor-related health effects (e.g., nausea, headache), this concentration would not be expected to cause odor-related health effects due to the likely conservative nature of odor-based AMCV for isoprene and its characteristic mild odor.

Annual Average Concentrations

In 2011, all annual averages were below their respective long-term AMCVs for the second time in many years of sampling in Region 12:

- Based on the approximately 4,500 24-hour metals measurements, all monitored annual average concentrations of metals were below their respective long-term AMCVs or NAAQS (lead only);
- Based on the approximately 1,600 24-hour measurements, all annual average concentrations of carbonyls were also below their respective long-term AMCVs;
- Based on approximately 2,700 24-hour measurements, all annual average concentrations for PAHs/SVOCs were below long-term AMCVs; and
- Based on averages from approximately 78,700 24-hour canister measurements and approximately 3,673,000 hourly autoGC measurements (not counting measurements from three industry-sponsored autoGC sites (one EPA/DOJAM and two TIM)), all annual VOC concentrations were also less than their respective long-term AMCVs.

Thus, 100% of all annual averages were below their respective long-term, health-based AMCVs and no long-term, adverse health effects would be expected due to exposure to those concentrations. However, sites of ongoing agency and/or public interest for monitored annual benzene concentrations are discussed below.

Galena Park - Benzene

The monitored 2011 average benzene concentration based on every sixth-day 24-hour canister samples at the Galena Park site is 0.92 ppb_v, and is below the long-term, health-based AMCV (1.4 ppb_v) for the fourth time in several years (see Figure 3). The 2010, 2009, and 2008 annual averages of 1.1, 0.82, and 1.3 ppb_v, respectively, were also below the long-term AMCV.

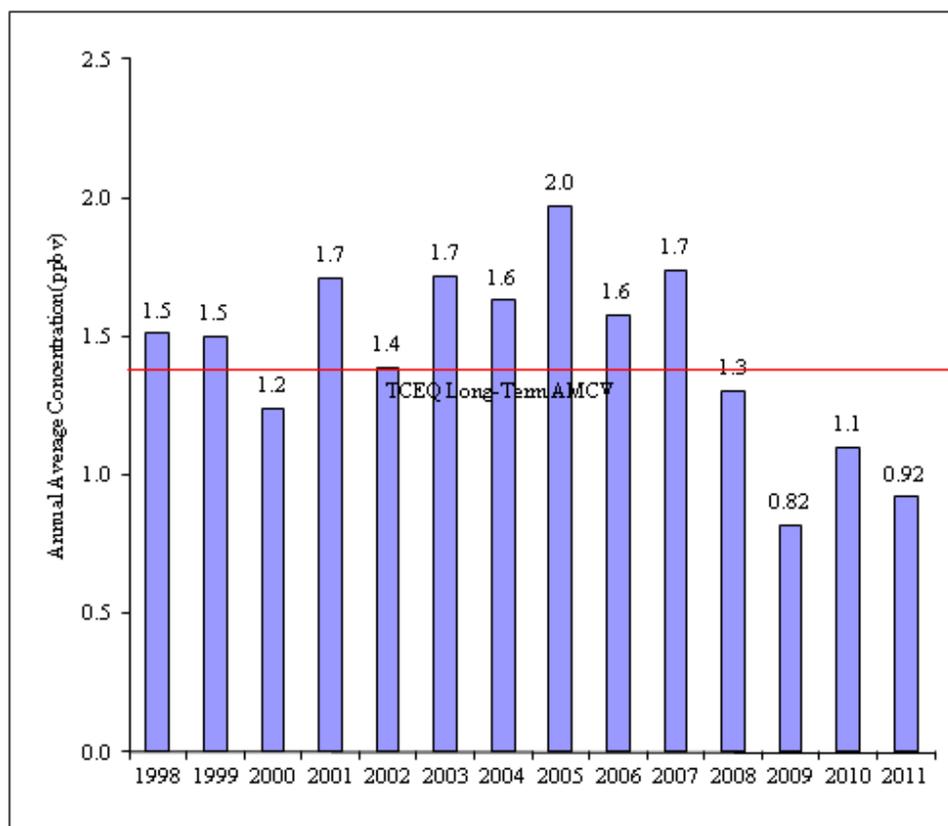


Figure 3. Annual Average Benzene Concentrations at the Galena Park Site

The 2008-2011 averages represent a significant improvement in air quality that is likely the result of significant efforts in the area by the TCEQ (e.g., focused agency resources, special investigations utilizing the latest technology, enhanced compliance and enforcement), along with the cooperation of industry (e.g., ERAs). For example, reductions in the annual benzene concentrations may partially reflect the results of ERAs previously entered into by the TCEQ with several facilities identified during an earlier Find-and-Fix investigation (Kinder Morgan Terminals, Vopak Terminals, TEPPCO Pipeline) to reduce VOCs, including benzene. The TCEQ has continued to work cooperatively with industry in the area (e.g., Kinder Morgan Galena Park Terminal) to help identify benzene sources of interest. TCEQ activities in 2011 in the Galena Park area included, but were not limited to, the following:

- Periodic focused investigations and GasFindIR reconnaissance investigations.
- Compliance investigations, emission event investigations, and review of performance testing (RPFT) investigations at Pasadena Refining Systems resulted in four Notices of Enforcement (NOEs) and two Notices of Violation (NOVs).
- Compliance investigations and emission event investigations at Houston Refining resulted in the issuance of three NOEs and two NOVs.
- A full site inspection was conducted at the Valero Refining - Houston Refinery from July 25 through August 2, 2011. A total of 12 violations were identified with all violations associated with an NOV. The violations cited included:
 - Failure to seal open ended lines;

- Failure to perform quarterly visual observations on two tail gas incinerators; and
- Failure to operate the Tail Gas Incinerator below the permitted SO₂ emissions limit of 250 ppm.

Although annual averages at the site have historically fluctuated above and below the long-term AMCV (see Figure 3), the 2008-2011 annual benzene averages suggest an overall downward trend. Additionally, the long-term (14-year) site average based on all available years of data combined (1.4 ppb_v based on 1998-2011 data) now equals the long-term (i.e., 70-year) AMCV (1.4 ppb_v). Furthermore, the preliminary January-July average for 2012 (\approx 0.80 ppb_v based on January-July data from the new autoGC or \approx 0.94 ppb_v based on January-March canister data combined with April-July data from the new autoGC data) being below or within the range for the same period in 2008-2011 (0.85-1.1 ppb_v) while being well below that over the same period in 2005-2007 (1.6-2.0 ppb_v) suggests maintained improvement. Although this area is currently on the APWL (Site# [APWL1206](#)), data from 2008 to date indicate sufficient achievements in reducing ambient air concentrations such that the reported levels are no longer of concern for potential long-term, adverse health effects. This determination should be considered in context with the [APWL protocol](#).

Lynchburg Ferry - Benzene

The autoGC VOC monitor at the Lynchburg Ferry site did not operate at the site for the full calendar year in 2011. More specifically, September 12 was the last full day of operation at the site on the north side of the ferry crossing as it had to be relocated to the south side of the crossing per the US Department of Homeland Security. Sampling resumed around December 13, 2011. Thus, the 5,716 hours of autoGC sampling available for 2011 (65% of the year) does not meet the 75% data completeness objective of the agency. However, the annual average benzene concentration based on the autoGC data would be 0.67 ppb_v. The co-located, every sixth-day 24-hour Summa canister data (45 samples) do meet the 75% data completeness objective and provide an annual average concentration of 0.91 ppb_v (although the 45 valid canister samples cover fewer hours of the year (1,080 hours or 12%) than the autoGC). Thus, for purposes of this discussion, the monitored 2011 annual average benzene concentration at the Lynchburg Ferry site will be based on the mean of the every sixth-day 24-hour canister samples, which is 0.91 ppb_v.

The annual average is below the long-term, health-based AMCV (1.4 ppb_v) for the fourth time since monitoring began at the Lynchburg Ferry site in 2003 (see Figure 4). The 2010, 2009, and 2008 annual averages of 0.83, 0.89, and 1.1 ppb_v, respectively, were also below the long-term AMCV. This represents a significant improvement in air quality and is likely the result of significant efforts in the area by the TCEQ (e.g., focused agency resources, special investigations utilizing the latest technology, enhanced compliance and enforcement, source directionality evaluations), industry (e.g., ERAs, Monument Area Air Quality Focus Group), and others (e.g., US Coast Guard). The overall downward trend in annual benzene concentrations at the Lynchburg Ferry site over the years is clearly evident (see Figure 4). Additionally, preliminary autoGC data for 2012 suggest that benzene concentrations in the Lynchburg Ferry area may remain similar to those in recent years.

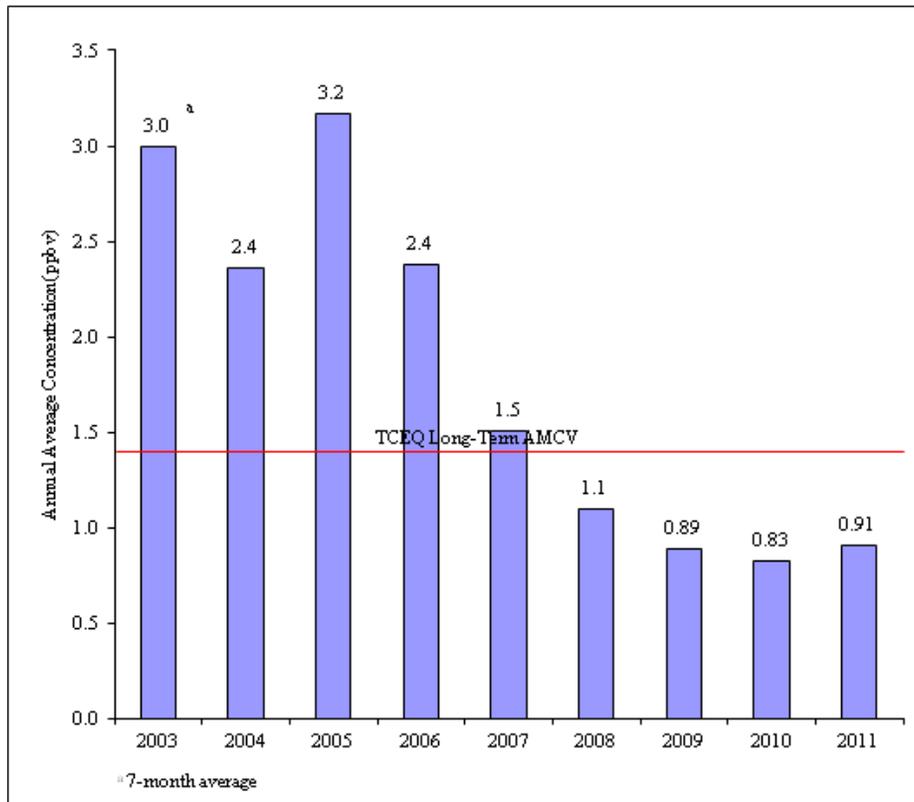


Figure 4. Annual Average Benzene Concentrations at the Lynchburg Ferry Site

Again, the significant decrease in annual averages over the past several years is likely attributable to TCEQ activities and other initiatives in the Lynchburg Ferry area. TCEQ Region 12 staff report that activities in 2011 in the Lynchburg Ferry area included, but were not limited to, the following:

- Special investigations when relatively high levels of benzene were detected by area monitors. In response to a benzene trigger level exceedance (1-hour level ≥ 75 ppbv) at the Lynchburg Ferry monitoring site, Region 12 staff reviewed air concentration and meteorological data to identify potential sources, which resulted in focused facility investigations at Channel Shipyard and Southwest Shipyard including the use of the GasFindIR camera.
- A Permit Compliance Certification (PCC) investigation on August 22, 2011, at Southwest Shipyard resulted in one NOE being issued with one violation.
- Combinations of reconnaissance investigations, compliance investigations, stack sampling reviews, and emission event investigations at Vopak Terminals and Intercontinental Terminals.
 - Two NOV's were issued to Vopak.
 - One NOV was issued to Intercontinental Terminals.
 - A PCC review conducted for Vopak Terminals resulted in the issuance of violations that included:
 - Failure to seal open ended lines; and

- Failure to simultaneously use an approved analyzer while repairing a component in VOC service.
- A full site inspection was conducted at Intercontinental Terminals on August 3, 2011, and resulted in the issuance of violations that included:
 - Failure to maintain records of the daily flare visible emission observation logs.
- Reconnaissance investigations with the GasFindIR camera were performed approximately every eight weeks in the south Houston Ship Channel area along Battleground Road/Independence Highway.

The TD will continue to monitor benzene concentrations in the Lynchburg Ferry area to determine whether annual benzene concentrations remain below the long-term AMCV such that the long-term site average based on all available years of data combined eventually equals or is less than the long-term AMCV (1.4 ppb_v). Although the long-term site average is currently 1.6 ppb_v based on eight complete years of data (2004-2011), it is important to note that the long-term AMCV for benzene is a lifetime (e.g., 70-year) average-concentration comparison value and in no way represents a distinct demarcation between where adverse long-term health effects would and would not be expected to occur, so comparison to an 8-year site average is conservative. Additionally, 120 ppb_v is the approximate continuous lifetime environmental exposure concentration corresponding to the lowest level of benzene exposure for which the EPA has indicated that they are fairly confident as being associated with increased cancer risk (40 ppm_v-years of occupational exposure). Thus, although somewhat above the long-term (i.e., lifetime) AMCV, exposure to the 8-year site average (1.6 ppb_v) for a lifetime would result in a cumulative exposure level that is 75 times less than that identified by the EPA as being associated with elevated benzene cancer (e.g., AML) risk. Similar statements would apply to the evaluation of the long-term site benzene average at the Marathon 11th St. (7-year mean of 1.7 ppb_v) site, which is discussed below.

Texas City Marathon-Sponsored 11th St. S. Site-Benzene

Marathon Petroleum Company (Marathon) initially collected benzene data at this off-site monitor just north of Marathon from October 2004 to October 2005 under a TCEQ agreed order (Agreed Order 2001-0575-AIR-E). Marathon then collected data at the site from January 30, 2006, to January 31, 2007, under a benzene emission investigation plan with the TCEQ and EPA. On April 1, 2007, Marathon again began collecting benzene data at the site per an agreement with the EPA and the US Department of Justice (DOJ). Then on November 5, 2007, the site was moved 1 block north to the corner of 11th St. S. and 6th Ave. S. The site was deactivated on December 31, 2010. A new agreement between Marathon and EPA was established for the 11th St. S. monitor with an effective date of July 1, 2011, although Marathon has provided data to TCEQ for the entire year of 2011.

In 2011, for the second time since monitoring began, the annual average benzene concentration measured at the Marathon-sponsored site (0.84 ppb_v) was below TCEQ's long-term AMCV (1.4 ppb_v) (see Figure 6). The 2010 and 2011 averages represent a 49-62% reduction compared to the 2005-2009 averages (1.8-2.2 ppb_v).

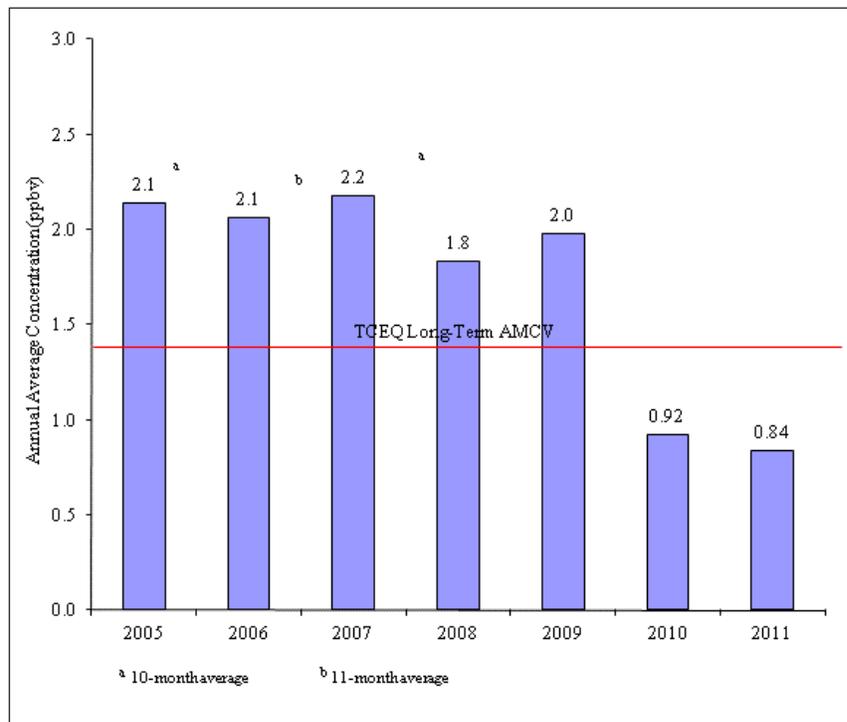


Figure 6. Annual Average Benzene Concentrations at the Marathon-Sponsored 11th St. S. Site

TCEQ activities in 2011 related to benzene in Texas City included, but were not limited to, the following:

- Focused investigations and reconnaissance investigations in the Texas City area to address on-going issues discovered through use of GasFindIR or through visual observations. Fence-line reconnaissance investigations during normal business hours and at night.
- At the BP Texas City Refinery:
 - There were six NOEs and ten NOV's issued.
 - A review of the PCC was conducted for BP Texas City refinery. A NOV was issued with five violations. The violations cited included:
 - Failure to document annual visible emissions checks;
 - Failure to monitor pumps; and
 - Failure to monitor relief valves and valves.
 - An enforcement follow-up investigation was conducted in July 2011 to determine whether the measures taken by the BP Texas City refinery provided the corrective action required by an Enforcement Order (Docket Number 2005-0224-AIR-E). This investigation was a follow-up to a number of investigations conducted from October 2003 through September 2005.
 - Additionally, two NOEs and five NOV's were issued to BP Chemical in 2011 as a result of compliance investigations and emission events.
- A review of the PCC conducted for Marathon, which resulted in the issuance of one NOE and one NOV. As a result, 23 violations were cited and included:

- Failure to maintain the Refinery Plant Flare HRVOC GC Analyzer;
- Failure to maintain with a cap or plug open end lines;
- Failure to maintain the Alkylation Flare HRVOC flow meter; and
- Failure to maintain minimum temperature and O₂ concentration limits on the SRU #1 and SRU #2.

The area of Texas City located south of State Highway 1765, which contains this Marathon-sponsored site, is currently on the APWL (Site# [APWL1202](#)) for elevated long-term concentrations of benzene. However, with the 2010 and 2011 benzene averages at the 11th St. S. site being well below the long-term AMCV, there have been significant improvements in reducing ambient air concentrations such that the levels reported for recent years are not of concern for potential long-term, adverse health effects. This determination should be considered in context with the [APWL protocol](#).

Texas City BP-Sponsored Site-Benzene

The BP-sponsored 31st St. site monitor (and a BP on-site monitor) was previously operated under a BP agreement with the TCEQ. However, in 2009, BP entered into a Temporary Injunction with the Attorney General's Office (No. D-1-GV-09-000921) which required BP to operate the two existing monitors and an additional monitor (the Logan St. monitor) which began operating in April 2010. The BP-sponsored 31st St. site monitor is discussed here because of continued interest due to historical long-term AMCV exceedances for benzene.

Annual average benzene concentrations at the BP-sponsored 31st St. site in Texas City have declined significantly from 2005 to 2011 (see Figure 7). The monitored 2011 average benzene concentration at the site (0.28 ppb_v) is well below the long-term AMCV (1.4 ppb_v), and is part of the overall trend in declining annual benzene levels at the site. Additionally, the long-term site average (8-year mean of 1.3 ppb_v based on 2004-2011 complete years of data) is below the long-term (i.e., 70-year) AMCV.

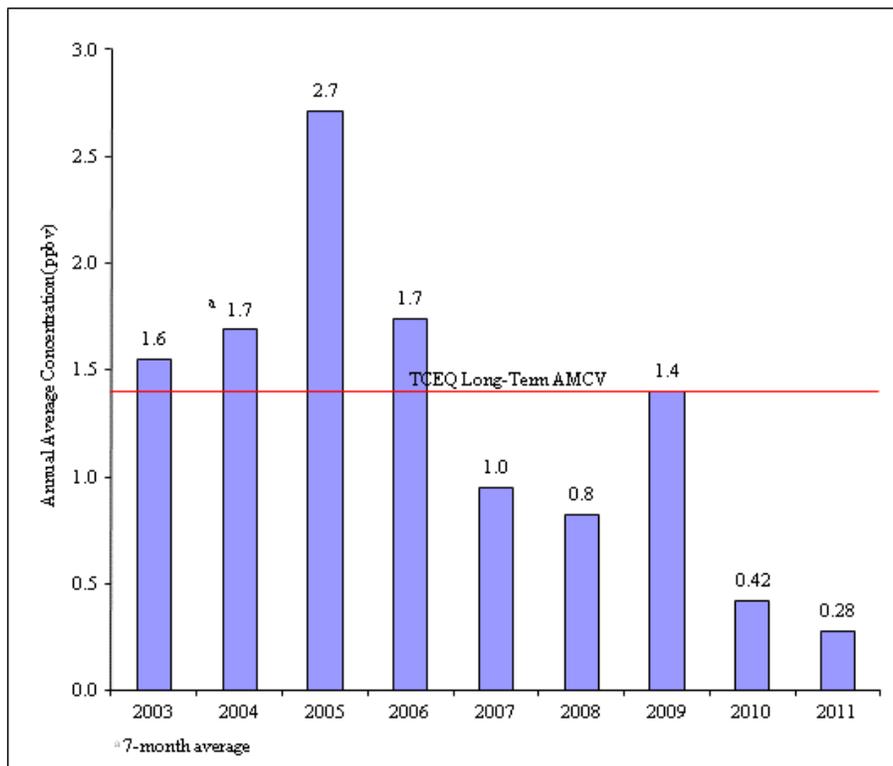


Figure 7. Annual Average Benzene Concentrations at the BP-Sponsored Site

The area of Texas City which contains the BP-sponsored 31st St. site is currently on the same APWL as the Marathon-sponsored site (Site# [APWL1202](#)) for elevated long-term concentrations of benzene monitored in previous years. However, the annual benzene average has been at or below the AMCV at the BP-sponsored 31st St. site for five consecutive years. Thus, data from 2007 to date indicate more than sufficient achievements in reducing ambient air concentrations at this site such that the reported levels are no longer of concern for potential long-term, adverse health effects. This determination should be considered in context with the [APWL protocol](#).

If you have any questions regarding this memorandum, please contact me by phone at (512) 239-5691 or by email at Joseph.Haney@tceq.texas.gov. For questions regarding the APWL, you may visit the TCEQ website at http://www.tceq.state.tx.us/implementation/tox/AirPollutantMain/APWL_index.html.

Appendix 1. Monitored Air Toxics in Region 12 in 2011

List 1. Target VOC Analytes in Canister Samples

1,1,2,2-Tetrachloroethane	Bromomethane	Methylcyclohexane
1,1,2-Trichloroethane	c-1,3-Dichloropropylene	Methylcyclopentane
1,1-Dichloroethane	c-2-Butene	m-Ethyltoluene
1,1-Dichloroethylene	c-2-Hexene	n-Butane
1,2,3-Trimethylbenzene	c-2-Pentene	n-Decane
1,2,4-Trimethylbenzene	Carbon Tetrachloride	n-Heptane
1,2-Dichloropropane	Chlorobenzene	n-Hexane
1,3,5-Trimethylbenzene	Chloroform	n-Nonane
1,3-Butadiene	Chloromethane (Methyl Chloride)	n-Octane
1-Butene	Cyclohexane	n-Pentane
1-Hexene + 2-Methyl-1-Pentene	Cyclopentane	n-Propylbenzene
1-Pentene	Cyclopentene	n-Undecane
2,2,4-Trimethylpentane	Dichlorodifluoromethane	o-Ethyltoluene
2,2-Dimethylbutane (Neohexane)	Dichloromethane (Methylene Chloride)	o-Xylene
2,3,4-Trimethylpentane	Ethane	p-Diethylbenzene
2,3-Dimethylbutane	Ethyl Benzene	p-Ethyltoluene
2,3-Dimethylpentane	Ethylene	Propane
2,4-Dimethylpentane	Ethylene Dibromide (1,2-Dibromoethane)	Propylene
2-Chloropentane	Ethylene Dichloride (1,2-Dichloroethane)	Styrene
2-Methyl-2-Butene	Isobutane	t-1,3-Dichloropropylene
2-Methylheptane	Isopentane (2-Methylbutane)	t-2-Butene
2-Methylhexane	Isoprene	t-2-Hexene
2-Methylpentane (Isohexane)	Isopropylbenzene (Cumene)	t-2-Pentene
3-Methyl-1-Butene	m & p-Xylene	Tetrachloroethylene
3-Methylheptane	m-Diethylbenzene	Toluene
3-Methylhexane	Methyl Chloroform (1,1,1-Trichloroethane)	Trichloroethylene
3-Methylpentane		Trichlorofluoromethane
4-Methyl-1-Pentene		Vinyl Chloride
Acetylene		
Benzene		

List 2. Target Carbonyl Analytes

2,5-Dimethylbenzaldehyde	Formaldehyde	o-Tolualdehyde
Acetaldehyde	Heptaldehyde	Propanal - Propionaldehyde
Acetone	Hexanaldehyde	p-Tolualdehyde
Acrolein - Unverified	Isovaleraldehyde	Valeraldehyde
Benzaldehyde	Methyl Ethyl Ketone	
Butyraldehyde	(MEK)/Methacrolein	
t-Crotonaldehyde	m-Tolualdehyde	

List 3. Target Metal Analytes

Aluminum (PM _{2.5} , PM ₁₀)	Chromium VI (TSP*)	Nickel (PM _{2.5} , PM ₁₀)
Antimony (PM _{2.5} , PM ₁₀)	Cobalt (PM _{2.5} , PM ₁₀)	Selenium (PM _{2.5} , PM ₁₀)
Arsenic (PM _{2.5} , PM ₁₀)	Copper (PM _{2.5} , PM ₁₀)	Tin (PM _{2.5} , PM ₁₀)
Barium (PM _{2.5} , PM ₁₀)	Lead (PM _{2.5} , PM ₁₀ , TSP**)	Zinc (PM _{2.5} , PM ₁₀)
Cadmium (PM _{2.5} , PM ₁₀)	Manganese (PM _{2.5} , PM ₁₀)	
Chromium (PM _{2.5} , PM ₁₀)	Molybdenum (PM _{2.5} , PM ₁₀)	

*Only monitored at the Deer Park monitoring site; TSP = total suspended particulate.

** Only monitored at the Deer Park and Houston East monitoring sites.

List 4. Target PAH Analytes

Acenaphthene	Benzo(g,h,i)perylene	Indeno(1,2,3-cd)pyrene
Acenaphthylene	Benzo(k)fluoranthene	Naphthalene
Anthracene	Chrysene	Phenanthrene
Benzo(a)anthracene	Dibenzo(a,h)anthracene	Pyrene
Benzo(a)pyrene	Fluoranthene	
Benzo(b)fluoranthene	Fluorene	

List 5. Target VOC Analytes in AutoG

1-Butene	Benzene	n-Heptane
1-Pentene	c-2-Butene	n-Hexane
1,2,3-Trimethylbenzene	c-2-Pentene	n-Nonane
1,2,4-Trimethylbenzene	Cyclohexane	n-Octane
1,3-Butadiene	Cyclopentane	n-Pentane
1,3,5-Trimethylbenzene	Ethane	n-Propylbenzene
2-Methyl-2-Butene*	Ethyl Benzene	n-Undecane*
2-Methylheptane	Ethylene	o-Xylene
2-Methylhexane	Isobutane	p-Xylene + m-Xylene
2,2-Dimethylbutane	Isopentane	Propane
2,2,4-Trimethylpentane	Isoprene	Propylene
2,3-Dimethylpentane	Isopropyl Benzene -	Styrene
2,3,4-Trimethylpentane	Cumene	t-2-Butene
2,4-Dimethylpentane	Methylcyclohexane	t-2-Pentene
3-Methylheptane	Methylcyclopentane	Toluene
3-Methylhexane	n-Butane	
Acetylene	n-Decane	

*Only monitored at the Danciger, Lake Jackson, Texas City 34th St., Wallisville Rd., Haden Rd., and Lynchburg Ferry monitoring sites.

Ashley Wadick, Regional Director, Region 12, et al.

October 15, 2012

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