Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

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Date: October 5th, 2007

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Subject: Health Effects Review of Ambient Air Monitoring Data Collected in TCEQ Region 12 during 2006

Conclusions

- The reported 2006 annual average benzene concentrations in the Air Pollutant Watch List Areas that contain the Lynchburg Ferry, Galena Park and BP Texas City-sponsored sites indicate a continued decline in benzene levels in these areas. Despite the reductions reported in 2006 and continued improvement in 2007, these sites are still in areas of concern regarding potential long-term, adverse health effects and emission reductions are recommended.
- Increasing levels of benzene concentrations in 2005 were investigated in the Shoreacres vicinity. Declining benzene levels in 2006 and to date in 2007 appear to be a result of enforcement activities conducted in the area.
- The annual average benzene concentration at the Texas City-34th St. site decreased to a level that prompted the removal of Air Pollutant Watch List (APWL) Site # 1203 in Texas City from the APWL.
- The reported 2006 annual average 1,3-butadiene concentration at Milby Park (1.30 ppb_v) indicates a continued downward trend. While the 1,3-butadiene levels have significantly decreased, further reductions are encouraged in order to attain the interim long-term goal of 1 ppb_v.
- Hourly levels of several VOCs (most notably, styrene at both the Lynchburg Ferry and Milby Park sites) would be odorous to people if exposed. Direct health effects such as eye irritation would not have been expected; however, odor-related health effects such as headaches and nausea may have occurred.

Background

This memorandum's primary purpose is to convey the Toxicology Section's (TS) evaluation of ambient air toxics sampling conducted at monitoring network sites in Region 12–Houston during 2006, as well as highlight investigations and emission reductions made in the areas discussed in this evaluation. Please note, however, that many investigations are still ongoing and not appropriate for discussion in this memorandum. We reviewed summary results for volatile organic compounds (VOCs) from 1- and 24-hour canister samples, 1-hour automated gas-chromatography (autoGC) VOC samples, 1- and 24-hour carbonyl 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 an

aerodynamic diameter of 10 microns (PM_{10}) or less. Criteria pollutant data were not evaluated in this memorandum. Appendix 1 is a list of the target analytes that were evaluated for this review. Information regarding monitoring sites and target analytes is presented in Table 1 and summarized below:

- 1-hour canister VOC sampling at 3 sites
- 24-hour canister VOC sampling at 17 sites
- 1- and 24-hour carbonyl sampling at 3 sites
- 24-hour metals sampling at 7 sites
- 1-hour autoGC VOC monitoring at
  - 5 TCEQ sites, and
  - 7 Enhanced Industry-Sponsored Monitoring (EISM) sites
  - 1 TCEQ-Industry Agreed Order Monitoring site (AOM)

Table 1. Air toxics sampling site information in TCEQ Region 12 for year 2006.

County	EPA Site ID	City and Site Location	Network	Monitored Compounds
Brazoria	48-039-1003	Clute 426 Commerce Street	TCEQ	VOC (24-hour canister)
Brazoria	48-039-0618	Danciger Along U.S. Hwy. 1459 in Brazoria County	EISM	VOC (autoGC)
Brazoria	48-039-1016	Lake Jackson 109-B Brazoria Hwy 332-W	EISM	VOC (autoGC)
Brazoria	48-039-0619	Mustang Bayou Liverpool	EISM	VOC (autoGC)
Galveston	48-167-0014	Galveston, Airport 8715 Cessna Street	TCEQ	VOC (1- & 24-hour canister)
Galveston	48-167-0053	Texas City, Nessler Pool 17th and 5th Ave	TCEQ	VOC (24-hour canister)
Galveston	48-167-0005	Texas City, Ball Park 2516 1/2 Texas Ave.	TCEQ	VOC (24-hour canister)
Galveston	48-167-0056	Texas City, 34th St. 2212 North 34th St.	EISM	VOC (autoGC)
Harris	48-201-0036	Jacinto Port Corner of 1st and Elsbeth Streets	TCEQ	VOC (24-hour canister)
Harris	48-201-1039	Deer Park 4514 1/2 Durant St.	TCEQ	VOC (24-hour canister), Carbonyls, Metals
				VOC (autoGC)
Harris	48-201-0024	Houston, Aldine 4510 1/2 Aldine Mail Rd	TCEQ	VOC (1- & 24-hour canister), Metals
Harris	48-201-1034	Houston, East 1262 1/2 Mae Drive	TCEQ	Metals
Harris	48-201-1035	Houston, Clinton 9525 1/2 Clinton Drive	TCEQ	VOC (24-hour canister), Carbonyls, Metals
				VOC (autoGC)
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 (24-hour canister), Carbonyls, Metals
				VOC (autoGC)
Harris	48-201-0061	La Porte, Shoreacres 3903 1/2 Old Hwy 146	TCEQ	VOC (24-hour canister)
Harris	48-201-0069	Houston, Milby Park 2201-a Central Street	TCEQ	VOC (autoGC)
Harris	48-201-6000	Houston, Cesar Chavez 4829A Galveston Rd.	TCEQ	VOC (autoGC)
Harris	48-201-1015	Baytown, Lynchburg Ferry 1001 B Lynchburg Rd.	EISM	VOC (24-hour canister)
				VOC (autoGC)
Harris	48-201-0617	Baytown, Wallisville Rd. 4727 Wallisville Rd.	EISM	VOC (autoGC)

Harris	48-201-0307	Houston, Manchester/Central 9401 1/2 Manchester Rd.	TCEQ	VOC (24-hour canister)
Harris	48-201-0029	Tomball, NW Harris County 16822 Kitzman St.	TCEQ	VOC (1- & 24-hour canister)
Harris	48-201-0030	Houston, Channelview North US90/Sheldon Rd.	TCEQ	VOC (24-hour canister)
Harris	48-201-0055	Houston, Bayland Park 6400 Bissonnet St.	TCEQ	VOC (24-hour canister), Metals
Harris	48-201-0058	Baytown 7201 ½ Bayway Dr.	TCEQ	VOC (24-hour canister)
Harris	48-201-0806	Haden Rd. (HRM-3) 1504 ½ Haden Dr.	EISM	VOC (24-hour canister) VOC (autoGC)
Galveston	N/A	BP North America Products, Inc.-Texas City 31st St. (Between Texas Ave. and 5th Ave.)	AOM	VOC (autoGC)
Montgomery	48-339-0078	Conroe 9472A Highway 1484	TCEQ	Metals

All data collected at the TCEQ and EISM monitors must meet the 75% data completeness objective, and are analyzed by the TCEQ laboratory. The data collected at the AOM monitor must meet a 70% data completeness objective and are analyzed by a third party contractor. One-hour canister VOC, autoGC VOC, and carbonyl data were evaluated for potential acute health and odor concerns. The annual averages from one-hour autoGC and 24-hour samples (VOCs, carbonyls, and metals) were evaluated for potential chronic health concerns. Measured chemical concentrations were compared to the appropriate TCEQ health-based and odor-based Effects Screening Levels (ESLs). Information on the ESLs can be obtained by contacting the TCEQ Toxicology Section (512-239-1795) or visiting the TCEQ website: (www.tceq.state.tx.us/implementation/tox/esl/ESLMain.html).

Evaluation

One-hour Concentrations

A significant majority of the one-hour canister VOC, autoGC VOC, and carbonyl concentrations were below their respective short-term health- and/or odor-based ESLs. Therefore, neither short-term adverse health effects nor odors would have been expected due to exposure to those reported concentrations. For the reported one-hour concentrations that exceeded their respective short-term health- and/or odor-based ESLs, further evaluation was conducted to determine the potential for health effects or odors and the results are discussed below.

The few reported one-hour concentrations of chemicals that exceeded their respective short-term, health-based ESLs are benzene, formaldehyde, 1,3-butadiene, and styrene. Further examination determined that acute health effects (e.g. eye irritation, throat irritation, etc.) would not have been expected as a result of exposure to those reported one-hour concentrations. The magnitude and frequency of hourly benzene concentrations reported at the Texas City autoGC on 34th St. (Texas City-34th St.), Lynchburg Ferry site, and the autoGC sponsored by BP Products North America, Inc. in Texas City.(BP Texas City-sponsored), as well as the hourly 1,3-butadiene concentrations at the Milby Park site were of note and will be discussed individually.

At the Texas City-34th St. site, there were 4 hourly benzene concentrations above the short-term ESL of 25 ppb_v, with a maximum concentration of 58 ppb_v. This represents a continued reduction in short-term benzene concentrations reported in this area when compared to the 18 hourly ESL exceedances reported in 2005 and the 113 hourly ESL exceedances reported in 2004. The continued downward trend in short-term benzene concentrations contributed to a downward trend in long-term (or annual) concentrations, which is addressed in the *Annual Average Concentration* section of this evaluation.

There were 85 hourly benzene concentrations above the short-term ESL of 25 ppb_v, with a maximum concentration of 418.98 ppb_v at the Lynchburg Ferry site. There were 32 hourly benzene concentrations above the short-term ESL measured at the BP-sponsored site with a maximum concentration of 70.72 ppb_v. The maximum reported concentrations at both sites were significantly below levels attributable to short-term, adverse health effects; therefore no such effects would have been expected as a result of exposure to those concentrations. In addition, a significant reduction in frequency of short-term benzene exceedances was observed at both sites when compared to the previous years. The reduction in both frequency of ESL exceedances and magnitude of the reported benzene concentrations contributed to a reduction in the long-term (or annual) benzene concentrations in both areas. The long-term (or annual) concentrations are addressed under the *Annual Average Concentration* section of this evaluation.

At the Milby Park site, there were 8 one-hour 1,3-butadiene concentrations above the short-term ESL of 50 ppb_v, with a maximum reported concentration of 1,611.25 ppb_v compared to 3 ESL exceedances in 2005 with a maximum concentration of 82.25 ppb_v. Elevated 1,3-butadiene concentrations were reported when winds were out of the southeast (see Appendix 2). Short-term adverse health effects due to exposure to the maximum reported concentration would not have been probable. The maximum concentration reported in 2006 was one of several elevated concentrations that were associated with an emissions event that occurred at Texas Petrochemical Company (TPC) on September 14th and 15th, 2006. The frequency and magnitude of the reported elevated 1,3-butadiene concentrations contributed to the long-term (or annual) concentration. The long-term (or annual) concentration is addressed under the *Annual Average Concentration* section of this evaluation.

The reported one-hour autoGC VOC concentrations that exceeded their respective odor-based ESLs are shown below in Table 2. The low frequency and magnitude of the odor-based ESL exceedances listed in Table 2 would not have been expected to have caused odor-related adverse health effects with the exception of the reported styrene concentrations at the Lynchburg Ferry and Milby Park sites. These reported concentrations warranted further evaluation and discussion.

At the Lynchburg Ferry site, there were 52 hourly styrene concentrations reported above the odor-based ESL of 25 ppb_v, with a maximum concentration of 358.35 ppb_v. This represents an approximate 44% reduction in the number of odorous styrene concentrations when compared to the 92 such concentrations reported in 2005. There were 16 odorous styrene concentrations reported at the Milby Park site in 2006, which is four times greater than the number of such concentrations reported in 2005. Although the styrene concentrations reported at both sites would not have been expected to cause direct acute health effects such as eye and skin irritation, exposure to strong unpleasant odors can cause odor-related health effects such as headache and nausea. Potential sources near the Lynchburg Ferry and Milby Park sites were determined by the TS through the use of wind directional data compiled from hourly autoGC data collected at each site. Higher styrene concentrations were reported at the Lynchburg Ferry site when the winds were from the north and northwest (Appendix 3) and at the Milby Park site when winds were from the east and southeast (Appendix 4). Although the frequency of odorous styrene concentrations reported at the Lynchburg Ferry site decreased from 2005 to 2006, this area will remain on the Air Pollutant Watch List (APWL), APWL Site # APWL1204, because of the odorous conditions that continue to be monitored.

Table 2. Exceedances of Odor-Based ESLs by 2006 AutoGC-Monitored Hourly VOC Concentrations				
Site	**Chemical**	**Number of hourly concentrations above the odor-based ESL**	**Maximum measured concentration (ppb_v)**	**Odor-based ESL (ppb_v)**
Cesar Chavez	Isoprene	1	6.74	5
Channelview	Isoprene	5	7.72	5
Danciger	Isoprene	10	9.08	5
Deer Park	Isoprene	2	20.99	5
Haden Rd	Isoprene	2	7.70	5
	1-Butene	3	116.54	69
Lynchburg Ferry	Styrene	52	358.35	25
	Isoprene	11	20.32	5
	t-2-Pentene	1	42.41	30
Milby Park	Styrene	16	53.76	25
	Isoprene	1	7.13	5
	Isobutane	1	3,306.50	2,000
Wallisville Rd.	Isoprene	2	6.99	5

Annual Average Concentrations

All reported annual average concentrations of metals and a significant majority of the annual average concentrations of VOCs and carbonyls were below their respective long-term, health-based ESLs. Therefore, no long-term adverse health effects would be expected from those concentrations. Further examination was conducted for those chemicals with annual average concentrations above their respective long-term (or annual) ESL in order to evaluate the potential for long-term, adverse health effects. In addition, areas exhibiting reductions in reported annual benzene concentrations were also evaluated. The results are discussed below.

Texas City

The 2006 reported annual average benzene concentrations at the following sites were below the long-term, health-based ESL of 1 ppb_v: Texas City Ball Park (0.82 ppb_v), Nessler Pool (0.62 ppb_v), and Texas City-34th St. (0.41 ppb_v). The 2006 reported annual average concentration of 0.41 ppb_v reported at the Texas City-34th St. site indicates a significant reduction in long-term (or annual) benzene concentrations as it is approximately 47% less than the 2005 annual average of 0.78 ppb_v and approximately 75% less than the 2004 annual average of 1.63 ppb_v (see Figure 1). Therefore, the APWL area located north of Farm to Market Road 1764 (APWL Site# APWL1203), which contains the Texas City-34th St. site, was removed from the APWL on July 18th, 2007.

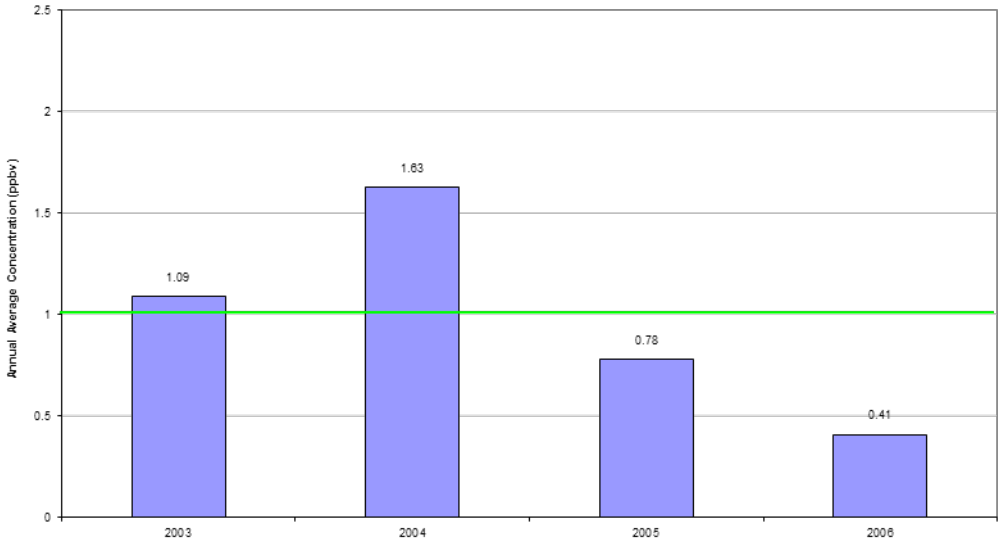


Figure 1. Trend Analysis of Benzene Concentrations at the Texas City-34th St. Site

The 2006 reported annual average benzene concentration reported at the BP Texas City-sponsored site (1.74 ppb_v) is approximately 36% less than the 2005 average (2.70 ppb_v). While the benzene concentrations near BP Texas City have shown a significant decrease (see Figure 2), the current annual average concentration is still above the long-term, health-based ESL of 1 ppb_v. The area of Texas City located south of State Highway 1765, which contains the BP Texas City-sponsored site, is currently on the TCEQ APWL for the elevated long-term concentrations of benzene reported in previous years. Despite the continued downward trend of benzene concentrations in this area, further benzene reductions are recommended; therefore this area (APWL Site # APWL1202) will remain on the APWL until the TS has determined the benzene concentrations at this site are no longer of concern.

Figure 2. Trend Analysis of Benzene Concentrations at the BP Texas City-Sponsored Site

Lynchburg Ferry

At the Lynchburg Ferry site, the 2006 reported annual average benzene concentration based on every sixth-day 24-hour canister samples was 3.93 ppb_v, while the annual average concentration based on hourly samples collected at the co-located autoGC was 2.38 ppb_v. Both are above the long-term, health-based ESL of 1 ppb_v. However, the annual average based on the hourly autoGC samples is more accurate for representing long-term exposure; therefore, this average was used in our assessment. The 2006 annual average of 2.38 ppb_v represents an approximate reduction of 25% when compared to the 2005 annual average (see Figure 3). Potential benzene sources near the Lynchburg Ferry site were identified by using wind directional data, and the results indicated that higher benzene concentrations were associated with winds blowing from the northeast and the southwest (see Appendix 5). In 2006, several facilities (Oiltanking, Vopak Terminals, and Intercontinental Terminals) in the Lynchburg Ferry area entered into Emission Reduction Agreements in order to reduce VOC emissions, including benzene. The reduction in benzene concentrations between 2005 and 2006 at the Lynchburg Ferry site possibly reflects the results of these agreements.

Preliminary data for 2007 indicates that benzene concentrations in the Lynchburg Ferry area are continuing to decline. Such reductions may be attributable to additional enforcement activities and initiatives in the Lynchburg Ferry area. Several industrial facilities in the Lynchburg Ferry area formed the Monument Area Air Quality Focus Group (MAAQFC) in a collaborative attempt to reduce benzene emissions in this area. The MAAQFC is composed of: Rohm and Haas Texas Inc., Shell Chemicals Inc., Texas Molecular, Intercontinental Terminals, Channel Shipyard, Kirby Inland Marine, and Vopak Terminals-Deer Park. An automatic notification system now alerts agency and MAAQFC members to conduct investigative actions when hourly benzene concentrations reported at the Lynchburg Ferry monitor exceed a particular hourly concentration. Investigations in the area have led to enforcement actions, as well as agreements, to implement additional emission controls at local facilities. TCEQ is also working in a collaborative effort with both the MAAQFC and the U.S. Coast Guard to identify and mitigate potential sources of benzene emissions from barges in transit, as well as barge lightering activities in the ship channel. Although averages to date at the Lynchburg Ferry monitor indicate that the 2007 benzene levels approximately 45% lower than the same time period in 2005, the reported levels are still of concern for potential long-term, adverse health effects. Therefore, this area (APWL Site # APWL1204) will remain on the APWL, and further benzene emission reductions are recommended.

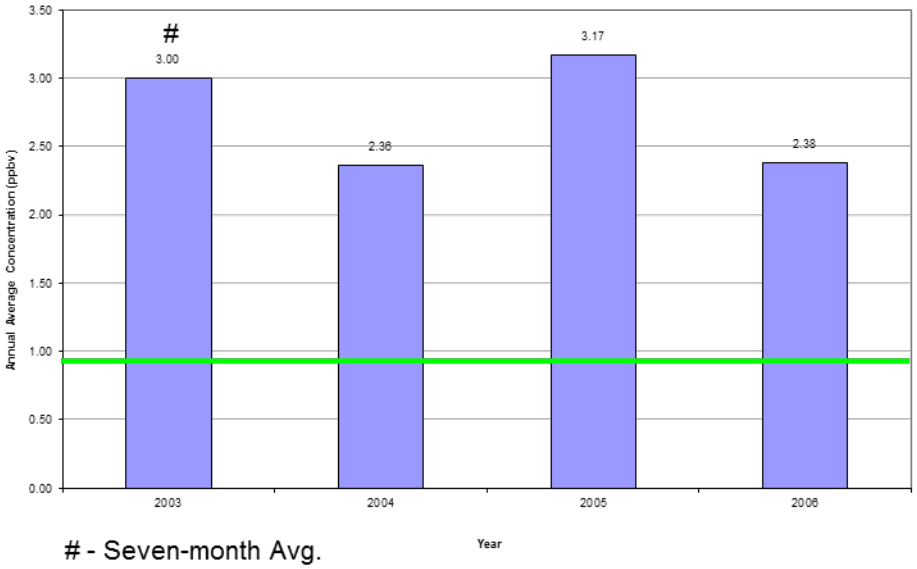


Figure 3. Trend Analysis of Benzene Concentrations at the Lynchburg Ferry Site

On July 19th, 2006, an every-sixth-day 24-hour canister sampler was established at the corner of 1st and Elsbeth Streets in the Jacintoport neighborhood situated northwest of the Lynchburg Ferry site. The purpose of the Jacintoport site (EPA Site ID # 48-201-0036) is to assess long-term benzene concentrations in this area. Technical problems with the sampler occurred after the initial day of data collection on July 22nd, 2006. Collection of valid data resumed on August 21st, 2006. The amount of data collected for 2006 is equal to that of approximately three and one-half months of data. Due to the limited amount of data, an annual average benzene concentration at the Jacintoport site was not available for evaluation in this assessment. However, subsequent to measurements of elevated benzene concentrations during June 2005 and April 2006 mobile monitoring trips in the Jacintoport area, the TCEQ issued a NOE against K-Solve LP (K-Solv), who later entered into a voluntary emission reduction agreement with TCEQ. In 2006, K-Solv implemented the installation of the agreed additional emission controls in accordance with their voluntary reduction agreement.

Galena Park

The 2006 reported annual average benzene concentration based on every sixth-day 24-hour canister samples at the Galena Park site was 1.58 ppb_v, which is less than the 2005 annual average of 1.97 ppb_v and the 2004 annual average of 1.63 ppb_v. A trend analysis indicated that the 2006 annual average benzene concentration is the lowest reported average since 2002 (see Figure 4). In 2006, TCEQ negotiated emission reduction agreements with Kinder Morgan Liquids Terminals, Vopak Terminals and TEPPCO Pipeline Company to reduce volatile organic compounds, including benzene. These facilities were identified during the Find and Fix investigation conducted during 2005. In addition, a NOE was issued against Texmark Chemicals in 2007. Reconnaissance investigations conducted by regional investigators are ongoing in an effort to further reduce benzene emissions in this area. Despite the 20 % reduction in benzene concentrations observed at the Galena Park site in 2006 when compared to 2005, the reported levels are still of concern for potential long-term, adverse health effects. Therefore, this area will remain on the APWL (APWL Site # APWL1206) and further benzene emission reductions are recommended.

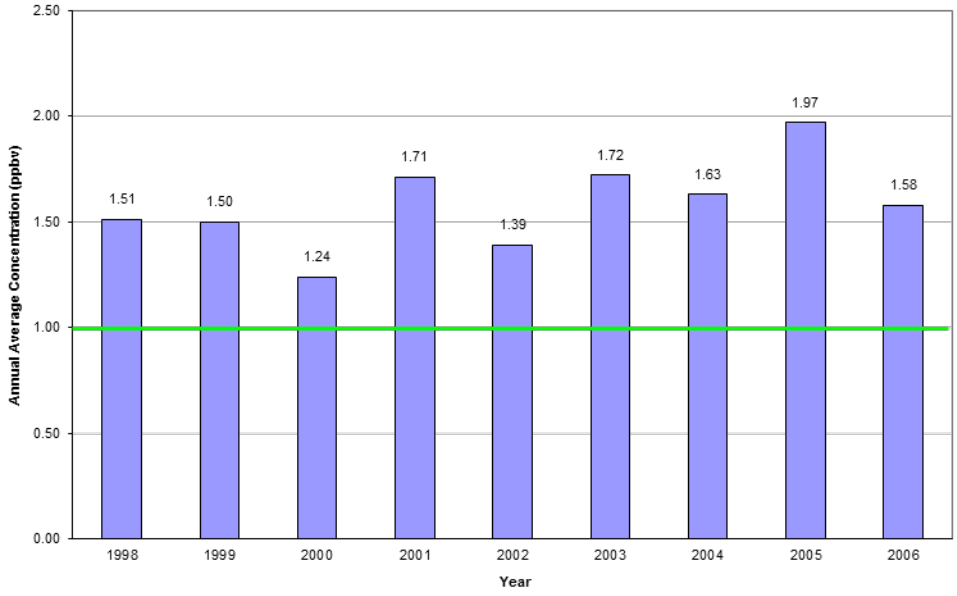


Figure 4. Trend Analysis of Benzene Concentrations at the Galena Park Site

Shoreacres

Increasing levels of benzene concentrations in 2005 were investigated in the Shoreacres vicinity. The 2006 reported annual average benzene concentration based on every sixth-day 24-hour samples at the Shoreacres site was 0.89 ppb_v. This concentration is below the long-term, health-based ESL of 1 ppb_v and represents an approximate 25% reduction when compared to the 2005 annual average concentration of 1.18 ppb_v and appears to be due to agency actions taken in the area. As shown in Figure 5, the benzene levels have historically fluctuated. During mobile monitoring investigations conducted on April 20th-28th, 2006 elevated benzene concentrations were reported downwind of Davis Petroleum, Total Petrochemical Company and Gulf Coast Waste Disposal Authority (GCWDA). Enforcement actions, including implementation of additional control measures, were taken against Davis Petroleum and GCWDA. Preliminary 2007 benzene concentrations reported near the Shoreacres site indicate a continued downward trend.

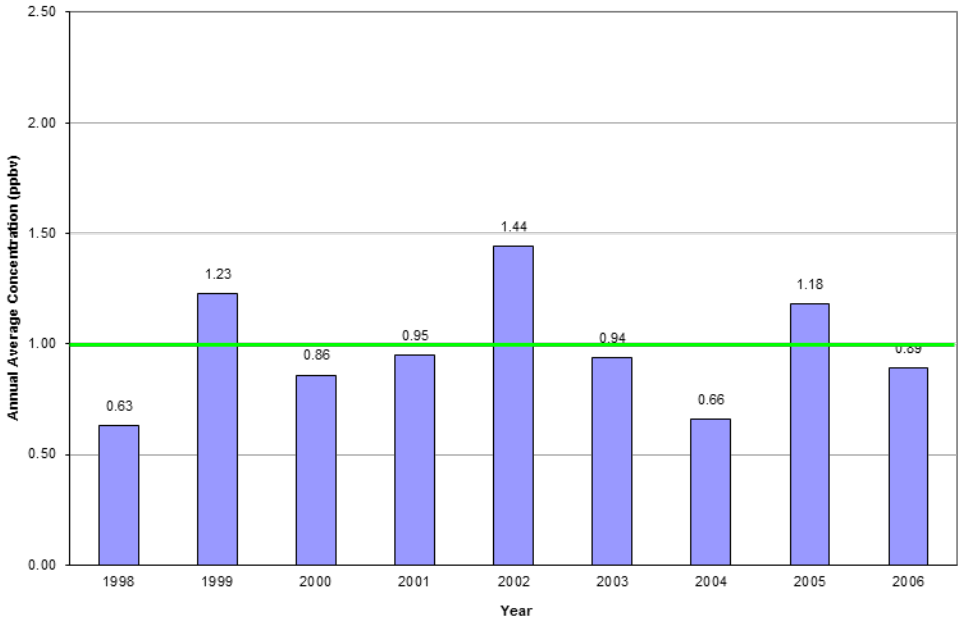


Figure 5. Trend Analysis of Benzene Concentrations at the Shoreacres Site

Milby Park

The 2006 reported annual average 1,3-butadiene concentration of 1.30 ppb_v at the Milby Park site is 14% less than the 2005 annual average concentration of 1.52 ppb_v and is the lowest annual average measured at this site since monitoring began (see Figure 6). The continued reduction in the annual average concentration can be attributed to continued corrective activities associated with the voluntary emission reduction agreements entered into by TPC and Goodyear in 2004. The 2006 reported annual average concentration was significantly influenced by elevated 1,3-butadiene concentrations associated with an emissions event that occurred at TPC on September 14th and 15th, 2006. While the preliminary 2007 1,3-butadiene concentrations indicate a continued downward trend at the Milby Park site, the annual average concentration is still above the interim long-term goal of 1 ppb_v, and further reductions in 1,3-butadiene concentrations are encouraged in this area. This area (APWL Site# APWL 1207) will remain on the APWL and a re-evaluation of this area is likely after the TS has completed the development of the new long-term ESL for 1,3-butadiene utilizing the new ESL derivation process.

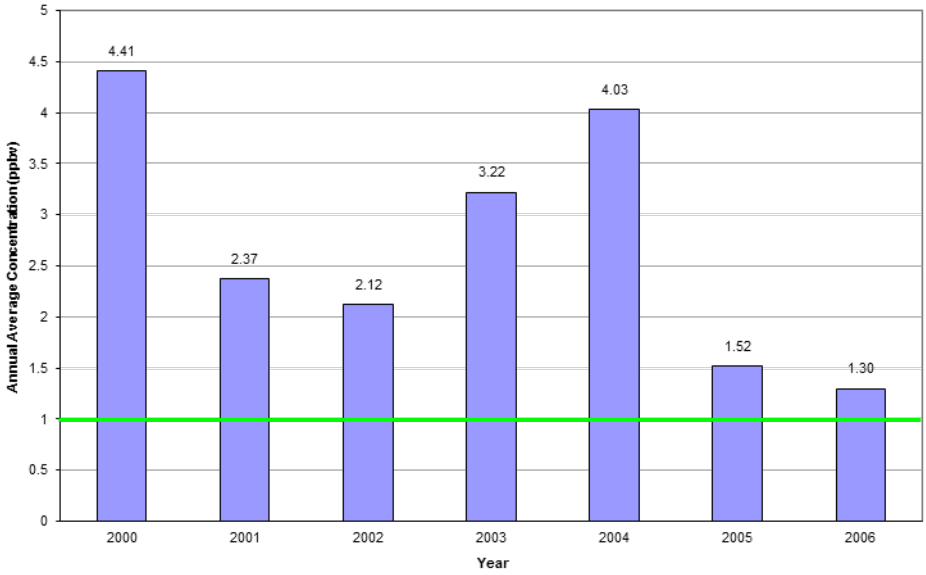


Figure 6. Trend Analysis of 1,3 Butadiene Concentrations at the Milby Park Site

Clinton Dr./Deer Park/Channelview

The 2006 reported annual average formaldehyde concentrations based on 24-hour samples near the Clinton Dr. (2.95 ppb_v), Deer Park (2.39 ppb_v) and Channelview sites (2.11 ppb_v) were above the current long-term, health-based ESL of 1.2 ppb_v. However, the United States Environmental Protection Agency has recently revised their toxicity assessment of formaldehyde. Therefore, based on this new information, the reported annual average concentrations at all three sites are not of concern regarding their potential to cause long-term, adverse health effects.

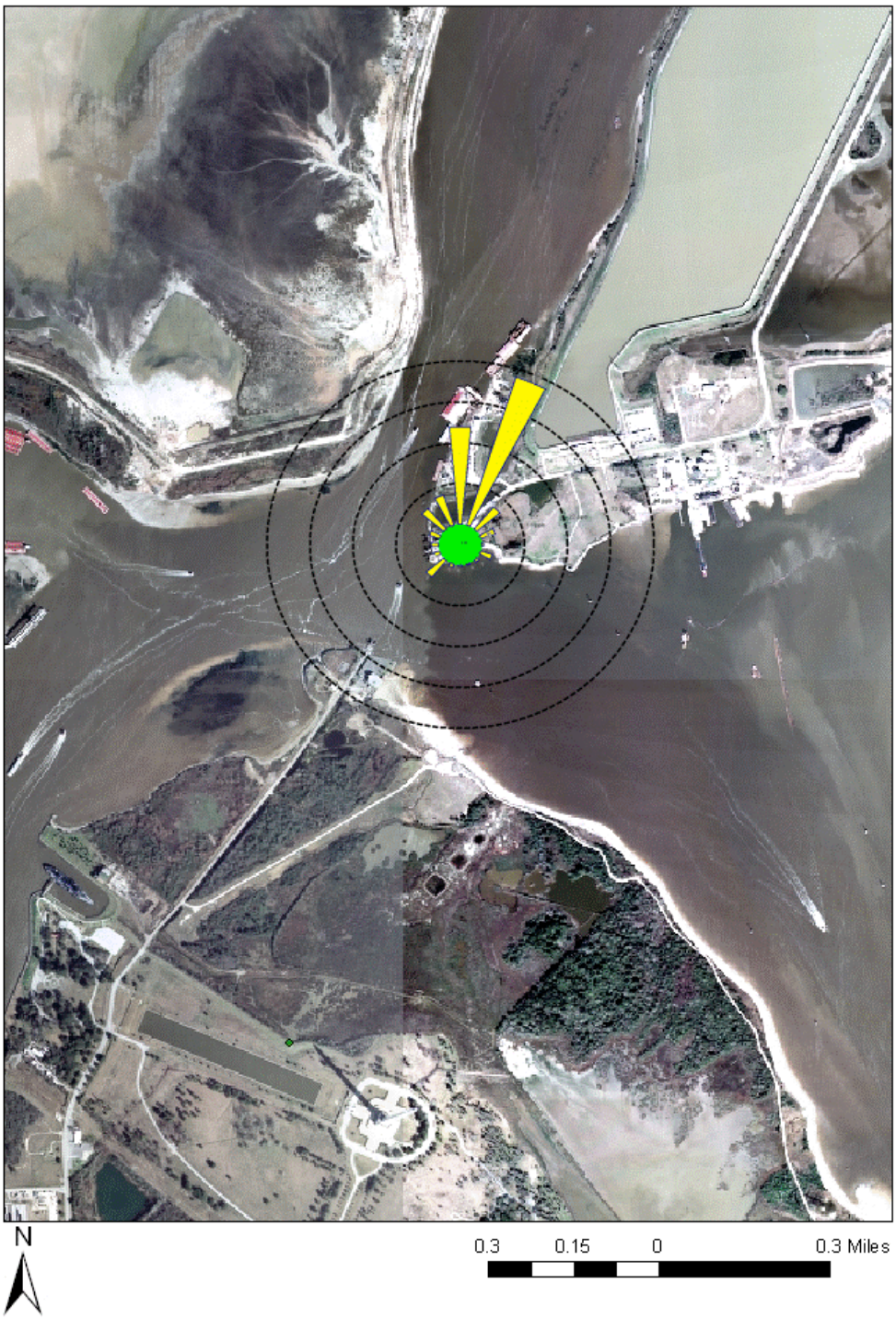
If you have any questions regarding this memorandum, please contact me by phone at (512) 239-1075 or by email at BKadluba@tceq.state.tx.us. For questions regarding the APWL, you may visit the APWL webpage on the TCEQ website.

Appendix 1. Monitored air toxics in TCEQ Region 12 for year 2006

Canister & AutoGC Target Analytes		Additional Canister Target Analytes	Additional AutoGC Target Analytes
1,2,3-Trimethylbenzene	Methylcyclopentane	1,1,1-Trichloroethane	1-Hexene
1,2,4-Trimethylbenzene	m-Ethyltoluene	1,1,2,2-tetrachloroethane	2-Methyl-1-Pentene
1,3,5-Trimethylbenzene	n-Butane	1,1,2-Trichloroethane	3-Methyl-1-Butene+Cyclopentene
1,3-Butadiene	n-Decane	1,1-Dichloroethane	a-Pinene
1-Butene	n-Heptane	1,1-Dichloroethylene	b-Pinene
1-Pentene	n-Hexane	1,2-Dibromoethane	Isobutene
2,2,4-Trimethylpentane	n-Nonane	1,2-Dichloroethane	
2,3,4-Trimethylpentane	n-Octane	1,2-Dichloropropane	
2,3-Dimethylbutane	n-Pentane	1-Hexene+2-methyl-1-pentene	
2,3-Dimethylpentane	n-Propylbenzene	2-Butanone	
2,4-Dimethylpentane	n-Undecane	2-Chloropentane	
2-Methyl-2-Butene	o-Ethyltoluene	2-Methyl-3-hexanone	
2-Methylheptane	o-Xylene	3-Hexanone	
2-Methylhexane	p-Diethylbenzene	3-Pentanone	
3-Methyl-1-Butene	p-Ethyltoluene	Bromomethane	
3-Methylheptane	Propane	Butyl Acetate	
3-Methylhexane	Propylene	Carbon Tetrachloride	
3-Methylpentane	p-Xylene + m-Xylene	Chlorobenzene	
4-Methyl-1-Pentene	Styrene	Chloroform	
Acetylene	t-2-Butene	Chloroprene	
Benzene	t-2-Hexene	CIS 1,3-dichloropropylene	
c-2-Butene	t-2-Pentene	Dichlorodifluoromethane	
c-2-Hexene	Toluene	Ethyl Acetate	
c-2-Pentene		Isobutyraldehyde	
Cyclohexane		Methyl Butyl Ketone (MBK)	
Cyclopentane		Methyl chloride	
Cyclopentene		Methyl t-Butyl ether	
Ethane		Methylene Chloride	
Ethyl Benzene		Methylisobutylketone	
Ethylene		n-Propyl Acetate	
Isobutane		Tetrachloroethylene - Perchloroethylene	
Isopentane		trans-1-3-Dichloropropylene	
Isoprene		Trichloroethylene	
m-Diethylbenzene		Trichlorofluoromethane	
Methylcyclohexane		Vinyl Chloride	
Carbonyls		Metals	
2,5-Dimethylbenzaldehyde	p-Tolualdehyde	Aluminum (PM 2.5)	Aluminum (PM 10)
Acetaldehyde	Propanal - Propionaldehyde	Antimony (PM 2.5)	Antimony (PM 10)
Acetone	Valeraldehyde	Arsenic (PM 2.5)	Arsenic (PM 10)
Acrolein		Barium (PM 2.5)	Barium (PM 10)
Benzaldehyde		Cadmium (PM 2.5)	Cadmium (PM 10)
Butylaldehyde		Chromium (PM 2.5)	Chromium (PM 10)
Crotonaldehyde - 2-Butenal		Cobalt (PM 2.5)	Cobalt (PM 10)
Formaldehyde		Copper (PM 2.5)	Copper (PM 10)
Heptaldehyde		Manganese (PM 2.5)	Manganese (PM 10)
Hexanaldehyde		Molybdenum (PM 2.5)	Molybdenum (PM 10)
Isovaleraldehyde		Nickel (PM 2.5)	Nickel (PM 10)
m-Tolualdehyde		Selenium (PM 2.5)	Selenium (PM 10)
MEK/Methacrolein		Tin (PM 2.5)	Tin (PM 10)
o-Tolualdehyde		Zinc (PM 2.5)	Zinc (PM 10)

Appendix 2. Source Direction Evaluation of 2006 1,3-Butadiene Concentrations at the Milby Park Site

Appendix 3. Source Direction Evaluation of 2006 Styrene Concentrations at the Lynchburg Ferry Site



Appendix 4. Source Direction Evaluation of 2006 Styrene Concentrations at the Milby Park Site

Appendix 5. Source Direction Evaluation of 2006 Benzene Concentrations at the Lynchburg Ferry Site

cc:
Susan Prosperie, Dept. of State Health Services
Arturo Blanco, City of Houston
Bob Allen, Harris County
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